



iJOIN

INFSO-ICT-317941



## **INFSO-ICT-317941 iJOIN**

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#### **Abstract**

This project management deliverable describes the project activity within the iJOIN project within the entire project lifetime. It compiles the information provided in the Quaterly Management Reports (QMRs) that have been produced along the project. Confidential information from the QMRs has not been included in this deliverable due to its public nature.

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# 1 Executive Summary

Overall, the project has been executed according to the plan. All partners actively participated in iJOIN through joint phone conferences and email discussions. Before giving a more detailed overview of the activities conducted throughout the project, we can state that in all phases of the execution, (a) the project has been on track with respect to the expected schedule, (b) the project has been on track with respect to the expected budget, and (c) there were no unexpected major deviations from the originally planned topics.

The project started on November 1<sup>st</sup>, 2012 and a kick-off (KO) meeting was held in November 2012 in Madrid. During the KO meeting, basic administrative and technical questions were discussed, including the way of cooperating and exchanging information, dissemination of results, as well as the scope of the project. A plenary meeting took place in Heidelberg in March 2013 which served to consolidate an integrated view of the iJOIN architecture. The third plenary meeting took place in Surrey in June 2013 and served to progress on the design of the candidate technologies and further refine the overall iJOIN architecture. The first virtual meeting took place in September 2013 with a strong emphasis on the design of novel algorithms for the candidate technologies. The fourth plenary meeting took place in Turin in November 2013, and had as primary focus the investigation of the candidate technologies designed by the project. The fifth plenary meeting took place in Grenoble in April 2014 and focused on the continuation of the work on the candidate technologies. The sixth plenary meeting was held in Bologna in June 2014 and served to integrate the mechanisms devised by the project. The second virtual meeting of the project took place in September 2014 and was very useful to discuss the planning of the overall performance evaluation and the corresponding trade-off analysis. The seventh plenary meeting was organized in Milan in November 2014 and focused on finalization of the global architectural view along with the corresponding candidate technologies of the architecture. The eighth plenary meeting of the project took place in Bremen in February 2015 and focused on the performance evaluation of the individual candidate technologies. Finally, the ninth and last plenary meeting was held in Dresden in April 2015 and focused on the project-wide performance evaluation as well as the organization of the periodic and final reports along with the final technical review. The project has concluded on April 30<sup>th</sup>, 2015.

In the following, we give a summary of the main activities performed in each of the quarters of the project.

The **first quarter** of iJOIN, we organized the various aspects of the project, including the way of cooperating and exchanging information, the dissemination of results, as well as the scope of the project. We also started the technical discussions, identified some high-level architectural guidelines and discussed about the potential technological candidates that may be part of the architecture. In this quarter, iJOIN also already started its dissemination and coordination activities with other related FP7 Call 8 projects.

The **second quarter** served to consolidate an integrated view of the iJOIN architecture. The first phone conference with the EAB has been organised and iJOIN received very positive and helpful feedback. iJOIN also participated to the concertation activities by contributing to a joint RAS paper as well as a panel discussion in concertation plenary meeting. The first set of internal reports was finalized on time and according to the project plan. An updated planning of the resources was prepared and approved by the project's General Assembly.

The key activities conducted in **third quarter** included (i) the work on the specification of the interaction between the different components of the iJOIN architecture, and (ii) the work on the design of the key technological candidates of the project and the underlying algorithms. A number of dissemination activities were also conducted, including the preparation of a success story for the Net Tech, the edition of the first video of the project (a demo of one of its technological candidates) and the organization of various workshops (together with other European projects). Additionally, iJOIN continued to participate to the concertation activities in the RAS cluster.

The key milestone in the **fourth quarter** was the completion of the deliverables D1/2/3/4/5/7.1, all of which were delivered on time. Additionally, another highlight in this quarter was the event where the president of the Madrid region awarded to iJOIN the Runner-up prize to the Best European R&D Cooperative Project of the Ninth Madrid Awards. Some of the main efforts in this quarter were addressed to the design of the key technological candidates of the project, with a special focus on the split of the functionality implemented by them. It is also worth highlighting in this quarter the contributions of the project to several of the ongoing 5G activities both in Europe and worldwide, including several panels on 5G organized by the European Commission, the special issue on 5G of IEEE Communications Magazine as well as some other activities in

the context of standardization bodies. A number of dissemination activities were conducted in this period, including the ongoing preparation of the second video of the project (describing the motivation and goals of the project) and the organization of various workshops (one co-located with a leading academic conference and the other with a strong industrial focus). Additionally, iJOIN continued to participate to the concertation activities in the RAS cluster (it is worth highlighting the participation of iJOIN in the October concertation meeting as one of the key projects addressing cloud technologies in the context of 5G)

In the **fifth quarter**, all iJOIN partners started the work towards the second milestone (due at the end of eight quarter). In this quarter, we analyse the work performed in the first period (up to Q4) in order to assess the project status and adjust the roadmap. The output of this analysis was used to prepare the first technical review. The output and comments of the reviewers that the reviewers provided in the technical review were used to further adjust the next steps in iJOIN.

During **sixth quarter** and after the successful completion of the 1<sup>st</sup> technical review, a document was prepared to explain how the reviewers' comments will be addressed and the work on addressing these comments already started. The project also participated to the 5G experiments initiative promoted by the commission. The project implemented two of its technology candidates, the RANaaS component and the SDN-based mobility mechanism. The work of on WP2-4 resulted in internal reports IR2.2, IR3.2, and IR4.2, which were completed and delivered on time.

During the **seventh quarter**, the work towards the second milestone (due to the end of Q8) continued. An important focus of the work in this quarter was the overall integration of the mechanisms devised by the project, which was reported in internal report IR5.2 (which was completed in this quarter and delivered on time). One of the major highlights of this seventh quarter was the participation in EuCNC. iJOIN showed an exhibit that included two demos (one on SDN-based mobility and the other on PHY-layer functional split) and several presentations (at the main conferences and at the workshops). Another important highlight of the project was the paper on Software-defined Wireless Networking published at IEEE Wireless Communications Magazine, which has been selected as the complimentary article of the month.

In **eighth quarter**, the second milestone of the project was successfully completed with the finalization of deliverables D2.2, D3.2, D4.2 and D6.1, which were finalized at due time, and followed all the internal procedures to guarantee a high quality. In agreement with the Project Officer, deliverable D5.2 was delayed one month in order to incorporate the feedback of the other deliverables in this important document. An amendment of the Grant Agreement, which had been prepared earlier, was approved in this quarter.

An important focus of the work in the **ninth quarter** was the finalization of deliverable D5.2. During this period, we have also prepared a document that provides an update on how the reviewers' comments of the first technical review were addressed in the project. One of the highlights of this quarter was the notification that the demonstration of the project would be shown at the Mobile World Congress in Barcelona in the booth of the commission. To this end, the project prepared a demonstration that comprises the RANaaS concept together with the iJOIN-driven mobility management schemes will be shown. One of the key activities performed in this quarter was also the performance evaluation of the individual candidate technologies of iJOIN.

The work in the **tenth (and last) quarter** of the project comprised the finalization of deliverables D1.1, D2.3, D3.3, D4.3, D5.3, D6.2, D7.2 and D7.3. All deliverables were completed by their deadline with a high quality. One of the key achievements of the project in this period was the global performance evaluation conducted. In particular, the performance improvements achieved by the various candidate technologies of the project were reported in deliverables D2.3, D3.3 and D4.3. These results were further combined to provide a project-wide performance analysis, which showed that the technology devised by the project either satisfies or is very close to the very ambitious figures that were targeted. Another major highlight in this quarter was the demonstration shown in the 5G booth organized by the European Commission at the Mobile World Congress in Barcelona. The demonstration attracted the attention and received very positive feedback from major industry players. Another highlight of this period was the iJOIN Winter School, which also attracted the attention of many industrial players in the 5G area, such as Alcatel-Lucent, Nokia, Deutsche Telekom and Vodafone, which were very active in the event and provided very valuable feedback.

## 2 Technical progress and achievements

In the following, we give a summary of the main technical achievements for each of the quarters of the project.

In the **first quarter**, the individual WPs set up their organisational structure, assigned individual tasks and topics to partners, and started the discussions. The discussions focused on scenarios, use cases, requirements, and technical contributions in order to make sure that the work within the WPs is within the project's scope. Each WP prepared a working document which eventually led the first internal report. This working document was meant to serve as a platform to collect, exchange, and comment on the information and topics of the individual partners. Furthermore, all WPs hosted periodic phone conferences which were well prepared and well attended in order to coordinate the work within work packages and to monitor the progress. A critical exercise within iJOIN was the coordination of WPs 2, 3, and 4 with WP 5. After multiple rounds of revisions, partners agreed on a common *modus operandi*. Furthermore, the frequency of the initially planned bi-weekly conference calls was increased in order to have more time for discussions of basic requirements, scenarios, and the architecture. This revision was the positive result of the collected input from partners, the detailed discussion within WP5, and the interest as well as involvement of all partners.

In the **second quarter** of the project, all work packages made remarkable progress and kept the work intensity of the first quarter. Most notably, the focus of the work in Q2 was on (1) definition of candidate technologies in WP2, WP3, and WP4: a set of candidate technologies were identified and, where possible, merged; (2) definition of assumptions and requirements by WP2-4 and the harmonisation of these assumptions and requirements within WP5, (3) assessment of the functional split, i.e. the individual functions of interest was described and a first assessment of their impact on a possible functional split was provided; (4) the internal report produced in this period provided a detailed SotA analysis, description of the investigated candidate technologies, relevance for iJOIN's scenarios, and the first identification of requirements and assumptions; and (5) in WP6, the work on demonstrators was kicked off and is focusing on a first assessment of the demonstrator capabilities and guidelines for partners on how to use these demonstrators.

In the **third quarter** of the project, all work packages made considerable progress with respect to the goals defined by first milestone in M12. The project was able to focus on the most important and relevant tasks, which need to be finished in order to allow for project-wide progress. In particular, it must be emphasised the high engagement of most partners, e.g. through Email discussions, TelCos, and also "Virtual Meetings" which were introduced to discuss exclusively technical contributions, while organisational matters were discussed in regular TelCos. This increased level of interaction helped improving the understanding of the individual technologies and required tasks for a project-wide harmonisation. This was reflected in the progress on the function split analysis as well as definition of the iJOIN architecture (logical, physical, and functional). In particular, the focus in Q3 was on (1) different architectural options were investigated, discussed in the individual WPs, and merged in WP5 in order to further converge on and harmonise the iJOIN architecture, with particular attention to the interaction of network controller and RANaaS controller; (2) investigation of different functional splits within iJOIN technologies as well as core functionality of 3GPP LTE which is not explicitly addressed by iJOIN technologies, each WP handling relevant RAN functionality and details the integration in a RANaaS environment; (3) application of the logical architecture to the individual core scenarios of iJOIN in order to describe the physical iJOIN architecture and derive requirements; (4) progressing the functional architecture within each WP and project-wide; (5) setting up templates, structure, and expectations for all deliverables, which are due in M12; and (6) definition of test platforms in IR6.1 in order to facilitate the discussion on the applicability of iJOIN technologies to the individual test platforms; in addition, one more testbed was introduced to demonstrate WP4 technologies with a particular focus on Software Defined Networking (SDN).

In the **fourth quarter**, all work packages worked closely together towards the first milestone MS1 and its target outcome. All work packages accomplished the pre-defined goals and were able to report their results in the first set of deliverables. In particular, these reports do not only show the view of each work package but also a consolidated view from the project which has been achieved through a harmonisation of assumptions, requirements, input and output information used by each candidate technology. The project still maintains a high activity in all work packages which is emphasised by regular virtual meetings within each work package as well as a project two-day virtual meeting. This virtual meeting provided an intermediate update from all work packages without causing further travel overhead and costs to the project. Finally, the



project further improved its dissemination activities which is reflected by overall 25 articles submitted or accepted (among those 8 journal publications). Furthermore, the project has been very active in disseminating its idea through various panel and workshop presentations. In particular, the focus in Q4 was on: (1) investigation of different general ways to split RAN functionality; (2) analysis of complexity and data rate (backhaul) requirements for individual technologies centralised through a RANaaS platform; (3) definition of interaction of individual technologies that are investigated within iJOIN, i.e., functional architecture; this includes also information exchange between different network entities, which builds the basis for the definition of interfaces; (3) definition of the network controller architecture (SDN controller) and its interaction with technologies investigated in context of iJOIN; (4) interaction across work packages and technologies in the individual WPs; (5) detailed analysis of selected functions in the context of a flexible functional split, (6) further elaboration on technology candidates within the individual work packages; (7) definition of potential demonstration efforts, i.e., demonstration platforms as well as technologies which are going to be implemented on the demonstration platform.

In the **fifth quarter**, iJOIN focused on the further analysis of the functional split between small-cells and RANaaS platform, the iJOIN network controller, and the harmonisation and convergence of candidate technologies. In particular, the main results were (1) candidate technologies were further refined, and their grouping was improved; this grouping was used to define common sets of assumptions, evaluation parameters, and comparable results, (2) WPs further focused on defining and implementing simulation and evaluation tools, with the goal of evaluating technologies based on relative comparison, (3) functional split was further investigated, in particular the impact of cloud-implementations (on commodity hardware), e.g. computational jitter, imperfect backhaul, the implementation of pre-coders and turbo-decoders on cloud-platforms; in addition, the definition of a virtual eNB was further advanced and a framework to compare and categorise functional split options was defined, (4) backhaul topologies and connectivity technologies were investigated and the output was used as input to all WPs to investigate the applicability of candidate technologies, (5) each WP set up one central document per candidate technology in order to provide a consistent up-to-date status of its investigated technologies; these documents were harmonised across WPs with the goal of serving as main means to exchange technology related information across WPs, (6) work continued on the physical architecture and logical architecture (mainly updates based on feedback from WPs), (7) demonstration steps were further refined, and metrics and evaluation criteria for the CTs were defined. The iJOIN Network Controller architecture was further refined as well.

In the **sixth quarter**, iJOIN focused on progressing with the analysis of RANaaS implementation on cloud-computing platforms and of constraints imposed by non-ideal backhaul. Furthermore, all WPs progressed with the definition and evaluation of candidate technologies. iJOIN also updated the work-plan and individual tasks in order to address appropriately the comments and suggestions during the technical review meeting in January 2014. The focus was on providing more results on project-wide applied concepts (e.g. computational complexity and cost-efficiency) as well as particular candidate technologies. In particular, the following work was conducted during this quarter: (1) further investigation were performed on the constraints imposed by cloud-implementations of RAN functionality, e.g. integration of FEC and precoding on GPP, computational complexity analysis, RANaaS dimensioning analysis, and latency impact on RAN performance, (2) discussion continued on functional split options, their benefits, requirements, and impact on the RAN performance, (3) progress was made towards a common evaluation model to be applied to all candidate technologies within a WP, resulting in a harmonized parameterization of all candidate technologies which allows for comparability of results within each WP as well as across WPs. (4) progress was also made on the definition of candidate technologies and achievement of preliminary results (5) The initial steps towards a cost-efficiency analysis was taken by defining a model which combines large-scale throughput analysis with computational complexity results used to assess the required computational resources and (6) we analysed the virtual eNodeB controller and implementation options.

In the **seventh quarter**, iJOIN progressed with analysing functional split and RANaaS on cloud-computing platforms. Particular attention was paid to practical constraints such as backhaul limitations, implementation options, feasible and preferred functional splits, as well as implementation constraints on virtual platforms. Furthermore, the workplan and targets for the first phase until M18 were revisited, and targets for the next phase until M24 were discussed and appropriately included in the workplan of each work package. iJOIN further focused on providing further preliminary results, on harmonizing candidate technologies, and on providing a consistent path towards final evaluation. In particular, the following work was in the focus of the quarter: (1) further investigation of functional split, i.e. implementation options, virtualization infrastructure, computational complexity, load balancing within RANaaS, preferred functional splits, migration of virtual

eNodeBs, and implementation requirements, (2) common evaluation scenarios were defined by down-selecting essential parameters, quantifying these parameters, and applying these parameters by all candidate technologies, (3) harmonization of evaluation objectives and identifying side-effects and impact of candidate technologies, (4) work continued on candidate technologies and provision of preliminary results, (5) a preliminary assessment of the cost-efficiency of iJOIN compared to traditionally deployed LTE was performed.

In the **eighth quarter**, iJOIN progressed with the analysis and evaluation of its key concepts, i.e. functional split and joint RAN/BH operation. A cost-efficiency study was formulated and the underlying framework was defined, the relation of each technology to the required functional split was described, backhaul requirements and necessary backhaul technologies for preferred functional splits were defined, and for each key concept a test-bed was implemented. iJOIN partners further pushed forward the integration of individual technologies into the iJOIN system concept in order to facilitate the final system-wide performance analysis. In particular, the following work was been in the focus of quarter: (1) A cost-efficiency study framework was derived; this study includes heterogeneous backhaul technologies as well as data processing constraints of Cloud-RAN data centers, (2) candidate technology definitions was finished and preliminary results were provided, which were the basis for a comprehensive result comparison and global evaluation, (3) for each test-bed, candidate technology implementations were provided, demonstrating iJOIN's key concepts, i.e. functional split and joint RAN/BH operation, (4) each WP performed a detailed analysis of compatibility and applicability of each candidate technology, i.e. applicability of metrics, scenarios, expected results, and interaction, (5) iJOIN defined a detailed roadmap to perform a project-wide evaluation of the iJOIN concept.

In the **ninth quarter**, iJOIN progressed with the final implementation and performance evaluation of candidate technologies. In previous quarters, candidate technologies had been derived, analysed and further refined in order to match the iJOIN system concept. In this quarter, iJOIN focused on the final implementation and quantitative evaluation of benefits for the iJOIN system, which is an important foundation for the project-wide performance analysis. The project-wide analysis was defined in detail, and the requirements, scenarios, and detailed parameters were further discussed in each WP and all applicable candidate technologies were identified. These candidate technologies provided quantitative results which were then integrated to describe the expected benefits of the iJOIN system concept. Within each WP, more detailed evaluation campaigns were performed with the goal of converging towards integrated and comparable results within each WP. Finally, iJOIN partners spent significant efforts to further progress with the simulator and particular demonstrator implementation plan. In particular, the following work was in the focus of quarter: (1) Preparation of Mobile World Congress demonstrators and support of European Commission during the exhibition preparation, (2) Intra-WP evaluation campaigns to provide comparable results from each WP, (3) Preparation of project-wide analysis, i.e. definition of methodology, scenarios, and parameters, (4) Finalisation of candidate technologies and evaluation of their performance, (5) Analysis of actual implementations of iJOIN scenarios based on operator feedback in order to provide results for realistic radio access and backhaul network implementations, (6) Definition of structure and required content of final deliverables, and (7) Progress with test-bed implementations and harmonization of proof-of-concept results with results obtained within each work package.

In the **tenth quarter**, iJOIN progressed significantly and finalised all remaining tasks. In particular, iJOIN partners focused on finalising the evaluation, integration, and harmonisation of individual candidate technologies in each work package. Furthermore, each work package finalised the last deliverable containing a comprehensive evaluation of the iJOIN system concept from a specific work package point of view. In WP5, these individual analyses were merged to provide a harmonised system concept and project-wide analysis which shows the performance of the iJOIN system within different baseline scenarios. iJOIN was very actively collaborating with Small-Cell Forum to disseminate its results towards the virtualisation working group of Small Cell Forum. In particular, the following was in the focus of this last quarter: (1) preparation of Mobile World Congress demonstrators and support of European Commission during the exhibition preparation, (2) finalisation of intra-WP evaluation campaigns to provide comparable results from each WP, (3) finalisation of project-wide analysis, (4) finalisation of candidate technologies and final evaluation of their performance, (5) analysis of actual implementations of iJOIN scenarios based on operator feedback in order to provide results for realistic radio access and backhaul network implementations, (6) finalisation of all project deliverables, (7) finalisation of test-bed implementations and harmonization of proof-of-concept results with results obtained within each work package and (9) information exchange with Small Cell Forum.

## 2.1 WP1: Management

### 2.1.1 Summary

WP1's main activity during the project involved the technical and administrative coordination of the different WPs, ensuring a correct development of the planned workflow. Additionally, the coordination of several dissemination activities has been performed. These activities include six scientific workshops co-located with top conferences such as GLOBECOM, ICC and VTC, an industrial workshop, two demonstrations at EuCNC and the MWC, several concertation activities including the contribution to a joint RAS paper, the participation in several panel discussions, the contribution to the 5G experiments initiative of the commission and the edition of an article at the commission's magazine. Finally, additional activities such as the coordination with the PO, the relationship with the European Commission, the coordination of plenary meeting of the project and the maintenance of the mailing lists, SVN, WebEx for audioconferences and other collaborative tools have been carried out. An update of the effort distribution, included in an amendment of the project's Grant Agreement, was prepared. Audioconferences with the General Assembly and the External Advisory Board were also organised when appropriate. The preparation of the periodic and final reports as well as the organization of the technical reviews was also performed by this WP.

Task	Status <sup>1</sup>	Variance	Cause/Way-Forward	Expected deadlines	Affected Partners
Task 1.1	Concluded	No delays or changes of topics expected	N. A.	All QMRs delivered D1.1 and D1.2 delivered	None
Task 1.2	Concluded	No delays or changes of topics expected	N. A.	See above	None

### 2.1.2 Task 1.1: Technical project coordination

First quarter:

Partner	Achievements Milestones Work items in progress
NEC	<ul style="list-style-type: none"> <li>• Coordination of WPs/WPLs</li> <li>• Coordination with PM with respect to project status</li> <li>• Review of WPs' templates and input for revisions</li> <li>• Coordination of workshop proposal for GC'13</li> <li>• Coordination with other Call 8 projects, e.g. TROPIC (presentation at TROPIC plenary)</li> <li>• Input to "Cloud Expert Group"</li> <li>• Input to concertation meeting</li> <li>• Support for KO meeting preparation (together with IMDEA)</li> <li>• Preparation of next plenary meeting in Heidelberg (March 13)</li> </ul>

Second quarter:

Partner	Achievements Milestones Work items in progress
NEC	<ul style="list-style-type: none"> <li>• Coordination of WPs</li> <li>• Coordination of work flow</li> </ul>

<sup>1</sup> Red = Major deviations and objectives may not be achieved; Yellow = Small deviations but objectives will be met; Green = On-track, no major deviations

	<ul style="list-style-type: none"> <li>• Preparation of plenary meeting in Heidelberg</li> <li>• Coordination of dissemination activities, e.g. GC'13 workshop, FUNEMS workshop, VTC'13 exhibition booth, concertation meeting, FIA</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Coordination among partners</li> <li>• Input to Heidelberg meeting:</li> <li>• Preparation and participation in concertation activities with a joint RAS paper.</li> </ul>

Third quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Coordination of WPs (e.g. PTC TelCos)</li> <li>• Coordination of work flow (e.g. structure of deliverables, interaction of WPs)</li> <li>• Review of internal reports</li> <li>• Preparation of plenary meeting in Guilford</li> <li>• Input to project blog</li> <li>• Coordination of dissemination activities, e.g. GC'13 workshop, FUNEMS workshop, VTC'13 exhibition booth</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Coordination among partners</li> <li>• Input to Guildford meeting.</li> <li>• Preparation of FIA meeting.</li> </ul>

Fourth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Coordination among partners</li> <li>• Preparation and participation at Cloud RAN Panel in the Future Networks Concertation meeting (23<sup>rd</sup> October 2013, Brussels).</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Coordination of WPs (e.g., PTC TelCos)</li> <li>• Coordination of work flow (e.g. structure of deliverables, interaction of WPs)</li> <li>• Review of deliverables</li> <li>• Preparation of virtual plenary meeting</li> <li>• Input to project blog</li> <li>• Coordination of dissemination activities</li> <li>• Support of Project Coordinator regarding amendment of CA</li> </ul>

Fifth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Coordination among partners</li> <li>• Preparation of technical review meeting</li> <li>• Preparation of periodic report</li> <li>• Coordination of WPs for preparation of the 1<sup>st</sup> Technical Audit</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Coordination of WPs (e.g. PTC TelCos)</li> <li>• Coordination of work flow (e.g. structure of deliverables, interaction of WPs)</li> <li>• Preparation of technical review meeting</li> <li>• Preparation of periodic report</li> <li>• Coordination of dissemination activities</li> </ul>

	<ul style="list-style-type: none"> <li>• Concertation activities in the context of Future Internet Assembly 2014 (iJOIN gives two presentations: <a href="https://www.fi-athens.eu/program">https://www.fi-athens.eu/program</a>)</li> </ul>
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Sixth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Coordination among partners</li> <li>• Coordination of iJOIN plenary meeting in April 2014</li> <li>• Presentation and preparation of the documents for the 5G experiments initiative</li> <li>• Preparation of the proposal for the exhibit at EuCNC</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Coordination of WPs (e.g. PTC TelCos)</li> <li>• Coordination of work flow (e.g. structure of deliverables, interaction of WPs)</li> <li>• Coordination of iJOIN plenary meeting in April 2014</li> <li>• Coordination of dissemination activities</li> <li>• Coordination of EAB TelCos</li> <li>• Concertation activities in the context of Future Internet Assembly 2014 (iJOIN gave two presentations: <a href="https://www.fi-athens.eu/program">https://www.fi-athens.eu/program</a>)</li> </ul>

Seventh quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Coordination of WPs (e.g. PTC TelCos)</li> <li>• Coordination of work flow (e.g. structure of deliverables, interaction of WPs)</li> <li>• Coordination of iJOIN plenary meeting in 24-26 June 2014 in Bologna</li> <li>• Coordination of dissemination activities</li> <li>• Concertation activities in the context of EuCNC 2014 including demo activities</li> <li>• Wrap-Up Q6, Update work plan towards second milestone within Q7</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Coordination among partners</li> <li>• Coordination of iJOIN plenary meeting in 24-26 June 2014 in Bologna</li> <li>• Preparation of the project at exhibit at EuCNC</li> <li>• Presentation of the project in the METIS workshop at EuCNC</li> </ul>

Eighth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Coordination among partners</li> <li>• Coordination of iJOIN plenary virtual meeting in September 2014</li> <li>• Preparation of a document for the 5G experiments initiative.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Coordination of WPs (e.g. PTC TelCos)</li> <li>• Coordination of work flow (e.g. structure of deliverables, interaction of WPs)</li> <li>• Coordination of iJOIN virtual meeting 30 Sep/01 Oct 2014</li> <li>• Coordination of dissemination activities</li> <li>• Concertation activities, e.g. Concertation meeting, 5G experiments/testbed meeting</li> <li>• Monitoring of progress towards milestone M3, gap analysis, roadmap for Q9+10</li> <li>• Coordination of iJOIN reports due at end of October</li> <li>• Preparation of iJOIN physical meeting 3-6 Nov 2014</li> </ul>

Ninth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Coordination among partners</li> <li>• Coordination of iJOIN plenary physical meeting in Milan in November 2014 .</li> <li>• Preparation of a several documents for the 5G experiments initiative and the MWC demonstrator, and participation in audioconferences.</li> <li>• Further input for the publication of the commission in 5G.</li> <li>• Preparation of the document that explains how the comments of the reviewers in the first technical review are being addressed.</li> <li>• Coordination of iJOIN Bremen plenary meeting in February 2015</li> <li>• Input to QMR report</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Coordination of WPs (e.g. PTC TelCos)</li> <li>• Coordination of work flow (e.g. structure of deliverables, interaction of WPs)</li> <li>• Coordination of dissemination activities</li> <li>• Concertation activities, e.g. coordination of iJOIN contribution to MWC</li> <li>• Monitoring of progress (particularly of project-wide analysis), update of progress report</li> <li>• Coordination with project members who are leaving project partners before end of the project</li> <li>• Coordination of physical meeting in Milan, 3-6 Nov 2014</li> <li>• Input to QMR report</li> </ul>

Tenth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Coordination of WPs (e.g. PTC TelCos)</li> <li>• Coordination of work flow (e.g. structure of deliverables, interaction of WPs)</li> <li>• Coordination of dissemination activities</li> <li>• Concertation activities, e.g. participation at concertation meeting</li> <li>• Monitoring of progress (particularly of project-wide analysis), update of progress report</li> <li>• Coordination with project members who are leaving project partners before end of the project</li> <li>• Input to final report and periodic report</li> <li>• Preparation of audit and final reporting (incl. final deliverables)</li> <li>• Coordination of physical meeting in Bremen, 25-27 Feb, and Dresden, 15-17 Apr</li> <li>• Input to QMR report</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Coordination among partners</li> <li>• Coordination of iJOIN Dresden plenary meeting in April 2015</li> </ul>

### 2.1.3 Task 1.2: Administrative project coordination

First quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Coordination among partners</li> <li>• Coordination with PM with respect to project status</li> </ul>

	<ul style="list-style-type: none"> <li>• Preparation and review of document templates and input for revisions</li> <li>• Input to concertation meeting</li> <li>• Organisation of KO meeting hosted by IMDEA</li> <li>• Preparation of collaborative tool for phone calls</li> <li>• Preparation of SVN repository for working documents</li> <li>• Design, setup, maintenance and hosting of the web page</li> <li>• Setup, configuration, maintenance and hosting of the project mailing lists</li> </ul>
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Second quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
IMDEA	<ul style="list-style-type: none"> <li>• Administrative coordination among partners</li> <li>• Coordination with PM with respect to project status</li> <li>• Relationship with the European Commission</li> <li>• Organization of a General Assembly phone call</li> <li>• Communication with the External Advisory Board</li> <li>• Input to Heidelberg meeting</li> <li>• Edition of QMR report</li> <li>• Planning of members Effort Distribution per Quarter</li> <li>• Management of budget</li> <li>• Management of collaborative tool for phone calls (WebEx)</li> <li>• Maintenance of SVN repository for working documents</li> <li>• Maintenance of mailing lists</li> <li>• Maintenance of web hosting</li> </ul>

Third quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
IMDEA	<ul style="list-style-type: none"> <li>• Administrative coordination among partners</li> <li>• Coordination with PM with respect to project status</li> <li>• Relationship with the European Commission</li> <li>• Communication with the External Advisory Board</li> <li>• Input to Guildford meeting.</li> <li>• Edition of QMR report</li> <li>• Management of budget</li> <li>• Management of collaborative tool for phone calls (WebEx)</li> <li>• Maintenance of SVN repository for working documents</li> <li>• Maintenance of mailing lists</li> <li>• Maintenance of web hosting</li> </ul>

Fourth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
IMDEA	<ul style="list-style-type: none"> <li>• Administrative coordination among partners</li> <li>• Coordination with PM with respect to project status</li> <li>• Relationship with the European Commission</li> <li>• Communication with the External Advisory Board</li> </ul>

	<ul style="list-style-type: none"> <li>• Edition of QMR report.</li> <li>• Management of budget</li> <li>• Management of collaborative tool for phone calls (WebEx)</li> <li>• Maintenance of SVN repository for working documents</li> <li>• Maintenance of mailing lists</li> <li>• Maintenance of web hosting</li> <li>• Preparation of a project video (ongoing)</li> </ul>
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Fifth quarter:

<b>Partner</b>	<b>Achievements</b>
	<b>Milestones</b>
	<b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Administrative coordination among partners</li> <li>• Preparation of a project video</li> <li>• Preparation of the contract amendment</li> <li>• Preparation of the management content of the periodic report</li> <li>• Coordination with PM with respect to project status</li> <li>• Relationship with the European Commission</li> <li>• Communication with the External Advisory Board</li> <li>• Edition of QMR report</li> <li>• Management of budget</li> <li>• Management of collaborative tool for phone calls (WebEx)</li> <li>• Maintenance of SVN repository for working documents</li> <li>• Maintenance of mailing lists</li> <li>• Maintenance of web hosting</li> <li>• Maintenance of Twitter project account</li> <li>• Maintenance of YouTube project channel</li> </ul>

Sixth quarter:

<b>Partner</b>	<b>Achievements</b>
	<b>Milestones</b>
	<b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Administrative coordination among partners</li> <li>• Preparation of the contract amendment</li> <li>• Coordination with PM with respect to project status</li> <li>• Relationship with the European Commission</li> <li>• Edition of QMR report.</li> <li>• Management of budget</li> <li>• Management of collaborative tool for phone calls (WebEx)</li> <li>• Maintenance of SVN repository for working documents</li> <li>• Maintenance of mailing lists</li> <li>• Maintenance of web hosting</li> <li>• Maintenance of Twitter project account</li> <li>• Maintenance of YouTube project channel</li> </ul>

Seventh quarter:

<b>Partner</b>	<b>Achievements</b>
	<b>Milestones</b>
	<b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Administrative coordination among partners</li> </ul>



	<ul style="list-style-type: none"> <li>• Preparation of the contract amendment</li> <li>• Coordination with PM with respect to project status</li> <li>• Relationship with the European Commission</li> <li>• Edition of QMR report</li> <li>• Management of budget</li> <li>• Management of collaborative tool for phone calls (WebEx)</li> <li>• Maintenance of SVN repository for working documents</li> <li>• Maintenance of mailing lists</li> <li>• Maintenance of web hosting</li> <li>• Maintenance of Twitter project account</li> <li>• Maintenance of YouTube project channel</li> </ul>
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Eighth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Administrative coordination among partners</li> <li>• Interview for a issue of the commission on 5G</li> <li>• Coordination with PM with respect to project status</li> <li>• Relationship with the European Commission</li> <li>• Edition of QMR report</li> <li>• Management of budget</li> <li>• Management of collaborative tool for phone calls (WebEx)</li> <li>• Maintenance of SVN repository for working documents</li> <li>• Maintenance of mailing lists</li> <li>• Maintenance of web hosting</li> <li>• Maintenance of Twitter project account</li> <li>• Maintenance of YouTube project channel</li> </ul>

Ninth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Administrative coordination among partners</li> <li>• Preparation of the contract amendment</li> <li>• Coordination with PM with respect to project status</li> <li>• Relationship with the European Commission, including the MWC related discussions.</li> <li>• Edition of QMR report.</li> <li>• Management of budget and preparation of an update of the effort distribution</li> <li>• Management of collaborative Management of collaborative tool for phone calls (WebEx)</li> <li>• Maintenance of SVN repository for working documents</li> <li>• Maintenance of mailing lists</li> <li>• Maintenance of web hosting</li> <li>• Maintenance of Twitter project account</li> <li>• Maintenance of YouTube project channel</li> </ul>

Tenth quarter:

Partner	Achievements Milestones Work items in progress
IMDEA	<ul style="list-style-type: none"> <li>• Administrative coordination among partners</li> <li>• Preparation of the contract amendment</li> <li>• Coordination with PM with respect to project status</li> <li>• Relationship with the European Commission</li> <li>• Edition of QMR report.</li> <li>• Management of budget</li> <li>• Management of collaborative tool for phone calls (WebEx)</li> <li>• Maintenance of SVN repository for working documents</li> <li>• Maintenance of mailing lists</li> <li>• Maintenance of web hosting</li> <li>• Maintenance of Twitter project account</li> <li>• Maintenance of YouTube project channel</li> </ul>

## 2.2 WP2: Holistic PHY Layer Design for Backhaul and Access

### 2.2.1 Summary

In the **first quarter**, the activities of WP2 started with the preparation of the kick-off meeting in Madrid. At the WP2 kick-off meeting, partners presented their topics of interest and technical contributions to WP2, followed by detailed technical discussions. The overall structure and organisation of WP2 was revised, activities among partners were clustered and possible risks were identified. Technical subtasks were defined by the TLs & WPL in order to proceed with the clustering of individual contributions to tasks.

The partners of WP2 started working on the IR 2.1 “Preliminary report on state-of-the-art and iJOIN PHY requirements, and scenarios”, contributing actively to the different sections of the SotA description based on their expertise. Furthermore, all partners started working on the definition of the partner specific PHY scenarios. Bi-weekly phone calls were held among all partners to discuss the contributions to the IR.

In Task 2.1, UoB contributed to an accepted conference article “Distributed Consensus-Based Linear Estimation with Erroneous Links” at 17th International ITG Workshop on Smart Antennas (WSA 2013).

In the **second quarter** of the project the work in WP2 continued towards a concrete description of the applied PHY approaches and their implementation in the overall architecture. Different scenarios and use cases were defined in cooperation with the other WPs. The partners developed further their candidate technologies and mapped them to the four iJOIN common scenarios. Furthermore, common assumptions, deployment assumptions, and requirements were discussed and a preliminary harmonised list among all CTs was generated.

These results were delivered to WP5 as initial input. A draft functional split of WP2 CTs was provided for WP5 based on the discussion at the Heidelberg meeting. Detailed descriptions on possible functional splits per CT using harmonised functional blocks were reported.

The intermediate report IR2.1 was finalised in time. This report serves as input for WP2 and as the basis for the upcoming work on the technical side. The report contains a detailed description of the PHY layer specific state of the art. Furthermore, the preliminary description of the CTs per partner is provided and each CT is assigned to at least one of the iJOIN CSs.

In the **third quarter** of the project the work in WP2 continued towards a concrete description of the applied PHY approaches and their implementation in the overall architect. For each CT several options for the functional split between local processing, cooperative processing, and centralized processing were developed using harmonised functional blocks.

As PHY processing is in principle performed in a chain structure, the last processing parts in the uplink and the first processing parts in the downlink can be implemented in a RANaaS environment. Consequently, detailed investigations for decoder and precoder implementations started. In order to derive the functional

architecture a common set of requested input and provided output signals with corresponding parameter description were derived for WP2 CTs.

In this quarter the partners in WP2 continued their publications activities on a high level by means of four published papers, five prepared papers. IMC presented two papers at ICC'13 and two papers at ISIT'13. The paper "Heterogeneous Backhaul for Cloud-Based Mobile Networks" is a joint paper of three WP2 partners was accepted for publication at the CLEEN 2013 workshop. For the same workshop, a paper on In-Network-Processing by UoB was also accepted.

In the **fourth quarter** of the project, the work in WP2 on implementing PHY approaches in the overall architecture continued. A stable version of interactions of the different candidate technologies was achieved. The required input, the provided output, the exchange of information within a CT, and the exchange of measurement data between the network entities was specified. Based on these definitions, a stable version of the functional architecture was derived which also includes the interactions with WP3 and WP4. The outcomes are described in D2.1 in detail and will serve as the basis for more detailed specifications of the interactions among the PHY layer functions and with WP3 and WP4. Furthermore, WP2 continued on investigating possible functional split options for each CT. In particular, aspects like computational needs per node and backhaul requirements were analysed. As the FEC is the last functional component on the PHY layer in the uplink and the precoder is the first PHY component in the downlink, these basic functions were selected for detailed investigations. First assessments on implementing these functions in the RANaaS were accomplished and are described in D2.1 as well. In addition, the implementation of a FEC decoder in a cloud environment is currently part of collaborative investigations with WP6. The first deliverable "D2.1 State-of-the-art of and promising candidates for PHY layer approaches on access and backhaul network" was finalised and delivered in due time.

In the **fifth quarter** of the project, the definition of the PHY layer of the iJOIN architecture and the implementation of PHY approaches into this architecture continued. The concept of flexible functional split was further investigated and in particular initial performance results for the implementation of forward error correction decoder on general purpose hardware have been achieved. After defining the draft logical and functional architecture in D2.1, the technical work focused on implementing the CTs with respect to this definition. To this end, the PHY properties of the veNB were further specified in order to investigate the impact on the performance in the future. Partners with simulation tasks further developed their simulation tools considering main veNB properties, backhauling constraints and an LTE-based implementation. Partners in WP2 contributed to the presentation for the 1<sup>st</sup> technical review. Furthermore, WP2 created a draft table of contents for the next intermediate report IR2.2 and in collaboration with the other technical work packages common evaluation scenarios are developed. For these scenarios, the set of parameters per CT was defined and used to derive a common set of WP2 parameters which were harmonised with the other WPs.

The partners in WP2 continued to publish their results in conferences and journals. Two papers were submitted to IEEE ICC 2014 by UNIS and IMC, and one paper submitted to WSA 2014 by UoB have been accepted for publications. Based on the evaluation of the initially submitted white paper, UoB, NEC, TUD, SCBB, and CEA submitted the full paper "Benefits and Impact of Cloud Computing on 5G Signal Processing" for the special issue "Signal Processing for the 5G Revolution" of IEEE Signal Processing Magazine.

In the **sixth quarter** of the project, the intermediate report IR2.2 was finalized. This report contains for each candidate technology (CT) a technical update, a description of the evaluation methodology to demonstrate the impact on the iJOIN objectives, includes preliminary results, and lists the next steps towards deliverable D2.2. Further discussions on functional split options, the integration of the functional blocks precoder and decoder in the central node, as well as first results for integrating forward error correction decoding algorithms on general purpose hardware were provided. Furthermore, the integration of the virtual eNodeB was studied from a PHY perspective and a draft common evaluation model was derived. This 3GPP based evaluation model was used in the next deliverable D2.2 to achieve harmonized performance results for all CTs. The partners in WP2 participated in the plenary meeting in Grenoble, presenting updates for their CT discussing common topics like functional split, virtual eNodeB integration, and common evaluation scenarios. The partners in WP2 continued to publish their results on conferences and journals. The joint WP2 / WP3 paper "Towards a Flexible Functional Split for Cloud-RAN Networks" and the paper "Comparative Study of Distributed Consensus-based Estimation Schemes for Small-Cell Networks" by UoB were accepted at EuCNC 2014 in Bologna. Furthermore, the paper "Benefits and Impact of Cloud Computing on 5G Signal Processing" submitted by UoB, NEC, TUD, SCBB, and CEA for the special issue "Signal Processing for the 5G Revolution" of IEEE Signal Processing Magazine was revised.

In the **seventh quarter** of the project, the technical content and the structure of the deliverable D2.2 was prepared. The interaction of WP2 CTs was analysed to explore the compatibility and interoperability of approaches and corresponding performance gains. A detailed procedure to determine the size of exchange messages per functional split for quantifying the backhaul rates was developed. In cooperation with WP3 and WP4 the point-to-point properties of backhaul techniques was revised. Together with the discussion of backhaul topologies these investigations were used to analyse the requirements and performance gains of the different PHY techniques in the iJOIN architecture. Furthermore, the WP2 partners continued to implement their CTs in the iJOIN architecture and updated the evaluation methodology the final evaluation campaigns. These, in cooperation with WP6 forward error correction decoder algorithms on cloud platforms were implemented and evaluated. A demonstration was developed by UoB and NEC to demonstrate the required numbers of CPU cores for different operating several iSCs centrally. In three Virtual Meetings the partners presented updates of their CTs, discussed current results and next steps. Furthermore, the partners in WP2 participated in the plenary meeting in Bologna, presenting updates for their CT discussing common topics like functional split, virtual eNodeB integration, common evaluation scenarios, and interactions of WP2 CTs. The table of contents for D2.2 was discussed. The partners in WP2 continued to publish their results on conferences and journals. At EuCNC 2014 in Bologna the joint WP2 / WP3 paper “Towards a Flexible Functional Split for Cloud-RAN Networks” and the “Comparative Study of Distributed Consensus-based Estimation Schemes for Small-Cell Networks” by UoB were presented. In addition, the invited paper “Decoder Implementation for Cloud Based Architectures” by UoB, CEA and NEC was presented in the “Mobile Cloud Infrastructures and Services (MCIS)” workshop at EuCNC. Furthermore, the paper “Benefits and Impact of Cloud Computing on 5G Signal Processing” by UoB, NEC, TUD, SCBB, and CEA was accepted for the special issue “Signal Processing for the 5G Revolution” of IEEE Signal Processing Magazine and will be published in November 2014. A paper of IMC got accepted for presentation at ISWCS 2014 and UoB and TUD submitted papers for Globecom’2014.

In the **eight quarter** of the project, the second deliverable “D2.2 Definition of PHY layer approaches that are applicable to RANaaS and a holistic design of backhaul and access network” was finalized and delivered in due time. The possible functional splits were identified, the size of the messages for forwarding the payload and the signalling information were derived, and the principle properties per split were discussed for uplink and downlink processing. The impact of a virtualized implementation for the function blocks precoder and decoder was discussed and for two forward error correction decoding algorithms their implementation on the RANaaS cloud platform as well as performance results were presented. For each WP2 candidate technology the deliverable provides a detailed technical description including its implementation in the iJOIN architecture, the specification of the backhaul messages, and performance evaluations. In order to prepare the overall evaluation, the parameters for two evaluation scenarios were defined. The partners in WP2 participated in the plenary virtual meeting. In particular, updates per CT per presented and the interaction of CTs was discussed. The principle steps for determining the payload size per functional split was explained and the qualitative impact on iJOIN KPIs per CT was addressed. The partners in WP2 continued to publish their results on conferences and journals. At ISWCS a joint paper of IMC and TUD was presented. UoB submitted a paper proposing a new distributed detection approach to SCC’2015, which was accepted for publication. Furthermore, the paper “Benefits and Impact of Cloud Computing on 5G Signal Processing” by UoB, NEC, TUD, SCBB, and CEA was published as part of the special issue “Signal Processing for the 5G Revolution” of the IEEE Signal Processing Magazine in November 2014.

The **ninth quarter** of the project focused on final implementation of CTs and performance evaluation. In particular, for the project wide analysis the scenarios were implemented and initial results were achieved. Furthermore, the table of content of the third deliverable “D2.3 Final definition and evaluation of PHY layer approaches for RANaaS and joint backhaul-access layer” was defined and initial input was provided. The partners in WP2 participated in the plenary meeting in Milan. In particular, the status of CTs and the interaction of CTs were discussed in order to prepare the project wide analysis. The partners in WP2 continued to publish their results on conferences and journals. TUD prepared a paper about quantizer optimization for imperfect fronthaul submitted to IEEE Communication Letters and IMC submitted a paper dealing with distributed precoding to ICC. A joint paper of TUD, NEC, TI and UoB on the requirements of fronthaul and backhaul for Cloud RAN was submitted to the IEEE Wireless Communications Magazine. Furthermore, some WP2 partners contributed to the IEEE Communications Magazine paper discussing the benefits and challenges of virtualization in 5G networks. At IEEE Globecom, UoB presented a paper on in-network-processing algorithms.

The **tenth quarter** of the project was devoted to the final evaluation of the candidate technologies and to the finalization of deliverable D2.3. For each the CT the final implementation was specified and detailed performance evaluations applying the parameters of the common scenarios were conducted. These performance results were applied for the intra WP evaluation and were also partly used as input for the project wide analysis in D5.3. This evaluation indicated the promising set of novel PHY layer technologies for the different scenarios and the results demonstrated the gains achievable by these CTs. In addition to these evaluations, D2.3 provided also an update of the logical and functional architecture and numerical results for the lower layer functional split options utilizing the harmonized parameters. The partners in WP2 participated in the plenary meetings in Bremen and Dresden. The final evaluation and the finalization of D2.3 were the main topics of these meetings. Furthermore, part of WP2 results were presented at the iJOIN Winter School and the results of the functional split analysis was a topic of a joint teleconferences of iJOIN and officials of the Small Cell Forum. The partners in WP2 continued also to publish their results on conferences and journals. Papers presenting their joint PHY and MAC performance evaluations were submitted by SAGEMCOM to IEEE GLOBECOM 2015 and by CEA to IEEE SPAWC, respectively. In addition, UNIS submitted a journal contribution for the computational constrained cluster size optimization to IEEE Transactions on Wireless Communications. A revision of the submitted IEEE Communications Magazine paper discussing the benefits and challenges of virtualization in 5G networks was provided as well.

Task	Status	Variance	Cause/Way-Forward	Expected deadlines	Affected Partners
Task 2.1	Concluded	No delays or changing of topics	N.A.	IR2.1 and IR 2.2 delivered on time. D2.1, D2.2 and D2.3 delivered on time.	None
Task 2.2	Concluded	No delays or changing of topics	N.A.	see above	None
Task 2.3	Concluded	No delays or changing of topics	N.A.	see above	None

### 2.2.2 Task 2.1: PHY requirements and scenarios

First quarter:

Partner	Achievements Milestones Work items in progress
CEA	<ul style="list-style-type: none"> <li>Participation to WP2 Kickoff meeting in November 2012</li> <li>Attendance to WP2 bi-weekly phone calls</li> <li>Contribution to the definition of PHY requirements and scenarios</li> <li>Contribution to IR2.1: State of the art on cooperative MIMO channel models for LTE Rel. 10 (ongoing)</li> </ul>
IMC	<ul style="list-style-type: none"> <li>Attendance to the kick-off meeting and participation in the discussions</li> <li>Participation to WP2 bi-weekly phone calls</li> <li>Contribution to the definition and discussion of the WP2 use cases, scenarios, and requirements</li> </ul>
SCBB	<ul style="list-style-type: none"> <li>Attend kick-off meeting in Madrid (22,23/11/12)</li> <li>Attend the periodic WP2 phone calls</li> <li>Definition of scenarios and use cases to be investigated in WP2 (started)</li> </ul>
TI	<ul style="list-style-type: none"> <li>Participation to the Kick Off meeting and call conferences</li> <li>Focus on fiber transmission</li> <li>Contribution to IR2.1 in SoTA for KPIs definition available at</li> </ul>

<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP periodic phone calls</li> <li>• Authoring contribution to deliverable IR2.1</li> <li>• SoTA research on wireless backhaul</li> <li>• Scenario definition for two serial links</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attendance at the kick-off meeting, presentation of UNIS planned work and participation in the technical discussions.</li> <li>• Further detailing of UNIS topics in WP2.</li> <li>• Scenario definition for technical work on Coordinated Multipoint Transmission (COMP) with constrained and dynamic backhaul</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Definition of UoB topics within WP2</li> <li>• Definition of specific requirements and typical scenarios for cooperative reception by INP</li> </ul>

Second quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Attendance of bi-weekly phone calls</li> <li>• Contribution to assumption and requirements for WP2.</li> <li>• Contribution to IR2.1: finish to write the state of the art on cooperative MIMO channel models for LTE Rel.10</li> <li>• Update/Corrections of Sections 3.1.3, 3.2.3, 3.3.3, and 4.3 of IR2.1 document</li> <li>• Participation to the F2F meeting in Heidelberg</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attend general assembly meeting in Heidelberg (20-22/03/13)</li> <li>• Attend the periodic WP2 phone calls</li> <li>• Definition of scenarios and use cases to be investigated in WP2 (ongoing)</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend general assembly meeting in Heidelberg (20-22/03/13)</li> <li>• Attend the periodic WP2 phone calls</li> <li>• Definition of scenarios and use cases to be investigated in WP2 (ongoing)</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the Heidelberg meeting and to the WP specific call conferences</li> <li>• Finalisation of IR2.1</li> <li>• Contribution to the definition of the use cases together with WP5</li> <li>• In cooperation with T2.3 comparison of BH capacity with respect to traditional fibre transmission schemes</li> <li>• Requirements for different RATs and alternatives in splitting functionalities</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in plenary meeting in Heidelberg.</li> <li>• Participation in bi-weekly telephone conferences.</li> <li>• Defining assumptions and requirements for WP2</li> <li>• Contributions to IR 2.1.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attended iJOIN meeting in Heidelberg and contributed to refining the scope and focus of WP2 research topics especially the split of work between T2.2 and T2.3</li> <li>• Assumptions and technology requirements are provided for UNIS technical scenario CT2.4 in Section 4.4 of IR2.1</li> <li>• Mapped the Requirements and Assumptions of the UniS candidate technology to the WP5 use cases</li> <li>• Contributed in functional split table for CT2.4 i.e., related to DL CoMP</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Research on SotA for IR2.1, update of CT description, and review of selected sections.</li> <li>• Internal review of IR2.1 as WPL.</li> <li>• Collection and harmonisation of assumptions and requirements of all WP2 candidate technologies.</li> <li>• Common template for assumptions and requirements for WP2/WP3/WP4.</li> </ul>

Third quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Meetings/phone confs: <ul style="list-style-type: none"> <li>- Attendance of bi-weekly phone calls</li> <li>- Participation to the F2F meeting in Surrey</li> <li>- Participation to virtual meetings</li> </ul> </li> <li>• Contribution to Input/output for WP2.</li> <li>• Contribution to the I/O with logical network entity and parameters.</li> <li>• Start writing the contribution for D2.1 (ongoing)</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attending regular WP2 phone calls</li> <li>• Attending the Surrey meeting</li> <li>• Contribution in CT interaction related document input / output signals for the proposed CT with identification of sources and sinks.</li> <li>• Preparation and discussion for structure and timeline of D2.1. Some initial editorial work already started</li> <li>• Contribution to functional split of the proposed CT.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend general assembly meeting in Guildford (26-28/07/13).</li> <li>• Attend the periodic WP2 phone calls</li> <li>• Definition of scenarios and use cases to be investigated in WP2 (ongoing)</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the Guildford meeting and to the WP specific call conferences</li> <li>• Finalisation of IR2.1 and first drafting of D2.1</li> <li>• Contribution to the definition of the functional split, and the input and outputs requested by the proposed CT together with WP5</li> <li>• In cooperation with T2.3 comparison of BH capacity with respect to traditional fiber transmission schemes</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Participation in Surrey meeting.</li> <li>• Contributions to D2.1.</li> <li>• Investigation on heterogeneous backhaul technologies resulting in publication.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Finalised IR2.1 as its editor helped in the internal review and made the document available for submission to the EU in time.</li> <li>• Contributed to the discussion on the functional split / architecture document from the perspective of UniS candidate technology CT2.4</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Final update of IR2.1.</li> <li>• Preparation of Functional Architecture document and definition of input / output signals for INP.</li> <li>• Consolidation and Harmonization of Functional Architecture document and CT/WP interactions.</li> <li>• Preparation and discussion of structure of D2.1.</li> </ul>

Fourth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Attendance of bi-weekly phone calls and minutes.</li> <li>• Contribution to D2.1. <ul style="list-style-type: none"> <li>• Corrections and suggestions for the introduction (sect. 1), executive summary (sect. 2) and conclusion (sect. 7)</li> <li>• Correction and suggestions of the CT 2.4 (sect 3.2.4, 4.4, 6.2.4)</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• Modification of our contributions (sect 3.2.3, 4.3, 6.2.3, 6.3.1)</li> <li>• Modification and harmonisation of the Input/Output definition (sect. 5.1)</li> <li>• Participation to the Virtual meetings.</li> <li>• Preparation of slides for the virtual meeting for our CT2.3 held on 29/10/2013.</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Participation in virtual meeting.</li> <li>• Editorship of deliverable D2.1.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend virtual meeting (24-25/09/13)</li> <li>• Attend the periodic WP2 phone calls</li> <li>• Definition of scenarios and use cases to be investigated in WP2 (ongoing) <ul style="list-style-type: none"> <li>◦ 2 iSCs with 2 (edge) UEs on the same resources in an Indoor environment (CS4)</li> </ul> </li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the Virtual Meeting and to the WP specific call conferences</li> <li>• Finalisation of D2.1</li> <li>• Contribution to the definition of the functional split, and the input and outputs requested by the proposed CT</li> <li>• Editing of Section 6 in D2.1 on Functional Split</li> <li>• Contribution in D2.1.</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Participation in virtual meeting.</li> <li>• Contributions to D2.1.</li> </ul>
<b>UNIS</b>	<ul style="list-style-type: none"> <li>• Participated in regular bi-weekly WP2 telcos, as well as WP2 virtual meeting on 29th Oct. 2013</li> <li>• Attended iJOIN Virtual Plenary meeting in Sep. 2013 and presented UNIS candidate technology CT2.4 (scenarios, requirements, inputs, outputs) to all partners including initial results</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Finalisation of Functional Architecture document and specification of input / output signals for CT2.1.</li> <li>• Rewriting CT2.1 description for D2.1.</li> <li>• Complete review of D2.1 as WPL.</li> <li>• Extension of SotA sections in D2.1.</li> </ul>

Fifth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Attendance of bi-weekly phone calls</li> <li>• Participation to the Virtual meetings</li> <li>• Prepare ppt for CT to represent current status</li> <li>• Elaboration of the link to WP3 CTs, on going</li> <li>• Update figures for CT2.3</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation to WP2 Telcos on biweekly basis.</li> <li>• Preparation of CT2.5 status slides for Turin meeting.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend general assembly meeting in Turin (26-28/11/13)</li> <li>• Attend the periodic WP2 phone calls</li> <li>• Definition of scenarios and use cases to be investigated in WP2 (ongoing) <ul style="list-style-type: none"> <li>◦ 2 iSCs with 2 (edge) UEs on the same resources in an Indoor environment (CS4)</li> </ul> </li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the Virtual Meeting and to the WP specific call conferences</li> <li>• Participation to the Plenary Meeting</li> <li>• Editorial responsibility of IR2.2</li> <li>• Update of the CT 2.6</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Participation in Turin meeting 26-28 Nov 2013.</li> </ul>



	<ul style="list-style-type: none"> <li>• Participation in WP2 virtual meetings.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Participated in regular bi-weekly WP2 telcos, as well as iJOIN Plenary meeting in Turin in Nov. 2013 and discussed the way forward for WP2 research in the Reporting Period 2 as well as the preparation of Audit Slides.</li> <li>• Held a telco with IMC to coordinate and collaborate UNIS and IMC work on downlink CoMP and explored the opportunities of Joint Work.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Preparation of plenary meeting in Turin as WPL.</li> <li>• Preparation of CT2.1 status slides for Turin meeting.</li> <li>• Participation in IWPC 2013 with presentation.</li> </ul>

### 2.2.3 Task 2.2: Joint backhaul and radio access design

First quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Participation to WP2 Kickoff meeting in November 2012</li> <li>• Attendance to WP2 bi-weekly phone calls</li> <li>• Contribution to the definition of PHY requirements and scenarios</li> <li>• Contribution to IR2.1: State of the art on cooperative MIMO channel models for LTE Rel. 10 (ongoing)</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attendance to the kick-off meeting and participation in the discussions</li> <li>• Participation to WP2 bi-weekly phone calls</li> <li>• Contribution to the definition and discussion of the WP2 use cases, scenarios, and requirements</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Attend kick-off meeting in Madrid (22,23/11/12)</li> <li>• Attend the periodic WP2 phone calls</li> <li>• Definition of scenarios and use cases to be investigated in WP2 (started)</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the Kick Off meeting and call conferences</li> <li>• Focus on fiber transmission</li> <li>• Contribution to IR2.1 in SoTA for KPIs definition available at</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP periodic phone calls</li> <li>• Authoring contribution to deliverable IR2.1</li> <li>• SoTA research on wireless backhaul</li> <li>• Scenario definition for two serial links</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attendance at the kick-off meeting, presentation of UNIS planned work and participation in the technical discussions.</li> <li>• Further detailing of UNIS topics in WP2.</li> <li>• Scenario definition for technical work on Coordinated Multipoint Transmission (COMP) with constrained and dynamic backhaul</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Definition of UoB topics within WP2</li> <li>• Definition of specific requirements and typical scenarios for cooperative reception by INP</li> </ul>

Second quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Preparation of a ppt file illustrating the proposed CT.</li> <li>• Provide input for the functional split assignment document.</li> <li>• Review of Section 4.2 (CT2.2) of the IR2.1 document</li> <li>• Detailed and extensive analysis of different state of the art solutions for JNCC</li> </ul>

	<ul style="list-style-type: none"> <li>Start the development of a simulation chain that will integrate both state of the art and the proposed solution for JNCC</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>Analysis of the 3GPP Downlink PHY Layer (ongoing)</li> <li>Literature study on dynamic clustering and interference cancellation (ongoing)</li> <li>Update of the proposed CT in IR2.1.</li> <li>Contribution to IR2.1 (DL PHY, SoTA for CoMP strategies).</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>Analysis of the 3GPP uplink modulation &amp; coding scheme (ongoing)</li> <li>State of the art on the turbo-detection principle (ongoing)</li> <li>Contribution to IR2.1 (§3.1.2.1, §3.1.2.2, §3.2.1, §4.2).</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>Participation the Heidelberg meeting and to the WP specific call conferences</li> <li>Finalisation of IR2.1</li> <li>Functional split work in coordination with the other partners, with particular focus on frequency domain transmission</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>Analysis of channel models for LTE RAN and mmWave backhaul (ongoing)</li> <li>Development of joint link model for access and backhaul (ongoing)</li> <li>Analysis of functional split between access and backhaul.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>Attendance and participation in WP2 bi-weekly tele-conferences and provided updated of T2.2 and also IR2.1 as its editor</li> <li>Following contributions were made to IR2.1: <ul style="list-style-type: none"> <li>a) Contribution in providing state of the art description about CoMP and ICIC techniques in Section 3.2.2 of IR2.1</li> <li>b) Introduction, executive summary and conclusion are provided in Sections 1, 2 and 6 of IR 2.1, respectively</li> <li>c) Contributions in providing state of the art literature for the wireless and backhauling in Section 3.3.2 of IR2.1</li> <li>d) Harmonisation of all the sections as editor of IR2.1 to produce stable version of IR2.1 and make available for internal reviews</li> <li>e) Addressing comments of internal reviewers along with individual section contributors and providing a clean and stable document ready for external review</li> </ul> </li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>Coordination of WP2 work including organisation, moderation and wrap-up of biweekly phone conferences</li> <li>Preparation of poster and presentation at Workshop on Smart Antennas (WSA) in Stuttgart, Germany.</li> <li>Preparation of Heidelberg meeting as WPL.</li> <li>Preparation &amp; attendance of WP2 meeting in Heidelberg.</li> <li>Research on In-Network-Processing algorithms under non-perfect and constrained communication conditions (to be published in future conference paper)</li> <li>Initiation of discussion on functional split in WP2.</li> <li>Moderating ongoing discussion on functional split in WP2 using harmonized functional blocks.</li> </ul>

Third quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>Meetings/phone confs: <ul style="list-style-type: none"> <li>- Attendance of bi-weekly phone calls</li> <li>- Participation to the F2F meeting in Surrey</li> <li>- Participation to virtual meetings</li> </ul> </li> <li>Contribution to Input/output for WP2.</li> <li>Contribution to the I/O with logical network entity and parameter.</li> <li>Start writing the contribution for D2.1 (ongoing)</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>Attending regularly WP2 biweekly telephone calls</li> </ul>

	<ul style="list-style-type: none"> <li>Defining the functional split for the proposed CT on ICIC</li> <li>Attending the WP2 meetings in Guildford</li> <li>Preparation of four papers: 2 appear in IEEE ICC 2013 and two in IEEE ISIT 2013</li> <li>Further study on State of the art for CoMP related techniques and possible cloud implementations</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>Analysis of the 3GPP uplink modulation &amp; coding scheme (ongoing)</li> <li>Implementation of the 3GPP uplink modulation &amp; coding scheme (started) <ul style="list-style-type: none"> <li>MCS for Rel.10 PUSCH on AWGN channel</li> </ul> </li> <li>State of the art on the turbo-detection principle (ongoing)</li> <li>Definition of input/output for our Candidate Technology (CT2.2) w.r.t to its integration within iJOIN architecture (started).</li> <li>Analysis of the functional split of our Candidate Technology (CT2.2), definition of the scenarios (started).</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>Participation to the Guildford meeting and to the WP specific call conferences</li> <li>Drafting of D2.1</li> <li>Functional split work in coordination with the other partners, and especially with the proposed work on wireless BH</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>Participation in WP2 bi-weekly phone calls.</li> <li>Participation in Surrey meeting</li> <li>Contributions to D2.1.</li> <li>Investigation of I/Q stream backhauling with mmWave technology, resulting in publication.</li> <li>Participation and presentation in WP2 virtual meetings</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>Attended the iJOIN meeting in Surrey and participated in discussions and presented the UNIS contribution in WP2 meeting</li> <li>Attended the bi-weekly teleconferences for WP2</li> <li>Contribution to the consolidated document about the I/O requirements.</li> <li>Attended three virtual meetings and delivered presentation about the progress of CT 2.4 in the virtual meeting on 22-07-2013.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>Coordination of WP2 work including organization, moderation and wrap-up of biweekly phone conferences</li> <li>Coordination of WP2 virtual meetings and participation</li> <li>Preparation of template to investigate options for functional split per CT and definition of functional split options for INP.</li> <li>Preparation of Guildford meeting as WPL.</li> <li>Preparation &amp; attendance of WP2 meeting in Guildford.</li> <li>Preparation of paper on In-Network-Processing for CLEEN '13 workshop.</li> <li>Preparation of paper on In-Network-Processing submitted to Globecom IWCPM '13 workshop.</li> <li>Presentation of CT2.1 in WP2 virtual meeting.</li> <li>Algorithmic work on In-Network Processing algorithms (to be published in future)</li> </ul>

Fourth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>Implementation of the transmission chain of the Joint Network-Channel Coding for the Multiple Access Relay Channel</li> <li>Optimisation of the whole system (codes, network coding)</li> <li>Simulation results for different scenarios for the proposed CT</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>Participation in WP2 bi-weekly phone calls.</li> <li>Participation in WP2 virtual meeting</li> </ul>

	<ul style="list-style-type: none"> <li>• Contributions to D2.1.</li> <li>• Investigation of Precoder in the cloud.</li> <li>• Investigations for the split precoder implementation in the cloud and small cells.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Analysis of the 3GPP uplink modulation &amp; coding scheme (done)</li> <li>• Implementation of the 3GPP uplink modulation &amp; coding scheme (ongoing) <ul style="list-style-type: none"> <li>○ MCS for Rel.10 PUSCH simulated on AWGN channel</li> </ul> </li> <li>• State of the art on the turbo-detection principle (done)</li> <li>• Link-level simulation tool chain development (started) <ul style="list-style-type: none"> <li>○ 2 iSCs, 2 UEs setup <ul style="list-style-type: none"> <li>▪ Rayleigh channel model (started)</li> </ul> </li> <li>○ Rel.10 MCS integration (started)</li> <li>○ Baseline receiver <ul style="list-style-type: none"> <li>▪ MMSE-IRC (started)</li> </ul> </li> <li>○ Single Point Turbo Detection <ul style="list-style-type: none"> <li>▪ No iSC cooperation (started)</li> <li>▪ iSC cooperation (not started)</li> </ul> </li> <li>○ Multi Point turbo detection (started)</li> </ul> </li> <li>• Simulation of candidate technology CT2.2 (started) <ul style="list-style-type: none"> <li>○ First results in deliverable D2.1</li> </ul> </li> <li>• Contribution to D2.1 (in particular sect. 3.2.1, sect. 4.2, sect. 5, sect. 6.1, sect. 6.2.2)</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the Virtual Meeting and to the WP specific call conferences</li> <li>• Finalisation of D2.1</li> <li>• Functional split work in coordination with the other partners, and especially with the proposed work on wireless BH</li> <li>• Contribution in D2.1.</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls</li> <li>• Participation in WP2 virtual meeting.</li> <li>• Contributions to D2.1.</li> <li>• Contributions to white paper “Benefits and Impact of Cloud Computing on 5G Signal Processing</li> <li>• Investigation of noise resilient decoders for joint access and backhaul (ongoing)</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Coordination of WP2 work including organisation, moderation and wrap-up of biweekly phone conferences</li> <li>• Coordination of WP2 virtual meetings and participation</li> <li>• Organisation of joint WP2/WP6 virtual meeting on decoder@cloud implementation.</li> <li>• As WPL: Harmonisation of CT inputs/outputs and requirements, specification of exchanged information for D2.1.</li> <li>• Description of CT2.1 functional split options for D2.1.</li> <li>• Organisation and preparation of virtual plenary meeting as WPL.</li> <li>• Preparation of technical presentation for WP2 virtual plenary meeting and participation therein</li> <li>• Preparation of final paper on In-Network-Processing accepted at Globecom IWCPM ‘13 workshop.</li> <li>• Preparation of paper on In-Network Processing to be submitted to WSA 2014.</li> <li>• Research on novel In-Network Processing Algorithms (to be published in future paper)</li> <li>• Preparation of White Paper “Benefits and Impact of Cloud Computing on 5G Signal Processing”, IEEE Signal Processing Magazine.</li> </ul>
<b>UNIS</b>	<ul style="list-style-type: none"> <li>• Prepared a document on Precoder@Cloud and refined the document after discussions and several iterations with IMC and WP2 leader UoB. It was later merged in to D2.1 in Section 6.3.2.</li> <li>• Contributed to WP2 Functional Architecture Input / Output document from the perspective of UNIS CT2.4. The document was later merged with D2.1.</li> <li>• Contributed to WP2 deliverables D2.1 in Section 3.2 as its editor and partner contributor to 3.2.2 on StoA on CoMP; section 4.4 where UNIS CT2.4 is described in detail including the results; Section 6.2.4 where functional split options for CT2.4 are</li> </ul>

	<p>described; and finally to Section 6.3.2 as contributor on Percoder@Cloud implementation options.</p> <ul style="list-style-type: none"> <li>• Took part in review of D2.1 namely sections 6.1 and 6.3.</li> </ul>
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Fifth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Simulations of transmissions by using the simulation platform implementing the Joint Network-Channel Coding for the Multiple Access Relay Channel in order to have a better insight on the used channel/network codes.</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Progress on the CT, getting more scenarios addressed. Simulator development. Trying to incorporate more information theoretic aspect in the problem formulation.</li> <li>• Presented the latest development in Virtual Meeting on 4<sup>th</sup> of December.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Implementation of the 3GPP uplink modulation &amp; coding scheme (ongoing) <ul style="list-style-type: none"> <li>○ MCS for Rel.10 PUSCH simulated on AWGN channel</li> </ul> </li> <li>• Link-level simulation tool chain development (ongoing) <ul style="list-style-type: none"> <li>○ 2 iSCs, 2 UEs setup <ul style="list-style-type: none"> <li>▪ Rayleigh channel model (ongoing)</li> </ul> </li> <li>○ Rel.10 MCS integration (ongoing)</li> <li>○ Baseline receiver <ul style="list-style-type: none"> <li>▪ MMSE-IRC (ongoing)</li> </ul> </li> <li>○ Single Point Turbo Detection <ul style="list-style-type: none"> <li>▪ No iSC cooperation (ongoing)</li> <li>▪ iSC cooperation (not started)</li> </ul> </li> <li>○ Multi Point Turbo detection (ongoing)</li> </ul> </li> <li>• Simulation of candidate technology CT2.2 (ongoing)</li> <li>• Provide input to prepare the 1<sup>st</sup> Audit</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the Virtual Meeting and to the WP specific call conferences</li> <li>• Participation to the Plenary Meeting</li> <li>• Editorial responsibility of IR2.2</li> <li>• Update of the CT 2.6</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Participation in Turin meeting 26-28 Nov 2013.</li> <li>• Contributions to white paper “Benefits and Impact of Cloud Computing on 5G Signal Processing</li> <li>• Investigation of noise resilient decoders for joint access and backhaul (ongoing)</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Coordination of WP2 work including organization, moderation and wrap-up of biweekly phone conferences</li> <li>• Coordination of WP2 virtual meetings and participation</li> <li>• Moderation of WP2 session in Turin meeting as WPL.</li> <li>• Draft definition of WP2 working document.</li> <li>• Preparation of WP2 input for first periodic report.</li> <li>• Preparation and participation in technical review as WPL.</li> <li>• Presentation of paper at Globecom IWCPM ‘13 workshop.</li> <li>• Preparation of final version paper accepted at WSA 2014.</li> <li>• Preparation of paper for IEEE Signal Processing Magazine.</li> <li>• Research on novel In-Network Processing algorithms (to be published in future paper)</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Discussed the scope of work for Percoder@Cloud with Dirk (WP2 leader) and Peter (Project TM) and also liaised with Paul from IMC in order to address the project requirement of General Purpose Hardware computing at the Cloud. UNIS and IMC will jointly address this issue by considering outdated of CSI caused by computational jitter of GP HW and its corresponding impact on CoMP performance.</li> <li>• Held several in house meetings to further advance UNIS work on DL CoMP; it has</li> </ul>

	<p>been decided two directions will be pursued; first one a continuation of existing work on theoretical investigations based upon original plan; secondly we will also assess the possibility of some simulations study for DL CoMP modelling so that practical hardware imperfections caused by real clouds can be taken into account.</p> <ul style="list-style-type: none"> <li>• Updated the CT2.4 with all the latest updates as well as editable figures.</li> <li>• After discussions with Dario, a joint WP2-WP5 activity has been initiated, in which UNIS will work to extend the power models of EARTH project in order to include energy spent on wireless backhauling as well as cloud processing. This activity will also include publishing the result in a magazine paper.</li> </ul>
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Sixth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Attendance of bi-weekly phone calls (minutes in the folder WP2/telco)</li> <li>• Attendance of WP2 virtual meeting</li> <li>• Participation to the F2F meeting in Grenoble</li> <li>• Participation to the iJOIN IR2.2, definition of the iJOIN WP2 CT evaluation framework</li> <li>• Implementation and investigation of several joint network channel coding designs, including (1) different constructions of the bit-interleaver placed between channel and network codes, and (2) different structures of the network-coding graph (using binary or non-binary codes, possibly coupled with a repeat-accumulate structure). Simulations have been run to assess the performance of the proposed designs. Results have been reported in the internal report IR2.2.</li> <li>• C/C++ implementation of (1) a multi-codeword LDPC decoder and (2) a parallel LDPC decoder for multiprocessor/multicore platforms. Multithreading implemented by using Message Passing Interface (MPI) and Open Multi-Processing (OpenMP). Simulations have been run to assess the achievable throughput and to investigate the scalability with respect to the number of processors and/or cores. Results have been reported in the internal report IR2.2.</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Participation in Grenoble meeting 01-03 Apr 2014.</li> <li>• Contribution to IR2.2</li> <li>• Participation in WP2 virtual meetings.</li> <li>• Derivation of new analytical results relative to the performance of distributed precoding with imperfectly shared channel state information.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend general assembly meeting in Grenoble (01-03/04/14)</li> <li>• Attend the periodic WP2 phone calls</li> <li>• Implementation of the 3GPP uplink modulation &amp; coding scheme (done) <ul style="list-style-type: none"> <li>○ MCS for Rel.10 PUSCH simulated on AWGN channel</li> </ul> </li> <li>• Link-level simulation tool chain development (ongoing) <ul style="list-style-type: none"> <li>○ 2 iSCs, 2 UEs setup <ul style="list-style-type: none"> <li>▪ Rayleigh channel model (done)</li> <li>▪ ITU-R InH channel model (started)</li> </ul> </li> <li>○ Rel.10 MCS integration (done) <ul style="list-style-type: none"> <li>▪ HARQ implementation (started)</li> </ul> </li> <li>○ Baseline receiver <ul style="list-style-type: none"> <li>▪ MMSE-IRC (done)</li> </ul> </li> <li>○ Single Point Turbo Detection <ul style="list-style-type: none"> <li>▪ No iSC cooperation (ongoing)</li> <li>▪ iSC cooperation (not started)</li> </ul> </li> <li>○ Multi Point Turbo detection (done)</li> </ul> </li> <li>• Simulation of candidate technology CT2.2 (ongoing) <ul style="list-style-type: none"> <li>○ 2 iSCs with 2 (edge) UEs on the same resources in an Indoor environment</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>(CS4) <ul style="list-style-type: none"> <li>○ Symmetric setup (same MCS, Power ...)</li> <li>○ Using ITU-R InH channel model (Baseline vs MPTD)</li> </ul> </li> <li>● Contribution to IR2.2 (in particular §2.2, §3.2, §4.2, §4.4.2, §5.4)</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>● Participation to the F2F Meeting and to the WP specific call conferences</li> <li>● Editorial responsibility of IR2.2</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>● Participation in WP2 bi-weekly phone calls.</li> <li>● Participation in Grenoble meeting 01-03 Apr 2014.</li> <li>● Contribution to IR2.2</li> <li>● Participation in WP2 virtual meetings.</li> <li>● Contributions to magazine article “Benefits and Impact of Cloud Computing on 5G Signal Processing</li> <li>● Contributions to paper “Towards a Flexible Functional Split for Cloud-RAN Networks”</li> <li>● Investigation of noise resilient decoders for joint access and backhaul (ongoing)</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>● Participated in regular bi-weekly WP2 telcos, as well as iJOIN Plenary meeting in Grenoble in April. 2014.</li> <li>● Discussed with IMC offline to coordinate the work on Precoder@Cloud for IR2.2</li> <li>● Under backhaul constraints, theoretical investigations for DL CoMP on achievable rate based on Compress and Forward (CF) relay scheme have been investigated for CT2.4, a conference paper submitted to ICC’14 have been accepted for publication.</li> <li>● On-going work on Precoder@Cloud with practical backhaul constraints (delay). The delay model and how it affects the DL CoMP have been figured out. In the next step, theoretical and numerical work on optimizing the cooperative cluster size in the presence of RANaaS processing and CSI feedback delay will be main focus of investigation.</li> <li>● In the Grenoble meeting, UNIS work in CT2.4 was presented and discussed.</li> <li>● Contribution to IR2.2 in sections 3.4, 4.1.2, 4.4.4.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>● Coordination of WP2 work including organization, moderation and wrap-up of biweekly phone conferences</li> <li>● Preparation and moderation of WP2 session in Grenoble meeting as WPL.</li> <li>● Preparation of CT2.1 status slides for Grenoble meeting.</li> <li>● Preparation of paper “Distributed Consensus-based Estimation for Small-Cell Cooperative Networks” for EuCNC 2014.</li> <li>● Preparation of joint WP2 and WP3 paper “Towards a Flexible Functional Split for Cloud-RAN Networks” for EuCNC 2014.</li> <li>● Research on novel In-Network Processing algorithms</li> <li>● Implementation of 3GPP LTE uplink link level simulation chain (ongoing) and implementation of INP algorithms</li> <li>● Contribution to IR2.2.</li> <li>● Complete review of IR2.2 as WPL.</li> </ul>

Seventh quarter:

<b>Partner</b>	<b>Achievements</b>
	<p><b>Milestones</b></p> <p><b>Work items in progress</b></p>
<b>IMC</b>	<ul style="list-style-type: none"> <li>● Participation in WP2 bi-weekly phone calls.</li> <li>● Participation in Bologna meeting 24-26 June 2014.</li> <li>● Contribution to D2.2</li> <li>● Participation in WP2 virtual meetings.</li> <li>● Development of a new precoding algorithm being robust to distributed CSIT. Development of the interface to apply our algorithm with the TUD backhaul demonstrator.</li> <li>● An accepted paper for WP2 to be presented at ISWCS2014, titled “Robust Precoding</li> </ul>

	for Network MIMO with Hierarchical CSIT”
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Editorship of and contribution to D2.2</li> <li>• Participation in WP2 virtual meetings.</li> <li>• Contributions to magazine article “Benefits and Impact of Cloud Computing on 5G Signal Processing</li> <li>• Investigation of noise resilient decoders for joint access and backhaul and preparation of paper</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Coordination of WP2 work including organization, moderation and wrap-up of biweekly phone conferences</li> <li>• Preparation and moderation of WP2 session in Bologna meeting as WPL.</li> <li>• Preparation of CT2.1 status slides for Bologna meeting.</li> <li>• Preparation of final paper and poster “Comparative Study of Distributed Consensus-based Estimation Schemes for Small-Cell Networks” for EuCNC 2014.</li> <li>• Preparation of final version of joint WP2 and WP3 paper “Towards a Flexible Functional Split for Cloud-RAN Networks” for EuCNC 2014.</li> <li>• Preparation of paper and presentation “Decoder Implementation for Cloud Based Architectures” for EuCNC 2014.</li> <li>• Preparation of paper “Distributed Consensus-based Estimation for Small-Cell Cooperative Networks” for BWA 2014.</li> <li>• Research on novel In-Network Processing algorithms</li> <li>• Implementation of 3GPP LTE uplink link level simulation chain (ongoing) and implementation of INP algorithms</li> <li>• Final Contribution to IR2.2.</li> <li>• Preparation of D2.2.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Participated in regular bi-weekly WP2 telcos.</li> <li>• Attending the iJOIN meeting in Bologna, participation in the discussions and presented UNIS work update in WP2.</li> <li>• Participation in WP2 virtual meetings and presented the idea of optimal cluster size.</li> <li>• On-going work on Precoder@Cloud with practical backhaul constraints. The delay model and how it affects the DL CoMP have been figured out. The theoretical derivation based on random UE and iSC dropping have been done. In the next step, numerical work on optimizing the cooperative cluster size in the presence of RANaaS processing and CSI feedback delay will be main focus of investigation.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend general assembly meeting in Bologna (24-26/06/14)</li> <li>• Attend the periodic WP2 phone calls</li> <li>• Link-level simulation tool chain development (ongoing) <ul style="list-style-type: none"> <li>○ 2 iSCs, 2 UEs setup <ul style="list-style-type: none"> <li>▪ ITU-R InH channel model (ongoing)</li> </ul> </li> <li>○ Rel.10 MCS integration (done) <ul style="list-style-type: none"> <li>▪ HARQ implementation (ongoing)</li> </ul> </li> <li>○ Single Point Turbo Detection <ul style="list-style-type: none"> <li>▪ No iSC cooperation (ongoing)</li> <li>▪ iSC cooperation (not started)</li> </ul> </li> </ul> </li> <li>• Simulation of candidate technology CT2.2 (ongoing) <ul style="list-style-type: none"> <li>○ 2 iSCs with 2 (edge) UEs on the same resources in an Indoor environment (CS4)</li> <li>○ Symmetric setup (same MCS, Power ...)</li> <li>○ Using ITU-R InH channel model (Baseline vs MPTD)</li> </ul> </li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Attendance of bi-weekly phone calls</li> <li>• Preparation of one session of Virtual Meeting</li> <li>• Prepare ppt for CT to represent current status</li> <li>• Prepare ppt for the evaluation methodology and common parameters</li> <li>• Redaction of the IR2.2 and redaction of the D2.2</li> <li>• Simulations of several transmission schemes by using the link level evaluation platform chain of the Joint Network-Channel Coding for the Multiple Access Relay Channel.</li> </ul>



	<p>Different strategies at the relaying and destination small cell have been considered</p> <ul style="list-style-type: none"> <li>• Run simulations for the multi-codeword LDPC on the RANaaS testbed provided by UoB.</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the F2F Meeting and to the WP specific call conferences</li> <li>• Contribution to D2.2</li> <li>• Participation in WP2 virtual meetings.</li> </ul>

Eighth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Coordination of WP2 work including organization, moderation and wrap-up of biweekly phone conferences</li> <li>• Preparation and moderation of WP2 session in Virtual Meeting as WPL.</li> <li>• Preparation of CT2.1 status slides for Virtual Meeting.</li> <li>• Preparation of WP2 session in Milan meeting as WPL.</li> <li>• Preparation of final version of paper “Distributed Consensus-based Estimation for Small-Cell Cooperative Networks” for BWA workshop at Globecom 2014.</li> <li>• Research on novel In-Network Processing algorithms</li> <li>• Preparation of paper “Distributed Augmented Lagrangian Method for Cooperative Estimation in Small Cell Networks” submitted to SCC 2015.</li> <li>• Implementation of 3GPP LTE uplink link level simulation chain (ongoing) and implementation of INP algorithms</li> <li>• Complete review of D2.2 as WPL</li> <li>• Final Contribution to D2.2.</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Implementation of CT 2.5 in the millimeter wave backhaul simulator</li> <li>• Participation in virtual meeting and presentation in WP2 for the proposed CT</li> <li>• Paper for WP2 was presented at ISWCS2014, titled “Robust Precoding for Network MIMO with Hierarchical CSIT”</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Participated in regular bi-weekly WP2 telcos.</li> <li>• Participation in WP2 virtual meetings and presented evaluation results</li> <li>• On-going work on Precoder@Cloud with practical delay constraints. The analytical work on optimizing the cooperative iSC number in a veNB in the presence of RANaaS processing and CSI feedback delay has been investigation and reported in D2.2. A journal paper based upon this work is currently being prepared.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend virtual meeting (30/09-01/10/14)</li> <li>• Attend the periodic WP2 phone calls</li> <li>• Link-level simulation tool chain development (ongoing) <ul style="list-style-type: none"> <li>○ 2 iSCs, 2 UEs setup <ul style="list-style-type: none"> <li>▪ ITU-R InH channel model (done)</li> </ul> </li> <li>○ Rel.10 MCS integration <ul style="list-style-type: none"> <li>▪ HARQ implementation (ongoing)</li> </ul> </li> <li>○ Single Point Turbo Detection <ul style="list-style-type: none"> <li>▪ No iSC cooperation (ongoing)</li> <li>▪ iSC cooperation (not started)</li> </ul> </li> </ul> </li> <li>• Simulation of candidate technology CT2.2 (ongoing) <ul style="list-style-type: none"> <li>○ 2 iSCs with 2 (edge) UEs on the same resources in an Indoor environment (CS4)</li> <li>○ Symmetric setup (same MCS, Power ...)</li> <li>○ Using ITU-R InH channel model (Baseline vs MPTD)</li> <li>○ Impact of HARQ considered</li> </ul> </li> <li>• Contribution to D2.2 (in particular §3.3, §3.4, §4.2)</li> </ul>

<b>CEA</b>	<ul style="list-style-type: none"> <li>• Attendance of bi-weekly phone calls (minutes in the folder WP2\telco)</li> <li>• Participation in virtual F2F meeting 30 September – 01 October: <ul style="list-style-type: none"> <li>◦ Prepare ppt for CT to present current status</li> <li>◦ Prepare ppt to present CT categorization and common topics (decoder@cloud)</li> </ul> </li> <li>• Contribution to deliverable D2.2 (Sections 3.2.2, 4.3)</li> <li>• Review of deliverable D2.2 (Sections 3.1, 4.2, Appendix 1)</li> <li>• Simulations of several transmission schemes by using the link level evaluation platform chain of the Joint Network-Channel Coding for the Multiple Access Relay Channel. Different strategies at the relaying and destination small cell have been considered.</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the WP specific call conferences</li> <li>• Analysis and derivation of formulas for BH throughput calculation of most promising PHY functional splits</li> <li>• Contribution to D2.2</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Editorship of and contribution to D2.2</li> <li>• Contributions to magazine article “Benefits and Impact of Cloud Computing on 5G Signal Processing</li> <li>• Investigation of noise resilient decoders for joint access and backhaul and preparation of paper</li> </ul>

Ninth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Coordination of WP2 work including organization, moderation and wrap-up of biweekly phone conferences.</li> <li>• Preparation and moderation of WP2 session in Milan Meeting as WPL.</li> <li>• Preparation of plenary status slides for Milan Meeting.</li> <li>• Presentation of paper “Distributed Consensus-based Estimation for Small-Cell Cooperative Networks” on BWA workshop at Globecom 2014.</li> <li>• Research on novel In-Network Processing algorithms</li> <li>• Preparation of final version of paper “Distributed Augmented Lagrangian Method for Cooperative Estimation in Small Cell Networks” accepted at SCC 2015.</li> <li>• Contribution to IEEE Communications Magazine paper “Benefits and Challenges of Virtualization in 5G Radio Access Networks”</li> <li>• Contribution to IEEE Wireless Communications Magazine paper “Fronthaul Requirements for a Flexible Functional Split in Cloud Radio Access Networks”</li> <li>• Implementation of 3GPP LTE uplink link level simulation chain (ongoing) and implementation of INP algorithms</li> <li>• Coordination of project wide evaluation results.</li> <li>• Work on D2.3 as editor.</li> <li>• Contribution to D2.3.</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Update of simulator to get the simulation results to be used for the inputs in D2.3 for the common scenarios under harmonized assumptions</li> <li>• Preparation for the contributions to D2.3</li> <li>• Provided the slides for the Milan Meeting for the proposed CT.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Participated in regular bi-weekly WP2 telcos.</li> <li>• Participation in WP2 face to face meeting (11-03/11-06) and presented evaluation results</li> <li>• Contribution to D2.3</li> </ul>

	<ul style="list-style-type: none"> <li>The analytical work on optimizing the cooperative iSC number in a veNB in the presence of RANaaS processing and CSI feedback delay has been investigated and reported in D2.2. Initial evaluation results have been provided to verify the effectiveness of the proposed approaches in D2.2. A journal paper based upon this work is about to submit.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>Attend the periodic WP2 phone calls</li> <li>Link-level simulation tool chain development (ongoing) <ul style="list-style-type: none"> <li>ITU-R Urban Micro channel model (started) <ul style="list-style-type: none"> <li>For project-wide evaluation</li> </ul> </li> <li>Single Point Turbo Detection <ul style="list-style-type: none"> <li>No iSC cooperation (ongoing)</li> <li>iSC cooperation (started)</li> </ul> </li> </ul> </li> <li>Simulation of candidate technology CT2.2 <ul style="list-style-type: none"> <li>2 iSCs with 2 (edge) UEs on the same resources in an Indoor environment (CS4) (ongoing) <ul style="list-style-type: none"> <li>Symmetric setup (same MCS, Power ...)</li> <li>Using ITU-R InH channel model (Baseline vs MPTD)</li> </ul> </li> <li>2 iSCs with 2 (edge) UEs on the same resources in an Outdoor environment (CS1 &amp; 3) (started) <ul style="list-style-type: none"> <li>Symmetric setup (same MCS, Power ...)</li> <li>Using ITU-R UMi channel model</li> </ul> </li> </ul> </li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>Participation in WP2 bi-weekly phone calls.</li> <li>Participation in Milan meeting.</li> <li>Contribution to D2.3</li> <li>Contributions to magazine article “Fronthaul Requirements for a Flexible Functional Split in Cloud Radio Access Networks”</li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>Attendance of bi-weekly phone calls</li> <li>Participation to the Milan F2F meeting</li> <li>Started work on the evaluation of the area throughput for CT2.3 in the square scenario. Area throughput achieved for different BH characteristics (in-band/out-band backhauling, various BH data rates) and different transmission strategies (pure relaying, JNCC) are currently being investigated. Results will be included in Deliverable D2.3.</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>Participation to the WP specific call conferences</li> <li>Contribution to D2.3</li> </ul>

Tenth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>Attendance of bi-weekly phone calls</li> <li>Participation to the Bremen F2F meeting (webex)</li> <li>Participation to the Dresden F2F meeting (webex)</li> <li>Work on the evaluation of the area throughput for CT2.3 in the square scenario. Area throughput achieved for different BH characteristics (in-band/out-band backhauling, various BH data rates) and different transmission strategies (pure relaying, JNCC) were investigated and results are included in deliverable D2.3.</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>Participation to the Bremen F2F meeting and contribution to WP2 slide set</li> <li>Participation in WP2 bi-weekly phone calls.</li> <li>Refinement of the contributions to D2.3</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>Coordination of WP2 work including organization, moderation and wrap-up of biweekly phone conferences.</li> <li>Preparation and moderation of WP2 session in Bremen Meeting as WPL.</li> <li>Preparation of plenary status slides for Bremen Meeting.</li> <li>Preparation and moderation of WP2 session in Dresden Meeting as WPL</li> </ul>

	<ul style="list-style-type: none"> <li>• Research on novel In-Network Processing algorithms</li> <li>• Presentation of paper “Distributed Augmented Lagrangian Method for Cooperative Estimation in Small Cell Networks” at SCC 2015</li> <li>• Finalization of 3GPP LTE uplink link level simulation chain and implementation of INP algorithms</li> <li>• Preparation and contribution of simulation results for evaluation of CT2.1 for D2.3</li> <li>• Coordination of WP2 project wide evaluation results.</li> <li>• Final Contribution to D2.3.</li> <li>• Work on D2.3 as editor, including complete review.</li> <li>• Contribution to the revision of the IEEE Communications Magazine paper “Benefits and Challenges of Virtualization in 5G Radio Access Networks”.</li> <li>• Contribution to paper “Implementation and Analysis of Forward Error Correction Decoding for Cloud-RAN Systems” for ICC IWCPM ‘13 workshop.</li> <li>• Contribution to IEEE Wireless Communications Magazine paper “Fronthaul Requirements for a Flexible Functional Split in Cloud Radio Access Networks”.</li> <li>• Contribution to IEEE Transactions on Wireless Communications paper “Performance Analysis and Optimal Cooperative Cluster Size for Randomly Distributed Small Cells under Cloud RAN Benefits and Challenges of Virtualization in 5G Radio Access Networks”.</li> <li>• Preparation and participation in telco with Small Cell Forum.</li> <li>• Presentation of talk “PHY Processing for Small Cell Cooperative Networks” at iJOIN Winter School summarizing WP2 topics.</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Participation in Bremen meeting.</li> <li>• Participation in iJOIN winter school.</li> <li>• Participation in and organization of Dresden meeting.</li> <li>• Contribution to D2.3</li> <li>• Contributions to magazine article “Fronthaul Requirements for a Flexible Functional Split in Cloud Radio Access Networks”</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Participated in regular bi-weekly WP2 telcos.</li> <li>• Participation in WP2 face to face meeting and iJOIN school (23/02-27/02) in Bremen</li> <li>• Participation in WP2 face to face meeting (15/04-17/04) in Dresden.</li> <li>• Contribution to D2.3</li> <li>• The analytical work on optimizing the cooperative iSC number in a veNB in the presence of RANaaS processing and CSI feedback delay has been submitted to IEEE Transactions on wireless communications.</li> <li>• Performed external review of D2.3</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the WP specific call conferences</li> <li>• Contribution to D2.3</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Attend the periodic WP2 phone calls</li> <li>• Attend General Assembly (Bremen)</li> <li>• Contribution to D2.3</li> <li>• Link-level simulation tool chain development (done) <ul style="list-style-type: none"> <li>○ ITU-R Urban Micro channel model (done)</li> </ul> </li> <li>▪ For project-wide evaluation <ul style="list-style-type: none"> <li>○ Single Point Turbo Detection</li> </ul> </li> <li>▪ No iSC cooperation (done)</li> <li>▪ iSC cooperation (stopped, lack of time)</li> <li>• Simulation of candidate technology CT2.2 <ul style="list-style-type: none"> <li>○ 2 iSCs with 2 (edge) UEs on the same resources in an Indoor environment (CS4) (done)</li> </ul> </li> <li>▪ Symmetric setup (same MCS, Power ...)</li> <li>▪ Using ITU-R InH channel model (Baseline vs MPTD) <ul style="list-style-type: none"> <li>○ 2 iSCs with 2 (edge) UEs on the same resources in an Outdoor environment (CS1 &amp; 3) (done)</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>▪ Symmetric setup (same MCS, Power ...)</li> <li>▪ Using ITU-R UMi channel model</li> </ul>
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### 2.2.4 Task 2.3: Efficient backhauling for RANaaS

First quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the Kick Off meeting and call conferences</li> <li>• Description of Frequency Domain radio over fibre transmission, seen as viable option for fibre backhauling/fronthauling</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attendance to the kick-off meeting and participation in the discussions</li> <li>• Participation to WP2 bi-weekly phone calls</li> <li>• Started detailing different work-items for Task 2.3.</li> <li>• Started state-of-the-art study for in-band relaying based backhaul.</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP periodic conferences</li> <li>• Authoring contribution to deliverable IR2.1</li> </ul>

Second quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Literature study on wireless backhaul – Backhaul enabled through relays (ongoing)</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the Heidelberg meeting and to the WP specific call conferences</li> <li>• Finalisation of IR2.1</li> <li>• Study on capacity enhancement method for transmission over fiber BH links and BH fundamental parameters definition</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Analysis of FEC performance for joint access and backhaul link (ongoing)</li> <li>• Analysis of compression techniques for backhaul links (ongoing)</li> </ul>

Third quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls</li> <li>• Attending F2F in Surrey</li> <li>• Study of SOTA and problem formulation for wireless backhaul</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the Guildford meeting and to the WP specific call conferences</li> <li>• Drafting of D2.1</li> <li>• Focus on fibre frequency domain backhauling/fronthauling definition, including possible alternatives related to different functional splits in the transceiver chain</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Participation in Surrey meeting.</li> <li>• Contributions to D2.1.</li> <li>• Investigation of joint coding on RAN and mmWave BH links (ongoing, first results in D2.1):</li> </ul>

Fourth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Participation in WP2 virtual meeting.</li> <li>• Contributions to D2.1.</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the Virtual Meeting and to the WP specific call conferences</li> <li>• Finalisation of D2.1</li> <li>• Focus on fibre frequency domain backhauling/fronthauling definition, including possible alternatives related to different functional splits in the transceiver chain</li> <li>• Contribution in WP2 virtual meeting.</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Participation in WP2 virtual meeting.</li> <li>• Contributions to D2.1.</li> </ul>

Fifth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• For the proposed CT, trying to evaluate efficient backhaul content.</li> <li>• Coordinating the action item for physical layer constraints on the backhaul.</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the Virtual Meeting and to the WP specific call conferences</li> <li>• Participation to the Plenary Meeting</li> <li>• Editorial responsibility of IR2.2</li> <li>• Preparation of a Virtual Meeting on backhauling work</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Participation in Turin meeting 26-28 Nov 2013.</li> <li>• Contributions to WP2 audit presentation.</li> <li>• Investigation of joint coding for access and backhaul (ongoing)</li> </ul>

Sixth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Participation in Grenoble meeting 01-03 Apr 2014.</li> <li>• Contribution to IR2.2</li> <li>• Participation in WP2 virtual meetings.</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the WP specific call conferences</li> <li>• Participation to the Plenary Meeting</li> <li>• Editorial responsibility of IR2.2</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Participation in Grenoble meeting 01-03 Apr 2014.</li> <li>• Contribution to IR2.2</li> <li>• Participation in WP2 virtual meetings.</li> <li>• Introduction of an soft-input/soft-output dequantizer for improved BH (ongoing)</li> <li>• Development of mmWave BH model for WP6 API</li> </ul>

Seventh quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the WP specific call conferences</li> <li>• Contributions to backhaul evaluation</li> <li>• Contribution to D2.2</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Participation in Bologna meeting 24-26 June 2014.</li> <li>• Contribution to D2.2</li> <li>• Participation in WP2 virtual meetings.</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Contribution to D2.2</li> <li>• Participation in WP2 virtual meetings.</li> <li>• Introduction of an soft-input/soft-output dequantizer for improved BH, reported in D2.2</li> <li>• Contributions to backhaul evaluation</li> <li>• Investigations of mapping user throughput to area throughput</li> </ul>

Eighth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the WP specific call conferences</li> <li>• Participation in iJOIN virtual meeting</li> <li>• Contribution to D2.2</li> <li>• Contribution to backhaul classification</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Contribution to D2.2</li> <li>• Participation in virtual meeting.</li> <li>• Evaluation of improved receivers for joint access/BH (ongoing, partially reported in D2.2)</li> </ul>

Ninth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Participation in Milan meeting.</li> <li>• Contribution to D2.3</li> <li>• System level evaluation of joint coding schemes, partially reported in D2.3</li> <li>• Preparation of paper "Quantizer optimization for Cloud-based Mobile Networks with Imperfect Fronthaul"</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the WP specific call conferences</li> <li>• Contribution to D2.3</li> </ul>

Tenth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP2 bi-weekly phone calls.</li> <li>• Participation in Bremen meeting.</li> <li>• Participation in iJOIN winter school.</li> <li>• Participation in and organization of Dresden meeting.</li> <li>• Contribution to D2.3</li> <li>• System level evaluation of joint coding schemes, reported in D2.3</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the WP specific call conferences</li> <li>• Participation to the Bremen F2F meeting (via webex)</li> <li>• Participation to the Dresden F2F meeting (via webex)</li> <li>• Contribution to D2.3</li> </ul>

## 2.3 WP3: Holistic MAC/RRM Design for Backhaul and Access

### 2.3.1 Summary

In the **first quarter**, the work started during the preparation of the kick-off meeting in Madrid, where partners presented as well as discussed the different topics they want to contribute. Topics were assigned to iJOIN objectives and tasks, and initial synergies between different partners were identified. Furthermore, responsibilities for tasks leaders and deliverable editors as well as editorial and administrative procedures were defined. The work on IR 3.1 has started with a table of contents, and assignment of sections and subsections on state-of-the-art and scenario descriptions to partners. The state-of-the-art section addressed LTE including and beyond Rel. 10, MAC-layer radio resource management techniques, backhaul technologies from MAC perspective, cloud RAN as well as for cloud platforms. For scenario definitions a template was created to capture the characteristics, interdependencies and contribution of each scenario. Nine different scenarios were identified, where some of them are joint scenarios between different partners. Synchronisation between partners is on-going to finalise these scenarios. After the kick-off meeting, regular phone conferences were held for status synchronisation regarding IR 3.1, status updates of the different tasks as well as administrative issues. In Task 3.3, University of Surrey submitted an article on “Graph-based Multi-cell Scheduling for Weighted Capacity Maximization in Small Cells” to the IEEE Transactions on Wireless Communications.

In the **second quarter** of the project the partners described their respective CTs in more detail, specifying architectural and deployment assumptions and the applicability of CTs to common scenarios. The assumptions for the individual CTs were used to create a common set of assumptions within WP3, which then was used as input for WP5 for further work on the logical iJOIN architecture. Furthermore, starting from the WP3 meeting in Heidelberg, an initial evaluation of the impact of functional split on system functions was conducted. Results were presented at the Heidelberg meeting and included in IR 3.1. In this context, a contribution by HP introduced a first description of how the RANaaS concept can be realized on common cloud platforms, creating the notion of a “virtual eNB”. In parallel, work on the functional architecture of iJOIN started by collecting input and output requirements of the individual CTs, which was used to define interfaces for the functional and logical iJOIN architecture. The first internal report of WP3 work, IR 3.1, was finalised in time, containing state of the art, description of nine CTs, a common set of assumptions as well as a first evaluation of the functional split impact.

In the **third quarter**, WP3 continued to work towards a comprehensive description of a functional architecture for functional placement and interaction of CTs and 3GPP system functions. In a first step, partners contributed the I/O parameters of their respective CTs which were then used in a second step to create a consolidated table of I/O parameters in.



In a further step, sinks and source of information was added such that relationships between CTs and system functions as well as between WPs can be defined. Furthermore, WP3 continued to work on investigating the implications of functional split and functional decomposition on various system aspects, such as interfaces, potentially implementation, etc. For this purpose, partners investigated different options for function placement of their CTs.

Furthermore, partners started to investigate the impact of functional split on some system functions (segmentation/link control, inter-cell RRM, cell selection) in detail. The draft deliverable D3.1 was created a new ToC was agreed and implemented, including new sections on functional architecture and functional split. WP3 contributed to iJOIN dissemination activities with an accepted paper titled “A Backhaul-Aware Cell Selection Algorithm for Heterogeneous Cellular Networks” at IEEE PIMRC ‘13, and by contributing to two papers accepted at the Future Networks Mobile Summit 2013 in Lisboa, Portugal. Furthermore, IMDEA submitted an article to Elsevier Ad Hoc Networks.

In the **fourth quarter** of the project, WP3 continued to work towards a comprehensive description of the iJOIN RRM/MAC functions to enhance the current 3GPP radio access network. Accordingly the interactions of the different candidate technologies were identified and presented. In particular the required inputs, the provided outputs, the exchange of information within CTs, and the exchange of measurements amongst the iJOIN functional entities and 3GPP system functions were described. Henceforth, a stable version of the WP3 functional architecture was provided which also includes the interactions with WP2 and WP4. The result of this work is described in details in D3.1 and serves as the basis for further investigations and to enable fruitful interactions amongst WPs. Beside the functional architecture, WP3 continued to investigate the possible functional split options for each RRM/MAC CT. In particular, achievable gains due to the centralised processing, computational effort and backhaul/latency requirements were qualitatively evaluated. Furthermore partners investigated in detail how to realise the functional split for system functions which are essential for the radio access architecture on the example of cell selection, inter-cell RRM, and segmentation/reassembly protocols. First assessments on implementing these functions in the RANaaS were accomplished and are described in D3.1 as well. The deliverable “D3.1 Final report on MAC/RRM state-of-the-art, Requirements, scenarios and interfaces in the iJOIN architecture” was finalised and delivered in time.

In the **fifth quarter** of the project, WP3 participated in the plenary meeting in Torino from November 26<sup>th</sup> to 28<sup>th</sup>, and presented results of first year in the 1<sup>st</sup> technical review of the project on January, 15<sup>th</sup> 2014. WP3 focused the technical work on progress the concept of the flexible functional split, and on creating comparable results for individual CTs based on the achievements in D3.1. For the functional split, an initial framework for applying functional split options across WPs and CTs was drafted. The framework was based on a unified view of minimal centralisation requirements for different CTs as one factor, and took into account dependencies to lower layers as well as backhaul characteristics. The framework was presented in the 1<sup>st</sup> technical review. Furthermore, WP3 created a draft table of contents for intermediate report IR 3.2. In close collaboration with the other technical work packages, common standard evaluation scenarios were developed to be used to evaluate CTs such that performance gains could be objectively measured for the iJOIN target objectives. Partners in WP3 contributed to the presentation for the 1<sup>st</sup> technical review. Status slide sets for each CT was updated following the last plenary meeting in Torino.

In the **sixth quarter** of the project, WP3 focused on the finalization of IR 3.2. The main features of this intermediate report included updates on candidate technologies, further details on design and integration aspects of the virtual eNodeB, and a draft common evaluation model to be used by all partners within WP3. The candidate technology update included the progress since D3.1, including initial preliminary results. Additionally, the methodology for the evaluation of the CTs was detailed and the next steps towards the deliverable D3.2 were listed. Furthermore, IR 3.2 focused on the virtual eNodeB (veNB) concept; specifically the impact on the CTs as well as the general concept of functional split was discussed. In addition to this, practical issues like the implementation of the RANaaS part of a veNB on cloud infrastructure and the constraints imposed by compatibility with existing 3GPP standards were discussed. Finally, IR 3.2 included a fully harmonized draft model for common evaluations between different candidate technologies. The model was based on standardized 3GPP evaluation scenarios, and was adapted and enhanced by iJOIN-specific parameters, e.g. in order to capture the impact of different backhaul configurations. Partners in WP3 participated in the plenary meeting in Grenoble from April 1st to 3rd, presenting novel results and discussing functional split, virtual eNodeB and common evaluation scenarios.

In the **seventh quarter** of the project, the technical content and the structure of the deliverable D3.2 was prepared. The interaction of WP3 CTs was analysed to explore the compatibility and interoperability of

approaches and corresponding performance gains. A compatibility matrix based on well-defined criteria has been prepared and was used as input for WP5. Furthermore, WP3 initiated the creation of a per-hop table of BH technology characteristics, which will be completed in co-operation with WP2, WP4 and WP5 in the next quarter. Additionally, WP3 partners finalized the definition of the common evaluation scenarios and started implementing the scenarios in their evaluation tools. WP3 continued to work on aspects of the functional split and the virtual eNodeB in the course of completing IR 3.2. All partners in WP3 participated in the plenary meeting in Bologna in June 2014. The main focus was on the discussion of the interactions of the WP3 CTs, the backhaul analysis, the finalization of common evaluation scenarios, and the table of contents and expected contributions for D3.2. The partners in WP3 continued to publish their results on conferences and journals. At EuCNC 2014 in Bologna the joint WP3 / WP2 paper “Towards a Flexible Functional Split for Cloud-RAN Networks” was presented. In addition, the papers “Energy Saving Enhancement for LTE-Advanced Heterogeneous Networks with Dual Connectivity”, “The Role of Computational Outage in Dense Cloud-Based Centralized Radio Access Network” and “Robust Proportional Fair Scheduling with Imperfect CSI and Fixed Outage Probability” were accepted at IEEE VTC Fall 2014, IEEE GLOBECOM 2014, and IEEE PIMRC 2014.

In the **eight quarter** of the project, the main focus of the work was on the finalization of Deliverable D3.2, with a focus on refinement and further analysis of the iJOIN architecture and the integration of CTs therein, as well as on numerical results. In D3.2, a methodological framework for deriving functional split configurations within the scope of WP3 was derived. This framework considered different input factors such as backhaul capabilities, 3GPP constraints and requirements on latency as well as the required centralization of RAN functions for specific CTs. A detailed analysis of the benefits and disadvantages of different functional split options for the RAN protocol stack was conducted and used to derive a set of preferred functional splits in the overall project as well as for global evaluation purposes. Furthermore, implementation aspects of the virtual eNodeB concept into the RANaaS platform were analysed. Numerical results for all CTs were derived and included in D3.2, as well as message sequence charts to integrate CTs into the overall iJOIN architecture. D3.2 was reviewed and delivered according to the established time plan. One virtual meeting and a physical plenary meeting were conducted, both focusing on progressing work on D3.2 and on creating a methodology for an overall evaluation in D3.3 and other WPs.

In the **ninth quarter** of the project, the main focus was on the final implementation evaluation of CTs. Methodologies for internal WP3 evaluation and for a project-wide analysis of CTs were developed. In parallel, the structure and table of contents of the final deliverable D3.3 was defined. WP3 partners participated in the plenary meeting in Milan, where the before mentioned aspects were effectively worked on. WP3 partners continued their dissemination activities, with contributions to a joint IEEE Communication Magazine article on virtualization in 5G networks, and with submission to IEEE VTC and IEEE ICC.

In the **tenth quarter**, WP3 concentrated fully on the final evaluation of candidate technologies, as well as on the finalization of deliverable D3.3. The CT evaluation was conducted by all partners within scheduled timeframe with the planned scenarios and parameter ranges. The evaluation results were harmonized within WP3, and were used partially as input for the system-wide evaluation in deliverable D5.3. The individual CT description and evaluation sections in D3.3 were updated with the newly created results and findings. A thorough review of the whole D3.3 deliverable, both internally and externally, was conducted; resulting comments were addressed and incorporated into the document by all partners. Furthermore, the RANaaS cloud architecture was finalized and contributed to D5.3 in close collaboration with WP5 and other work packages. The evaluation as well as the finalization of D3.3 was the main point of attention in two plenary meetings in Bremen and in Dresden. Additionally, WP3 partners presented to the iJOIN winter school event in Dresden. WP3 also organized a joint teleconference between iJOIN and Small Cell Forum officials and delegates, with the purpose to synchronize on RAN functional assumptions and results. In parallel, WP3 contributed in collaborative work to two papers for the European Conference on Networks and Communications, and two papers submitted to IEEE GLOBECOM 2015

Task	Status <sup>1</sup>	Variance <sup>2</sup>	Cause/Way-Forward <sup>3</sup>	Expected deadlines <sup>4</sup>	Affected Partners <sup>5</sup>
<b>Task 3.1</b>	Concluded	No delays or changing of topics	N.A.	IR3.1 and IR 3.2 delivered on time. D3.1, D3.2 and D3.3 delivered on time.	None
<b>Task 3.2</b>	Concluded	No delays or changing of topics	N.A.	see above	None
<b>Task 3.3</b>	Concluded	No delays or changing of topics	N.A.	see above	None

### 2.3.2 Task 3.1: Requirements, scenarios and interfaces of RRM and MAC functions in the iJOIN RANaaS architecture

First quarter:

Partner	Achievements Milestones Work items in progress
<b>CEA</b>	<ul style="list-style-type: none"> <li>Participation to WP3 Kickoff meeting in November 2012</li> <li>Participation to WP3 regular phone calls</li> <li>Contribution to the definition of scenarios and use cases</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>Participation to kick-off meeting</li> <li>Participation to WP periodic conferences</li> <li>Authoring contribution to deliverable IR3.1, in particular authoring section 3.5 (state of art of cloud platforms' technical compliance with respects to LTE architectures)</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>Attendance to the KO meeting and discussion participation</li> <li>Participation to WP3 bi-weekly phone calls</li> <li>Contribution to the definition and discussion of the WP3 use cases and requirements</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>Attendance to the KO meeting and discussion participation</li> <li>Participation to WP3 bi-weekly phone calls</li> <li>Contribution to the definition and discussion of the WP3 use cases, scenarios, and requirements</li> <li>Edition and contribution to IR3.1 template</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>Coordination of WP3 work (incl. regular phone calls)</li> <li>Preparation of WP3 KO meeting in Nov'12</li> <li>Set up of WP3 working document, collecting initial input for scenarios and use cases</li> <li>Harmonisation with WP2/WP4/WP5 (common templates, avoiding redundant work, ...)</li> <li>RAN/Cloud tutorial with HP to agree on common language, expectations, ...</li> <li>Definition of relevant use cases and scenarios</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>Attend kick-off meeting in Madrid (22,23/11/12)</li> <li>Attend the periodic WP3 phone calls</li> <li>Definition of scenarios and use cases to be investigated in WP3 (started)</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>Attending the kick-off meeting / participation in the discussions and presented planned UNIS work in WP3.</li> <li>Attendance of WP3 bi-weekly tele-conferences.</li> <li>Contribution to deliverable IR3.1: Defining the UniS technical scenarios (in sections 4.1, 4.3, 4.5).</li> </ul>

<b>UoB</b>	<ul style="list-style-type: none"> <li>• Contribution to use cases/scenarios</li> <li>• Initial investigation of specific requirements and typical scenarios for cooperative reception by INP in the MAC context</li> <li>• Initial contribution to IR3.1</li> </ul>
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Second quarter:

<b>Partner</b>	<b>Achievements Milestones Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Contribution to deliverable IR3.1: Description / Assumptions / Requirements for CT 3.2, 3.3 and, 3.5.</li> <li>• Contribution to the definition of RAN functionalities that can be split/moved from standard eNBs to the iJOIN RANaaS</li> <li>• Participation to the F2F meeting in Heidelberg</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation to meeting in Heidelberg</li> <li>• Participation and contribution to all the WP periodic conferences</li> <li>• Contribution to deliverable IR3.1: Co-authoring with NEC of section 4.6 (CT 6: Assess and increase utilisation and energy efficiency); added reference to IR5.1; Small refinements to section 3.5; Peer review of the deliverable final version</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attending regular biweekly WP3 telcos</li> <li>• Defined the proposed use case in detail with corresponding assumptions, requirements and functional split</li> <li>• IR3.1 contributions for SoTA on functional split for cloud based RAN networks</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to the Heidelberg meeting and participation in the discussions.</li> <li>• Participation to WP3 bi-weekly phone calls</li> <li>• Contribution to the definition and discussion of the WP3 use cases, scenarios, and requirements</li> <li>• Contribution to the analysis of the L2 functionalities that can be split between eNB and RANaaS.</li> <li>• Editor responsibility of deliverable IR3.1.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Coordination of WP3 work (incl. regular phone calls)</li> <li>• Preparation/attendance of WP3 meeting in March '13</li> <li>• Harmonisation with WP2/WP4/WP5 (common templates, avoiding redundant work, ...)</li> <li>• Harmonised mappings of WP3 CTs to common scenarios</li> <li>• Harmonised definition of assumptions in WP3 scope</li> <li>• Initiation of discussion on functional split in WP3; creation of corresponding slides</li> <li>• Creation of consolidated initial functional split assessment</li> <li>• Creation of SoTA section 3.1 in IR 3.1</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend general assembly meeting in Heidelberg (20-22/03/13).</li> <li>• Attend the periodic WP3 phone calls</li> <li>• Definition of scenarios and use cases to be investigated in WP3 (ongoing)</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attending the iJOIN meeting in Heidelberg / participation in the discussions and presented planned UNIS work in WP3</li> <li>• Attendance of WP3 bi-weekly tele-conferences</li> <li>• Contribution to deliverable IR3.1: Updating the UniS technical scenarios (in sections 4.1, 4.3, 4.5)</li> <li>• Discussion on the Requirements and Assumptions for the UniS technical scenarios and matching them to the WP5 use cases</li> <li>• Contribution to functional split table: Defining the L2 QoS Management function.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Definition of CT Assumptions and Requirements for IR3.1.</li> <li>• Participation in Heidelberg meeting</li> <li>• Update of CT description in IR3.1.</li> </ul>

	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences</li> </ul>
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Third quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Editor of the deliverable D3.1</li> <li>• Contribution to deliverable D3.1: Sections 5 and 6.</li> <li>• Participation to the F2F meeting in Surrey</li> <li>• Participation to the WP3 bi-weekly phone-conferences</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation to F2F meeting in Guildford</li> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Contribution to deliverable IR3.1. In particular: <ul style="list-style-type: none"> <li>○ Authoring of chapter 3.5</li> <li>○ Authoring of chapter 4.6</li> <li>○ Internal peer review</li> </ul> </li> <li>• Contribution to discussion on functional architecture. In particular: <ul style="list-style-type: none"> <li>○ Introduction and development of the <i>virtual eNB</i> concept, and its positioning inside the iJOIN architecture</li> <li>○ Related presentation in Guildford meeting</li> </ul> </li> <li>• Start working on deliverable D3.1 (in phase of section assignment)</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attendance of WP3 bi-weekly telephonic calls.</li> <li>• Discussion on the functional split / architecture and I/O for the IMC candidate technology along with corresponding sources and sinks</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to the Guildford meeting and participation in the discussions.</li> <li>• Participation to WP3 bi-weekly phone calls</li> <li>• Contribution to the definition and discussion of the WP3 use cases, scenarios, and requirements</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Definition of functional split options for segmentation/reassembly on PDCP/RRC.</li> <li>• Preparation of plenary meeting in Guildford:</li> <li>• Slides/material for WP3 breakout sessions, GA overview, veNB input.</li> <li>• Coordination of functional architecture activities:</li> <li>• Templates for CT I/O relationship. <ul style="list-style-type: none"> <li>○ Consolidated input across CTs</li> </ul> </li> <li>• Preparation/moderation of bi-weekly phone calls</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend general assembly meeting in Guildford (26-28/07/13).</li> <li>• Attend the periodic WP3 phone calls</li> <li>• Definition of scenarios and use cases to be investigated in WP3 (ongoing)</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attending the iJOIN meeting in Surrey / participation in the discussions and presented UNIS work update in WP3</li> <li>• Provided final contributions to IR3.1 in StoA and UNIS candidate technologies</li> <li>• Attendance of WP3 bi-weekly tele-conferences</li> <li>• Contribution to the first draft of deliverable D3.1, investigating the Inter-cell RRM system function.</li> <li>• Discussion on the functional split / architecture and I/O for the UniS candidate technologies</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Participation in Guildford meeting</li> <li>• Specification of Functional Architecture for CT3.8</li> <li>• Participation in biweekly phone conferences</li> </ul>

Fourth quarter:

<b>Partner</b>	<b>Achievements Milestones Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Editor of the deliverable D3.1</li> <li>• Contribution to deliverable D3.1: Sections 1, 2 , 3, and 5.</li> <li>• Preparation/Participation to the virtual meeting held on 24-09-2013</li> <li>• Participation to the WP3 bi-weekly phone-conferences</li> <li>• Definition of functional split options for cell selection.</li> <li>• Definition of functional WP3 functional interaction model.</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Contribution to deliverable D3.1. In particular: <ul style="list-style-type: none"> <li>○ Authoring of chapter 4.6</li> <li>○ Internal peer review</li> </ul> </li> <li>• Participation at virtual meeting (September 2013)</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Contributions to deliverable D3.1 in sections 4.2, 5.4 and 5.5.1.</li> <li>• Participation in the bi-weekly phone meetings.</li> <li>• Participation to the virtual meeting held on September 2013.</li> <li>• Proposal of the functional split options for cell selection and handover mechanisms.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Update of Section 3.1 (SoTA) in D3.1</li> <li>• Further investigation of functional split options for segmentation/reassembly on PDCP/RRC for D3.1</li> <li>• Coordination of functional architecture activities: <ul style="list-style-type: none"> <li>○ Harmonisation of I/O parameters per CT in WP3</li> <li>○ Definition of parameters for CT 3.4 and completion/refinement for other CTs</li> </ul> </li> <li>• Preparation of virtual plenary meeting: <ul style="list-style-type: none"> <li>○ Slides/material for WP3 breakout sessions, GA overview, veNB input.</li> </ul> </li> <li>• Preparation/moderation of bi-weekly phone calls</li> <li>• Analysis of HARQ, bottlenecks in a Cloud-RAN architecture</li> <li>• Analysis of Semi-deterministic scheduling requirements and bottlenecks</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend virtual meeting (24-25/09/13).</li> <li>• Attend the periodic WP3 phone calls</li> <li>• Definition of scenarios and use cases to be investigated in WP3 (ongoing) <ul style="list-style-type: none"> <li>○ Indoor scenario (CS4)</li> </ul> </li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in virtual meeting.</li> <li>• Investigations on the relation between quantization resolution and backhaul delay</li> </ul>
<b>UNIS</b>	<ul style="list-style-type: none"> <li>• Attending the iJOIN virtual meeting / participation in the discussions and presented UNIS work update in WP3.</li> <li>• Attendance of WP3 bi-weekly tele-conferences.</li> <li>• Contributed to WP3 deliverables D3.1 in Section 3.3 (state-of-the-art); Sections 4.1, 4.5 where UNIS CT3.1 and CT3.5 were described in detail including some preliminary results; Section 5.5 where functional split options for CT3.1 and CT3.5 are described; and finally to Section 5.6.2 as the contributor of the Inter-cell RRM function.</li> <li>• Took part in review of D3.1 namely sections 3.4 and 4.2.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Preparation of technical presentation for virtual meeting.</li> <li>• Participation in virtual meeting and presentation of CT3.8.</li> <li>• Finalisation of Functional Architecture for CT3.8</li> <li>• Participation in biweekly phone conferences</li> <li>• Review of D3.1.</li> </ul>

Fifth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Simulations of transmissions by using the simulation platform implementing the Joint Network-Channel Coding for the Multiple Access Relay Channel in order to have a better insight on the used channel/network codes.</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the Turin meeting (November 2013)</li> <li>• Contribution to deliverable IR3.2 (not direct authoring, mostly internal review)</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attending Biweekly WP3 Telcos.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Preparation/moderation of bi-weekly phone calls</li> <li>• Preparation of plenary meeting in Torino: <ul style="list-style-type: none"> <li>◦ Slides/material for WP3 breakout sessions</li> </ul> </li> <li>• Technical review preparation: <ul style="list-style-type: none"> <li>◦ Preparation of WP3 slides</li> <li>◦ Participation/presentation of WP3 achievements in 1<sup>st</sup> technical review</li> </ul> </li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend general assembly meeting in Turin (26-28/11/13)</li> <li>• Attend the periodic WP3 phone calls</li> <li>• Definition of scenarios and use cases to be investigated in WP3 (ongoing)</li> <li>• Indoor scenario (CS4)</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Turin meeting 26-28 Nov 2013.</li> <li>• Investigations on functional split, requirements</li> <li>• CT working slides</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attending the iJOIN meeting in Turin (25-28/11) / participation in the discussions and presented UNIS work update in WP3.</li> <li>• Attendance of WP3 bi-weekly tele-conferences.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Preparation of slides on functional split aspects of CT3.8 for Turin meeting.</li> <li>• Participation in WP3 session of Turin meeting and presentation of CT3.8.</li> <li>• Participation in biweekly phone conferences</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in the bi-weekly phone meetings.</li> <li>• Participation in Turin meeting 26-28 Nov 2013.</li> <li>• Requirements on functional split.</li> </ul>

### 2.3.3 Task 3.2: Joint access/backhaul RRM and novel backhaul solutions

First quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Initial state-of-the-art research on joint access/backhaul RRM</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to the kick-off meeting and participation in the discussions</li> <li>• Participation to WP3 bi-weekly phone calls</li> <li>• Initial state-of-the-art research on joint access/backhaul RRM</li> <li>• Edition and contribution to IR3.1 template</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Definition of NEC topics within WP3</li> <li>• Initial SotA research on “utilisation efficiency”, “Semi-deterministic/multi-level schedulers”, and existing interfaces (e.g., FAPI)</li> </ul>

<b>UniS</b>	<ul style="list-style-type: none"> <li>Contribution to deliverable IR3.1: Structuring and authoring section 3.3 which encloses the backhaul state-of-the-art literature and key MAC/RRM challenges.</li> <li>Update of central data repository with important references from the state-of-the-art literature regarding the backhaul and MAC/RRM challenges</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>Definition of UoB topics within WP3</li> <li>Preparation and participation in WP3 kick-off meeting</li> <li>Participation in bi-weekly phone calls</li> <li>Research on SotA for “Cloud RAN”</li> <li>Initial contributions to IR3.1</li> </ul>

Second quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>Contribution to deliverable IR3.1: Preparation of Description / Assumptions / Requirements for CT 3.2</li> <li>Development of an algorithm for backhaul aware cell selection in dense small cell environment</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>Research on a distributed algorithm performing resource allocation in a multihop wireless backhaul</li> <li>Editor responsibility of deliverable IR3.1.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>Literature review of approaches related to non-deterministic scheduling, e.g., complex networks, network information flow</li> <li>Definition/description of CT 3.4 on semi-deterministic scheduling</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>Contribution to deliverable IR3.1: Updating section 3.3 which encloses the backhaul state-of-the-art literature and key MAC/RRM challenges</li> <li>On-going work on analysing the Energy Efficient Backhaul Link Scheduling problem, as part of the UniS technical scenario 3.3</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>Research on SotA for IR3.1.</li> <li>Preparation of LTE simulation environment</li> <li>Research on In-Network-Processing Algorithms under non-perfect and constrained communication conditions (to be published in future conference paper)</li> </ul>

Third quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>Editor of the deliverable D3.1</li> <li>Contribution to deliverable D3.1: Section 4.</li> <li>Finalisation of an algorithm for backhaul aware cell selection in dense small cell environment</li> <li>Literature review of backhaul modelling: path loss, energy consumption, etc.</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>Attendance of WP3 bi-weekly telephonic calls.</li> <li>State of the art study on joint radio and backhaul resource allocation in the UL for the proposed candidate technology.</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>Submission of a paper to “Elsevier Ad Hoc Networks”</li> <li>Analysis on different topologies to model the deployment of small cells: rectangular grid, rectangular grid with perturbations, completely random.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>Further literature research for: <ul style="list-style-type: none"> <li>Non-deterministic scheduling</li> <li>Analytical models for scheduling including imperfect CSI, multi-level scheduling, and backhaul latency</li> </ul> </li> </ul>



	<ul style="list-style-type: none"> <li>○ Analytical models for queuing models including SINR, interference, statistics, ...</li> <li>○ Analytical models for scheduling performance, in particular ICIC and CoMP</li> <li>○ Stochastic cellular performance models (stochastic geometry) and their suitability</li> <li>○ Definition of work plan and expected gains for semi-deterministic scheduling (to be included in D3.1) based on literature research</li> <li>○ Further literature research/refinement for utilisation/energy efficiency metrics for RANaaS</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>● On-going work on system model and problem formulation for UniS CT3.1 (BH link scheduling and QoS aware flow forwarding).</li> <li>● On-going work on analysing the Energy Efficient Backhaul Link Scheduling problem, as part of the UniS technical scenario 3.3.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>● Research on extended SotA section for D3.1</li> <li>● Implementation of LTE simulation environment (ongoing)</li> </ul>

Fourth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>● Editor of the deliverable D3.1</li> <li>● Contribution to deliverable D3.1: Sections 1, 2, 3, and 5.</li> <li>● Preparation/Participation to the virtual meeting held on 24-09-2013</li> <li>● Participation to the WP3 bi-weekly phone-conferences</li> <li>● Definition of functional split options for cell selection.</li> <li>● Definition of functional WP3 functional interaction model.</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>● Participation in WP3 bi-weekly phone calls.</li> <li>● Participation in virtual meeting.</li> <li>● Literature study for the proposed CT on resource management.</li> <li>● Contributions to deliverable D3.1.</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>● Contributions to deliverable D3.1 in sections 4.2, 5.4 and 5.5.1.</li> <li>● Participation in the bi-weekly phone meetings.</li> <li>● Research on a novel distributed algorithm for joint access and backhaul resource allocation</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>● Analysis of CT3.4 “Semi-deterministic scheduling” <ul style="list-style-type: none"> <li>○ Literature research</li> <li>○ Proposal of algorithm to avoid bottlenecks</li> <li>○ Analysis of required I/O</li> </ul> </li> <li>● Detailed description of CT 3.4 in D3.1 (incl. architecture discussion)</li> <li>● Investigation on utilisation/energy efficiency in collaboration with HP, output in CT 3.6 in D3.1</li> <li>● Contribution to functional split investigation for CT 3.4 in D3.1</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>● Participation in WP3 bi-weekly phone calls.</li> <li>● Participation in virtual meeting.</li> <li>● Literature Analysis</li> <li>● Investigations on RRM under imperfect CSI conditions - ongoing</li> </ul>
<b>UNIS</b>	<ul style="list-style-type: none"> <li>● On-going work on analysing the BH link scheduling problem and solution framework for UNIS CT3.1 (BH link scheduling and QoS aware flow forwarding).</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>● Work on SotA section for D3.1</li> <li>● Work on CT3.8 description.</li> <li>● Implementation of LTE simulation environment (ongoing)</li> </ul>

Fifth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Simulations of transmissions by using the simulation platform implementing the Joint Network-Channel Coding for the Multiple Access Relay Channel in order to have a better insight on the used channel/network codes.</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attending WP3 virtual meeting.</li> <li>• Formulating the local and central interference control problem in the team decision framework.</li> <li>• Exploring the possibility of coordinating with TUD.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Continued work on functional split requirements (minimal centralisation requirements, cross-CT and WP relations)</li> <li>• Draft definition of joint framework for functional split across CTs</li> <li>• Continued work on utilization efficiency</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Turin meeting 26-28 Nov 2013.</li> <li>• Investigations on functional split, requirements:</li> <li>• Literature Analysis</li> <li>• Investigations on RRM under imperfect CSI conditions - ongoing</li> <li>• CT working slides</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• On-going work on analysing the BH link scheduling problem and solution framework for UniS CT3.1 (BH link scheduling and QoS aware flow forwarding).</li> <li>• Preparation of presentation for CT3.5 for the audit.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Preparation of skeleton for IR3.2 as editor</li> <li>• Participation in WP3 virtual meeting</li> <li>• Creation of a working slideset representing the current state of CT3.8 activities</li> <li>• Implementation of LTE simulation environment (ongoing)</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Turin meeting 26-28 Nov 2013.</li> </ul>

Sixth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Participation to the WP3 bi-weekly phone-conferences</li> <li>• Participation to the iJOIN IR3.2, including new details on CT3.2 and definition of the associated interfaces, definition of the iJOIN WP3 CT evaluation framework</li> <li>• Contribution to a joint WP2/WP3 paper for EUCNC'14</li> <li>• Preparation towards the Grenoble F2F meeting</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Grenoble meeting 01-03 April 2014.</li> <li>• Contribution to IR3.2</li> <li>• CT working slides</li> <li>• Development of a new cooperative approach for the power allocation/scheduling in a two iSCs scenarios based on the statistical information. Evaluation of the performance and comparison with the conventional solutions from the literature.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Further definition of functional split framework and virtual eNodeB role (see paper mentioned below)</li> <li>• Coordination and contribution to joint WP3 paper on functional split accepted at EuCNC</li> </ul>

	<ul style="list-style-type: none"> <li>• Contribution to common evaluation scenarios</li> <li>• Continued work on utilization efficiency</li> <li>• Preparation/moderation of bi-weekly phone calls</li> <li>• Preparation and execution WP3 part of plenary meeting in Grenoble: <ul style="list-style-type: none"> <li>◦ Slides/material for WP3 plenary and breakout sessions</li> </ul> </li> <li>• Support for coordination of common evaluation scenarios</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Grenoble meeting 01-03 April 2014.</li> <li>• Contribution to IR3.2</li> <li>• External review of IR2.2</li> <li>• CT working slides</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attending the iJOIN meeting in Grenoble - participated in the discussions and presented UNIS work update in WP3.</li> <li>• Attendance of WP3 bi-weekly tele-conferences.</li> <li>• Editing/Contribution to Section 4.1 of IR3.2, which discusses the functional split options and key configurations in WP3.</li> <li>• Internal review of IR3.2, sections 3.4, 5.2, 5.3.</li> <li>• Contribution on a joint WP3 paper which was submitted in EuCNC 2014 (accepted).</li> <li>• On-going work on design and implementation of the solution framework for UniS CT3.1 (BH link scheduling and QoS aware flow forwarding).</li> <li>• On-going work on system level simulations for the evaluation of our work in CT3.1.</li> <li>• Contribution to IR3.2 for CT3.1 (section 3.1, 4.4.1).</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Editorship of IR3.2</li> <li>• Preparation of and participation in WP3 session and breakout of Grenoble meeting</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Grenoble meeting 01-03 April 2014.</li> <li>• Contribution to IR3.2</li> <li>• CT working slides</li> <li>• Research on cell selection algorithms with backhaul restrictions (ongoing – expected to submit a paper in May).</li> </ul>

Seventh quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Finalization of IR3.2 as editor</li> <li>• Participation in biweekly phone conferences</li> <li>• Preparation of status slides for Bologna meeting</li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Definition of the iJOIN WP3 CT evaluation framework (definition of the system level parameter)</li> <li>• Participation to the CT categorization</li> <li>• Participation to the WP3 bi-weekly phone-conferences</li> <li>• Finalization of the iJOIN IR3.2</li> <li>• Preparation and participation to the Bologna F2F meeting</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attended iJOIN meeting in Bologna (23-26/6) / participated in the discussions and presented UNIS work update in WP3.</li> <li>• Participated in regular bi-weekly WP3 telcos.</li> <li>• Creation of a proposed ToC / timeline / action points for D3.2. Discussion for the harmonization of the ToC with WP2-4.</li> <li>• Creation / Editing of the initial D3.2 working document (as the main editor).</li> <li>• On-going work on the analysis and implementation of the solution framework for UniS CT3.1 (BH link scheduling and QoS aware flow forwarding).</li> <li>• On-going work on system level simulations for the evaluation of our work in CT3.1.</li> </ul>

<b>NEC</b>	<ul style="list-style-type: none"> <li>• CT interoperability investigation</li> <li>• Contribution to and support for coordination of common evaluation scenarios</li> <li>• Preparation/moderation of bi-weekly phone calls</li> <li>• Preparation and execution of WP3 part of plenary meeting in Bologna: <ul style="list-style-type: none"> <li>◦ Slides/material for WP3 plenary and breakout sessions</li> </ul> </li> <li>• Support for coordination of BH per-hop characteristics</li> <li>• Presentation of joint WP3/WP2 paper on EuCNC in Bologna</li> <li>• Analysis of computational complexity in Cloud-RAN</li> <li>• Derivation of framework for analysing diversity gains in Cloud-RAN</li> <li>• Analysis of BH parameters</li> <li>• Paper on “Energy Saving Enhancement for LTE-Advanced Heterogeneous Networks with Dual Connectivity”</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls</li> <li>• Participation in Bologna meeting 23-26 June 2014.</li> <li>• Contribution to IR3.2</li> <li>• Contribution to D3.2</li> <li>• CT working slides</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Bologna meeting 24-26 June 2014.</li> <li>• Contribution to D3.2</li> <li>• CT working slides</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Bologna meeting 24-26 June 2014.</li> <li>• Contribution to D3.2</li> <li>• Preparation and discussion relative to the common simulator to obtain harmonized simulations results of the proposed algorithm.</li> </ul>

Eighth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Contribution to D3.2</li> <li>• Participation in biweekly phone conferences</li> <li>• Preparation of status slides for virtual meeting</li> <li>• Participation in WP3 session of virtual meeting</li> <li>• Update of status slides for Milan meeting</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attending the iJOIN Virtual meeting (30/9-1/10) / participation in the discussions and presented UNIS work update in WP3.</li> <li>• Attendance at WP3 bi-weekly tele-conferences and discussions on the progress of WP3 and also reported the development of D3.2.</li> <li>• Editor and Reviewer of D3.2.</li> <li>• Final version of D3.2 delivered (30<sup>th</sup> October 2014).</li> <li>• On-going work on the analysis and implementation of the solution framework for UniS CT3.1 (BH link scheduling and QoS aware flow forwarding).</li> <li>• Description and simulation results were presented in the virtual meeting and included in D3.2.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Preparation/moderation of bi-weekly phone calls</li> <li>• Preparation and execution of WP3 part of virtual meeting on 30.9.2014: <ul style="list-style-type: none"> <li>◦ Slides/material for WP3 plenary and breakout sessions</li> </ul> </li> <li>• Preparation and execution of WP3 part of plenary meeting in Milan: <ul style="list-style-type: none"> <li>◦ Slides/material for WP3 plenary and breakout sessions</li> </ul> </li> <li>• Contribution to D3.2: <ul style="list-style-type: none"> <li>◦ System level simulator analysis of computational complexity in Cloud-RAN in</li> </ul> </li> </ul>

	<p>CT3.6</p> <ul style="list-style-type: none"> <li>○ Functional split options analysis and evaluation</li> <li>○ HARQ timing budget analysis at RANaaS platform</li> <li>○ ToC definitions, review, editorial corrections, CT descriptions.</li> </ul> <ul style="list-style-type: none"> <li>● Contribution to overall evaluation and CT comparison framework</li> <li>● Article on “Backhaul-aware Energy Efficient Heterogeneous Networks with Dual Connectivity” accepted at Springer Telecommunication Systems</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>● Participation in WP3 bi-weekly phone calls.</li> <li>● Contribution to D3.2 + Review</li> <li>● CT working slides</li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>● Participation in WP3 bi-weekly phone calls.</li> <li>● Participation in virtual F2F meeting 30 September – 01 October</li> <li>● Contribution to D3.2 (CT description, overall evaluation, and iJOIN architecture):</li> <li>● Update of CT working slides:</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>● Participation in WP3 bi-weekly phone calls.</li> <li>● Participation in Bologna meeting 23-26 June 2014.</li> <li>● Contribution to D3.2:</li> <li>● CT working slides:</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>● Participation in WP3 bi-weekly phone calls.</li> <li>● Participation in virtual meeting and presentation in WP3 for the proposed CT</li> <li>● Contribution to D3.2</li> <li>● Submission of a paper relative to CT 3.9 in ICC2014</li> <li>● Modification of the WP3 to improve the scalability and make the evaluation possible in the iJOIN common scenarios</li> </ul>

Ninth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>UoB</b>	<ul style="list-style-type: none"> <li>● Contribution to D3.3</li> <li>● Participation in biweekly phone conferences.</li> <li>● Preparation of status slides for Milan meeting.</li> <li>● Participation in WP3 session of Milan meeting.</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>● Participation in WP3 bi-weekly phone calls</li> <li>● Participation in Milan meeting.</li> <li>● Contribution to D3.3</li> <li>● CT working slides</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>● Attended the physical meeting (11-03/11-06) in Milan, and presented the update from UniS on WP3</li> <li>● Attendance of WP3 bi-weekly tele-conferences.</li> <li>● Ongoing preparation of one paper for EuCNC 2015</li> <li>● On-going work on the implementation of the solution framework for UniS CT3.1 (BH link scheduling and QoS aware flow forwarding).</li> <li>● Updates and new simulation results were introduced in D3.3.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>● Preparation/moderation of bi-weekly phone calls</li> <li>● WP3 plenary meeting in Milan: <ul style="list-style-type: none"> <li>○ Slides/material for WP3 plenary and breakout sessions</li> </ul> </li> <li>● Input to EuCNC articles</li> <li>● Input to architecture discussion, focus on iJOIN virtual eNodeB controller</li> <li>● Management of WP3 input to project-wide analysis</li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>● Participation to WP3 bi-weekly phone calls.</li> </ul>

	<ul style="list-style-type: none"> <li>• Participation to the Milan F2F meeting</li> <li>• Final assessment of the CT to be included in D3.3</li> <li>• CT working slides</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Contribution to D3.3</li> <li>• CT working slides</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Preparing contributions for D3.3</li> <li>• Update of the local simulator to obtain new results for CT3.9.</li> </ul>

Tenth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Contribution to D3.3</li> <li>• CT working slides</li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Bremen meeting.</li> <li>• Participation in and coordination of Dresden meeting.</li> <li>• Contribution to D3.3</li> <li>• Contribution to EuCNC paper</li> <li>• CT working slides</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation to the Bremen F2F meeting and contribution to WP3 slide set and for system wide results</li> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Refinement of contributions for D3.3 and update as per review comments</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Final contribution to D3.3.</li> <li>• Section 5 editorship of D3.3.</li> <li>• Participation in biweekly phone conferences.</li> <li>• Participation in WP3 session of Bremen meeting</li> <li>• Participation in WP3 session of Dresden meeting</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Preparation/moderation of bi-weekly phone calls</li> <li>• WP3 plenary meeting in Bremen: <ul style="list-style-type: none"> <li>○ Preparation of slides/material for WP3 plenary and breakout sessions in</li> <li>○ Moderation and lead of WP3 breakout session, reporting to plenary sessions</li> </ul> </li> <li>• WP3 plenary meeting in Dresden <ul style="list-style-type: none"> <li>○ Preparation of slides/material for WP3 plenary and breakout sessions in</li> </ul> </li> <li>• Further input to EuCNC articles</li> <li>• Deliverable D3.3: <ul style="list-style-type: none"> <li>○ Editorship of D3.3</li> <li>○ Contributions to several general sections</li> <li>○ Definition of RANaaS cloud architecture in collaboration with WP5 and WP3 partners</li> <li>○ Management of WP3 input to project-wide analysis</li> </ul> </li> <li>• CT 3.6 finalization on utilization efficiency, definition and evaluation of computational-complexity-aware scheduling methods; submission of related paper to IEEE GLOBECOM 2015</li> <li>• Contribution to paper on Cell DTX (CT 3.3), submitted to IEE GLOBECOM 2015</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Bremen meeting.</li> <li>• Participation in and organization of Dresden meeting.</li> <li>• Contribution to D3.3</li> </ul>

	<ul style="list-style-type: none"> <li>• Contribution to EuCNC paper</li> <li>• CT working slides</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attendance of WP3 bi-weekly telcos.</li> <li>• Attended the physical meeting (25-02/27-02) in Bremen, and presented the update from UniS on WP3</li> <li>• Attended the physical meeting (15-04/17-04) in Dresden, and presented the update from UniS on WP3</li> <li>• Contributed to Internal Review of D3.3</li> <li>• Finalised common scenario results for UniS CT3.1 (BH link scheduling and QoS aware flow forwarding).</li> <li>• Updates and new simulation results were introduced in D3.3.</li> </ul>

### 2.3.4 Task 3.3: Development of novel algorithms for MAC and RRM in RANaaS scenarios

First quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Initial survey on MAC/RRM state of the art for radio access</li> <li>• Initial state-of-the-art research on Green RRM and ICIC</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation to kick-off meeting</li> <li>• Participation to WP periodic conferences</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to the kick-off meeting and participation in the discussions</li> <li>• Participation to WP3 bi-weekly phone calls</li> <li>• Initial survey on MAC/RRM and ICIC state of the art for radio access</li> <li>• Edition and contribution to IR3.1 template</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Analysis of 3GPP uplink resource allocation for data channel (started)</li> <li>• Analysis of uplink system-level methodology for LTE system (started)</li> <li>• Analysis of classical (indoor/outdoor) small-cell deployment model (started)</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Development of an ICIC/RRM framework for dense small cell deployments and submission of this work to IEEE TWT after iJOIN approval.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Research on SotA “RRM aspects in the context of cooperative RX processing”</li> </ul>

Second quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Contribution to deliverable IR3.1: Preparation of Description / Assumptions / Requirements for CT 3.2</li> <li>• Development of an algorithm for backhaul aware cell selection in dense small cell environment</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation to meeting in Heidelberg, including part of the presentation on functional split;</li> <li>• Participation and contribution to all the WP periodic conferences</li> <li>• Analysis of possible RANaaS options for MAC layer functions</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Research on a distributed algorithm performing resource allocation and cell selection</li> <li>• Editor responsibility of deliverable IR3.1.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Analysis of 3GPP uplink resource allocation for data channel (ongoing)</li> <li>• Analysis of uplink system-level methodology for LTE system (ongoing)</li> <li>• Analysis of classical (indoor/outdoor) small-cell deployment model (ongoing)</li> </ul>

	<ul style="list-style-type: none"> <li>Contribution to IR3.1 (§4.7, §5, §6.1).</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>Prepared and uploaded presentation slides for the proposed ICIC/RRM framework that was submitted to IEEE TWT</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>First assessment of required interactions of candidate technology with other WPs.</li> </ul>

Third quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>Editor of the deliverable D3.1</li> <li>Contribution to deliverable D3.1: Section 4.</li> <li>Literature review of New Carrier Type based solutions.</li> <li>Research on an algorithm for energy saving in the New Carrier Type framework</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>Participation to F2F meeting in Guildford</li> <li>Participation and contribution to the WP biweekly conferences</li> <li>Contribution to investigation and discussion about applicability of MAC/RRM candidate technologies to functional split towards the RANaaS layer</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>Attendance to the Guildford meeting and participation in the discussions.</li> <li>Start working on contribution to deliverable D3.1</li> <li>Research on a distributed algorithm performing resource allocation and cell selection (ongoing)</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>Analysis of 3GPP uplink resource allocation for data channel (ongoing) <ul style="list-style-type: none"> <li>Rel.10 PUSCH</li> </ul> </li> <li>Analysis of uplink system-level methodology for LTE system (ongoing) <ul style="list-style-type: none"> <li>Specially the ITU-R channel model</li> </ul> </li> <li>Analysis of classical (indoor/outdoor) small-cell deployment model (ongoing)</li> <li>Definition of interworking of our Candidate Technology (CT3.7) within the iJOIN architecture (started).</li> <li>Analysis of the functional split of our Candidate Technology (CT3.7), definition of the scenarios (started).</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>Revision, modifications on the proposed Graph-based ICIC for dense small cells (CT3.5)</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>Research on performance of In-Network-Processing Algorithms under quantized information exchange conditions (to be published in future paper)</li> <li>Setting up document for first assessment of Inter-Cell RRM techniques.</li> </ul>

Fourth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>Editor of the deliverable D3.1.</li> <li>Contribution to deliverable D3.1: Sections 4 and 5.</li> <li>Literature review of New Carrier Type based solutions.</li> <li>Research on an algorithm for energy saving in the New Carrier Type framework</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>Participation and contribution to the WP biweekly conferences</li> <li>Extensive investigation together with NEC about candidate technology 3.6 (utilisation efficiency and energy efficiency in iJOIN)</li> <li>Contribution to deliverable D3.1. In particular: <ul style="list-style-type: none"> <li>Authoring of chapter 6.1</li> </ul> </li> </ul>



	<ul style="list-style-type: none"> <li>○ Authoring of chapter 6.2.6</li> <li>● Participation at virtual meeting with presentation of CT3.6 (September 2013)</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>● Contributions to deliverable D3.1 in sections 4.2, 5.4 and 5.5.1.</li> <li>● Participation in the bi-weekly phone meetings</li> <li>● Research on a centralised algorithm to perform quasi-optimal allocation of radio resources for dense networks</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>● Part of analysis on semi-deterministic scheduling</li> <li>● Analysis of algorithms to solve HARQ-lock when splitting between PHY and MAC <ul style="list-style-type: none"> <li>○ Literature research (in particular coding such as Gallagher)</li> </ul> </li> <li>● Analysis of existing algorithms (in particular outage analysis)</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>● Analysis of 3GPP uplink resource allocation for data channel (done) <ul style="list-style-type: none"> <li>○ Rel.10 PUSCH</li> </ul> </li> <li>● Analysis of uplink system-level methodology for LTE system (ongoing) <ul style="list-style-type: none"> <li>○ Specially the ITU-R channel model (M.2135)</li> </ul> </li> <li>● Analysis of classical (indoor/outdoor) small-cell deployment model (ongoing)</li> <li>● Analysis of 3GPP uplink power control (started)</li> <li>● System-level simulation tool chain development (started) <ul style="list-style-type: none"> <li>○ ITU-R Indoor/Hotspot layout (started) <ul style="list-style-type: none"> <li>▪ Extension to more than 2 iSCs dropped</li> <li>▪ Random drop of UEs (started)</li> </ul> </li> <li>○ Long-term fading implementation (started) <ul style="list-style-type: none"> <li>▪ InH LOS</li> <li>▪ InH Shadowing</li> <li>▪ InH Pathloss</li> </ul> </li> <li>○ Monte-Carlo static simulation framework (started) <ul style="list-style-type: none"> <li>▪ Received power and downlink geometrical factor evaluation (used for UE attachment)</li> </ul> </li> </ul> </li> <li>● Contribution to D3.1 (in particular §4.7, §5.1, §5.5.7)</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>● Participation in WP3 bi-weekly phone calls.</li> <li>● Participation in virtual meeting.</li> <li>● Literature Analysis</li> <li>● Investigations on proportional fair scheduling algorithms under imperfect CSI conditions - ongoing</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>● Description of functional split options for CT3.8.</li> <li>● Research on the effect of non-orthogonal resource allocation for In-Network Processing based Multi-User Detection (to be published in future paper)</li> </ul>
<b>UNIS</b>	<ul style="list-style-type: none"> <li>● Revision, modifications and addition of new results on the proposed Graph-based ICIC for dense small cells (CT3.5).</li> </ul>

Fifth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>● Simulations of transmissions by using the simulation platform implementing the Joint Network-Channel Coding for the Multiple Access Relay Channel in order to have a better insight on the used channel/network codes.</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>● Participation and contribution to the WP biweekly conferences</li> <li>● Participation and contribution to the Turin meeting (November 2013)</li> <li>● Continuation of investigation with NEC about candidate technology 3.6 (utilization efficiency and energy efficiency in iJOIN)</li> <li>● Contribution to preparation of the first Technical Audit, participation to rehearsal and audit</li> <li>● Contribution to deliverable IR3.2 (not direct authoring, mostly internal review)</li> </ul>

<b>NEC</b>	<ul style="list-style-type: none"> <li>• Analysis of HARQ processing; derivation of achievable rates for perfect CSI</li> <li>• Functional split analysis, in particular determination of 3GPP LTE protocol bottlenecks</li> <li>• Preparation of technical review meeting</li> <li>• Continued analysis of Semi-deterministic scheduling (PF analysis, first formulations for imperfect CSI)</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Analysis of uplink system-level methodology for LTE system (ongoing) <ul style="list-style-type: none"> <li>○ ITU-R M.2135 channel model (started)</li> </ul> </li> <li>• Analysis of classical (indoor/outdoor) small-cell deployment model <ul style="list-style-type: none"> <li>○ 3GPP TR 36.872 (started)</li> </ul> </li> <li>• Analysis of 3GPP uplink power control (ongoing)</li> <li>• System-level simulation tool chain development (ongoing) <ul style="list-style-type: none"> <li>○ ITU-R Indoor/Hotspot (InH) layout (ongoing) <ul style="list-style-type: none"> <li>▪ Extension to more than 2 iSCs dropped</li> <li>▪ Random drop of UEs (ongoing)</li> </ul> </li> <li>○ Long-term fading implementation (ongoing) <ul style="list-style-type: none"> <li>▪ InH LOS</li> <li>▪ InH Shadowing</li> <li>▪ InH Pathloss</li> </ul> </li> <li>○ Monte-Carlo static simulation framework (ongoing) <ul style="list-style-type: none"> <li>▪ Rayleigh channel for UE-iSC link implementation (started)</li> <li>▪ Basic uplink scheduling (cf. 3GPP TR 36.814) implementation (started)</li> </ul> </li> </ul> </li> <li>• Provide input to prepare the 1st Audit</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Turin meeting 26-28 Nov 2013.</li> <li>• Investigations on functional split, requirements</li> <li>• Investigations on proportional fair scheduling under imperfect CSI conditions - ongoing</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Revision, addition of new results and investigation of new deployment scenarios for the proposed Graph-based ICIC for dense small cells (CT3.5).</li> <li>• Preparation of presentation for CT3.5 for the audit.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Ongoing research on the effect of non-orthogonal resource allocation for In-Network-Processing based Multi-User Detection (to be published in future paper)</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in the bi-weekly phone meetings.</li> <li>• Participation in Turin meeting 26-28 Nov 2013.</li> <li>• Requirements on functional split.</li> <li>• Research on centralised cell selection algorithms (ongoing – expected to submit a paper in March - April).</li> </ul>

Sixth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Participation to the WP3 bi-weekly phone-conferences</li> <li>• Participation to the iJOIN IR3.2, including preliminary results on CT3.3 and definition of the associated interfaces</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Analysis of HARQ processing: finalization of evaluation and derivation of fast approximations</li> <li>• Paper on Opportunistic HARQ submitted to IEEE Wireless Comm Letters</li> <li>• Functional split analysis, in particular analysis of HARQ bottleneck</li> <li>• Continued analysis of Semi-deterministic scheduling in cooperation with TUD (PF analysis, first formulations for imperfect CSI); resulted in submission to IEEE PIMRC</li> </ul>

<b>UoB</b>	<ul style="list-style-type: none"> <li>• Participation in biweekly WP3 phone conferences</li> <li>• Implementation of LTE simulation environment (ongoing)</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Grenoble meeting 01-03 April 2014.</li> <li>• Contribution to IR3.2</li> <li>• CT working slides</li> <li>• Research on centralised cell selection algorithms (ongoing – expected to submit a paper in May).</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the Grenoble meeting (March-April 2014)</li> <li>• Continuation of investigation with NEC about candidate technology 3.6 (utilization efficiency and energy efficiency in iJOIN)</li> <li>• Investigation on RANaaS constraints</li> <li>• Contribution to deliverable IR3.2 (authoring and internal reviewing)</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend general assembly meeting in Grenoble (01-03/04/14)</li> <li>• Attend the periodic WP3 phone calls</li> <li>• Analysis of uplink system-level methodology for LTE system (ongoing) <ul style="list-style-type: none"> <li>• ITU-R M.2135 channel model (ongoing)</li> </ul> </li> <li>• Analysis of classical (indoor/outdoor) small-cell deployment model <ul style="list-style-type: none"> <li>• 3GPP TR 36.872 (ongoing)</li> </ul> </li> <li>• Analysis of 3GPP uplink power control (ongoing) <ul style="list-style-type: none"> <li>• Needs of tuning adjustment</li> </ul> </li> <li>• System-level simulation tool chain development (ongoing) <ul style="list-style-type: none"> <li>• CS4: ITU-R Indoor/Hotspot (InH) layout (done) <ul style="list-style-type: none"> <li>○ Extension to more than 2 iSCs dropped (done)</li> <li>○ Random drop of UEs (done)</li> </ul> </li> <li>• Long-term fading implementation (done) <ul style="list-style-type: none"> <li>○ InH LOS</li> <li>○ InH Shadowing</li> <li>○ InH Pathloss</li> </ul> </li> <li>• Short-term fading implementation (started) <ul style="list-style-type: none"> <li>○ InH fast fading generation</li> <li>○ time-to-frequency representation</li> </ul> </li> <li>• Monte-Carlo static simulation framework (ongoing) <ul style="list-style-type: none"> <li>○ Rayleigh channel for UE-iSC link implementation (done)</li> <li>○ ITU-R InH channel for UE-iSC link implementation (started)</li> <li>○ Basic uplink scheduling (cf. 3GPP TR 36.814) implementation (done)</li> </ul> </li> </ul> </li> <li>• Contribution to IR3.2 (in particular §2.1, §3.7, §4.1.1.2, §4.3.7, §5.1.2)</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Grenoble meeting 01-03 April 2014.</li> <li>• Contribution to IR3.2 Section 3</li> <li>• Development of robust rate allocation scheme and robust proportional fair scheduling scheme</li> <li>• Preparation of conference paper (submitted to PIMRC)</li> <li>• CT working slides</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Addition of new results and investigation of new deployment scenarios for the proposed Graph-based ICIC for dense small cells (CT3.5)</li> <li>• Ongoing work on a new simulation scenario (3GPP compliant) to evaluate the results using common assumptions with other WP3 CTs.</li> <li>• Contribution to IR3.2 for CT3.5 with new material (section 3.5, 4.4.5).</li> </ul>

Seventh quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Bologna meeting 23-26 June 2014.</li> <li>• Contribution to IR3.2</li> <li>• Contribution to D3.2</li> <li>• CT working slides</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the Bologna meeting (June 2014)</li> <li>• Definition of a model for categorizing candidate technologies and grouping them into interoperable blocks</li> <li>• Kicking-off discussion on RANaaS revised glossary</li> <li>• Contribution to deliverable IR3.2 (authoring –section 4.2 - and internal reviewing)</li> <li>• Deliverable D3.2 : contribution to ToC definition and assignments</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Work on LTE simulator for evaluation of CT3.8</li> <li>• Contribution to final definition of common evaluation scenarios</li> <li>• Contribution to CT interoperability discussion</li> <li>• Initial contribution to D3.2</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Continued work on utilization efficiency (new definition in IR 3.2/IR 5.2)</li> <li>• Contribution to IR 3.2</li> <li>• Discussed veNB RANaaS upper part definitions</li> <li>• Paper on “ The Role of Computational Outage in Dense Cloud-Based Centralized Radio Access Networks”</li> <li>• Continued work on semi-deterministic scheduling in cooperation with TUD (preparation of TWC submission)</li> <li>• Analysis of preferred functional splits in the scope of WP3</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Addition of new results for the proposed Graph-based ICIC for dense small cells (CT3.5).</li> <li>• Revision, submission and acceptance of this work in IEEE Access (a new fully open access multi-disciplinary journal from IEEE).</li> <li>• Ongoing work on a new simulation scenario (3GPP compliant) to evaluate the results using common assumptions with other WP3 CTs.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend general assembly meeting in Bologna (24-26/06/14)</li> <li>• Attend the periodic WP3 phone calls</li> <li>• Analysis of uplink system-level methodology for LTE system <ul style="list-style-type: none"> <li>○ ITU-R M.2135 channel model (ongoing)</li> </ul> </li> <li>• Analysis of classical (indoor/outdoor) small-cell deployment model <ul style="list-style-type: none"> <li>○ 3GPP TR 36.872 (done)</li> </ul> </li> <li>• Analysis of 3GPP uplink power control <ul style="list-style-type: none"> <li>○ Needs of tuning adjustment (ongoing)</li> </ul> </li> <li>• System-level simulation tool chain development <ul style="list-style-type: none"> <li>○ Short-term fading implementation (ongoing) <ul style="list-style-type: none"> <li>▪ InH fast fading generation</li> <li>▪ time-to-frequency representation</li> </ul> </li> <li>○ Monte-Carlo static simulation framework (ongoing) <ul style="list-style-type: none"> <li>▪ Rayleigh channel for UE-iSC link implementation (done)</li> <li>▪ ITU-R InH channel for UE-iSC link implementation (ongoing)</li> </ul> </li> <li>○ MPDT/SPTD implementation <ul style="list-style-type: none"> <li>▪ SPTD (started)</li> <li>▪ MPTD (not started)</li> </ul> </li> </ul> </li> </ul>

<b>CEA</b>	<ul style="list-style-type: none"> <li>• Participation to the WP3 bi-weekly phone-conferences</li> <li>• Elaboration of a machine learning framework to control the activation of the small cells</li> <li>• Finalization of the iJOIN IR3.2</li> <li>• Preparation and participation to the Bologna F2F meeting</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Bologna meeting 24-26 June 2014.</li> <li>• Contribution to D3.2</li> <li>• CT working slides</li> <li>• Preparation of final manuscript of conference paper (accepted for IEEE PIMRC)</li> <li>• Investigation and Implementation of Robust Rate adaptation and Scheduling Algorithms</li> <li>• Preparation of Journal Paper for IEEE Transactions on Wireless Communications</li> </ul>

Eighth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Addition of new results for the proposed Graph-based ICIC for dense small cells (CT3.5).</li> <li>• Ongoing work on a new simulation scenario (3GPP compliant) to evaluate the results using common assumptions with other WP3 CTs.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend virtual meeting (30/09-01/10/14)</li> <li>• Attend the periodic WP3 phone calls</li> <li>• Analysis of uplink system-level methodology for LTE system <ul style="list-style-type: none"> <li>○ ITU-R M.2135 channel model (done)</li> </ul> </li> <li>• Analysis of 3GPP uplink power control <ul style="list-style-type: none"> <li>○ Needs of tuning adjustment (ongoing) <ul style="list-style-type: none"> <li>▪ Inner loop disabled so far</li> </ul> </li> </ul> </li> <li>• System-level simulation tool chain development <ul style="list-style-type: none"> <li>○ Short-term fading implementation (done) <ul style="list-style-type: none"> <li>▪ InH fast fading generation</li> <li>▪ time-to-frequency representation</li> </ul> </li> <li>○ Monte-Carlo static simulation framework <ul style="list-style-type: none"> <li>▪ ITU-R InH channel for UE-iSC link implementation (done)</li> </ul> </li> <li>○ MPDT/SPTD implementation <ul style="list-style-type: none"> <li>▪ SPTD (ongoing)</li> <li>▪ MPTD (started)</li> </ul> </li> </ul> </li> <li>• Centralised RRM algorithm definition (started) <ul style="list-style-type: none"> <li>○ ‘Static’ version doing uplink pairing based on downlink RSRP</li> <li>○ Preliminary evaluation (started)</li> </ul> </li> <li>• Contribution to D5.2 (in particular §3.1, §3.2.1.2, §4.7)</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Bologna meeting 23-26 June 2014.</li> <li>• Contribution to D3.2</li> <li>• CT working slides</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Contribution to D3.2 + Review</li> <li>• CT working slides</li> <li>• Investigation and Implementation of Robust Rate adaptation and Scheduling Algorithms</li> <li>• Submission of Journal Paper for IEEE Transactions on Wireless Communications</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Work on LTE simulator for evaluation of CT3.8 and initial simulations</li> <li>• Contribution to discussion on evaluation criteria of selected evaluation scenarios</li> <li>• Internal review of D3.2 document</li> </ul>

<b>CEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in virtual F2F meeting 30 September – 01 October</li> <li>• Contribution to D3.2 (CT description, overall evaluation, and iJOIN architecture)</li> <li>• Update of CT working slides</li> <li>• Preparation and Submission of ICC 2015 paper: “Optimal Small Cell Control in Dual Connectivity Heterogeneous Networks”, A. De Domenico, V. Savin, and D. Kténas</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Analysing diversity gains and computational complexity in Cloud-RAN</li> <li>• Continued work on robust link-adaptation with TUD</li> <li>• Submitted paper to IEEE Transactions on Wireless Communications on computational complexity and on robust link-adaptation</li> <li>• Preparation of virtual meeting</li> <li>• Contributions to D3.2</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the plenary Virtual meeting (October 2014)</li> <li>• Refinement and completion of the model for categorizing candidate technologies, and grouping them into interoperable blocks</li> <li>• Contribution to deliverable DR3.2 (authoring –section 3.3 and section 4.6 - and internal reviewing)</li> </ul>

Ninth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Attend the periodic WP3 phone calls</li> <li>• Analysis of 3GPP uplink power control <ul style="list-style-type: none"> <li>○ Needs of tuning adjustment (ongoing) <ul style="list-style-type: none"> <li>▪ Inner loop disabled so far</li> </ul> </li> </ul> </li> <li>• System-level simulation tool chain development <ul style="list-style-type: none"> <li>○ Extension to project-wide evaluation <ul style="list-style-type: none"> <li>▪ CS1: Stadium (not started yet)</li> <li>▪ CS3: Wide Area (started)</li> </ul> </li> <li>○ Short-term fading implementation (extended) <ul style="list-style-type: none"> <li>▪ ITU-R UMi fast fading generation</li> </ul> </li> <li>○ Monte-Carlo static simulation framework <ul style="list-style-type: none"> <li>▪ ITU-R UMi channel for UE-iSC link implementation (done)</li> </ul> </li> <li>○ MPDT/SPTD implementation <ul style="list-style-type: none"> <li>▪ SPTD (ongoing)</li> <li>▪ MPTD (ongoing)</li> </ul> </li> <li>• Centralised RRM algorithm definition (ongoing) <ul style="list-style-type: none"> <li>○ ‘Static’ version doing uplink pairing based on downlink RSRP</li> <li>○ Preliminary evaluation (ongoing)</li> </ul> </li> </ul> </li></ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Contribution to D3.3</li> <li>• CT working slides</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Addition of new results for the proposed Graph-based ICIC for dense small cells (CT3.5) for the wide area scenario.</li> <li>• Ongoing work on a new simulation scenario (Stadium) to evaluate the results using common assumptions with other WP3 CTs.</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the PMB meeting sessions (Milan, November 2014)</li> <li>• First contributions to deliverable D3.3 (sections 3 and 4.6)</li> <li>• Start investigation on CT3.6 – Energy Efficiency evaluation</li> </ul>

	<ul style="list-style-type: none"> <li>• Contribution to EuCNC paper</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Work on LTE simulator for evaluation of CT3.8 and performing simulations.</li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Participation to WP3 bi-weekly phone calls.</li> <li>• Participation to the Milan F2F meeting.</li> <li>• Final assessment of the CT to be included in D3.3</li> <li>• CT working slides</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Milan meeting.</li> <li>• Contribution to D3.3</li> <li>• CT working slides</li> <li>• Investigation and implementation of multi-stage coordinated scheduling algorithms</li> <li>• Preparation of Letter about “Multi-Stage Coordinated Scheduling”</li> <li>• Revision of Journal Paper submitted to IEEE Transactions on Wireless Communications</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Continued work on robust link-adaptation with TUD</li> <li>• Revision of IEEE Transactions on Wireless Communications paper</li> <li>• Contribution to WP3 plenary meeting</li> <li>• Continued work on join RAN/Cloud-scheduler (also deployed in WP6 RANaaS demo)</li> </ul>

Tenth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Final work on LTE simulator for evaluation of CT3.8 and performing simulations.</li> <li>• Contribution of simulation results for D3.3</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Bremen meeting.</li> <li>• Participation in and organization of Dresden meeting.</li> <li>• Contribution to D3.3</li> <li>• CT working slides</li> <li>• Investigation and implementation of multi-stage coordinated scheduling algorithms</li> <li>• Preparation of final version of Journal Paper accepted at IEEE Transactions on Wireless Communications</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Contribution to D3.3</li> <li>• CT working slides</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the PMB meeting sessions (Bremen, February 2015; Dresden, April 2015)</li> <li>• Authoring contributions to deliverable D3.3 (sections 3.1.3, 4.6.3, 5.3.2)</li> <li>• D3.3: peer reviewing (Section 4.3)</li> <li>• Completed investigation on CT3.6 – Energy Efficiency evaluation methodology and results</li> <li>• Co-authoring of EuCNC 2015 paper</li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls.</li> <li>• Participation in Bremen meeting.</li> <li>• Participation in and coordination of Dresden meeting.</li> <li>• Contribution to D3.3</li> <li>• Contribution to EuCNC paper</li> <li>• CT working slides</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Attend the periodic WP3 phone calls</li> <li>• Attend General Assembly (Bremen)</li> </ul>

	<ul style="list-style-type: none"> <li>• Contribution to D3.3</li> <li>• System-level simulation tool chain development <ul style="list-style-type: none"> <li>○ Extension to project-wide evaluation</li> </ul> </li> <li>▪ CS1: Stadium (done)</li> <li>▪ CS3: Wide Area (done) <ul style="list-style-type: none"> <li>○ Short-term fading implementation (done)</li> </ul> </li> <li>▪ ITU-R UMi fast fading generation <ul style="list-style-type: none"> <li>○ Monte-Carlo static simulation framework (done)</li> </ul> </li> <li>▪ ITU-R UMi channel for UE-iSC link implementation (done) <ul style="list-style-type: none"> <li>○ MPDT/SPTD implementation</li> </ul> </li> <li>▪ SPTD (done)</li> <li>▪ MPTD (done)</li> <li>• Centralised RRM algorithm definition (done) <ul style="list-style-type: none"> <li>○ Enhancement of the previous ‘Static’ version doing uplink pairing based on downlink RSRP</li> <li>○ Final evaluation</li> </ul> </li> </ul>
NEC	<ul style="list-style-type: none"> <li>• Preparation/moderation of bi-weekly phone calls</li> <li>• Further input to EuCNC articles</li> <li>• Deliverable D3.3: Contribution on joint RAN/cloud scheduling</li> <li>• Preparation of simulations on joint RAN/cloud scheduling</li> </ul>
UniS	<ul style="list-style-type: none"> <li>• Finalised common scenario results for UniS CT3.5 (Graph-based ICIC for dense small cells).</li> <li>• Updates and new simulation results were introduced in D3.3.</li> </ul>

## 2.4 WP4: Network-Layer Solutions and System Operation and Management

### 2.4.1 Summary

In the **first quarter**, the work started during the preparation of the kick-off meeting. During the Madrid kick-off meeting, partners benefitted from the face-to-face interaction to better align topics of interest, as well as to identify areas for potential collaboration that were defined during the project proposal phase. Furthermore, partners presented and discussed target use case scenarios, as well as research interests, and assigned them to iJOIN objectives and tasks. On the administrative side, task leadership and deliverable editorship appointments were confirmed. Administrative procedures were also defined and agreed. On the research side, WP4 started to work on the first intermediate report, IR 4.1, by agreeing on the table of contents, assigning editorial responsibilities and providing a first version of the content. As a first step before providing input to IR4.1, a slide set on use cases and requirements was generated. These slides served as a means to ease and drive the initial discussions. Since the kick-off meeting, three regular phone conferences were held for status synchronisation regarding IR 4.1, status updates of the different tasks as well as administrative issues.

During the **second quarter** of the project, WP4 work continued at good pace. Use cases of interest for WP4 as well as the different core technologies were agreed upon. Areas of common interest were identified among partners, allowing for the merging of several candidate technologies proposed by individual partners, and therefore promoting further and tighter cooperation within the work package. The first intermediate report, IR 4.1, was finalised in due time, serving as a solid base for the upcoming work to be done on the technical side. Seven core technologies were identified, involving most of them collaboration among different partners. The use of software defined networking was discussed and agreed as a key pillar of the joint backhaul/radio access network design. Initial input to WP5, in terms of identification of common assumptions, deployment assumptions and requirements as well as a first functional WP4 split was provided and included in the intermediate report IR 5.1. Work on the functional architecture, both intra WP4 and with the other technical WPs, was also started, which is a critical component for the project. A submission from Task 4.2 FuNeMS 2013 was accepted for poster presentation. On the standardisation side, a contribution co-authored by iJOIN members related to Task 4.2 was adopted as DMM (Distributed Mobility Management) working group document in the IETF.

During the **third quarter** of the project, WP4 work continued at good pace. Significant advancements took place in the technical discussion towards the definition of a software defined networking architecture. A first



revision of the input/output interactions between the different WP4 modules was performed. Interfaces with other WPs (serving as input to WP5 architecture work) were defined and discussions are took place towards their definition. A network control oriented demonstrator was defined and discussed in cooperation with WP6 (included in IR6.1). This demonstrator will be used to implement and experiment with many of the WP4 technologies. On the standardisation side, contributions to DMM (Distributed Mobility Management) working group in the IETF continued. This work is related to Task 4.2.

During the **fourth quarter** of the project, significant advancements took place in WP4. The definition of the SDN-based architecture progressed quite a lot, achieving a stable version of the interactions among the different mechanisms/modules within WP4. As part of this exercise, the logical architecture of the iJOIN Network Controller (iNC) was defined, not only paying attention to the interfaces between the WP4 modules, but also with WP2 and WP3 ones. This was described in D4.1, and will serve as the starting point for the detailed specification of the WP4 architecture that will take place in the following months. As WP4 plays a key role in providing connectivity in the RAN and the backhaul, as well as providing measurements and monitoring (due to the SDN-centric adopted approach), the high-level interactions with WP2 and WP3 were identified and will be the object of further discussion within WP5 in the next months. The first deliverable, D4.1, was finalised and delivered in due time. This document is a very important milestone in WP4, as it analyses existing related work and paves the way for the mechanisms that will be developed throughout the project lifetime. Collaboration with WP6 continued to further define the network control oriented demonstrator, as well as to identify which WP4 candidate technologies are expected to be experimentally validated and assessed using the demonstrator. On the standardisation side, contributions to DMM (Distributed Mobility Management) working group in the IETF continued. This work is related to Task 4.2. Another very important result in this field is the input to the Open Networking Forum (ONF), responsible of the specification of OpenFlow, which contributed to the official creation of the Wireless & Mobile Working Group (WMWG). This WG includes as use cases of interest some being addressed by iJOIN. Therefore, potential extensions to OpenFlow to be proposed within iJOIN are of interest of this new WG.

During the **fifth quarter** of the project, the definition of the SDN-based architecture continued progressing. The logical architecture of the iJOIN Network Controller (iNC) was refined. In these months, an analysis of the different backhaul topologies and connectivity technologies that can be used in the backhaul was performed. This analysis was very important, not only for WP4, but also project wide, as it was used as fundamental input for the flexible functional split design in iJOIN. The high-level interactions with WP2 and WP3, identified in the previous months, started to be analysed in more detail. The outcome of this work was also included in IR4.2. Collaboration with WP6 continued, and input from WP4 was included in IR6.2. The development of one the demonstrators was done in collaboration to WP6 at UC3M and was used to showcase SDN & mobility related technologies. It was also be used to collect performance measurements aimed at validating some of the WP4 technologies. On the standardisation side, contributions to DMM (Distributed Mobility Management) working group in the IETF continued. This WP also contributed to the Wireless & Mobile Working Group (WMWG) of the Open Networking Forum (ONF). During the Turin meeting in November, the main focus was on the progress on each of the WP4 CTs. Partners in WP4 contributed to the presentation for the 1<sup>st</sup> technical review,

During the **sixth quarter** of the project, the definition of the SDN-based architecture continued progressing. The main focus of this quarter was the finalisation of the IR4.2. The main features of this intermediate report included updates on core technologies, including considerations on how to evaluate each of them, and some preliminary results. The high-level interactions with WP2 and WP3 were intensified. One of the key topics analysed as part of these cross-WP interactions was the analysis of the different backhaul topologies that are of interest for iJOIN and the impact on the mechanisms designed by WP2, WP3 and WP4. The first outcome of this work was included in IR4.2. A close collaboration with WP6 continued. The development of one the demonstrators was done in collaboration to WP6 at UC3M and used to showcase SDN & mobility related technologies. It was also used to gather some initial performance and validation results, which were also included in IR4.2. Part of the WP4 mechanisms deployed on this testbed was showcased in EuCNC 2014. On the standardisation side, contributions to DMM (Distributed Mobility Management) working group in the IETF continued. This WP also contributed to the Wireless & Mobile Working Group (WMWG) of the Open Networking Forum (ONF). Partners in WP4 participated in the plenary meeting in Grenoble from April 1st to 3rd. The main focus was on the progress on each of the WP4 CTs, the backhaul analysis and the progress on the implementation of some CTs using the testbed developed with WP6.

During the **seventh quarter** of the project, the main focus of the work was the detailed definition of the inter-CTs intra-WP4 interactions. Based on the already existing identified interactions, a more detailed low level design was started. The WP also started to work on the evaluation methodology to be followed in the final assessment to be reported in D4.3. The activity on the analysis of the different backhaul topologies that are of interest for iJOIN, as well as the impact on the mechanisms designed by WP2, WP3 and WP4 continued, in cooperation with WP2 and WP3. In relation to this, a very relevant study was the analysis of the RANaaS placement within the network. This work started in this quarter. A close collaboration with WP6 continued. The development of one the demonstrators was done in collaboration to WP6 at UC3M and used to showcase SDN & mobility related technologies. On the standardisation side, contributions to DMM (Distributed Mobility Management) working group in the IETF continued. A contribution to the SDN research group in the IRTF was presented in the last IETF meeting in July 2014. Partners in WP4 participated in the plenary meeting in Bologna in June 2014. The main focus was on the discussion of the interactions of the WP4 CTs, the backhaul analysis and the table of contents and expected contributions for D4.2.

During the **eighth quarter** of the project, the main focus was been the finalisation of the definition of the inter-CTs intra-WP4 interactions and the completion of D4.2. With the delivery of D4.2, the specification work of WP4 was mostly finished, with all core CTs fully defined, as well as their interactions. The WP started to work on the evaluation part, focusing on the methodology to be followed in the last six months of the project. The planned evaluation methodology to be followed was been described in D4.2. The analytical work on the RANaaS placement within the network continued during this quarter. The design of a RANaaS smart placement algorithm and its validation also continued. Another work that evolved during this quarter was the definition of the OpenFlow protocol interactions needed for CT4.2 and the identification of main gaps that could result in extensions of OpenFlow specifications. On the standardisation side, one of the contributions to the DMM (Distributed Mobility Management) working group in the IETF was approved to be published as Informational RFC. A paper was accepted on IEEE Communications Magazine, on DMM work. Partners in WP4 participated in a virtual meeting, which main focus was the finalisation of the discussion of the interactions of the WP4 CTs, as well as the definition of the evaluation methodology.

During the **ninth quarter** of the project, the main focus of the work was the finalisation of implementation of the CTs in order to start performing the evaluation to be reported in D4.3 at the end of the project. This implementation comprised simulations and experimental prototypes, depending of the CT. The scenarios used for the evaluation were harmonised to be able to generate comparable results. An important task with a project-wide impact was started and almost completed in this quarter, consisting on the analysis of practical realisations of iJOIN scenarios based on operators' feedback. These scenarios were based on the four Common Scenarios defined by WP5, but used also the input on the backhaul topologies and technologies performed in the last months. The scenarios were used as the common baseline for all the evaluations performed in WP4. The partners in WP4 participated in the plenary meeting in Milan with the main focus on the finalisation of the discussion on the definition of the evaluation methodology. The design of a RANaaS smart placement algorithm and its validation was almost finished in this quarter. On the standardisation side, one of the contributions to the DMM (Distributed Mobility Management) working group in the IETF was published as RFC 7429. A paper on DMM appeared on IEEE Communications Magazine.

During the **tenth quarter** of the project, WP4 effort was mostly devoted to the final evaluation of the candidate technologies and to the finalisation of deliverable D4.3. Each CT was evaluated on different scenarios, providing figures of improvement over baseline scenarios. An important contribution prior to this work was the analysis and description of practical realisations of iJOIN scenarios based on operators' feedback. The partners in WP4 participated in the plenary meeting in Dresden with the main focus on the finalisation of the deliverable D4.3 and the preparation of the final technical review. On the standardisation side, a contribution to the SDN research group at the IRTF was presented, receiving positive feedback. A paper on SDN and Energy Efficiency was accepted to appear in IEEE Network. Another paper on the global WP4 architecture was accepted at EuCNC 2015. Some of the SDN-control transport network mechanisms were successfully presented at the Mobile World Congress 2015.

Task	Status	Variance	Cause/Way-Forward	Expected deadlines	Affected Partners
<b>Task 4.1</b>	Concluded	No delays or changing of topics	N.A.	IR4.1 and IR 4.2 delivered on time. D4.1, D4.2 and D4.3 delivered on time.	None
<b>Task 4.2</b>	Concluded	No delays or changing of topics	N.A.	see above	None
<b>Task 4.3</b>	Concluded	No delays or changing of topics	N.A.	see above	None

## 2.4.2 Task 4.1: Network level requirements and state of the art analysis

First quarter:

Partner	Achievements Milestones Work items in progress
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attendance to the kick-off meeting</li> <li>• Participation to WP4 bi-weekly phone calls</li> <li>• Contribution to the definition and discussion of the WP4 use cases, scenarios, and requirements</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Preparation of NEC input to WP4</li> <li>• Participation in WP4 TelCos</li> <li>• NEC internal coordination of NEC's involvement in WP4</li> <li>• Participation in KO meeting</li> <li>• Contribution to use cases/scenarios (see IR4.1 working document)</li> <li>• Review of contributions of other partners and harmonisation with NEC input</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Proposal of use cases to be analysed in order to derive network requirements</li> <li>• Preparation and participation in the WP meeting held in Madrid</li> <li>• Participation in telcos</li> <li>• Analysis of the use case of congestion control. Potential interaction of RANaaS mechanisms with LPCC congestion control algorithms like LEDBAT</li> <li>• Preparation of contribution to IR4.1 based on use cases identified</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in kick-off meeting</li> <li>• Participation un WP periodic phone calls</li> <li>• Authoring contribution to deliverable IR4.1</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role</li> <li>• Slides preparation for the kick-off meeting.</li> <li>• Attendance to the kick-off meeting and participation in the discussions</li> <li>• Organisation and attendance to WP4 bi-weekly phone calls</li> <li>• Contribution to the definition and discussion of the WP4 use cases, scenarios, and requirements.</li> <li>• Contribution to IR4.1 template.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attendance at the kick-off meeting / participation in the discussions, and presentation of UNIS planned work in WP4.</li> <li>• Attendance in WP4 bi-weekly telcos and participation in technical discussions</li> <li>• Contribution to the preparation of case studies, scenarios and requirements</li> </ul>

Second quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attending regular biweekly telcos</li> <li>• Defined the two candidate technologies in detail with corresponding assumptions and requirements</li> <li>• IR4.1 contributions and update for the CTs</li> <li>• Merging the CT of UniS and IMC for energy optimization in IR4.1</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Preparation of NEC input to WP4</li> <li>• Participation in WP4 TelCos</li> <li>• Participation in plenary meeting</li> <li>• Contribution to use cases/scenarios (see IR4.1 working document)</li> <li>• Review of contributions of other partners and harmonization with NEC input</li> <li>• Editorial work for IR4.1, contributions to IR4.1</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Assistance to WP4 meeting held in Heidelberg</li> <li>• Participation in the elaboration of IR4.1 in the areas of congestion control and SDN</li> <li>• Participation in the WP telcos</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in plenary meeting in Heidelberg.</li> <li>• Participation in bi-weekly telephone conferences.</li> <li>• Defining assumptions and requirements for WP4.</li> <li>• Contributions to IR 4.1.</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role</li> <li>• Slides preparation for the Heidelberg meeting.</li> <li>• Attendance to the kick-off meeting and participation in the discussions</li> <li>• Organisation and attendance to WP4 bi-weekly phone calls</li> <li>• Contribution to the definition and discussion of the WP4 use cases, scenarios, and requirements.</li> <li>• Contribution to IR4.1</li> <li>• Coordination of the definition and collection of the WP4 assumptions, deployment assumptions and requirements.</li> <li>• Coordination of the definition of the WP4 functional split.</li> <li>• Internal review of IR4.1</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attended the iJOIN meeting in Heidelberg presenting UNIS contributions in WP4 meeting</li> <li>• Attended of WP4 bi-weekly tele-conferences</li> <li>• Contributed to IR4.1: Assumptions and requirements for the three technology candidates which UNIS is working on</li> <li>• Mapped the Requirements and Assumptions of the UniS technical candidates to the WP5 use cases</li> <li>• Contributed to functional split table in three technologies that UNIS contributes</li> </ul>

Third quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attending regular biweekly telcos.</li> <li>• Defining Inputs/outputs with corresponding sources/sinks for the proposed CTs</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Literature research on backhaul architectures to be considered in WP4.</li> <li>• Contributions to WP4.</li> </ul>

	<ul style="list-style-type: none"> <li>• Attending regular WP4 TelCos</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Assistance to WP4 meeting held in Guildford</li> <li>• Participation in the elaboration of D4.1 in the areas of congestion control and SDN</li> <li>• Participation in the WP telcos</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in Surrey meeting.</li> <li>• Participation in bi-weekly telephone conferences.</li> <li>• Defining assumptions and requirements for candidate technologies to be included in D4.</li> <li>• Contributions to deliverable D4.1.</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role.</li> <li>• Slides preparation for the Surrey meeting.</li> <li>• Attendance to the Surrey meeting and participation in the discussions.</li> <li>• Organisation and attendance to WP4 bi-weekly phone calls.</li> <li>• Coordination of the definition of the WP4 functional architecture. Input to WP5.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attendance of WP4 bi-weekly tele-conferences.</li> <li>• Provided final contributions to IR4.1 in StoA and UNIS candidate technologies.</li> <li>• In surrey meeting, proposed and presented the draft ToC and time plan for deliverable D4.1.</li> </ul>

Fourth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP4 bi-weekly phone calls.</li> <li>• Participation in virtual meeting.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Description of Joint Path Management and Topology Control</li> <li>• Requirements analysis for heterogeneous backhaul</li> <li>• Requirements analysis for different functions (network bootstrap, UE attachment, congestion management)</li> <li>• Corresponding contributions to D4.1</li> <li>• Attending regular WP4 TelCos</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Participation in the elaboration of D4.1 in the areas of congestion control and SDN</li> <li>• Participation in the WP telcos</li> <li>• Participation in the Project Virtual Meeting</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP4 bi-weekly phone calls.</li> <li>• Participation in virtual meeting.</li> <li>• Defining assumptions and requirements for candidate technologies to be included in D4.</li> <li>• Contributed to deliverable D4.1.</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role</li> <li>• Preparation of virtual plenary meeting.</li> <li>• Slides preparation for the virtual meeting.</li> <li>• Attendance to the virtual meeting and participation in the discussions</li> <li>• Organisation and attendance to WP4 bi-weekly phone calls</li> <li>• Update of SoTA section related to IP addressing and anchoring in D4.1</li> <li>• Coordination of the WP4 functional architecture discussion.</li> </ul>
<b>UNIS</b>	<ul style="list-style-type: none"> <li>• Attended the iJOIN virtual meeting and presented UNIS work update in WP4 on CT 4.1 and CT4.2.</li> <li>• Attendance of WP4 bi-weekly telcos</li> <li>• Contribution to deliverable D4.1. <ul style="list-style-type: none"> <li>○ Contributed to UNIS sections: section 3.2, 3.3, 4.1, 4.2, 4.4, 5.2</li> <li>○ Edit D4.1 and it will be ready for delivery on 31st Oct 2013</li> </ul> </li> </ul>

Fifth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attending Biweekly WP4 Telcos.</li> <li>• Preparation for WP4 session in Turin Meeting.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Introduction of Konstantinos Samdanis into project</li> <li>• Background understanding of iJoin including cloud-RAN architecture, functional split, transport and routing</li> <li>• Literature review</li> <li>• Review of ONF wireless group use cases and requirements for SDN use in Mobile Backhaul / LTE</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Participation in the elaboration of D4.1 in the areas of congestion control and SDN</li> <li>• Participation in the WP telcos</li> <li>• Participation in WP4 meeting in Torino</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP4 bi-weekly phone calls</li> <li>• Participation in Turin meeting 26-28 Nov 2013.</li> <li>• Contributed to discussions regarding the structure of D4.2.</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role.</li> <li>• Preparation of the Turin plenary meeting.</li> <li>• Slides preparation for the Turin plenary meeting.</li> <li>• Attendance to the Turin plenary meeting and participation in the discussions.</li> <li>• Organisation and attendance to WP4 bi-weekly phone calls.</li> <li>• Preparation of an SDN/OpenFlow tutorial.</li> <li>• Contributions to the first periodic report.</li> <li>• Preparation and presentation of the WP4 slides for the 1<sup>st</sup> Technical Review in Brussels.</li> <li>• Attendance to the 1st Technical Review in Brussels.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Remotely Attending WP4 session in the iJOIN Turin meeting, presenting UNIS work update in WP4 and participating in the discussion.</li> <li>• Attending WP4 bi-weekly telcos.</li> </ul>

### 2.4.3 Task 4.2: Network layer solutions for joint access/backhaul and RANaaS

First quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Review of state of the art of access/backhaul integration</li> <li>• Analysis of the use case of SDN concepts integration into RANaaS. Use of OpenFlow for topology reconfiguration and traffic policing</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role</li> <li>• Task leadership related activities</li> <li>• Slides preparation for the kick-off meeting.</li> <li>• Attendance to the kick-off meeting and participation in the discussions</li> <li>• Analysis of traffic offloading in a jointly designed backhaul/access architecture. Status: ongoing, unreported</li> <li>• Mobility within small-cell networks: analysis of techniques for a smart access network selection. Status: ongoing, unreported.</li> <li>• Analysis of the applicability of a DMM paradigm in the iJOIN architecture. Status: ongoing, unreported</li> </ul>

	<ul style="list-style-type: none"> <li>• Contribution to IR4.1.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Literature review on mobility management issues for small-cell networks</li> <li>• Uploaded initial ideas in addressing mobility for joint backhaul and small cell networks on the data repository</li> </ul>

Second quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Contributions to IR4.1, i.e. description of NEC research topic (joint backhaul/RAN controller)</li> <li>• Assumption/Requirement analysis for NEC WP4 core technologies</li> <li>• Contributions to WP4 internal architecture</li> <li>• Literature review/research on backhaul related topics for WP4</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Assistance to WP meeting held in Heidelberg</li> <li>• First proposal of congestion control solutions to overcome LPCC implications (incorporated to IR4.1)</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role</li> <li>• Task leadership related activities</li> <li>• Slides preparation for the Heidelberg meeting.</li> <li>• Attendance to the Heidelberg meeting and participation in the discussions</li> <li>• Analysis of traffic offloading in a jointly designed backhaul/access architecture. Status: ongoing. Initial considerations reported in IR4.1.</li> <li>• Mobility within small-cell networks: analysis of techniques for a smart access network selection. Status: ongoing. Initial considerations reported in IR4.1.</li> <li>• Analysis of the applicability of a DMM paradigm in the iJOIN architecture. Status: ongoing. Initial considerations reported in IR4.1.</li> <li>• Contribution to IR4.1.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Contributed to IR4.1: updating three technology candidates (mobility management in small cell networks / routing and congestion control/ network-wide energy optimization)</li> <li>• Worked on designing solution for mobility management in small cell networks</li> </ul>

Third quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Further Literature Research on Traffic Engineering algorithms applicable to wireless backhaul</li> <li>• Preliminary investigation on small cell backhaul topologies and traffic models</li> <li>• Research on suitable evaluation tools for WP4 backhaul evaluation (looked into ns3, Openflow)</li> <li>• Attending regular WP4 TelCos</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Assistance to WP meeting held in Guildford</li> <li>• First proposal of congestion control solutions to overcome LPCC implications (incorporated to IR4.1)</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role.</li> <li>• Task leadership related activities.</li> <li>• Slides preparation for the Surrey meeting.</li> <li>• Attendance to the Surrey meeting and participation in the discussions.</li> </ul>

	<ul style="list-style-type: none"> <li>• Mobility within small-cell networks: analysis of techniques for a smart access network selection following a SDN-based approach. Status: ongoing. Initial design considerations reported on the project</li> <li>• Analysis of the applicability of a DMM paradigm in the iJOIN architecture following a SDN-based approach. Status: ongoing. Initial design considerations reported on the project</li> <li>• Contribution to D4.1. File available on the project</li> <li>• Contribution to IR6.1 on the description of the SDN-based network control demonstrator. File available on the project</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• On-going work on CT4.2 Network-wide energy optimization.</li> <li>• On-going work on investigating the protocol to be used by CT 4.2</li> </ul>

Fourth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP4 bi-weekly phone calls.</li> <li>• Participation in virtual meeting.</li> <li>• Contributions to the deliverable D4.1 for the use case, assumptions and requirements, and SDN architecture related to congestion control and load balancing.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Further Literature Research on Traffic Engineering algorithms applicable to wireless backhaul</li> <li>• Research on suitable evaluation tools for WP4 backhaul evaluation (looked into NS3, OpenFlow)</li> <li>• First proposals of message formats and control signalling for SDN in backhaul networks, e.g. QinQ format and essential SDN commands for TEEM module</li> <li>• Attending regular WP4 TelCos</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Further development of the congestion control proposal for iTN in RANaaS scenarios</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role</li> <li>• Task leadership related activities</li> <li>• Slides preparation for the virtual meeting.</li> <li>• Attendance to the virtual meeting and participation in the discussions</li> <li>• Mobility within small-cell networks: analysis of techniques for a smart access network selection following a SDN-based approach. Status: ongoing. Design of high-level procedures, included in D4.1.</li> <li>• Analysis of the applicability of a DMM paradigm in the iJOIN architecture following a SDN-based approach. Status: ongoing. Design of high-level procedures, included in D4.1.</li> <li>• Final contributions to D4.1. File available on the project</li> <li>• Contributions to IR6.2 on the description of the SDN-based network control demonstrator. File available on the project</li> </ul>
<b>UNIS</b>	<ul style="list-style-type: none"> <li>• On-going work on refining solution for UNIS CT4.1 distributed IP anchoring and mobility management.</li> </ul>

Fifth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Some Editorial work for IR4.2.</li> <li>• Preparation for WP4 session in Turin Meeting making slide set for two CTs.</li> <li>• Developing a small system level simulator where our NW layer algorithm might be</li> </ul>



	validated.
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Preparation of technical review meeting</li> <li>• Participation in iJOIN Plenary meeting</li> <li>• Network deployment analysis with respect to U/C plane split, mobility patterns, density of RANaaS entities</li> <li>• Attending WP4 TelCos</li> <li>• Study of existing architectures that can be adopted, for positioning the RANaaS</li> <li>• Prepare paper for invited session at European Wireless 2014</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Further development of the congestion control proposal for iTN in RANaaS scenarios</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• On-going work on refining the proposed mobility management scheme and exploring the analytical modelling method for CT4.1 distributed mobility anchoring and mobility management.</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role.</li> <li>• Task leadership related activities.</li> <li>• Slides preparation for the Turin plenary meeting.</li> <li>• Attendance to the Turin plenary meeting and participation in the discussions.</li> <li>• Mobility within small-cell networks: analysis of techniques for a smart access network selection following a SDN-based approach. Status: ongoing. Design of high-level procedures, included in D4.1</li> <li>• Analysis of the applicability of a DMM paradigm in the iJOIN architecture following a SDN-based approach. Status: ongoing.</li> <li>• Updated contributions to IR6.2 on the description of the SDN-based network control demonstrator.</li> <li>• Contributions to the first periodic report.</li> <li>• Preparation and presentation of the WP4 slides for the 1st Technical Review in Brussels.</li> <li>• Attendance to the 1st Technical Review in Brussels.</li> </ul>

Sixth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP3 bi-weekly phone calls</li> <li>• Participation in Grenoble meeting 01-03 April 2014.</li> <li>• Contribution to IR3.2</li> <li>• CT working slides</li> <li>• Development of a new cooperative approach for the power allocation/scheduling in a two iSCs scenarios based on the statistical information. Evaluation of the performance and comparison with the conventional solutions from the literature.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Analysis of state of the art regarding the mobile backhaul topology and connectivity for supporting small cells considering heterogeneous technologies</li> <li>• Slide-set has been prepared which shows the challenges and a set of different solutions considering extensions of the current mobile backhaul and Greenfield solutions</li> <li>• Analysis of different cases considering the QoS expectation and the resiliency</li> <li>• High level analysis for positioning the RANaaS inside the LTE network considering the network capacity constraints, operator policies, the user activity and mobility patterns</li> <li>• Analysis on integrating carrier aggregation with multi-path support for small cell scenarios considering iJoin architecture of the virtual eNB (paper has been submitted to EW 2014)</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Participation in the elaboration of IR4.2 in the areas of congestion control and SDN</li> <li>• Participation in the WP telcos</li> <li>• Contribution to the discussion of network sharing option with RANaaS infrastructure</li> </ul>

	<ul style="list-style-type: none"> <li>• Further development of the congestion control proposal for iTN in RANaaS scenarios</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role.</li> <li>• Task leadership related activities.</li> <li>• Slides preparation for the Grenoble plenary meeting.</li> <li>• Updates on the SDN-based network control demonstrator.</li> <li>• Mobility within small-cell networks: analysis of techniques for a smart access network selection following a SDN-based approach. Status: ongoing. Design of high-level procedures.</li> <li>• Analysis of the applicability of a DMM paradigm in the iJOIN architecture following a SDN-based approach. Status: ongoing.</li> <li>• Updated description of CT4.1 description in IR4.2</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Remotely Attending WP4 session in the iJOIN Grenoble meeting.</li> <li>• Attending WP4 bi-weekly telcos.</li> <li>• Editing/Contributing to section 4 of IR4.2, which discusses an update on the functional architecture.</li> <li>• Ongoing work on mobility management and distributed IP anchoring (CT4.1) with an updated description and preliminary analytical results.</li> <li>• Contribution of the CT4.1 update to IR4.2- section 3.1 with preliminary analytical results.</li> </ul>

Seventh quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Analysis of deployment options for RANaaS</li> <li>• Analysis of side-constraints and side-effects of RANaaS deployment, e.g. BH parameters, routing, capacity, latency</li> <li>• Input to IR4.2</li> <li>• Participation in WP4 telcos and plenary meeting</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP4 phone calls.</li> <li>• Participation in Bologna meeting 24-26 June 2014.</li> <li>• Contribution to D4.2</li> <li>• Participation in virtual Meetings.</li> <li>• We have started formulating a joint optimization framework, to tackle simultaneously the Energy-minimization problem (CT4.2) and the Load Balancing (CT4.5) problem. Investigation in the trade-offs between them, and between accuracy-complexity.</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role.</li> <li>• Task leadership related activities.</li> <li>• Attending to Bologna meeting.</li> <li>• Slides preparation for the Bologna meeting.</li> <li>• Mobility within small-cell networks: analysis of techniques for a smart access network selection following a SDN-based approach. Status: ongoing. Design of high-level procedures.</li> <li>• CT4.1 description in IR4.2</li> <li>• CT4.1 preliminary results included in IR4.2</li> <li>• Discussions on the backhaul topology design. Status: ongoing.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attended WP4 session in the iJOIN Bologna meeting in June 2014.</li> <li>• Attended WP4 bi-weekly telcos.</li> <li>• Presented an update to the mobility management and distributed IP anchoring work in the Bologna meeting. It was decided it would not add much value to UC3M's work on centralised SDN based mobility management that has already been implemented in a the</li> </ul>

	form of a test-bed, so it was agreed to shift the focus in future to T4.3 on Energy Efficiency work.
<b>TID</b>	<ul style="list-style-type: none"> <li>• Edition of the D4.2. Proposal of Table of Contents.</li> <li>• Participation in the WP telcos and F2F meeting</li> <li>• Analysis of backhaul performance for different technological solutions from WP4 viewpoint</li> </ul>

Eighth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role.</li> <li>• Task leadership related activities.</li> <li>• Attending to Virtual meeting.</li> <li>• Slides preparation for the Bologna meeting.</li> <li>• CT4.1 description in D4.2:</li> <li>• CT4.1 preliminary results included in D4.2</li> <li>• Discussions on the required OpenFlow extensions for iJOIN architecture. Status: ongoing.</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Edition of the D4.2.</li> <li>• Participation in the WP telcos and WP virtual meeting</li> <li>• Analysis of backhaul performance for different technological solutions from WP4 viewpoint</li> <li>• Further development of the congestion control proposal for iTN in RANssS scenarios</li> <li>• Development of the simulation tool for the evaluation of the CT</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Analysis and description of RANaaS positioning and dimensioning options; analysis of side-constraints and update of model to include these constraints</li> <li>• Participation in WP4 telcos</li> <li>• Preparation of virtual meeting</li> <li>• Contributions to D4.2</li> <li>• Derivation of genetic algorithm to derive optimal RANaaS deployments</li> <li>• Preparation of example deployments for analysis</li> <li>• Study on path-computation algorithms</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attended WP4 bi-weekly telcos, and presented the signal &amp; protocol design for EE algorithm of NEO module</li> <li>• Attended the virtual meeting (09-30/10-01), and presented the update from UniS on developments in WP4</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP4 phone calls.</li> <li>• Participation in virtual meeting and presentation in WP4 for the proposed CT</li> <li>• Contribution to D4.2</li> <li>• Participation in virtual Meetings.</li> <li>• Formulation of a joint optimization framework, to tackle simultaneously the Energy-minimization problem (CT4.2) and the Load Balancing (CT4.5) problem. Investigation of “smart” load balancing techniques.</li> </ul>

Ninth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role.</li> </ul>

	<ul style="list-style-type: none"> <li>• Task leadership related activities.</li> <li>• Attending to Milan meeting.</li> <li>• Slides preparation for the Milan meeting.</li> <li>• CT4.1 description in D4.2:</li> <li>• CT4.1 preliminary results included in D4.2</li> <li>• Preparation for the MWC demo. Status: ongoing.</li> <li>• Discussions on the required OpenFlow extensions for iJOIN architecture. Status: ongoing.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Analysis and description of RANaaS positioning and dimensioning options; analysis of side-constraints and update of model to include these constraints</li> <li>• Participation in WP4 telcos</li> <li>• Preparation and participation to Milan plenary meeting</li> <li>• Derivation of genetic algorithm to derive optimal RANaaS deployments</li> <li>• Preparation of example deployments for analysis</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Edition of the D4.2.</li> <li>• Participation in the WP telcos and WP virtual meeting</li> <li>• Analysis of backhaul performance for different technological solutions from WP4 viewpoint</li> <li>• Analysis of real deployment scenarios of the mobile network transport infrastructure</li> <li>• Development of the simulation tool for the evaluation of the CT</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attended WP4 bi-weekly telcos</li> <li>• Attended the physical meeting (11-03/11-06), and presented the update from UniS on WP4, including CoMP-enhanced scheme for energy efficiency and analysis of iJOIN backhaul differentiation</li> <li>• Ongoing preparation of one paper for EuCNC 2015</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP4 phone calls.</li> <li>• Attending the iJOIN face-to-face meeting in Milan, 4/11-6/11 2015</li> <li>• Contribution to D4.3</li> <li>• Problem formulation for joint framework of Energy-minimization problem (CT4.2) and the Load Balancing (CT4.5) problem and further progress</li> <li>• Presentation of "Reducing the Energy Consumption of Small Cell Networks Subject to QoE Constraints" in Globecom December-2014, Texas</li> </ul>

Tenth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Definition and configuration of scenarios for simulations in the study of RANaaS deployment</li> <li>• Simulation and evaluation of RANaaS positioning and dimensioning options under different functional split options.</li> <li>• Participation in WP4 telcos</li> <li>• Input to deliverable D4.3</li> <li>• Paper preparation on RANaaS placement study</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Contributions to D4.3.</li> <li>• Participation in the WP telcos and WP virtual meeting</li> <li>• Analysis of backhaul performance for different technological solutions from WP4 viewpoint</li> <li>• Analysis of real deployment scenarios of the mobile network transport infrastructure</li> <li>• Development of the simulation tool for the evaluation of the CT</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role.</li> <li>• Task leadership related activities.</li> <li>• Attendance to Bremen meeting.</li> </ul>

	<ul style="list-style-type: none"> <li>• Attendance to Dresden meeting.</li> <li>• Slides preparation for the Bremen meeting.</li> <li>• Slides preparation for the Dresden meeting.</li> <li>• CT4.1 evaluation in D4.3</li> <li>• Final preparation for the MWC demo. Status: ongoing.</li> <li>• Discussions on the required OpenFlow extensions for iJOIN architecture.</li> <li>• Contributions to EuCNC 2015 WP4 paper submission “SDN-based Joint Backhaul and Access Design for Efficient Network Layer Operations” (accepted).</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attended WP4 bi-weekly telcos</li> <li>• Attended the physical meeting (25-02/27-02) in Bremen, and presented the update from UniS on WP4,</li> <li>• Attended the physical meeting (15-04/17-04) in Dresden, and presented the update from UniS on WP4,</li> <li>• Finalised common scenarios results on CoMP-enhanced scheme for energy efficiency. Updates and new results will be included in D4.3</li> </ul>

#### 2.4.4 Task 4.3: Network operation and system management

First quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attendance to the kick-off meeting</li> <li>• Participation to WP4 bi-weekly phone calls</li> <li>• Internal discussions on contributions and write up of ideas</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in kick-off meeting</li> <li>• Participation in WP periodic phone calls</li> <li>• Authoring contribution to deliverable IR4.1</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role</li> <li>• Slides preparation for the kick-off meeting.</li> <li>• Attendance to the kick-off meeting and participation in the discussions</li> <li>• Mobility within small-cell networks: analysis of UE required support for a smart access network selection. Status: ongoing, unreported</li> <li>• Analysis of traffic offloading in jointly designed backhaul/access architecture. Status: ongoing, unreported</li> <li>• Contribution to IR4.1.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• As T4.3 leader, contribution will be made to the iJOIN RANaaS paper that will be submitted to FUNEMS 2013 conference</li> </ul>

Second quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Definitions of WP4 use cases and requirements</li> <li>• Analysis of back haul using stochastic geometry (ongoing)</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role.</li> <li>• Slides preparation for the Heidelberg meeting.</li> <li>• Attendance to the Heidelberg meeting and participation in the discussions.</li> <li>• Mobility within small-cell networks: analysis of UE required support for a smart access network selection. Status: ongoing. Initial considerations reported in IR4.1.</li> </ul>

	<ul style="list-style-type: none"> <li>• Analysis of traffic offloading in a jointly designed backhaul/access architecture. Status: ongoing. Initial considerations reported in IR4.1.</li> <li>• Contribution to IR4.1.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Contributed to IR4.1: in section 6.1 “integrate WP4 technology candidates in iJOIN architecture”. The initial input addresses how WP4 technology fits within iJOIN architecture.</li> </ul>

Third quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Analysis of backhaul using stochastic geometry (on going).</li> <li>• Discussions about theoretical model refinement to reflect the technologies proposed by WP4 (on going).</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role</li> <li>• Slides preparation for the Surrey meeting.</li> <li>• Attendance to the Surrey meeting and participation in the discussions.</li> <li>• Mobility within small-cell networks: analysis of UE required support for a smart access network selection following a SDN-based approach. Status: ongoing. Initial design considerations reported</li> <li>• Analysis of traffic offloading in a jointly designed backhaul/access architecture following a SDN-based approach. Status: ongoing. Initial design considerations reported</li> <li>• Contribution to D4.1.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attended the iJOIN meeting in Surrey and presented UNIS work update in WP4, with a special focus on CT4.1.</li> <li>• Discussion on the WP4 architecture, I/O table and interfaces between modules for the UniS candidate technologies.</li> </ul>

Fourth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP4 bi-weekly phone calls.</li> <li>• Participation in virtual meeting.</li> <li>• Contributions to the deliverable D4.1 for the use case, assumptions and requirements, and SDN architecture related to candidate technology focusing on system-wide energy optimisation.</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Literature Analysis</li> <li>• Discussions about theoretical model refinement to reflect the technologies proposed by WP4 (on-going).</li> <li>• Investigation of backhaul cost models with a focus on different backhaul technologies (on-going).</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role</li> <li>• Slides preparation for the virtual meeting.</li> <li>• Attendance to the virtual meeting and participation in the discussions</li> <li>• Mobility within small-cell networks: analysis of UE required support for a smart access network selection following a SDN-based approach. Status: ongoing. First results included in D4.1</li> <li>• Final contributions to D4.1. File available on the project</li> </ul>

<b>UNIS</b>	<ul style="list-style-type: none"> <li>On-going work in defining the SDN based energy optimisation framework and signalling for UNIS CT4.2 network wide energy optimisation</li> </ul>
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Fifth quarter:

<b>Partner</b>	<b>Achievements Milestones Work items in progress</b>
<b>IMC</b>	<ul style="list-style-type: none"> <li>Making progress on the proposed CT for system level energy optimization. Some analytical and simulation work in progress.</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>Discussions about refining the theoretical model to include other WP4 technologies.</li> <li>Investigation of backhaul cost models with a focus on different backhaul technologies (on-going).</li> <li>Investigation of backhaul cost models in heterogeneous networks (on-going).</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>Preparation of presentation for CT4.2 for the audit.</li> <li>Ongoing work on investigating the energy saving algorithm running in iNC for CT4.2 network-wide energy optimisation.</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>Coordination of the work done within this task and the overall WP4, as part of WPL role</li> <li>Slides preparation for the Turin plenary meeting.</li> <li>Attendance to the Turin plenary meeting and participation in the discussions.</li> <li>Mobility within small-cell networks: analysis of UE required support for a smart access network selection following a SDN-based approach. Status: ongoing.</li> <li>Contributions to the first periodic report.</li> <li>Preparation and presentation of the WP4 slides for the 1st Technical Review in Brussels.</li> <li>Attendance to the 1st Technical Review in Brussels.</li> </ul>

Sixth quarter:

<b>IMC</b>	<ul style="list-style-type: none"> <li>Participation in WP3 bi-weekly phone calls.</li> <li>Participation in Grenoble meeting 01-03 April 2014.</li> <li>Contribution to IR3.2</li> <li>CT working slides</li> <li>Development of a new cooperative approach for the power allocation/ scheduling in a two iSCs scenarios based on the statistical information. Evaluation of the performance and comparison with the conventional solutions from the literature.</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>Participation in WP4 bi-weekly phone calls.</li> <li>Participation in the Grenoble meeting 31 Mar – 1 Apr 2014.</li> <li>Contributed to D4.2.</li> <li>Discussions about methods to refine the cost model to enable a comparison of iJOIN versus non-iJOIN type of backhaul technologies (on-going).</li> <li>Investigation of backhaul cost models in heterogeneous networks (on-going).</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>Coordination of the work done within this task and the overall WP4, as part of WPL role</li> <li>Slides preparation for the Grenoble plenary meeting.</li> <li>Mobility within small-cell networks: analysis of UE required support for a smart access network selection following a SDN-based approach. Status: ongoing.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>Ongoing work on investigating the energy saving algorithm running in iNC for CT4.2 network-wide energy optimisation.</li> <li>Contribution of UNIS updates to IR4.2 section 3.2.</li> </ul>

Seventh quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role.</li> <li>• Task leadership related activities.</li> <li>• Attendance to Bologna meeting.</li> <li>• Slides preparation for the Bologna meeting.</li> <li>• Mobility within small-cell networks: analysis of UE required support for a smart access network selection following a SDN-based approach. Status: ongoing.</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP4 phone calls.</li> <li>• Participation in Bologna meeting 24-26 June 2014.</li> <li>• Contribution to D4.2</li> <li>• Participation in virtual Meetings.</li> <li>• We have started formulating a joint optimization framework, to tackle simultaneously the Energy-minimization problem (CT4.2) and the Load Balancing (CT4.5) problem. Investigation in the trade-offs between them, and between accuracy-complexity.</li> <li>• The paper submitted to Globecom entitled “<i>Reducing the Energy Consumption of Small Cell Networks subject to QoE constraints</i>“ has been accepted .</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP4 bi-weekly phone calls.</li> <li>• Contributed to D4.2</li> <li>• Participation in Bologna meeting 24-26 June 2014.</li> <li>• Developed a cost model to enable a comparison of iJOIN versus non-iJOIN type of backhaul technologies (on-going).</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Ongoing work on investigating the implementation of EE algorithm in iJOIN in collaboration with IMC.</li> <li>• Held a telco with IMC to discuss the scope of joint work with IMC developing the algorithm and UNIS investigating the signalling aspects.</li> <li>• Prepared some slides on algorithm implementation for further discussion with Nick and Carlos.</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Further development of the congestion control proposal for iTN in RANssS scenarios</li> <li>• Development of the simulation tool for the evaluation of the CT</li> </ul>

Eighth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP4 bi-weekly phone calls</li> <li>• Contributed to D 4.2</li> <li>• Participation in virtual meeting</li> <li>• Developed a cost model to enable a comparison of iJOIN versus non-iJOIN type of backhaul technologies (on-going).</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Work on the implementation of EE algorithm in iJOIN in collaboration with IMC.</li> <li>• Signalling &amp; protocol design for EE, also the enhancement of EE algorithm by introducing CoMP in NEO decision</li> <li>• Telco and offline discussion with Luca and Nick on the interactions of modules for NEO functionality, and provide detailed design for such interactions as an input for Deliverable 4.2</li> <li>• Ongoing offline discussion with Luca and Nick on the potential OpenFlow extension for NEO</li> <li>• Contribution for the deliverable 4.2 in section 5.2 on CoMP enhanced scheme and</li> </ul>



	section 6.2.3
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP4 phone calls.</li> <li>• Participation in virtual meeting and presentation in WP4 for the proposed CT</li> <li>• Contribution to D4.2</li> <li>• Joint optimization framework, to tackle simultaneously the Energy-minimization problem (CT4.2) and the Load Balancing (CT4.5) problem.</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role.</li> <li>• Task leadership related activities.</li> <li>• Attending to Virtual meeting.</li> <li>• Slides preparation for the Bologna meeting.</li> <li>• Coordination of the functional architecture definition and of the interactions between functional modules.</li> <li>• CT4.1 interaction with other CTs defined in D4.2</li> <li>• Discussions on the required OpenFlow extensions for iJOIN architecture. Status: ongoing.</li> <li>• Mobility within small-cell networks: analysis of UE required support for a smart access network selection following a SDN-based approach. Status: ongoing.</li> </ul>

Ninth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Work on network-wide energy optimization in iJOIN in collaboration with IMC, focusing on energy efficiency control of backhaul network node.</li> <li>• Cooperation work with Luca Cominardi (IMDEA) on potential OpenFlow extensions focusing on support of wireless medium and switch on/off;</li> <li>• Cooperation work with Luca Cominardi (IMDEA) on the implementation of PBB-TE in iJOIN;</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP4 phone calls.</li> <li>• Attending the iJOIN face-to-face meeting in Milan, 4/11-6/11 2015</li> <li>• Contribution to D4.3</li> <li>• Problem formulation for joint framework of Energy-minimization problem (CT4.2) and the Load Balancing (CT4.5) problem and further progress</li> <li>• Preparation and Submission of another paper relative to CT 4.5 (for user-association and load balancing in small cell networks) into ICC workshop 2015</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role.</li> <li>• Task leadership related activities.</li> <li>• Attending to Milan meeting.</li> <li>• Slides preparation for the Milan meeting.</li> <li>• Coordination of the functional architecture definition and of the interactions between functional modules.</li> <li>• CT4.1 interaction with other CTs defined in D4.2</li> <li>• Discussions on the required OpenFlow extensions for iJOIN architecture. Status: ongoing.</li> <li>• Comparison of mobility solutions following a DMM approach: PMIPv6, routing and SDN-based. First version: accepted in IEEE Communications Magazine. To be presented in the iJOIN winter school. Extended version: ongoing.</li> <li>• Analysis of iJOIN backhaul topologies and technologies to be used in the final evaluation (to be reported in D4.3). Status: ongoing.</li> </ul>

Tenth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>UniS</b>	Finalised work on <ul style="list-style-type: none"> <li>• Network-wide energy optimization in iJOIN focusing on energy efficiency control of backhaul network node (in collaboration with IMC)</li> <li>• Potential OpenFlow extension, focusing on support of wireless medium and switch on/off (In collaboration with Luca-UC3M)</li> <li>• Implementation of PBB-TE (In collaboration with Luca-UC3M)</li> </ul> Updates included in D4.3
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation to the Bremen F2F meeting and contribution to WP4 slide set</li> <li>• Participation in WP4 phone calls.</li> <li>• Contribution to D4.3 for the CT and system wide results for network energy optimization</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Coordination of the work done within this task and the overall WP4, as part of WPL role.</li> <li>• Task leadership related activities.</li> <li>• Attendance to Bremen meeting.</li> <li>• Attendance to Dresden meeting.</li> <li>• Slides preparation for the Bremen meeting.</li> <li>• Slides preparation for the Dresden meeting.</li> <li>• CT4.1 evaluation in D4.3</li> <li>• Discussions on the required OpenFlow extensions for iJOIN architecture.</li> <li>• Analysis of iJOIN backhaul topologies and technologies to be used in the final evaluation. Status: included in D4.3</li> <li>• Comparison of the iJOIN backhaul transport control with the ONF architecture. Included in D4.3</li> <li>• A paper on SDN and Energy Efficiency has been accepted in IEEE Network: “An OpenFlow Architecture for Energy Aware Traffic Engineering in Mobile Networks”, Carlos Donato, Pablo Serrano, Antonio de la Oliva, Albert Banchs, Carlos J. Bernardos</li> </ul>

## 2.5 WP5: System Requirements and Integration

### 2.5.1 Summary

In the **first quarter** of the project, Tasks 5.1 and 5.2 worked together on the preparation of IR 5.1. Input from partners was collected for state of the art sections as well as input from WP2-3-4 on requirements. Thus, an important aspect in Q2 was the alignment with other WPs in order to ensure a proper identification of the interfaces for the definition of the iJOIN architecture. WP5 is worked in collaboration with other WPs on two papers on RANaaS and joint access/backhauling design, to be submitted to FuNeMs2013.

In the **second quarter**, the activities in WP5 continued with periodic telcos, further inputs from partners and WPs for the completion of the IR5.1, and e-mail discussions regarding the following topics:

- Reference scenarios
- Draft definition of the iJOIN logical architecture
- First set of harmonised assumptions and requirements
- First definition of functional architecture (definition of interfaces and information exchange between candidate technologies)

WP5 met physically in Heidelberg, where plenary sessions served to agree on main definitions related to the iJOIN architecture, and to make plans for the subsequent months. The last part of the period was dedicated to IR5.1 review phase and alignment with other WPs to ensure the consistency with other internal reports.

In the **third quarter**, the activities in WP5 continued with periodic telcos and e-mail discussions regarding the following topics:

- Functional split and functional architecture (definition of interfaces and information exchange between candidate technologies)
- Further discussion on draft iJOIN logical architecture
- Physical architectures (based on the 4 iJOIN common scenarios)
- Evaluation phase (discussion not completed)

WP5 met physically in Guildford, where plenary sessions focused on discussions on the iJOIN architecture (in particular control functions for the 2 iJOIN key enablers).

During the **fourth quarter** of the project, significant advancements took place in WP5. The definition of the draft iJOIN logical architecture (planned for M12) progressed quite a lot, achieving a stable version of the definitions and agreements, thanks to dedicated WP5 telcos and Virtual Meeting. Moreover, the process for the definition of functional architecture permitted the definition of interfaces between WP2, WP3 and WP4 modules. This was described in D5.1, and serves as the starting point for further elaborations of the detailed specification of the architecture that will take place in the following months. WP5 started driving also a work on functional split, by identifying some functional split variants, and by triggering discussion within related WPs. Another important aspect that will be studied in future months is also the set of requirements given by 3GPP specifications (for the practical feasibility of a certain split between RANaaS and iSCs). The first deliverable, D5.1, was finalised and delivered in due time. This document is a very important milestone in WP5, as it analyses existing related work (baseline system) and paves the way for a more detailed definition of interfaces and architecture that will be developed throughout the project lifetime. On the dissemination side, a project-wide paper for 5G was accepted to IEEE Communication Magazine.

During the **fifth quarter** of the project, and after the completion of D5.1 deliverable, harmonized WP results were presented at the F2F meeting in Turin, collected in the technical periodic report, and summarized also in the presentation for the audit (technical review meeting at Bruxelles). In the meantime, WP5 continued with the organization of recurrent biweekly telcos, and some significant advancement took place. In particular WP5 drove:

- a more detailed discussion on the definition of PHY architectures
- first thoughts on RAN sharing support by iJOIN project

A first skeleton (together with the related timeplan) of IR5.2 deliverable was drafted, and related section editors were assigned. All the WP5-related outcomes in this period were harmonized with other WPs. On the dissemination side, the IWPC workshop hosted by Telecom Italia took place on 25-28 November in Turin, and was a unique opportunity to collect the points of view of different stakeholders (from industrial companies, liked vendors and operators, to research institutions and EU projects).

During the **sixth quarter** of the project, a first round of contributions was integrated in IR5.2, and harmonized WP results were presented at the F2F meeting in Grenoble (31 March - 2 April), in order to align the workflow that will allow for project-wide evaluations, comparison and possibly, finally, combination of individual results. WP5 continued the organization of recurrent biweekly telcos, and made significant progress, in particular in the context internal report IR5.2:

- a more detailed definition of evaluation parameters for PHY architectures definitions
- further discussion on RAN sharing, 3GPP support and role of iJOIN entities for RAN sharing
- elaboration of a comprehensive power model for energy efficiency evaluations

On the dissemination side, a WP5 paper on Energy Efficiency evaluation esd written and submitted for IEEE Network SI on “Unveiling 5G Wireless Networks: Emerging Research Advances, Prospects, and Challenges”. Finally CLEEN2014 workshop (organized together with TROPIC and MCN projects) took place in Istanbul, co-located with WCNC2014.

During the **seventh quarter** of the project, a second round of contributions was integrated in IR5.2, and final harmonized version of IR5.2 was revised and discussed during the F2F meeting in Bologna (24 June - 26 June). In the meantime, WP5 continued with the organization of recurrent biweekly telcos, and some significant advancement took place in WP5, in the view of next deliverable D5.2. In particular, WP5 drove

the definition of a common workflow in order to provide global evaluations of performances at project completion:

1. Definition of four CSs and related PHY architectures (with high level parameters)
2. Alignment of common assumptions across all CTs, in order to have comparable results
3. Understand (at WP level) the conceptual possibility to have multiple CTs in a system
4. Evaluate combination of numerical results wrt. the targets

The first step was addressed in IR5.2. The second step was preliminarily addressed in IR234.2. Steps 3 and 4 were left for the final deliverable D5.3. On the dissemination side, the workshop “SON and CLOUD RAN USA” has been organized and chaired.

During the **eighth quarter** of the project, D5.2 deliverable was defined in terms of ToC (Table of Contents) and timeplan (in accordance with PO, D5.2 delivery date has been delayed to M25, in order to permit a better alignment with other deliverables in WP234, due at M24). Two rounds of contributions were integrated, in order to have a stable version ready for discussion during next F2F meeting in Milan. In the meantime, WP5 continued with the organization of recurrent biweekly telcos, and some significant advancement took place in WP5 discussions. In particular:

- Update of common scenarios in iJOIN
- preliminary discussions about the methodology for the global evaluation
- aspects related to tradeoff analysis, especially in a cross-WP perspective
- further alignment on alignment of common assumptions across all CTs, in order to have comparable results
- further discussion on metrics, in the view of evaluating combination of numerical results wrt. the targets
- alignment with WP6 leader on harmonization of testbeds and WP5 assumptions

On the dissemination side, a paper on Energy Efficiency was been submitted to IEEE access and accepted. In addition, iJOIN concepts were presented during the “Fronthaul & CRAN summit” in Barcelona (28-29 October).

During the **ninth quarter** of the project, D5.2 deliverable was completed and delivered. Furthermore, structure (table of contents) and timeplan for D5.3 were defined. In the meantime, WP5 continued with the organization of recurrent biweekly telcos. WP5 further progressed with the final definition of the iJOIN system architecture, functional split integration and application of joint RAN/BH concept. In addition, WP5 partners continued to work on contributions to the project wide evaluation, which are the foundation for the derivation of iJOIN system design criteria. WP5 contributed to a feature topic of the IEEE Communications Magazine standards supplement on advanced cloud and virtualization techniques for 5G networks. This contribution was a joint effort of WP5 partners and captures mostly achievements described in D5.2. Furthermore, a joint paper was submitted to the IEEE VTC’15 workshop on 5G Architecture. Finally, WP5 prepared a workshop proposal for EuCNC’15 in collaboration with FP7 projects TROPIC and CROWD.

During the **tenth quarter** of the project, D5.3 deliverable was completed and delivered. In the meantime, WP5 continued with the organization of recurrent biweekly telcos. WP5 further finalized the final definition of the iJOIN system architecture, cloud architecture and relations with ETSI NFV framework, functional split integration and application of joint RAN/BH concept. In addition, WP5 partners work on contributions to the project wide evaluation which was discussed also during the last F2F meeting in Dresden, in the view of the final WP5 report D5.3. Finally, WP5 prepared CLEEN2015 half-day workshop, co-located with EuCNC’15 and in collaboration with FP7 projects TROPIC and CROWD.

Task	Status <sup>1</sup>	Variance <sup>2</sup>	Cause/Way-Forward <sup>3</sup>	Expected deadlines <sup>4</sup>	Affected Partners <sup>5</sup>
<b>Task 5.1</b>	Green	No delays or changes of topics	N.A.	IR5.1 and IR 5.2 delivered on time. D5.1, D5.2 and D5.3 delivered on time.	none
<b>Task 5.2</b>	Green	No delays or changes of topics	N.A.	see above	none

## 2.5.2 Task 5.1: System Requirements and Deployment Scenarios

First quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP5 Kick-off meeting</li> <li>• Participation in regular phone calls</li> <li>• Input to WP5 working document on CEA scenarios and use cases</li> <li>• Definition of baseline assumptions and related questions (together with NEC)</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation to kick-off meeting</li> <li>• Participation to WP periodic conferences</li> <li>• Peer reviewing contribution to deliverable IR5.1 (as far as T5.1 related topics are concerned), focused on IT-cloud computing perspective, HP's core competence</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attendance to the kick-off meeting and participation in the discussions</li> <li>• Participation to WP5 regular phone calls</li> <li>• Contribution to the definition and discussion of the WP5 use cases, scenarios, and requirements</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to the kick-off meeting and participation in the discussions</li> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Contribution to IR5.1 document</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Input to WP5 working document on NEC scenarios and use cases</li> <li>• Definition of baseline assumptions and related questions (together with CEA)</li> <li>• NEC internal discussion of requirements/deployment scenarios; harmonisation with input from other partners</li> <li>• Harmonisation with WP3 and WP4 work</li> <li>• Participation in regular phone calls</li> <li>• Participation in WP5 KO meeting</li> <li>• Ramp-up of work on metrics</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Attend kick-off meeting in Madrid (22,23/11/12)</li> <li>• Attend the periodic WP5 phone calls</li> <li>• Input to IR5.1 on the scenario, use cases, definition</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Coordination of WP5 work (incl. regular phone calls)</li> <li>• Preparation of WP5 KO meeting in Nov'12</li> <li>• Set up of WP5 working document, collecting initial input for scenarios and use cases</li> <li>• Harmonisation with WP2/WP3/WP4 (common templates, avoiding redundant work, ...)</li> <li>• Contributions on EARTH project and on backhauling technologies</li> <li>• Definition of relevant use cases and scenarios</li> <li>• First PPT contribution on TI view and scenarios</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Preparation and participation in the WP meeting held in Madrid</li> <li>• Preparation of contribution to IR5.1</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in kick-off meeting</li> <li>• Participation in WP periodic phone calls</li> <li>• Authoring contribution to deliverable IR5.1</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Attendance to the kick-off meeting and participation in the discussions</li> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Contribution to IR5.1 document.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Provided scenarios from UNIS for overall iJOIN scenario development</li> </ul>

<b>UoB</b>	<ul style="list-style-type: none"> <li>• Input to WP5 working document on UoB scenarios and use cases</li> <li>• Harmonisation with WP2 and WP3 work</li> <li>• Participation in WP5 kick-off meeting</li> <li>• Participation in regular phone calls</li> </ul>
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Second quarter:

<b>Partner</b>	<b>Achievements Milestones Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Contribution to deliverable IR5.1: scenario and use cases definition, identification of relevant objectives, SoTA on relevant UE projects and small cell deployment evaluation assumptions</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation to meeting in Heidelberg;</li> <li>• Participation and contribution to all the WP periodic conferences</li> <li>• Deliverable IR5.1: Contribution to section 4.4.5 (Other projects on datacentre energy saving)</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attending regular biweekly telcos</li> <li>• Contribution to FuNEMS 2013 paper on RANaaS</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to the Heidelberg meeting and participation in the discussions.</li> <li>• Attendance to WP5 bi-weekly phone calls.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Input to IR5.1 (cloud SotA, use cases, requirements/assumptions, functional split, architecture)</li> <li>• NEC internal discussion of requirements/deployment scenarios; harmonisation with input from other partners</li> <li>• Harmonisation with WP3 and WP4 work</li> <li>• Participation in regular phone calls</li> <li>• Participation in WP5 plenary meeting</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend general assembly meeting in Heidelberg (20-22/03/13).</li> <li>• Attend the periodic WP5 phone calls</li> <li>• Input to IR5.1 on the scenario, use cases, definition.</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Coordination of WP5 work (incl. regular phone calls)</li> <li>• Participation to the Heidelberg meeting in March 2013</li> <li>• Preparation of WP5 sessions for Heidelberg meeting</li> <li>• Contributions on IR5.1 document, on area throughput, energy efficiency and EU project EARTH, terminology, first contribution on evaluation methodology</li> <li>• Definition of first draft of iJOIN logical architecture</li> <li>• Harmonisation with WP2/WP3/WP4 (common templates, avoiding redundant work, ...)</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Participation in the WP meeting held in Heidelberg</li> <li>• Contributions to IR5.1: definition of the wide area scenario</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in plenary meeting in Heidelberg.</li> <li>• Participation in bi-weekly telephone conferences.</li> <li>• Contributions to IR 5.1.</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Attendance to the Heidelberg meeting and participation in the discussions</li> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Contribution to IR5.1 document.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Provided detailed description for two of overall iJOIN scenarios [Stadium and Square] in a template which was agreed by other partners and used for description of other scenarios as well</li> </ul>

<b>UoB</b>	<ul style="list-style-type: none"> <li>• Input to IR5.1.</li> <li>• Harmonization with WP2 assumptions and requirements for definition of iJOIN architecture.</li> <li>• Discussion of iJOIN overall assumptions and definition of terminology w.r.t. requirements</li> <li>• Participation in WP5 plenary meeting in Heidelberg</li> </ul>
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Third quarter:

<b>Partner</b>	<b>Achievements Milestones Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Attending regular biweekly telcos</li> <li>• Participation to the F2F meeting in Surrey</li> <li>• Harmonisation with WP3 Requirement and assumptions</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation to F2F meeting in Guildford</li> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Liaisoning towards WP6 for the discussion about demonstrators</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attending all WP5 sessions physically in Surrey</li> <li>• Attending regular biweekly telcos.</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to the Guildford meeting and participation in the discussions.</li> <li>• Attendance to WP5 bi-weekly phone calls.</li> <li>• Harmonization with other WPs</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Contributions to Surrey meeting</li> <li>• Attending regular WP5 TelCos</li> <li>• Support of definition of test platforms; jointly with WP6 (IR6.1)</li> <li>• Harmonization of requirements and assumptions across WPs</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend general assembly meeting in Surrey.</li> <li>• Attend the periodic WP5 phone calls</li> <li>• Common Scenario 4 (CS4 – Indoor) mapping to the logical/physical WP5 architecture (started)</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Coordination of WP5 work (incl. regular phone calls).</li> <li>• Preparation of WP5 sessions for Guildford meeting</li> <li>• Participation to Guildford meeting (June 2013). Preparation and presentation of WP5 sessions.</li> <li>• Review of IR5.1 document an alignment with other WPs for guaranteeing coherence in the view of the IR5.1 delivery to PO.</li> <li>• Coordination with D5.1 editor in order to agree on timeplan and document skeleton</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Participation in the WP meeting held in Guildford</li> <li>• Contributions to D5.1: definition of the wide area scenario</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP5 bi-weekly phone calls.</li> <li>• Participation in Surrey meeting.</li> <li>• Contributions to D5.1</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Attendance to the Surrey meeting and participation in the discussions</li> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Contribution to physical mapping of CS2.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Provided final contributions to IR5.1 to the scenarios description</li> <li>• Provided external review of IR5.1</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Discussion of iJOIN overall assumptions and definition of terminology w.r.t. requirements</li> <li>• Participation in WP5 plenary meeting in Guildford</li> </ul>

Fourth quarter:

<b>Partner</b>	<b>Achievements Milestones Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Editor of the deliverable D3.1</li> <li>• Contribution to deliverable D3.1: Sections 4 and 5.</li> <li>• Literature review of New Carrier Type based solutions.</li> <li>• Research on an algorithm for energy saving in the New Carrier Type framework</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation at virtual meeting (September 2013)</li> <li>• Related sections of D5.1 (as main editor)</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP5 bi-weekly phone calls.</li> <li>• Participation in WP5 virtual meeting.</li> <li>• Contributions to D5.1 regarding the iJOIN demonstration activity.</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to the virtual meeting and participation in the discussions.</li> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Harmonisation with other WPs</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Contributions to virtual meeting</li> <li>• Attending regular WP5 TelCos</li> <li>• Support of definition of test platforms; jointly with WP6 (IR6.1)</li> <li>• Contributions to definition of functional and logical architecture, including virtual eNB definition (see WP5 TelCo and meeting minutes)</li> <li>• Contributions to D5.1, e.g. functional split, functional architecture, logical architecture</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend virtual meeting (24-25/09/13)</li> <li>• Attend the periodic WP5 phone calls</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Coordination of WP5 work (incl. regular phone calls).</li> <li>• Preparation of WP5 sessions for Virtual meeting</li> <li>• Participation to Virtual meeting (September 2013). Preparation and presentation of WP5 sessions.</li> <li>• Coordination of D5.1 activities together with editor and alignment with WPLs for the finalisation of the document. Internal review of D5.1.</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Participation in the WP telcos</li> <li>• Contributions to the preparation of D5.1</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP5 bi-weekly phone calls.</li> <li>• Participation in WP5 virtual meeting.</li> <li>• Contributions to D5.1.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Discussion of iJOIN overall assumptions and definition of terminology w.r.t. requirements</li> <li>• Participation in WP5 session of virtual meeting</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Attendance to the virtual meeting and participation in the discussions</li> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Contributions to D5.1 (e.g., mapping of CS).</li> </ul>
<b>UNIS</b>	<ul style="list-style-type: none"> <li>• Attending regular WP5 bi-weekly telcos</li> <li>• Attending the iJOIN Virtual Plenary meeting</li> <li>• Harmonisation with WP2, 3, and 4</li> </ul>



Fifth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Participation to the regular WP5 phone-conferences</li> <li>• Preparation and participation to the iJOIN F2F meeting in Turin (25/28-11-2014)</li> <li>• Contribution to the revision of the IEEE Com Mag</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the Turin meeting (November 2013)</li> <li>• Finalization of deliverable D5.1 (as main editor)</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attending biweekly phone calls.</li> <li>• Discussion on iJOIN scenarios and use cases.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Preparation of technical review meeting</li> <li>• Participation in iJOIN Plenary meeting</li> <li>• Discussion of impact of U/C plane split on architecture</li> <li>• Attending WP5 TelCos</li> <li>• Editorship of IR5.2</li> <li>• Analysis of network deployment options and the impact of density of RANaaS entities on the architecture</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend general assembly meeting in Turin (26-28/11/13)</li> <li>• Attend the periodic WP5 phone calls</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Participation in the WP telcos</li> <li>• Contribution in cooperation with TI to Network Sharing discussion for incorporation in IR5.2</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP5 bi-weekly phone calls.</li> <li>• Participation in Turin meeting 26-28 Nov 2013.</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Attendance to the Turin meeting and participation in the discussions</li> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• First contributions to IR5.2.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attending regular WP5 bi-weekly telcos</li> <li>• Attending the iJOIN Plenary meeting in Turin in Nov. 2013 and discussed the way forward for WP5 work tasks for the 2<sup>nd</sup> reporting period.</li> <li>• Harmonization with WP2, 3, and 4</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Discussion of iJOIN functional architecture</li> <li>• Preparing reports of WP2 status as WPL</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to the Turin meeting and participation in the discussions</li> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• First contributions to IR5.2.</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Coordination of WP5work (incl. regular phone calls).</li> <li>• Participation to the Plenary F2F Meeting (and related organization for hosting the meeting in Turin)</li> <li>• Preparation of WP5 contribution for iJOIN Technical Review report (and related presentation for audit meeting in Bruxelles)</li> <li>• TI Contributions to WP5 scenarios and PHY architectures</li> <li>• First Contribution on RAN sharing</li> </ul>

Sixth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Participation to the WP5 bi-weekly phone-conferences</li> <li>• Participation to the iJOIN IR5.2, editing the iJOIN common evaluation framework, and contribution to computational load balancing aspects of RANaaS hardware</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP5 bi-weekly phone calls.</li> <li>• Participation in Grenoble meeting 01-03 Apr 2014.</li> <li>• Contribution to a joint WP5 paper on Energy Efficiency for IEEE Network</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Quantitative analysis of computational complexity in Cloud-RAN, i.e. AMC assignment, AMC complexity, impact of turbo-decoding iterations, ...</li> <li>• First steps towards analytical framework for evaluation of computational outage and computational diversity</li> <li>• First summary of results in IEEE Globecom submission</li> <li>• Discussion of requirement for SLS, in particular for the implementation work in T6.1</li> <li>• Attending WP5 TelCos</li> <li>• Editorial work on IR5.2</li> <li>• Contribution to and support for coordination of common evaluation scenarios</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend general assembly meeting in Grenoble (01-03/04/14)</li> <li>• Attend the periodic WP5 phone calls</li> <li>• Prepare Common Scenario 4 (Shopping Mall/Airport) slides</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Coordination of WP work (incl. regular phone calls).</li> <li>• Participation to the Plenary F2F Meeting in Grenoble</li> <li>• Preparation and submission of a WP5 paper on Energy Efficiency for IEEE Network:</li> <li>• TI Contributions to IR5.2 on RAN sharing (section 3.4) and energy efficiency (6.1.2)</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Participation in the WP telcos</li> <li>• Contributions to IR5.2 in the areas of flexible functional split implementation options and RAN sharing</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP5 bi-weekly phone calls.</li> <li>• Participation in Grenoble meeting 01-03 Apr 2014.</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Contributions to IR5.2.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attending regular WP5 bi-weekly telcos</li> <li>• Attending the iJOIN Plenary meeting in Grenoble in April 2014.</li> <li>• Attended ad-hoc telcos to discuss and contribute to the work on developing iJOIN power model, it was presented at Grenoble meeting and it has been partially included to the paper: "Energy Efficiency benefits of RAN-as-a-Service concept for a cloud-based 5G mobile network infrastructure" that has been submitted to IEEE networks magazine.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Discussion of iJOIN functional architecture</li> <li>• Preparing reports of WP2 status as WPL</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Contributions to IR5.2.</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the Grenoble meeting (April 2014)</li> </ul>

Seventh quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Coordination of WP5 work (incl. regular phone calls).</li> <li>• Participation to the Plenary F2F Meeting in Bologna</li> <li>• Final contributions on energy efficiency in IR5.2</li> <li>• Alignment with D5.2 editor for the definition of ToC and timeplan, also in alignment with D5.3 editor.</li> <li>• Review of IR5.2 for the final delivery.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Attended regular WP5 bi-weekly telcos</li> <li>• Attended iJOIN plenary meeting in Bologna and prepared input for WP5 sessions and joint sessions</li> <li>• Editing, reviewing and contribution to IR 5.2</li> <li>• Continued quantification of computational gains in Cloud-RAN</li> <li>• Continued development of framework to assess computational complexity</li> <li>• Contribution to and support for coordination of common evaluation scenarios</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Contribution to IR5.2.</li> <li>• Participation in Bologna meeting 23-26 June 2014.</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP5 bi-weekly phone calls.</li> <li>• Participation in Bologna meeting 24-26 June 2014.</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Participation in the WP telcos</li> <li>• Contributions to IR5.2 in the areas of flexible functional split implementation options and RAN sharing</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Discussion of iJOIN functional architecture</li> <li>• Preparing reports of WP2 status as WPL</li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Participation to the WP5 bi-weekly phone-conferences</li> <li>• Preparation and participation to the Bologna F2F meeting</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the Bologna F2F (June 2014)</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend general assembly meeting in Bologna (24-26/06/14)</li> <li>• Attend the periodic WP5 phone calls</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Attendance to WP5 bi-weekly phone calls.</li> <li>• Attendance to Bologna meeting.</li> <li>• Contributions to IR5.2.</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP5 bi-weekly phone calls.</li> <li>• Contributions to D5.1</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attending regular WP5 bi-weekly telcos</li> <li>• Attended iJOIN Plenary meeting in Bologna in June 2014, and discussed harmonization with WP2, 3, and 4 regarding the evaluation of CTs</li> </ul>

Eighth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Coordination of WP5 work (incl. regular phone calls).</li> <li>• Participation to the Virtual Meeting (30/09 – 01/10)</li> <li>• Update of energy efficiency contribution in D5.2 and submission of EE paper for IEEE access</li> </ul>

	<ul style="list-style-type: none"> <li>• Alignment with D5.2 editor for partners contributions.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Attending regular WP5 bi-weekly telcos</li> <li>• Preparation of virtual meeting</li> <li>• Contributing to D5.2, updating among others parts on functional split, joint RAN/BH, and project-wide trade-off analysis</li> <li>• Contributions on iveC definitions</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP5 bi-weekly phone calls.</li> <li>• Participation in virtual meeting</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the Virtual meeting (September 2014)</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attending regular WP5 bi-weekly telcos</li> <li>• Attending the iJOIN virtual meeting in 30<sup>th</sup> September 2014.</li> <li>• Harmonization with WP2, 3, and 4</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Attendance to WP5 bi-weekly phone calls.</li> <li>• Attendance to Virtual meeting.</li> <li>• Contributions to D5.2.</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Participation in WP5 bi-weekly phone calls.</li> <li>• Participation in virtual meeting organized last week of September.</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Editorship of D5.2.</li> <li>• Contribution to D5.2.</li> <li>• Participation in Virtual meeting.</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Participation in the WP telcos and WP virtual meeting</li> <li>• Contributions to D5.2</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Discussion of iJOIN functional architecture</li> <li>• Preparing reports of WP2 status as WPL</li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Contribution to D5.2.</li> <li>• Participation in Virtual F2F meeting 30 September-01 October</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Prepare and attend virtual meeting (30/09-01/10/14)</li> <li>• Attend the periodic WP5 phone calls</li> <li>• Finalisation of the common scenario deployment of interest <ul style="list-style-type: none"> <li>○ Common Scenario 4 (Airport/shopping mall)</li> <li>○ For CT2.2 and CT3.7</li> </ul> </li> </ul>

### 2.5.3 Task 5.2: iJOIN Architecture with a joint access-backhaul network and RANaaS

First quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Input to IR5.1 on EU collaborative projects related to iJOIN</li> <li>• Input to IR5.1 on 3GPP release 12 modelling of ideal/non-ideal backhaul</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation to kick-off meeting</li> <li>• Participation to WP periodic conferences</li> <li>• Authoring contribution to deliverable IR5.1 – specifically chapter 3.3 (Cloud Architecture), 3.4 (Other European Projects)</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to the kick-off meeting and discussion participation</li> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Coordination and editing of a project paper submission to FuNeMS 2013 on joint backhaul/access</li> </ul>

<b>NEC</b>	<ul style="list-style-type: none"> <li>• Revision of considered iJOIN architecture, e.g. based on initial assumptions resulting from 3GPP R12 discussions</li> <li>• Input to WP5 working document</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Edition of IR5.1 (due M6), incl. table of content, partners' contribution handling &amp; integration, ...</li> <li>• Contribution to IR5.1</li> <li>• Investigation on the architecture/interfaces supporting WP2/3 activities (started)</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Tasks 5.1 and task 5.2 at this stage work together.</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in kick-off meeting</li> <li>• Participation in WP periodic phone calls</li> <li>• Authoring contribution to deliverable IR5.1</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Attendance to the kick-off meeting and participation in the discussions</li> <li>• Attendance to WP5 bi-weekly phone calls.</li> <li>• Coordination and editing of a project paper submission to FuNeMS 2013 on joint backhaul/access.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Contributed to technical discussions in WP5 telcos and provided input on template circulated to gather views from all partners regarding iJOIN architecture development.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Input to WP5 working document on UoB architecture for INP</li> </ul>

Second quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Contribution to deliverable IR5.1: Identification of RAN functions that can be centralised in the RANaaS platform (complexity, gain, etc.)</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation to meeting in Heidelberg</li> <li>• Participation and contribution to all the WP periodic conferences</li> <li>• Deliverable IR5.1: Contribution to section 6.1 (RAN functional split), with additional focus on utilisation and energy efficiency</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to the Heidelberg meeting and participation in the discussions.</li> <li>• Attendance to WP5 bi-weekly phone calls.</li> <li>• Coordination and editing of a project paper submission to FuNeMS 2013 on joint backhaul/access</li> <li>• Discussion of iJOIN overall assumptions and definition of terminology</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Contributions to the definition of the draft architecture and initial functional split assessment</li> <li>• Harmonisation of T3.2 and T4.2 work with WP5 expectations and scope</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Edition of IR5.1 (due M6) incl. partners' contribution handling &amp; integration, ...</li> <li>• Contribution to IR5.1 (§1-Introduction, §2-Executive summary, §3-Motivations, §4.1.2, §4.4.1(BeFEMTO), §5.1, §5.3.4, §7-Conclusion).</li> <li>• Investigation on the architecture/interfaces supporting WP2/3 activities (ongoing)</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• See activities reported in task 5.1</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in plenary meeting in Heidelberg.</li> <li>• Participation in bi-weekly telephone conferences.</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Attendance to the Heidelberg meeting and participation in the discussions</li> <li>• Attendance to WP5 bi-weekly phone calls.</li> <li>• Contribution to iJOIN logical entities definition. Document available on the project</li> <li>• Contribution to iJOIN logical architectural discussion.</li> <li>• Coordination and editing of the camera-ready version of the paper accepted (poster presentation) in FuNeMS 2013 on joint backhaul/access.</li> </ul>

<b>UniS</b>	<ul style="list-style-type: none"> <li>Contributed to technical discussions in WP5 telcos and face to face meeting in Heidelberg on the developing iJOIN architecture</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>Participation in biweekly phone conferences</li> <li>First assessment of interactions between and requirements of functional blocks</li> </ul>

Third quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>Contribution to iJOIN logical architectural discussion</li> <li>Harmonization with WP3 logical architecture</li> <li>Input on the iJOIN logical architecture</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>Participation to F2F meeting in Guildford</li> <li>Participation and contribution to the WP biweekly conferences</li> <li>Contribution to investigation and discussion of logical and functional architecture; introduction of virtual eNB concept (activity split between WP3 and WP5)</li> <li>Main editor of deliverable D5.1: <ul style="list-style-type: none"> <li>Definition of table of content, tweaking the structure of predecessor IR5.1;</li> <li>Assignments of authoring;</li> <li>Definition of deliverable working plan;</li> <li>Authoring of: <ul style="list-style-type: none"> <li>Section 7 (introduction);</li> <li>Chapter 7.2.2</li> </ul> </li> </ul> </li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>Attendance to the Guildford meeting and participation in the discussions.</li> <li>Attendance to WP5 bi-weekly phone calls.</li> <li>Discussion of iJOIN logical architecture and definition of logical entities.</li> <li>Contribution to the poster for the paper accepted in FuNeMS 2013 on joint backhaul/access</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>Contributions to Surrey meeting</li> <li>Contributions to definition of functional and logical architecture (see WP5 TelCo and plenary meeting minutes)</li> <li>Attending regular WP5 TelCos</li> <li>Contributions to D5.1</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>Summary of Rel10 baseline architecture</li> <li>First (consolidated) draft of iJOIN logical architecture</li> <li>Investigation on the architecture/interfaces supporting our WP2/3 activities for CT2.2 and CT3.7 (ongoing)</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>Task 5.1 and task 5.2 at this stage work together. (see section 2.5.2)</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>Participation in WP5 bi-weekly phone calls.</li> <li>Participation in Surrey meeting.</li> <li>Contributions to D5.1.</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>Attendance to the Surrey meeting and participation in the discussions</li> <li>Attendance to WP5 bi-weekly phone calls</li> <li>Contribution to iJOIN logical entities definition.</li> <li>Contribution to iJOIN logical architectural discussion.</li> <li>Contribution to the poster for the paper accepted (poster presentation) in FuNeMS 2013 on joint backhaul/access.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>Contributed to technical discussions in WP5 telcos and face to face meeting in Guildford on the developing iJOIN architecture</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>Participation in biweekly phone conferences</li> <li>Participation in discussion and delivering harmonized input of WP2 for iJOIN</li> </ul>

	Functional architecture. <ul style="list-style-type: none"> <li>• Discussion of iJOIN paper contribution for IEEE Wireless Communications Magazine</li> </ul>
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Fourth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Editor of the deliverable D3.1.</li> <li>• Contribution to deliverable D3.1: Sections 4 and 5</li> <li>• Literature review of New Carrier Type based solutions</li> <li>• Research on an algorithm for energy saving in the New Carrier Type framework</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation at virtual meeting (September 2013)</li> <li>• Main editor of deliverable D5.1: produced five evolutive versions of the deliverable up to final release (October 31<sup>st</sup>)</li> <li>• Related discussions on architecture, with special focus on logical architecture, functional split options, veNB concept positioning</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to the virtual meeting and participation in the discussions.</li> <li>• Attendance to WP5 bi-weekly phone calls.</li> <li>• Contributions to D5.1.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Contributions to and preparation of virtual meeting</li> <li>• Analysis of functional split, contribution to discussion of functional split definition</li> <li>• Definition of utilisation efficiency</li> <li>• Attending regular WP5 TelCos</li> <li>• Review of D5.1</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Update of iJOIN logical architecture.</li> <li>• Investigation on the architecture/interfaces supporting our WP2/3 activities (ongoing)               <ul style="list-style-type: none"> <li>◦ For CT2.2 and CT3.7</li> </ul> </li> <li>• Contribution to D5.1 (in particular sect. 3, sect. 4.1.2, sect. 4.4, sect. 5.3.4, sect. 7).</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Task 5.1 and task 5.2 at this stage work together. (see section 2.5.2)</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP5 bi-weekly phone calls</li> <li>• Participation in WP5 virtual meeting.</li> <li>• Contributions to D5.1.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences</li> <li>• Participation in discussion and delivering harmonised input of WP2 for iJOIN Functional architecture in D5.1.</li> <li>• Contributions to D5.1, e.g. functional split, functional architecture.</li> <li>• Review of D5.1</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Attendance to the virtual meeting and participation in the discussions</li> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Contributions to D5.1 (e.g., logical entities definition).</li> </ul>
<b>UNIS</b>	<ul style="list-style-type: none"> <li>• Contributed to technical discussions about developing the iJOIN Functional and Logical architecture</li> </ul>

Fifth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Participation to the regular WP5 phone-conferences</li> <li>• Preparation and participation to the iJOIN F2F meeting in Turin (25/28-11-2014)</li> <li>• Contribution to the revision of the IEEE Com Mag</li> </ul>

<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the Turin meeting (November 2013)</li> <li>• Finalisation of deliverable D5.1 (as main editor)</li> <li>• Contribution to preparation of the first Technical Audit, participation to rehearsal and audit</li> <li>• Contribution to architectural discussions, especially on functional split options and veNB definition</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Preparation of technical review meeting</li> <li>• Participation in iJOIN Plenary meeting</li> <li>• Attend WP5 TelCos</li> <li>• Analysis of network deployment options and their impact on the density of RANaaS entities</li> <li>• Continued synchronization of functional architecture across WPs</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Provide editable figure of the current iJOIN logical architecture</li> <li>• Investigation on the architecture/interfaces supporting our WP2/3 activities (ongoing) <ul style="list-style-type: none"> <li>◦ For CT2.2 and CT3.7</li> </ul> </li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Task 5.1 and Task 5.2 at this stage work together. (see section 2.5.2)</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP5 bi-weekly phone calls.</li> <li>• Participation in Turin meeting 26-28 Nov 2013.</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Attendance to the Turin meeting and participation in the discussions</li> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• First contributions to IR5.2.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Contributed to technical discussions of iJOIN Functional and Logical architecture.</li> <li>• Together with WP2, it was agreed that UNIS will work on extending the power models of EARTH project to include the backhaul processing as well as cloud processing. Work has started in this regards, and UNIS is reviewing a similar work in this directions investigated recently by CEA; it will be extended further to include the architectural framework of iJOIN.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences</li> <li>• Participation in WP5 session of Turin meeting</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to the Turin meeting and participation in the discussions</li> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• First contributions to IR5.2.</li> </ul>

Sixth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Participation to the WP5 bi-weekly phone-conferences</li> <li>• Contribution to a IEEE network magazine on energy efficiency</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Editorial work on IR5.2</li> <li>• Analysis of functional split and their impact on system performance</li> <li>• Attending WP5 TelCos</li> <li>• Further definition of the virtual eNodeB design, specifically the iveC (at meeting in Grenoble.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Investigation on the architecture/interfaces supporting our WP2/3 activities (ongoing) for CT2.2 and CT3.7</li> <li>• Contribution to IR5.2 (in particular §3.1, §3.3.3, §4.2)</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Task 5.1 and task 5.2 at this stage work together. (see section 2.5.2)</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP5 bi-weekly phone calls.</li> <li>• Participation in Grenoble meeting 01-03 Apr 2014.</li> </ul>



<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Contributions to IR5.2.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences</li> <li>• Participation in WP5 session of Grenoble meeting</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the Grenoble meeting (April 2014)</li> <li>• Contribution to the paper for IEEE Wireless Communication Magazine, development of the energy efficiency research case</li> <li>• Authoring contribution to IR5.2 (section 4.1)</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Discussion and Presentation of key assumptions for the physical architecture of the Squarev Scenario (CS2). Contributed to IR5.2 (section 3.3) the physical architecture of the iJOIN common scenario 2 (Square).</li> <li>• Contributed to the joint work on developing iJOIN power model together with TI, CEA, SC, and IMC. To this end, a consistent system-level power consumption model has been built which considers all key consuming elements of iJoin architecture. This will help us to at least perform a quantitative analysis on the RANaaS system power consumption and discuss the potential benefits in terms of energy efficiency, especially when varying the load in the RANaaS. This power model could also act as a useful reference for the performance evaluation of innovative RAN functionalities in the view of future 5G systems. A joint paper has been submitted based on this work to IEEE Networks magazine paper.</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Contributions to IR5.2.</li> </ul>

Seventh quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Contribution to IR5.2.</li> <li>• Participation in Bologna meeting 23-26 June 2014.</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Coordination of WP5 work (incl. regular phone calls).</li> <li>• Participation to the Plenary F2F Meeting in Bologna</li> <li>• Final contributions on energy efficiency in IR5.2</li> <li>• Alignment with D5.2 editor for the definition of ToC and timeplan, also in alignment with D5.3 editor.</li> <li>• Review of IR5.2 for the final delivery.</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences.</li> <li>• Participation and contribution to the Bologna meeting (June 2014).</li> <li>• Contribution (authoring – section 4.1 - and reviewing) to deliverable IR5.2.</li> <li>• Ownership of virtualization technical items inside iJOIN architectural framework.</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Attendance to WP5 bi-weekly phone calls.</li> <li>• Attendance to Bologna meeting.</li> <li>• Contributions to IR5.2.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Analysis of functional split, i.e. preferred splits, virtualization methods, impact of cloud-platform, implementation constraints</li> <li>• Cooperation with TUD to develop cost-efficiency analysis of iJOIN system</li> <li>• Attending WP5 calls and plenary meeting</li> <li>• Contributing to IR5.2</li> </ul>

<b>UoB</b>	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences</li> <li>• Participation in WP5 session of Bologna meeting</li> <li>• External review of IR5.2.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Investigation on the architecture/interfaces supporting our WP2/3 activities <ul style="list-style-type: none"> <li>○ For CT2.2 and CT3.7 (ongoing)</li> </ul> </li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Participation to the WP5 bi-weekly phone-conferences</li> <li>• Participation to the iJOIN IR5.2, elaboration of the iJOIN common evaluation framework (per use case model definition) and contribution on the computational load balancing for cloud computing.</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP5 bi-weekly phone calls.</li> <li>• Participation in Bologna meeting 01-03 Apr 2014.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Revision of UNIS contributions in IR5.2 (sections 3.3, 4.1) for the physical architecture of the iJOIN common scenario 2 (Square) and the Area Throughput metric.</li> <li>• Discussion and preparation of a table for the per-hop BH technology assumptions for capacity and latency.</li> </ul>

Eighth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Coordination of WP5 work (incl. regular phone calls).</li> <li>• Participation to the Virtual Meeting (30/09 – 01/10)</li> <li>• Update of energy efficiency contribution in D5.2 and submission of EE paper for IEEE access</li> <li>• Alignment with D5.2 editor for partners contributions.</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Attendance to WP5 bi-weekly phone calls.</li> <li>• Attendance to Virtual meeting.</li> <li>• Contributions to D5.2.</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the Virtual meeting (September 2014)</li> <li>• Contribution (authoring – section 3 and section 5.1) to deliverable D5.2</li> <li>• Ownership of virtualization technical items inside iJOIN architectural framework</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Analysis of functional split, i.e. description of preferred splits, migration functionality, and preliminary results</li> <li>• Continued work on cost-efficiency analysis of iJOIN system</li> <li>• Attending WP5 calls and plenary meeting</li> <li>• Contributing to D5.2</li> <li>• Preparation of virtual meeting and physical meeting in Milan</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Investigation on the architecture/interfaces supporting our WP2/3 activities (ongoing) <ul style="list-style-type: none"> <li>◦ For CT2.2 and CT3.7</li> </ul> </li> <li>• Contribution to D5.2 (in particular §4.4, §5.2)</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Contributed in D5.2 for the physical architecture of the iJOIN common scenario 2 (Square) and the Area Throughput metric.</li> <li>• Discussion and preparation of a table for the per-hop BH technology assumptions for capacity and latency.</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Contribution to D5.2.</li> <li>• Participation in Virtual meeting.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences</li> <li>• Participation in WP5 session of virtual meeting</li> <li>• Contribution to D5.2.</li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Contribution to D5.2.</li> <li>• Participation in Virtual F2F meeting 30 September-01 October</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP5 bi-weekly phone calls.</li> <li>• Contributions to D5.2</li> </ul>

Ninth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Attendance to WP5 bi-weekly phone calls</li> <li>• Contribution to D5.3.</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Coordination of WP5 work (incl. regular phone calls).</li> <li>• Participation to the F2F Meeting (03/11/2014 – 06/11/2014)</li> <li>• Preparation of WP5 session at F2F</li> </ul>

	<ul style="list-style-type: none"> <li>• Internal review of D5.2 and delivery to project coordinator</li> <li>• Preliminary discussions on D5.3 organization (timeplan and ToC)</li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Participation to WP5 bi-weekly phone calls.</li> <li>• Participation to the Milan F2F meeting</li> <li>• Definition of the D5.3 ToC and timeline</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the PMB meeting sessions (Milan, November 2014)</li> <li>• Contributions to deliverable D5.2 (section 3 – revision of iJOIN Glossary - and section 5.1 – 5.1.2, 5.1.6)</li> <li>• External review of deliverable D5.2</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Analysis of functional split, i.e. description of preferred splits, analysis aggregated rates</li> <li>• Attending WP5 calls and Milan plenary meeting</li> <li>• Contributing to D5.3</li> <li>• Contribution to project-wide analysis</li> <li>• Preparation and submission of IEEE Communications Magazine contribution (standards supplement)</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences</li> <li>• Participation in WP5 session of Milan meeting</li> <li>• Contribution to D5.3</li> <li>• Coordination of project wide evaluation results as WP2L</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Investigation on the architecture/interfaces supporting our WP2/3 activities (ongoing), i.e. CT2.2 and CT3.7</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Attendance to WP5 bi-weekly phone calls.</li> <li>• Attendance to Milan meeting.</li> <li>• Contributions to the specification of the iJOIN virtual eNode B Controller (iveC). To be included in D5.3. Status: ongoing.</li> <li>• Contributions to D5.2.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Attending regular WP5 bi-weekly telcos</li> <li>• Attending the iJOIN face-to-face meeting in Milan, 3/11-6/11 2015.</li> <li>• Harmonization with WP2, 3, and 4</li> <li>• UNIS contributions and updates in D5.2 for the physical architecture of the iJOIN common scenario 2 (Square) and the Area Throughput metric.</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Participation in WP telcos and WP virtual meeting</li> <li>• Contributions to D5.2</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP5 bi-weekly phone calls.</li> <li>• Participation in Milan meeting</li> <li>• Contributions to D5.3</li> </ul>

Tenth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Attend WP5 calls</li> <li>• Attend General Assembly (Bremen)</li> <li>• Contribution to D5.3</li> <li>• Investigation on the architecture/interfaces supporting our WP2/3 activities (done) <ul style="list-style-type: none"> <li>○ For CT2.2 and CT3.7</li> </ul> </li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Attendance to WP5 bi-weekly phone calls.</li> <li>• Attendance to Bremen meeting.</li> <li>• Attendance to Dresden meeting.</li> <li>• Contributions to the updated logical architecture definition (WP4 aspects) included in D5.3</li> </ul>

	<ul style="list-style-type: none"> <li>Contributions to the specification of the iJOIN virtual eNode B Controller (iveC). Included in D5.3</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>Participation in biweekly phone conferences</li> <li>Participation in WP5 session of Bremen meeting</li> <li>Participation in WP5 session of Dresden meeting</li> <li>Final contribution to D5.3.</li> <li>Coordination of project wide evaluation results as WP2L</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>Participation in WP5 bi-weekly phone calls.</li> <li>Participation in Bremen meeting.</li> <li>Participation in iJOIN winter school.</li> <li>Participation in and organization of Dresden meeting.</li> <li>Contributions to D5.3</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>Attending regular WP5 bi-weekly telcos</li> <li>Contributed to discussions and work related to iJOIN project wide analysis that is reflected in D5.3</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>Coordination of WP5 work (incl. regular phone calls).</li> <li>Participation to the F2F Meeting in Bremen (23/02/2015 – 27/02/2015)</li> <li>Preparation of WP5 session at F2F</li> <li>Participation to the F2F Meeting in Dresden (15/04/2015 – 17/04/2015)</li> <li>Preparation of WP5 session at F2F</li> <li>Internal review of D5.3 and delivery to project coordinator for the official delivery to the PO</li> <li>Organization of CLEEN2015 workshop</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>Attending WP5 calls</li> <li>Contributing to and editorial of D5.3</li> <li>Preparation of plenary meeting in Bremen and Dresden</li> <li>Finalisation of project-wide performance analysis</li> <li>Revision of IEEE Communications Magazine contribution (standards supplement)</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>Participation and contribution to the WP biweekly conferences</li> <li>Participation and contribution to the PMB meeting sessions (Bremen, February 2015; Dresden, April 2015)</li> <li>Contribution to the design review of iJOIN Cloud architecture and iJOIN related terminology</li> <li>Contribution to ETSI/NFV compliance analysis</li> <li>Contribution to related sections of D5.3</li> <li>Co-authoring paper for 5GArch workshop</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>Participation in WP telcos and WP F2F meetings in Bremen and Dresdeng</li> <li>Contributions to D5.3</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>Attendance to WP5 bi-weekly phone calls</li> <li>Contribution to D5.3.</li> <li>Description of the iJOIN general systems guidelines and impact on CT design</li> <li>Contribution to the overall performance evaluation</li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>Participation in WP5 bi-weekly phone calls.</li> <li>Participation in Bremen meeting.</li> <li>Participation in Dresden meeting.</li> <li>Edition and Contributing to D5.3</li> </ul>

## 2.6 WP6: Proof-of-concept

### 2.6.1 Summary

Following the project plan, the work in WP6 started in the **second quarter**. It kicked off during the 2<sup>nd</sup> iJOIN meeting in Heidelberg on 20-22 March, 2013 with HP presenting a general overview for cloud based demonstration activities. During this quarter, all participants attended the biweekly regular telcos and the focus of discussion was to specify the demonstration capabilities for both of the test platforms which would be separately used for RANaaS and Joint RAN/BH demonstrations. In the meantime, the skeleton for IR6.1 was agreed upon with partners' assignments. The focus of report is on the expectation from demonstration activities and the description in detail the capabilities of two demonstrators. It also provides guidelines how partners can make the demonstration activities for their studies carried out in other work packages. The request for system level requirements was launched to WP5.

In the **third quarter**, there was quite good progress in WP6. iJOIN started with two test platforms. Later it was identified that for WP4 technology proposals, we would need a different demonstration environment. For this reason, SDN based demonstration platform becomes the part of iJOIN demonstration activities. On the technical front, partners regularly attended the biweekly telcos. For the two platforms (RANaaS and 60 GHz one), the owning partners provided good descriptions which were presented to WP6 partners in the regular telcos and then to everyone in the Surrey meeting in June 2013. These details and further have been included in IR6.1. The table of content for this report IR6.1 was downsized after detailed discussions in the Surrey meeting. As there was only one partner contributing in T6.2, UoB and IMC shifted some part of their activity from T6.1 to T6.2.

In the **fourth quarter**, the first WP6 internal report IR6.1 was submitted on time and the partners started working toward the next internal report IR6.2. This IR is entitled "Proof-of-concept setup and definition of interfaces" and hence highly focused on defining in detail the interfaces and APIs related to three demonstrators under consideration. This document is a big cornerstone as it should enable the consortium members to understand how they can implement their technology proposals on these testbeds for final demonstration. We took another initiative for this document by expanding it such as to include the technology candidates from other work packages WP2, WP3 and WP4 which have been short-listed for demonstration. These would be provided along with their respective performance criteria and metrics to be evaluated. During the first years, all partners were fully committed to the activity in WP6 and there was very good presence and active participation in WP6 telcos.

The most important achievement in WP6 during the **fifth quarter** was finalisation and in-time delivery of internal report IR6.2. Detailed description for three testbeds was included. For possible demonstrations, interfaces and API for the three testbeds were detailed. Some relevant CTs were taken from the technical work-packages WP2, WP3 and WP4 which were found to be the suitable candidates for demonstration. Details on the demonstration steps for these CTs were added. Furthermore evaluation criteria and metrics of interest for all these CTs have been noted down. As a side note, IR6.2 got very good remarks from external review process, external to WP6 but internal to iJOIN. WP6 participated in the plenary meeting in Turin from November 26<sup>th</sup> to 28<sup>th</sup>, and presented the progress made during the first year. Later WP6 partners further refined those contributions for the 1<sup>st</sup> technical review presentation.

In the **sixth quarter** of the project, WP6 participated in the plenary meeting in Grenoble from April 1st to 3rd, and presented the progress made during the quarter. Overall the progress in WP6 was quite satisfactory. Partners were very active in biweekly telcos and in fulfilling the work-items assigned to them. Two cloud instances at UoB and TI were developed. 60GHz platform at TUD we left in quite good shape. SDN testbed at UC3M/IMDEA was experimented upon. Work progressed towards having these platforms up and running in next 3, 4 months so as to get experimental results from iJOIN candidate technologies.

During this **seventh quarter** of the project, WP6 participated in the plenary meeting in Bologna (24-26 June), and presented the progress made during the quarter. WP6 had two very important achievements in the quarter. Firstly RANaaS testbed instances at UoB and TI was setup. They were properly configured and in running state. Partners were given external access for these testbeds. Secondly preliminary results were obtained over two other testbeds, namely 60GHz testbed and SDN testbed. These results were presented in Bologna meeting and were documented in the current public deliverable D6.1. Apart from the continuous work on testbeds, the other main activity in WP6 was centred on the preparation of deliverable D6.1.

Preliminary results from 60GHz testbed and SDN testbed were incorporated and refined. Work towards preliminary experimental results from RANaaS platform progressed to put them together in D6.1 along with results obtained from other testbeds.

In this **eighth quarter** of the project, WP6 participated in the virtual meeting from April 1st to 3rd, and presented the progress made during the quarter. WP6 made excellent progress during the quarter. The two most important highlights of this quarter were the following:

- All the three iJOIN testbeds were up and running and preliminary results were obtained by running iJOIN proposed algorithms over these testbeds. These preliminary results became the first proof-of-concept for iJOIN and were further enhanced for final demonstrations at the end of the project.
- WP6 delivered its first public deliverable D6.1. This deliverable provided the detailed description for the three testbeds. The most important contribution of this document were the preliminary results from the three testbeds.

All the WP6 partners were very active in biweekly telcos and in fulfilling the work-items assigned to them. As indicated, all the testbeds were up and running. The WP also identified enhancement for these testbeds and new features which should be implemented in the coming months, to allow for a final and comprehensive demonstrations for iJOIN ideas.

In the beginning of the **ninth quarter**, WP6 participated in the Milan meeting from November 4th to 6th, and presented the progress and the status of the ongoing demonstration activities. All WP6 partners worked hard and made good progress on the WP6 activities during this quarter. The important highlights of this quarter were the following:

- All the three iJOIN testbeds were up and running and preliminary results were obtained by running iJOIN proposed algorithms over these testbeds. Improvement of these results and obtaining them under more realistic scenarios was the main focus of the development work in the quarter.
- WP6 began to work on its second and last deliverable D6.2. This deliverable would provide detailed proof-of-concept results for the three iJOIN testbeds. The proof-of-concept results and the achievability of the iJOIN concepts would be discussed in this deliverable (to be delivered M30).

Biweekly telcos were organized to ensure the progress and coordination of activities in WP6. All partners participated regularly in these telcos and they were of great help to share a common understanding on different testbed setups and simulators developed by different iJOIN partners.

In the **tenth quarter** of the project, WP6 participated in two F2F meeting, 25-27 February 2015 in Bremen and 15-17 April 2015 in Dresden. Status of testbeds and demonstration activities conducted under WP6 were shared in WP6 sessions during both F2F meetings. WP6 achieved extremely important and ambitious milestones during this quarter. The three most important highlights of this last quarter were the following:

- All the three iJOIN testbeds were up and running and final results were obtained by running iJOIN proposed algorithms over these testbeds. These results furnished very conclusive proof-of-concept for iJOIN.
- WP6 delivered its last deliverable D6.2. This deliverable provided the final experimental results from the three testbeds developed under iJOIN.
- Two of the iJOIN testbeds related to RANaaS and SDN were very successfully presented at MWC 2015 (March 2-5) in Barcelona at the booth of European Commission.

All of the WP6 partners were very active in biweekly telcos and in fulfilling the work-items assigned to them. The conclusive and convincing experimental results for iJOIN proof-of-concept coming from three different hardware testbeds clearly indicated the sheer hard work and determination shown by all partners throughout the project.

Task	Status	Variance	Cause/Way-Forward	Expected deadlines	Affected Partners
<b>Task 6.1</b>	Green	No delays or changes of topics	N.A.	IR6.1 and IR 6.2 delivered on time. D6.1, D6.2 and delivered on time.	none
<b>Task 6.2</b>	Green	No delays or changes	N.A.	see above	none

		of topics			
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## 2.6.2 Task 6.1: RANaaS in small-cell environment

Second quarter:

Partner	Achievements Milestones Work items in progress
HP	<ul style="list-style-type: none"> <li>• Participation to meeting in Heidelberg, including a general presentation of cloud computing features and possible options for using our platform in the RANaaS demonstrator</li> <li>• Participation and contribution to all the WP periodic conferences</li> <li>• Deliverable IR6.1: Authoring of the deliverable's draft structure</li> </ul>
IMC	<ul style="list-style-type: none"> <li>• Coordinating the regular biweekly telcos</li> <li>• Contributions to IR6.1 skeleton and partners assignments</li> </ul>
IMDEA	<ul style="list-style-type: none"> <li>• Participation in bi-weekly telephone conferences.</li> </ul>
UoB	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences</li> <li>• Initial assessment of possibilities for demonstration on the HP cloud platform and additionally on the TUD 60GHz demonstrator</li> </ul>

Third quarter

Partner	Achievements Milestones Work items in progress
HP	<ul style="list-style-type: none"> <li>• Participation to F2F meeting in Guildford, with presentation on task status and OpenStack appliance</li> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Definition of cloud demonstrator platform: <ul style="list-style-type: none"> <li>○ specification of technical platform</li> <li>○ specification of usage constraints</li> <li>○ definition of requirements for candidate technologies to be deployed on the demonstrator (in particular, interfaces to the RANaaS layer)</li> <li>○ support to CTs for possible deployment to the demonstrator (algorithm recoding, implementation in virtual machines,...)</li> </ul> </li> <li>• Main editor of deliverable IR6.1: <ul style="list-style-type: none"> <li>○ Definition of structure</li> <li>○ Authoring assignments</li> <li>○ Definition of working plan</li> <li>○ Direct authoring: <ul style="list-style-type: none"> <li>▪ Chapter 1</li> <li>▪ Chapter 3 (introduction)</li> <li>▪ Chapter 3.1</li> <li>▪ Chapter 4 (introduction)</li> <li>▪ Chapter 4.1</li> <li>▪ Chapter 5</li> <li>▪ Chapter 6</li> </ul> </li> <li>○ Integration of contents and release</li> </ul> </li> <li>• Development and release of a special software package, to allow CTs making in house their OpenStack appliance and self-testing possible deployment of their functions to the cloud demonstrator</li> </ul>



<b>IMC</b>	<ul style="list-style-type: none"> <li>• Presentation of the WP6 activities in Surrey meeting.</li> <li>• Coordinating the regular biweekly telcos.</li> <li>• Preparation of the structure of IR6.1</li> <li>• Contributions to IR6.1.</li> <li>• Review of IR6.1</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in bi-weekly telephone conferences.</li> <li>• Contribution to IR.6.1</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Cloud platform discussion</li> <li>• Internal preparation of development work for SLS, i.e. extension to multi-processor/computer environments, which requires a re-design of the simulator platform</li> <li>• Review of IR6.1</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences</li> <li>• Review of IR6.1.</li> <li>• Installation and evaluation of cloud platform demo provided by HP.</li> <li>• Participation in WP6 plenary meeting in Guildford</li> </ul>

Fourth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation at virtual meeting (September 2013) with production of a RANaaS testbed presentation</li> <li>• Finalisation of the deliverable IR6.1 (main editor)</li> <li>• Authoring of the RANaaS testbed section of the deliverable</li> <li>• Contributions to deliverable IR6.2 (on-going) for the RANaaS testbed section</li> <li>• Internal development and continuous technology upgrade of the RANaaS baseline platform, as internal replica of the ones who will host the actual demonstrator (e.g. with continuous upgrade of the cloud OpenStack platform)</li> <li>• Investigation of functions relevant to iJOIN (e.g. for latency simulation)</li> <li>• Development of an OpenStack appliance for partners willing to install and try it</li> <li>• Support to UoB and TI for their own setup of a RANaaS platform, and for setting up the needed remote access (e.g. definition of hardware requirements)</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Organising and participating WP6 bi-weekly phone calls.</li> <li>• Participation in virtual meeting and presentation of overall WP6 activities and future work items.</li> <li>• Contributions to IR6.2 for the executive summary and CT from WP2 (candidate for demonstration on 60 GHz platform)</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in bi-weekly telephone conferences.</li> <li>• Contributions to IR6.2. File available on the project</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Cloud platform discussion</li> <li>• Kick-off of internal development work for SLS. i.e. extension to multi-processor/computer environments, which requires a re-design of the simulator platform</li> <li>• Contribution to IR6.2</li> <li>• Participation in TelCos</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences.</li> <li>• Planning and dimensioning UoB RANaaS testbed.</li> <li>• Description of UoB RANaaS testbed for IR6.2.</li> <li>• Participation in joint WP2/WP6 virtual meeting on decoder@cloud implementation.</li> </ul>

Fifth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the Turin meeting (November 2013)</li> <li>• Editing (RANaaS testbed section) and reviewing of deliverable IR6.2</li> <li>• Contribution to preparation of the first Technical Audit, participation to rehearsal and audit</li> <li>• Internal maintenance and continuous technology upgrade of the RANaaS baseline platform, as internal replica of the ones who will host the actual demonstrator (with continuous upgrade of the cloud OpenStack platform)</li> <li>• Preliminary investigation of TCP/IP connectivity issues and configuration for the RANaaS testbed</li> <li>• Support to UoB and TI for their own setup of a hosted RANaaS platform, definition of hardware requirements and setup of the needed remote access</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Preparation and participation in technical review as WPL.</li> <li>• Coordination of WP6 work including organization, moderation and wrap-up of biweekly phone conferences</li> <li>• Contribution to IR6.2, responsible for sections “Exec Summary”, Conclusions and CT input to 60GHz testbed.</li> <li>• Performed full review of IR6.2 as WPL.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Contributions to IR6.2</li> <li>• Attending WP TelCos</li> <li>• Continued development of system level simulator <ul style="list-style-type: none"> <li>○ Porting to Linux</li> <li>○ Started implementation of multi-threading library</li> </ul> </li> <li>• Continued discussion on employed cloud-platform</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Setup of TI internal activities</li> <li>• Drafting IR6.2 (for TI testbed description)</li> <li>• HW configuration for test bed in TI premises</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences.</li> <li>• Planning and dimensioning UoB RANaaS testbed.</li> <li>• Revising description of UoB RANaaS testbed for IR6.2.</li> <li>• Review of IR6.2</li> <li>• Preparation of slide set to show current status</li> <li>• Implementation of a general purpose hardware, implementation of a turbo decoder (to be published)</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences</li> <li>• Contribution to IR6.2, Section 4.3 and 3.5.1</li> <li>• Review of Section 5.1 of IR6.2</li> <li>• Implementation of the SDN Testbed (ongoing)</li> </ul>

Sixth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Organization and participation in WP6 bi-weekly phone calls.</li> <li>• Prepared the presentation on testbed status and WP6 activities for Grenoble meeting 01-03 Apr 2014.</li> <li>• Contribution to D6.1</li> </ul>

<b>NEC</b>	<ul style="list-style-type: none"> <li>• Contributions to D6.1</li> <li>• Attending WP TelCos</li> <li>• Continued development of system level simulator <ul style="list-style-type: none"> <li>○ Implementation of multi-threading library</li> <li>○ Started to set-up scheduler interface for multi-stage scheduling</li> </ul> </li> <li>• Continued discussion on employed cloud-platform</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the WP specific call conferences</li> <li>• Work on the testbed preparation</li> <li>• Contribution to the IR6.2</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences. Contribution of description of UoB RANaaS testbed for D6.1.</li> <li>• Further development of general purpose hardware implementation of a LTE-compliant turbo decoder (to be published)</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP6 bi-weekly phone calls.</li> <li>• Contribution to D6.1</li> <li>• SDN Testbed deployment completed</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the Grenoble meeting (April 2014)</li> <li>• Technical cloud support to installation of the RANaaS platform in the physical testbeds</li> <li>• Main editor of deliverable D6.1</li> </ul>

Seventh quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the WP specific call conferences</li> <li>• Work on the testbed preparation</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the Bologna meeting (June 2014)</li> <li>• Technical cloud support to installation of the RANaaS platform in the physical testbeds at TI and UoB</li> <li>• Main editor and reviewer of deliverable D6.1</li> <li>• Proxying WP6 leader in some telcos and in the Bologna F2F meeting</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP6 bi-weekly phone calls.</li> <li>• Contribution to D6.1</li> <li>• CT4.1 demo presented at EuCNC'04.</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Organization and participation in WP6 bi-weekly phone calls.</li> <li>• Prepared the presentation on testbed status and WP6 activities for Bologna meeting 24-26 June 2014.</li> <li>• Contribution to D6.1</li> <li>• Performed initial review of candidate technologies for 60GHz and SDN testbeds reported in D6.1.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences</li> <li>• Physical installation and setup of RANaaS testbed</li> <li>• Installation, configuration and test of OpenStack software on RANaaS testbed</li> <li>• Contribution to D6.1</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Contributing to D6.1 wrt CT4.3 and CT3.4</li> <li>• Participation in bi-weekly phone conferences</li> <li>• Development of demo for EuCNC (computational gains)</li> <li>• Continued development of system level simulator</li> </ul>

Eighth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the Virtual meeting (October 2014)</li> <li>• Main editor and reviewer of deliverable D6.1</li> <li>• Technical cloud support to installation of the RANaaS platform in the physical testbeds at TI and UoB</li> <li>• Proxying WP6 leader in some telcos</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Contributing to D6.1</li> <li>• Update system level simulations for multi-stage scheduling</li> <li>• Update CRAN demo to incorporate actual decoders</li> <li>• Participation in regular telcos</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences</li> <li>• Participation in WP6 session of virtual meeting</li> <li>• Further configuration and test of OpenStack platform on RANaaS testbed</li> <li>• Design, implementation, test and execution of decoding demo on RANaaS testbed</li> <li>• Processing of results of RANaaS testbed demo for D6.1</li> <li>• Further contributions to D6.1 and internal review</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Organization and participation in WP6 bi-weekly phone calls.</li> <li>• Attendance to iJOIN Virtual meeting. Prepared the presentation on testbed status and WP6 activities for Virtual meeting 30 September 2014.</li> <li>• Contribution to D6.1 in the form of results for CT2.5 and introduction</li> <li>• Review of various sections in D6.1.</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Contribution to D6.1 and its external review</li> <li>• Work on update of server used for testbed in WP6 for “Multi-Layer Scheduling and Robust Link Adaptation” CT</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP6 bi-weekly phone calls.</li> <li>• Contribution to D6.1</li> </ul>

Ninth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP6 bi-weekly phone calls.</li> <li>• Contribution to D6.2</li> <li>• Preparation for the MWC demo. Status: ongoing.</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to WP6 meeting sessions (Milan, November 2014)</li> <li>• Technical cloud support to setup and maintenance of the RANaaS platform in the physical testbeds at TI and UoB</li> <li>• Technical support to the process of implementing the selected CTs into the RANaaS demonstrators</li> <li>• Proxying WP6 leader in the PMB and in some telcos</li> <li>• Contribution to deliverable D6.2 (section 3 and Annex A)</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Contributing to D6.2</li> <li>• Update system level simulations for multi-stage scheduling</li> <li>• Update CRAN demo to incorporate actual decoders, more monitoring/visualization elements, and preparation of using SINR traces</li> <li>• Participation in regular telcos</li> </ul>

<b>UoB</b>	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences.</li> <li>• Participation in WP6 session of Milan meeting.</li> <li>• Administration of RANaaS testbed</li> <li>• Refinement and execution of decoding demo on RANaaS testbed</li> <li>• Processing of results of RANaaS testbed demo for D6.2.</li> <li>• Preparation of demo at Mobile World Congress</li> <li>• Further contributions to D6.2</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Organization and participation in WP6 bi-weekly phone calls.</li> <li>• Coordination with WP6 colleagues and providing the slide set for the Milan Meeting WP6 session.</li> <li>• Contribution to D6.2</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Testbed Server configuration and conference call participation</li> </ul>

Tenth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences.</li> <li>• Participation in WP6 session of Bremen meeting</li> <li>• Participation in WP6 session of Dresden meeting.</li> <li>• Administration of RANaaS testbed</li> <li>• Refinement and execution of decoding demo on RANaaS testbed</li> <li>• Contributing results of RANaaS testbed demo for D6.2.</li> <li>• Preparation of Cloud-RAN scheduling demo for Mobile World Congress</li> <li>• Further extension and improvement of Cloud-RAN scheduling demo for final audit</li> <li>• Final contributions to D6.2</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Organization of telcos and other WP6 activities as WP6 leader.</li> <li>• Participation to the Bremen F2F meeting and slide preparation for WP6 session</li> <li>• Attendance to Dresden Meeting using WebEx and preparation of the WP6 slide set</li> <li>• Organization and participation in WP6 bi-weekly phone calls.</li> <li>• Contribution to D6.2 and doing the internal review</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Testbed Server configuration and conference call participation</li> <li>• Participation to the Bremen F2F meeting (via webex)</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Contributing to D6.2</li> <li>• Preparation Mobile World Congress 2015</li> <li>• Implementation of addition features to RANaaS demo, in particular joint RAN/cloud scheduler and system level simulation results</li> <li>• Testing of RANaaS demo</li> <li>• Update of GUI</li> <li>• Participation in WP6 telcos</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the WP biweekly conferences</li> <li>• Participation and contribution to the PMB meeting sessions (Bremen, February 2015; Dresden, April 2015)</li> <li>• Support to finalization of RANaaS demonstrators implementation tasks as cloud and OpenStack technology experts; <ul style="list-style-type: none"> <li>◦ in particular, local preparation at HP Lab of virtual machine images to be deployed into the testbeds</li> </ul> </li> <li>• Authoring (section 3.1, Appendix A) and peer reviewing (3.2, 4.2) contribution to D6.2</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in WP6 bi-weekly phone calls.</li> <li>• Contribution to D6.2</li> <li>• Preparation of the SDN demo for Mobile World Congress (MWC2015, 2-5 March)</li> </ul>

### 2.6.3 Task 6.2: Joint access and backhaul network layer activities

Second quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in bi-weekly telephone conferences.</li> <li>• Analysis of existing hardware towards use as iJOIN demonstrator</li> </ul>

Third quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP6 bi-weekly phone calls.</li> <li>• Participation in Surrey meeting and presentation on Joint Access and Backhaul testbed</li> <li>• Contributions to IR6.1</li> <li>• Assessment of testbed capabilities and requirements for partner integration and API development (ongoing, partially reported in IR6.1</li> </ul>

Fourth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP6 bi-weekly phone calls.</li> <li>• Participation in virtual meeting and Backhaul testbed</li> <li>• Editorship of and contributions to IR6.2</li> <li>• Design and implementation of testbed, and API development (ongoing, partially reported in IR6.2</li> </ul>

Fifth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP6 bi-weekly phone calls.</li> <li>• Participation in Turin meeting 26-28 Nov 2013.</li> <li>• Editorship of and contributions to IR6.2</li> <li>• Design and implementation of testbed, and API development (ongoing, partially reported in IR6.2</li> <li>• Contributions to WP6 audit presentation.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Revised description of CT2.1 and related demonstration plans for IR6.2.</li> <li>• Preparation of slides for WP6 session of Turin meeting</li> <li>• Participation in WP6 session of Turin meeting</li> </ul>

Sixth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP6 bi-weekly phone calls.</li> </ul>

	<ul style="list-style-type: none"> <li>• Participation in Grenoble meeting 01-03 Apr 2014.</li> <li>• Contribution to D6.1</li> <li>• Design and implementation of testbed (ongoing, partially reported in D6.1)</li> <li>• Improved API</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Contributed CT2.1 demonstration plans for D6.1.</li> <li>• Preparation of slides for WP6 session of Grenoble meeting</li> <li>• Participation in WP6 session of Grenoble meeting</li> </ul>

Seventh quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP6 bi-weekly phone calls.</li> <li>• Contribution to D6.1</li> <li>• Design and implementation of testbed (ongoing, partially reported in D6.1)</li> <li>• Integration of CTs 2.1, 2.5 and 2.7 into testbed</li> <li>• Simulation to produce preliminary results for all three CTs (ongoing, partially reported in D6.1)</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Participation in biweekly phone conferences</li> <li>• Integration of TUD mmWave demonstrator into simulation chain and preparation of demo on Joint access and backhaul testbed</li> </ul>

Eighth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP6 bi-weekly phone calls.</li> <li>• Contribution to D6.1</li> <li>• Design and implementation of testbed (ongoing, partially reported in D6.1)</li> <li>• Integration of CTs 2.1, 2.5 and 2.7</li> <li>• Simulation to produce preliminary results for all three CTs (ongoing, partially reported in D6.1)</li> <li>• Preparation and development of a GUI for demonstrating the joint access and BH testbed at the opening of the 5GLab Germany and the Industry Partner Program event of the Vodafone Chair at TUD</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Processing of results of demonstration of CT2.1 on Joint access and backhaul testbed, and editorial preparation for D6.1.</li> </ul>

Ninth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP6 bi-weekly phone calls.</li> <li>• Participation in Milan meeting</li> <li>• Editorship and contributions to D6.2</li> <li>• Implementation and testing of adaptive code rate for joint access and backhaul testbed</li> <li>• Integration and evaluation of CTs on joint access and backhaul testbed, partially reported in D6.2</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Processing of results of demonstration of CT2.1 on Joint access and backhaul testbed, and editorial preparation for D6.2.</li> </ul>

Tenth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Modification of simulation software for execution of Joint access and backhaul testbed</li> <li>• Generation of file sets for execution on Joint access and backhaul testbed and interaction with testbed owner</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in WP6 bi-weekly phone calls.</li> <li>• Participation in Bremen meeting.</li> <li>• Participation in iJOIN winter school.</li> <li>• Participation in and organization of Dresden meeting.</li> <li>• Editorship and contributions to D6.2</li> <li>• Integration and evaluation of CTs on joint access and backhaul testbed, reported in D6.2</li> </ul>

## 2.7 WP7: Exploitation, Standardisation, and Dissemination

### 2.7.1 Summary

In the **first quarter**, the activities of the WP were initiated in the Kick-Off meeting in Madrid. Several topics concerning dissemination were discussed (participation in FuNeMS 2013, contribution to IWPC, standardisation bodies iJOIN could contribute to, Twitter account, etc.). Proper mechanisms for collecting the dissemination information were established using the project documentation server. With respect to FuNeMS 2013, two contributions were agreed upon, one describing the iJOIN perspective for joint access/backhaul, and the other for RANaaS. It was agreed to take advantage of the RAS cluster meeting on February 27<sup>th</sup> to propose other EU projects to participate in the workshop. A workshop proposal on iJOIN relevant topics was submitted to Globecom 2013 as well. A first set of potential standardisation bodies were identified, whose activities are being monitored, including 3GPP (RAN1, RAN2 and RAN3), ISO, IETF (DMM and NEXT WG), etc. Concerning other dissemination activities, CEA LETI also carried out a presentation of the iJOIN project during the TROPIC plenary held in January 2013 (Grenoble, France). Also a poster was prepared for the Future Internet Assembly (FIA) meeting sponsored by the European Commission to be held in May in Aalborg. Two papers were submitted: one to be presented by the University of Bremen at the 17th International ITG Workshop on Smart Antennas (WSA 2013); and a second one to be submitted to the IEEE Transactions on Wireless Communications by the University of Surrey.

During the **second quarter**, all three tasks of WP7 were active. The preparation of exploitation plan continued, in order to identify opportunities for the potential exploitation of the project results. In terms of standardisation activities, the activities related to the project objectives in both 3GPP (RAN WGs 1, 2 and 3) and IETF (DMM and NETEXT WGs) were monitored. The work in IETF resulted in the co-authorship of the DMM WG adopted Internet Draft “Distributed Mobility Management: Current practices and gap analysis”. In terms of dissemination, iJOIN gave a presentation of the project in the FP7 Future Networks Concertation Meeting organized in Brussels on February 28. It was agreed that the project will organise the First International Workshop on Cloud-Processing in Heterogeneous Mobile Communication Networks (IWCPM 2013), held in Atlanta, Georgia, on December 9th, 2013, co-located with IEEE Globecom 2013. The Call for Papers was prepared and distributed to different parties. The project also worked in the preparation of a workshop for VTC2013-fall as a joint initiative between different EU projects (iJOIN, TROPIC and MCN). On top of this, several papers were submitted to IEEE PIMRC 2013 and IEEE Transactions on Information Theory. Maintenance activities related to the project’s web site and Twitter account, as well as the dissemination database were also carried out.

In the **third quarter**, the work the preparation of two workshops continued (IWCPM 2013 and CLEEN 2013, co-located with IEEE Globecom 2013 and IEEE VTC 2013 conferences, respectively). Several papers were submitted to both conferences (IEEE ICC 2013, IEEE ISIT 2013) and journals (IEEE JSAC). The project was represented with posters and presentations at the FIA and FUNEMS meetings. In terms of



standardisation, focus has been put on IETF and 3GPP. Also, the preparation of the first deliverable has been initiated.

In the **fourth quarter**, the activities in WP7 focused on the preparation of the first deliverable that reports the exploitation, standardisation and dissemination plans for the project and the achievements in these areas during the first year. On top of this, several new papers were produced, both for international congresses and magazines. In this sense, a paper for the IEEE Communications Magazine special issue on 5G was submitted and accepted to appear in the May 2014 number. Also, a paper was submitted to the IEEE Transactions on Mobile Computing. In terms of standardisation support, contributions to IETF, ONF and ITU-R were produced. On top of this the usual monitoring of standardisation bodies was also carried out. It is also worth highlighting that the project received a prize from the Madrid Regional Government.

The activities in WP7 during the **fifth quarter** focused, after the delivery of the first deliverable in M12, on the generation of standardisation contributions and new papers that collect the project results, as well as the monitoring of relevant bodies. The WP also devoted some efforts to the preparation of the Technical Review, in order to prepare a documentation package for the reviewers. Several papers were submitted to magazines and relevant congresses, and final editing of several accepted was also undertaken. The project also co-organised of IEEE Globecom Workshop on Cloud-Processing in Heterogeneous Mobile Communication Networks. Also, the WPC workshop was organised by Telecom Italia in Turin. In terms of standardisation support, contributions to 3GPP, IETF, and ITU-R were produced. On top of this, the usual monitoring of standardisation bodies was also carried out.

The activities in WP7 during the **sixth quarter** focused on the production of standardisation contributions and new papers that collect the project results, as well as the monitoring of relevant bodies. Several papers were submitted to magazines, and some of them were accepted, including IEEE Network Magazine, IEEE Transactions on Mobile Computing, IEEE Signal Processing Magazine and IEEE Wireless Communications. Several papers have been prepared for EUCNC'14, and several submissions to Globecom 2014, ICC 2014 and PIMRC 2014. The project has collaborated in the preparation of the CLEEN 2014 workshop. In terms of standardisation support, monitoring of 3GPP RAN1, RAN3, RAN4 and SA2 activities was performed, as well as ONF and IETF DMM WG. With respect to the latter, a new draft of the "Distributed Mobility Management: Current practices and gap analysis" document was prepared. Also, a contribution to ITU-R WP5D workshop on vision beyond 2020 (February 2014) was submitted.

The activities in WP7 during the **seventh quarter** focused on the production of standardisation contributions and new papers that collect the project results, as well as the monitoring of relevant bodies. There was a significant production of publications, with papers submitted to relevant congresses (IEEE INFOCOM 2015, ISWCS 2014) and magazines (IEEE Communications Magazine, IEEE Signal Processing Magazine, IEEE Access...). Several papers were presented for EUCNC'14, and two demonstrations were carried out in project booth. The project continued collaborating in the preparation of the CLEEN 2014 workshop. In terms of standardisation support, monitoring of 3GPP RAN1, RAN3, RAN4 and SA2 activities was performed, as well as ONF and IETF DMM, NETEXT and SPRING WGs. With respect to the latter, a new version of the "Distributed Mobility Management: Current practices and gap analysis" document was produced.

The activities in WP7 during the **eighth quarter** resulted in a significant production of publications, with papers submitted to relevant congresses (IEEE ICC 2015, Globecom 2015, SCC 2015) and magazines (IEEE Transaction on Wireless Communications, IEEE Communications Magazine). Papers submitted in previous quarters were accepted by IEEE Access, IEEE Communications Magazine and Springer Journal of Telecommunication Systems. There was also work on the preparation of the IWCPM Workshop at ICC 2015 and the iJOIN school "5G Cloud Technologies: Benefits and Challenges" hosted by the University of Bremen. During the quarter several presentations of the project results were carried out in different venues and fora (Live123 webinar, ITG ZdN 2014, 5G Global Conference, WWRF#33, MONAMI 2014, Fronthaul & CRAN 2014 summit,...). There was also a demonstration the joint access and BH testbed at the opening of the 5GLab Germany and the Industry Partner Program event of the Vodafone Chair at Technical University Dresden. In terms of standardisation support, monitoring of 3GPP RAN1, RAN3, RAN4 and SA2 activities was performed, as well as ONF and IETF SPRING (DMM, NEXET, WGs, SDN, proposed NFV RGs).

The activities in WP7 during the **ninth quarter** in terms of dissemination resulted in the submission of several papers to different workshops (5G-Architecture workshop in IEEE VTC 2015, Cloud Computing workshop in ICC 2015, WONC in Globecom 2015). On top of this, several papers were submitted to high

impact publications like IEEE Communications Magazine and IEEE Wireless Letters. Several papers were also submitted to EuCNC 2015. A presentation at IWPC workshop on “Network Virtualization” (Dusseldorf, 20-21 January 2015) was carried out by Telecom Italia. In terms of standardisation support, monitoring of 3GPP RAN1, RAN3, RAN4 and SA2 activities was performed, as well as ONF and IETF/IRTF (DMM, NEXET, WGs, SDN, proposed NFV RGs). A document generated by the project. “Distributed Mobility Management: Current practices and gap analysis”, was published as RFC 7429.

The activities in WP7 during the **tenth quarter** in terms of dissemination resulted in the submission of several papers to several conferences: IEEE Globecom 2015, EuCNC 2015, IEEE SPAWC 2015. On top of this, several papers were submitted to high impact publications like IEEE Communications Magazine and IEEE Transactions on Wireless Communications. Additionally, two events of significant importance in iJOIN dissemination activities took place:

- The presence of iJOIN in the booth of the European Commission in the Mobile World Congress 2015, held in Barcelona. Two demos were presented there, one devoted to the RANaaS platform and other to the use of SDN in the backhaul network. The EC exhibition booth in general and the iJOIN demo in particular gained quite good interest from visitors. Besides many visitors who initiated discussion with iJOIN representatives at the booth, we introduced the iJOIN concept to high-profile guests Commissioner G. Oettinger, Vice-President A. Ansip, and Director M. Campolargo (DG CONNECT).
- The organization of the iJOIN school “5G Cloud Technologies: Benefits and Challenges” took place in Bremen in February 2015. This two-day workshop hosted a number of presentations from iJOIN and other research projects (MiWeBa, HARP, TROPIC, CROWD, METIS, MCN), companies (Nokia, Intel), operators (Vodafone, Telefónica I+D, Telecom Italia) as well as the Small-Cell forum looking at the role of cloud computing in 5G networks. The program as well as the presentations were made available on the webpage (<http://www.ict-ijoin.eu/ijoin-winter-school/>). Additionally, video recordings of the talks were published in iJOIN’s Youtube channel.

In terms of standardisation support, monitoring of 3GPP RAN1, RAN3, RAN4 and SA2 activities was performed, as well as ONF and IETF/IRTF (DMM, NEXET, WGs, SDN, proposed NFV RGs). Also project members attended ETSI ISG MEC and 3GPP SA2 meetings. On top of this, there was a close cooperation between iJOIN and the Small Cell Forum. iJOIN contributed through NEC to two documents on virtualization in small cell networks as well as on coverage and capacity in small-cell networks with particular results from iJOIN on preferred functional splits, fronthaul requirements, multiplexing gain in fronthaul networks, as well as latency requirements of different functional splits. In order to synchronise the work of SCF and iJOIN, SCF representatives were invited to the iJOIN winter school, i.e. the RPH group chair Nick Johnson and editor of the document “virtualization in small cell networks”, Clare Somerville, participated. In addition, iJOIN participated in SCF regular phone calls and iJOIN has been presented at the SCF plenary meeting in April 2015 by the Technical Manager of iJOIN, Dr. Peter Rost.

Task	Status	Variance	Cause/Way-Forward	Expected deadlines	Affected Partners
Task 7.1	Concluded	No delays or changes of topics	N.A.	D7.1, D7.2 and D7.3 delivered on time.	None
Task 7.2	Concluded	No delays or changes of topics	N.A.	see above	none
Task 7.3	Concluded	No delays or changes of topics	N.A.	see above	none

### 2.7.2 Task 7.1: Exploitation and intellectual property

First quarter:

Partner	Achievements Milestones Work items in progress
HP	<ul style="list-style-type: none"> <li>• Participation to kick-off meeting</li> <li>• General participation to task activities</li> </ul>

	<ul style="list-style-type: none"> <li>• Internal dissemination session at HP Italy Innovation Center</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in the WP meeting held in Madrid</li> <li>• Analysis of exploitation opportunities and associated business cases</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Preparation and participation in the WP meeting held in Madrid</li> <li>• Preparation of exploitation plan proposal</li> </ul>

Second quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in the WP meeting held in Heidelberg</li> <li>• Analysis of exploitation opportunities and associated business cases</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Preparation and participation in the WP meeting held in Heidelberg</li> <li>• Preparation of exploitation plan proposal</li> </ul>

Third quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in the WP meeting held in Guildford</li> <li>• Analysis of exploitation opportunities and associated business cases</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Preparation of the WP first deliverable</li> </ul>

Fourth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in the virtual meeting</li> <li>• Analysis of exploitation opportunities and associated business cases</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Participation in the Project Virtual meeting.</li> <li>• Edition of the WP first deliverable</li> </ul>

Fifth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Setup of TI internal activities</li> <li>• Drafting IR6.2 (for TI testbed description)</li> <li>• HW configuration for test bed in TI premises</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Finalization of the WP first deliverable</li> <li>• Participation in the Project Technical Review in Brussels as WP7 Leader</li> <li>• Preparation of documentation for Project Technical Reviewers</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in the virtual meeting</li> <li>• Analysis of exploitation opportunities and associated business cases</li> </ul>

Sixth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Presentation of iJOIN concepts and public results to NEC internal and external customers</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Patentability analysis</li> </ul>
<b>TID</b>	<b>November:</b> <ul style="list-style-type: none"> <li>• Preparation of patent on advanced congestion control mechanisms for RANaaS</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in the virtual meeting</li> </ul>

Seventh quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TID</b>	<b>November:</b> <ul style="list-style-type: none"> <li>• Preparation of patent on advanced congestion control mechanisms for RANaaS</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in the virtual meeting</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Continuation of patentability analysis.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Presentation of iJOIN to business units</li> <li>• Presentation of iJOIN to (potential) customers</li> </ul>

Eighth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TID</b>	<b>November:</b> <ul style="list-style-type: none"> <li>• Preparation of patent on advanced congestion control mechanisms for RANaaS</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Continuation of patentability analysis.</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in Virtual meeting.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Presentation of iJOIN system and results to business units and customers</li> </ul>

Ninth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Preparation for the MWC demo.</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Preparation of patent on advanced congestion control mechanisms for RANaaS</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• 3GPP monitoring (RAN#1, #3 and #4)</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Presentation of NEC's results to potential customers</li> <li>• Preparation of business unit contributions</li> </ul>

Tenth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Organization of meetings and internal events on 5G and cloud technologies</li> <li>• Contribution to deliverables D7.2 and D7.3</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Coordination of the D7.3 preparation</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Participation in Virtual meeting.</li> <li>• Contributions to D7.2</li> <li>• Editorship and contributions to D7.3</li> <li>• Presentation of the SDN demo at Mobile World Congress (MWC2015, 2-5 March, Barcelona)</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• IPR preparation and management of proposed IPR</li> <li>• Internal presentation of iJOIN to BU</li> <li>• Contribution to D7.3</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the PMB meeting sessions (Bremen, February 2015; Dresden, April 2015)</li> <li>• Development of content and authoring of HP section of D7.3 deliverable</li> </ul>

### 2.7.3 Task 7.2: Standardisation

First quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Monitoring of IETF relevant activities (DMM and NETEXT WGs)</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• 3GPP monitoring (RAN#1, #3 and #4)</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Preparation of standardisation plan proposal</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Monitoring of IETF relevant activities (DMM and NETEXT WGs)</li> </ul>

Second quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Monitoring of IETF relevant activities (DMM and NETEXT WGs)</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• 3GPP monitoring (RAN#1, #3 and #4)</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Preparation of standardisation plan proposal</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Monitoring of IETF relevant activities (DMM and NETEXT WGs).</li> <li>• Co-authorship of an adopted DMM WG: “Distributed Mobility Management: Current practices and gap analysis”, draft-ietf-dmm-best-practices-gap-analysis-00. Available at: <a href="http://tools.ietf.org/html/draft-ietf-dmm-best-practices-gap-analysis-00">http://tools.ietf.org/html/draft-ietf-dmm-best-practices-gap-analysis-00</a></li> </ul>

Third quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>Monitoring of IETF relevant activities (DMM and NETEXT WGs)</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>Input to 3GPP RAN group on small cell enhancements SI</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>3GPP monitoring (RAN#1, #3 and #4)</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>Monitoring of relevant of 3GPP activities</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>Monitoring of IETF relevant activities (DMM and NETEXT WGs).</li> <li>Co-authorship of an adopted DMM WG: "Distributed Mobility Management: Current practices and gap analysis", draft-ietf-dmm-best-practices-gap-analysis-01. Available at: <a href="http://tools.ietf.org/html/draft-ietf-dmm-best-practices-gap-analysis-01">http://tools.ietf.org/html/draft-ietf-dmm-best-practices-gap-analysis-01</a></li> </ul>

Fourth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>Monitoring of IETF relevant activities (DMM and NETEXT WGs)</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>Monitoring of 3GPP RAN2 work on small cell enhancements</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>3GPP monitoring (RAN#1, #3 and #4)</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>At the ITU WP 5D meeting #17 a short contribution from iJoin was presented by TI;</li> <li>The document, co-authored by TI, NEC, Intel and Telefonica, was to propose a more in-depth iJoin presentation at the ITU WP 5D #18 in February 2014, contributing to "Research views on IMT beyond 2020". The document was noted. Link of the document: <a href="http://www.itu.int/md/R12-WP5D.AR-C-0324/en">http://www.itu.int/md/R12-WP5D.AR-C-0324/en</a></li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>Monitoring of relevant of 3GPP activities</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>Monitoring of IETF relevant activities (DMM and NETEXT WGs)</li> <li>Co-authorship of an adopted DMM WG: "Distributed Mobility Management: Current practices and gap analysis", draft-ietf-dmm-best-practices-gap-analysis-01. Available at: <a href="http://tools.ietf.org/html/draft-ietf-dmm-best-practices-gap-analysis-02">http://tools.ietf.org/html/draft-ietf-dmm-best-practices-gap-analysis-02</a></li> </ul>

Fifth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>NEC</b>	<ul style="list-style-type: none"> <li>3GPP LTE RAN2 Monitoring, in particular Small Cell Enhancements SI</li> <li>Preparation of contribution to ITU-R and its presentation</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>3GPP monitoring (RAN#1, #3 and #4)</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>Support for the preparation of a contribution to the ITU-R WP5D Workshop on "Research views on IMT beyond 2020"</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>Monitoring of relevant of 3GPP activities</li> </ul>

<b>UC3M</b>	<ul style="list-style-type: none"> <li>Monitoring of IETF relevant activities (DMM and NETEXT WGs).</li> <li>Preparation of a new version of an adopted DMM WG: “Distributed Mobility Management: Current practices and gap analysis”, draft-ietf-dmm-best-practices-gap-analysis-03</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>Monitoring of IETF relevant activities (DMM and NETEXT WGs)</li> </ul>

Sixth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>NEC</b>	<ul style="list-style-type: none"> <li>Monitoring of 3GPP RAN1/2 with respect to small cell and CoMP WI/SI</li> <li>Monitoring of 3GPP SA2 with respect to iJOIN relevant topics</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>3GPP monitoring (RAN#1, #3 and #4)</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>Submitted a contribution to ITU-R WP5D workshop on vision beyond 2020 (February 2014). The document provided an overview of the project's activities, in view of possible contributions to ITU-R Report on technology beyond 2020.</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>Monitoring of relevant of 3GPP activities</li> <li>Monitoring of ONF activities</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>Monitoring of IETF relevant activities (DMM and NETEXT WGs).</li> <li>Preparation of a new version of an adopted DMM WG: “Distributed Mobility Management: Current practices and gap analysis”, draft-ietf-dmm-best-practices-gap-analysis-04 (under preparation)</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>Monitoring of IETF relevant activities (DMM and NETEXT WGs)</li> </ul>

Seventh quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>Monitoring of IETF relevant activities (DMM and NETEXT WGs)</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>Monitoring of 3GPP RAN1/2 with respect to small cell and CoMP WI/SI</li> <li>Monitoring of 3GPP SA2 with respect to iJOIN relevant topics</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>Monitoring of relevant of 3GPP activities</li> <li>Monitoring of ONF activities</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>Monitoring of IETF/IRTF relevant activities (DMM, NETEXT, SPRING WGs, SDN, proposed NFV RGs).</li> <li>Preparation of a new version of an adopted DMM WG: “Distributed Mobility Management: Current practices and gap analysis”, draft-ietf-dmm-best-practices-gap-analysis-07. Currently on the last stage of the publication process as RFC.</li> <li>Presentation of the following draft on the IETF 90<sup>th</sup> meeting in Toronto, July 2014: “Cooperating Layered Architecture for SDN”, draft-contreras-sdnrg-layered-sdn-00</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>Monitoring of standardization bodies.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>3GPP monitoring (RAN#1, #3 and #4)</li> </ul>

Eighth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>NEC</b>	<ul style="list-style-type: none"> <li>Monitoring of 3GPP SA, RAN WGs</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>Monitoring of relevant of 3GPP activities</li> <li>Monitoring of ONF activities</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>Monitoring of standardization bodies.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>3GPP monitoring (RAN#1, #3 and #4)</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>Monitoring of IETF/IRTF relevant activities (DMM, NETEXT, SPRING WGs, SDN, proposed NFV RGs).</li> <li>Preparation of a new version of an adopted DMM WG: “Distributed Mobility Management: Current practices and gap analysis”, draft-ietf-dmm-best-practices-gap-analysis-08. Accepted as Informational RFC.</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>Monitoring of IETF relevant activities (DMM and NETEXT WGs)</li> </ul>

Ninth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>Monitoring of IETF relevant activities (DMM and NETEXT WGs)</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>Monitoring ETSI ISG MEC</li> <li>Monitoring and contribution to 3GPP SA2</li> <li>Monitoring and preparation of contribution to Small-Cell Forum (WG Small-Cell Virtualization)</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>Monitoring of standardization bodies.</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>Monitoring of relevant of 3GPP activities</li> <li>Monitoring of ONF activities</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>Monitoring of IETF/IRTF relevant activities (DMM, NETEXT, SPRING WGs, SDN, proposed NFV RGs).</li> <li>“Distributed Mobility Management: Current practices and gap analysis” published as RFC 7429.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>Submission to paper ICC workshop on cloud computing</li> </ul>

Tenth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>Monitoring of IETF relevant activities (DMM and NETEXT WGs)</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>Monitoring of relevant of 3GPP activities</li> <li>Monitoring of ONF activities</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>Monitoring of IETF/IRTF relevant activities (DMM, NETEXT, SPRING WGs, SDN, proposed NFV RGs).</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>Attending ETSI ISG MEC in Shanghai, P.R. China</li> <li>Attending and contributing to 3GPP SA2 #107, SA2#108</li> <li>Attending and contributing to Small-Cell Forum (WG Small-Cell Virtualization),</li> </ul>



	organization of joint teleconference between iJOIN and SCF <ul style="list-style-type: none"> <li>• Attending Small-Cell Forum plenary Singapore, April 2015</li> <li>• Contribution to D7.2</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• 3GPP monitoring (RAN#1, #3 and #4)</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to WP7 telco</li> <li>• Contribution to deliverables D7.2 and D7.3</li> </ul>

#### 2.7.4 Task 7.3: Dissemination

First quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Input to FUNEMS'13 contributions</li> <li>• Presentation of the iJOIN project during the TROPIC plenary held in January 2013 (Grenoble, France)</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation to kick-off meeting</li> <li>• General participation to task activities</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Attendance to the kick-off meeting and participation in the discussions</li> <li>• Project presentation within team</li> <li>• Internal team meetings for future dissemination opportunities.</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Preparation and presentation of the iJOIN 2-pager and presentation for the RAS cluster session held during the Future Networks 10th FP7 Concertation Meeting at Brussels on October 10-11.</li> <li>• Input to FUNEMS'13 contributions</li> <li>• Creation of the project Twitter account</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Input to FUNEMS'13 contributions</li> <li>• Preparation of Globecom'13 workshop proposal</li> <li>• Input to coordination of FIA'13 poster</li> <li>• Coordination of publication dissemination process</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• On-going work for "conference paper" target</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Preparation of draft skeleton for a common paper on RANaaS to be submitted to FuNeMs2013</li> <li>• Preparation of draft proposal for possible IWPC workshop hosted by TI and supported by iJOIN</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Preparation of dissemination plan proposal</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Authoring contribution to FuNeMS paper on joint access and backhaul</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Preparation and presentation of the iJOIN 2-pager and presentation for the RAS cluster session held during the Future Networks 10th FP7 Concertation Meeting at Brussels on October 10-11.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Preparation of workshop proposal for GC'13</li> <li>• Input to FUNEMS'13 contribution</li> <li>• Work on WSA2013 final paper</li> </ul>

Second quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Conference paper "A Backhaul-Aware Cell Selection Algorithm for Heterogeneous</li> </ul>

	Cellular Networks” submitted to IEEE PIMRC 2013
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation to Heidelberg meeting</li> <li>• General participation to task activities</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Contributions to FuNEMS 2013 paper on RANaaS</li> <li>• Submitted a paper to IEEE Transactions on Information Theory.</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Preparation of the iJOIN presentation for the RAS Cluster session held during the FP7 Future Networks Concertation Meeting celebrated at Brussels on February 28.</li> <li>• Preparation of the iJOIN poster for the Future Internet Assembly to be celebrated at Dublin on May 7-10</li> <li>• Preparation of the IWCPM 2013 workshop proposal to Globecom</li> <li>• Maintenance of the project Twitter account: @ict_ijoin</li> <li>• Maintenance of the project website: <a href="http://www.ict-ijoin.eu">http://www.ict-ijoin.eu</a></li> <li>• Creation of the IWCPM 2013 website: <a href="http://www.ict-ijoin.eu/iwcpm2013/">http://www.ict-ijoin.eu/iwcpm2013/</a></li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Contributions to FUNEMS papers</li> <li>• Contributions to FUNEMS workshop, FIA poster, VTC’13 exhibition booth</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• On-going work for “conference paper” target</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Driving the preparation of common paper on RANaaS submitted to FuNeMs2013</li> <li>• Preparation of draft proposal for possible IWPC workshop hosted by TI and supported by iJOIN</li> <li>• Preparation of workshop proposal for VTC2013-fall as a joint initiative between different EU projects (iJOIN, TROPIC and MCN)</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Preparation of dissemination plan proposal</li> <li>• Maintenance of the dissemination database</li> <li>• Cooperation in the preparation and diffusion of Globecom’13 workshop proposal</li> <li>• Definition of work plan for Twitter account dissemination</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Reviewed the papers submitted to FuNeMS 2013</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Contribution to the project poster to be presented in the FIA event in Dublin.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Ground work for upcoming publications is in progress</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Contribution to FUNEMS paper.</li> <li>• Preparation of Globecom Workshop.</li> </ul>

Third quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Conference paper “A Backhaul-Aware Cell Selection Algorithm for Heterogeneous Cellular Networks” accepted to IEEE PIMRC 2013</li> <li>• Journal paper “Cell Selection for Joint Optimization of the Radio Access and Backhaul in Heterogeneous Cellular Networks” submitted to IEEE TWC</li> <li>• TPC member of IEEE CLEEN 2013 workshop (hosted by vtc-fall 2013)</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation to F2F meeting in Guildford</li> <li>• Serving in the TPC of CLEEN 2013</li> <li>• Contribution to poster for VTC 2013</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Submission/publication of 4 papers. <ul style="list-style-type: none"> <li>◦ 2 papers for IEEE ICC 2013</li> <li>◦ 2 papers for IEEE ISIT 2013</li> </ul> </li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Maintenance of the project Twitter account: @ict_ijoin</li> </ul>

	<ul style="list-style-type: none"> <li>Maintenance of the project website: <a href="http://www.ict-ijoin.eu">http://www.ict-ijoin.eu</a></li> <li>Creation of the CLEEN 2013 website: <a href="http://www.ict-ijoin.eu/cleen2013/">http://www.ict-ijoin.eu/cleen2013/</a></li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>Preparation of ComMag article</li> <li>Input to poster presented at FUNEMS 2013.</li> <li>Input to poster presented at FIA 2013.</li> <li>Preparation of PPT slides for MobileCloudNetworking workshop</li> <li>Preparation of VTC'13 booth posters.</li> <li>Input to RAS cluster white paper on 5G</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>On-going work for "conference paper" target</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>Organization of CLEEN2013 workshop, co-located with VTC2013-fall in Las Vegas (2 September 2013). Preparation of CfP and workshop material in collaboration with iJOIN partners and other EU projects TROPIC and MCN</li> <li>Collaboration with partners for the creation of CLEEN2013 workshop website: <a href="http://www.ict-ijoin.eu/cleen2013/">http://www.ict-ijoin.eu/cleen2013/</a></li> <li>Workshop Link in official VTC website: <a href="http://www.ieeevtc.org/vtc2013fall/workshops.php#W1">http://www.ieeevtc.org/vtc2013fall/workshops.php#W1</a></li> <li>Finalisation of WP5 paper on RANaaS for FuNEMS2013</li> <li>Preparation of paper for VTC CLEEN 2013 related to WP2 activities in iJOIN, with particular focus on fronthauling data rate reduction techniques.</li> <li>Preparation of skeleton for IEEE WCM paper</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>Preparation of dissemination plan proposal</li> <li>Maintenance of the dissemination database</li> <li>Cooperation in the preparation and diffusion of Globecom'13 workshop proposal</li> <li>Inputs to the project Twitter account</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>Preparation and presentation of iJOIN exhibition booth at VTC2013-spring.</li> <li>Accepted publication in CLEEN 2013.</li> <li>Submitted publication to Globecom IWCPM 2013.</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>Attendance to the FIA event in Dublin and presentation of the project poster to be presented.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>Presented FuNEMS 2013 paper from iJOIN WP5 in Lisbon Portugal on 4th July 2013.</li> <li>Ground work for upcoming publications is in progress</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>Input to poster of VTC'13 booth poster.</li> <li>Preparation of Globecom Workshop as TPC Chair.</li> <li>Contribution to joint CLEEN '13 Paper.</li> <li>Preparation of CLEEN '13 paper on INP.</li> <li>Preparation of paper on In-Network-Processing submitted to Globecom IWCPM '13 workshop.</li> </ul>

Fourth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>Editor of the deliverable D3.1.</li> <li>Contribution to deliverable D3.1: Sections 4 and 5.</li> <li>Literature review of New Carrier Type based solutions.</li> <li>Research on an algorithm for energy saving in the New Carrier Type framework</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>Contribution to IEEE CommMag publication</li> <li>Minors (participation to virtual meeting)</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>Presentation of iJOIN Posters in the Intel ERIC 2013 Conference showcase.</li> <li>Publication submitted to ICC 2014</li> </ul>

<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Maintenance of the project Twitter account: @ict_ijoin</li> <li>• Maintenance of the project website: <a href="http://www.ict-ijoin.eu">http://www.ict-ijoin.eu</a></li> <li>• Creation of the CLEEN 2013 website: <a href="http://www.ict-ijoin.eu/cleen2013/">http://www.ict-ijoin.eu/cleen2013/</a></li> <li>• Contributions to D7.1</li> <li>• News on the event of the iJOIN award: <a href="http://www.networks.imdea.org/whats-new/news/2013/ijoin-research-project-receives-runner-prize-ninth-madrid-awards">http://www.networks.imdea.org/whats-new/news/2013/ijoin-research-project-receives-runner-prize-ninth-madrid-awards</a></li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Leading preparation and submission of ComMag article for 5G Special Issue</li> <li>• Preparation of white paper proposal to IEEE Signal Processing Magazine.</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Paper submitted and accepted at ISWCS Workshop (GLOBECOM'13, Atlanta, USA).</li> <li>• Paper submitted to IEEE Com Mag 5G issue.</li> <li>• Contribution to D7.1.</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Finalisation of the organisation of CLEEN2013 workshop, co-located with VTC2013-fall in Las Vegas (2 September 2013). Finalisation of CfP and workshop material in collaboration with iJOIN partners and other EU projects TROPIC and MCN.</li> <li>• Collaboration with partners for the finalisation of CLEEN2013 workshop website: <a href="http://www.ict-ijoin.eu/cleen2013/">http://www.ict-ijoin.eu/cleen2013/</a></li> <li>• Workshop Link in official VTC website: <a href="http://www.ieeevtc.org/vtc2013fall/workshops.php#W1">http://www.ieeevtc.org/vtc2013fall/workshops.php#W1</a></li> <li>• Contribution to WP5 paper on 5G.</li> <li>• TI Presentation on iJOIN activities to Italian AICT event (Milan, 18 October 2013).</li> <li>• Preparation of CLEEN2014 workshop, co-located with WCNC 2014 in conjunction with WCNC 2014 - April 6, 2014 - Istanbul, Turkey. Finalisation of CfP and workshop material in collaboration with iJOIN partners and other EU projects TROPIC and MCN</li> <li>• Collaboration with partners for the preparation of CLEEN2014 workshop website: <a href="http://www.ict-ijoin.eu/cleen2014/">http://www.ict-ijoin.eu/cleen2014/</a></li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Maintenance of the dissemination database</li> <li>• Inputs to the project Twitter account</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in CLEEN2013 workshop and presentation of paper on backhauling.</li> <li>• Accepted publication.</li> <li>• Contributions to white paper "Benefits and Impact of Cloud Computing on 5G Signal Processing".</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Submission of the following article to IEEE Transactions on Mobile Computing: "Analytic Evaluation and Experimental Validation of a Network-based IPv6 Distributed Mobility Management Solution", Fabio Giust, Antonio de la Oliva and Carlos J. Bernardos</li> <li>• Participation in the organisation of the CLEEN 2013 workshop, collocated with IEEE VTC 2013.</li> <li>• Participation in the panel of the CLEEN 2013 workshop, representing iJOIN, collocated with IEEE VTC 2013.</li> </ul>
<b>UNIS</b>	<ul style="list-style-type: none"> <li>• Prepared and submitted one paper to ICC; and one paper to IEEE Comm Surveys and Tutorials from WP2 and WP3 work.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Preparation of Globecom IWCPM Workshop as TPC Chair, e.g. organizing review process, preparation of program, etc.</li> <li>• Presentation of paper on In-Network-Processing at CLEEN '13 workshop.</li> <li>• Preparation of final paper on In-Network-Processing accepted at Globecom IWCPM '13 workshop</li> <li>• Preparation of paper on In-Network Processing to be submitted to WSA 2014.</li> <li>• Preparation of White Paper "Benefits and Impact of Cloud Computing on 5G Signal Processing", IEEE Signal Processing Magazine.</li> </ul>

Fifth quarter:

<b>Partner</b>	<b>Achievements Milestones Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Participation to the regular WP5 phone-conferences</li> <li>• Preparation and participation to the iJOIN F2F meeting in Turin (25/28-11-2014)</li> <li>• Contribution to the revision of the IEEE Com Mag</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation to WP7 sessions in Turin meeting and audit (rehearsal)</li> <li>• Review of IEEE CommMag publication</li> <li>• Initial work on a WP5 energy efficiency paper for Wireless Communication Magazine</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Submitted a paper to ISIT 2014.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Co-organization of IEEE Globecom Workshop on Cloud-Processing in Heterogeneous Mobile Communication Networks (<a href="http://www.ict-ijoin.eu/iwcpm2013/index.html">http://www.ict-ijoin.eu/iwcpm2013/index.html</a>)</li> <li>• Co-authoring IEEE Signal Processing Magazine submission; obtaining measurements for turbo-decoder implementation on cloud-platform</li> <li>• Editorship for final manuscript of IEEE Communications Magazine article</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Accepted paper presented at IWCPM Workshop (Globecom'13, Atlanta, USA)</li> <li>• Update of paper accepted to IEEE Com Mag 5G issue</li> <li>• Contribution to paper submitted to the Signal Processing Mag on the 5G revolution</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Organization of IWPC workshop in Turin</li> <li>• Organization of CLEEN2014 workshop (co-located with IEEE WCNC 2014)</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Maintenance of the dissemination database</li> <li>• Inputs to the project Twitter account</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Participation in IWCPM2013 workshop and presentation of paper on backhauling.</li> <li>• Contributions to white paper "Benefits and Impact of Cloud Computing on 5G Signal Processing".</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Submission of a minor revision of the following article to IEEE Transactions on Mobile Computing: "Analytic Evaluation and Experimental Validation of a Network-based IPv6 Distributed Mobility Management Solution", Fabio Giust, Carlos J. Bernardos and Antonio de la Oliva.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Co-organization of IEEE Globecom Workshop on Cloud-Processing in Heterogeneous Mobile Communication Networks (IWCPM) as TPC Chair and participation. <ul style="list-style-type: none"> <li>◦ Web: <a href="http://www.ict-ijoin.eu/iwcpm2013/index.html">http://www.ict-ijoin.eu/iwcpm2013/index.html</a></li> </ul> </li> <li>• Presentation of paper on In-Network-Processing at Globecom IWCPM'13 workshop.</li> <li>• Preparation of final paper on In-Network Processing accepted at WSA 2014.</li> <li>• Co-Authoring paper "Benefits and Impact of Cloud Computing on 5G Signal Processing" submitted to IEEE Signal Processing Magazine.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• UNIS paper on DL CoMP performance investigations in WP2 has been accepted for Oral presentation at ICC 2014.</li> <li>• Further work for upcoming publications is in progress.</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Maintenance of the project Twitter account: @ict_ijoin</li> <li>• Maintenance of the project website: <a href="http://www.ict-ijoin.eu">http://www.ict-ijoin.eu</a></li> <li>• Creation of the CLEEN 2014 website: <a href="http://www.ict-ijoin.eu/cleen2014/">http://www.ict-ijoin.eu/cleen2014/</a></li> <li>• News on the event of the iJOIN technical review: <a href="http://www.ict-ijoin.eu/successful-technical-review-european-commission/">http://www.ict-ijoin.eu/successful-technical-review-european-commission/</a></li> </ul>

Sixth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Contribution to a joint WP2/WP3 paper for EUCNC'14</li> <li>• Contribution to a IEEE network magazine on energy efficiency</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Contributions to joint WP5 paper on energy efficiency.</li> <li>• Submitted a paper on "<i>Reducing the Energy Consumption of Small Cell Networks subject to QoE constraints</i>" to Globecom 2014.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Contribution to EuCNC, IEEE Globecom 2014, and IEEE Wireless Comm Letter publication</li> <li>• Revision of IEEE Signal Processing Magazine article</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Maintenance of the project Twitter account: @ict_ijoin</li> <li>• Maintenance of the project website: <a href="http://www.ict-ijoin.eu">http://www.ict-ijoin.eu</a></li> <li>• Maintenance of the CLEEN 2014 website: <a href="http://www.ict-ijoin.eu/cleen2014/">http://www.ict-ijoin.eu/cleen2014/</a></li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Update of paper submitted to the Signal Processing Mag on the 5G revolution</li> <li>• Contribution to paper submitted to EuCNC 2014 (Bologna, Italy)</li> <li>• Contribution to paper submitted to IEEE Networks Magazine</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• CLEEN2014 workshop final organization and chairmanship.</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Maintenance of the dissemination database</li> <li>• Inputs to the project Twitter account</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Contributions to magazine article "Benefits and Impact of Cloud Computing on 5G Signal Processing"</li> <li>• Contributions to paper "Towards a Flexible Functional Split for Cloud-RAN Networks"</li> <li>• Publication titled "An Analysis of Backhaul Costs of Radio Access Networks using Stochastic Geometry" accepted at ICC 2014.</li> <li>• Preparation of conference paper (submitted to PIMRC)</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Acceptance and submission of proofs of the following article to IEEE Transactions on Mobile Computing: "Analytic Evaluation and Experimental Validation of a Network-based IPv6 Distributed Mobility Management Solution", Fabio Giust, Carlos J. Bernardos and Antonio de la Oliva.</li> <li>• Acceptance and submission of final version of the following article: "An Architecture for Software Defined Wireless Networking", Carlos J. Bernardos, Antonio de la Oliva, Pablo Serrano, Albert Banchs, Luis M. Contreras, Hao Jin, Juan Carlos Zúñiga, IEEE Wireless Communications, Special Issue on "Research &amp; Standards: Leading the Evolution of Telecom Network Architectures"</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• Two joint papers were submitted, one based on work in WP3 to EuCNC 2014 (which has been accepted), the other was in the review process for publication in IEEE Networks magazine paper.</li> <li>• Paper submitted from WP2 to ICC 2014 was accepted.</li> <li>• Further work for upcoming publications is in progress.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Editorship for revised paper "Benefits and Impact of Cloud Computing on 5G Signal Processing" submitted to IEEE Signal Processing Magazine.</li> <li>• Preparation of paper "Comparative Study of Distributed Consensus-based Estimation Schemes for Small-Cell Networks" for EuCNC 2014.</li> <li>• Contribution to paper "Towards a Flexible Functional Split for Cloud-RAN Networks" for EuCNC 2014 (Bologna, Italy)</li> </ul>

Seventh quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Submission of paper to IEEE JSAC SI HCN “Are heterogeneous cloud-based radio access networks cost-effective?”</li> <li>• Preparation of submission to IEEE TWC on computational complexity</li> <li>• Submission of accepted papers at IEEE PIMRC and IEEE Wireless Communications Letters</li> <li>• Accepted paper at IEEE Globecom 2014</li> <li>• Revision of (accepted) magazine article “Benefits and Impact of Cloud Computing on 5G Signal Processing</li> </ul>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Maintenance of the project Twitter account: @ict_ijoin</li> <li>• Maintenance of the project website: <a href="http://www.ict-ijoin.eu/">http://www.ict-ijoin.eu/</a></li> <li>• Maintenance of the CLEEN 2014 website: <a href="http://www.ict-ijoin.eu/cleen2014/">http://www.ict-ijoin.eu/cleen2014/</a></li> <li>• iJOIN booth at EuCNC 2014</li> <li>• News on iJOIN at EuCNC conference 2014: <a href="http://www.ict-ijoin.eu/ijoin-eucnc-2014/">http://www.ict-ijoin.eu/ijoin-eucnc-2014/</a></li> <li>• Submission of the following article to IEEE Communications Magazine special issue on Recent Advances in Technologies for Extremely Dense Wireless Networks: “Distributed Mobility Management for future 5G networks: overview and analysis of existing approaches”, Luca Cominardi, Fabio Giust, Carlos J. Bernardos.</li> <li>• Submission of the following article to IEEE INFOCOM 2015: “Distributed Mobility Management solutions for next mobile network architectures”, Luca Cominardi, Fabio Giust, Carlos J. Bernardos and Antonio de la Oliva.</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• UNIS paper on Graph theory based RRM in Small Cells got accepted at IEEE Access.</li> <li>• Further work for upcoming publications is in progress.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Editorship for revised paper “Benefits and Impact of Cloud Computing on 5G Signal Processing” submitted to IEEE Signal Processing Magazine.</li> <li>• Preparation of final paper and poster “Comparative Study of Distributed Consensus-based Estimation Schemes for Small-Cell Networks” for EuCNC 2014.</li> <li>• Contribution to final version of joint WP2 and WP3 paper “Towards a Flexible Functional Split for Cloud-RAN Networks” for EuCNC 2014.</li> <li>• Preparation of joint (UoB, CEA, and NEC) paper and presentation “Decoder Implementation for Cloud Based Architectures” for EuCNC 2014.</li> <li>• Preparation of paper “Distributed Consensus-based Estimation for Small-Cell Cooperative Networks” for BWA 2014.</li> <li>• Preparation and demonstration of “Decoder Implementation in Cloud” demo at EuCNC 2014</li> <li>• iJOIN booth at EuCNC 2014</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Submission of the following article to IEEE Communications Magazine special issue on Recent Advances in Technologies for Extremely Dense Wireless Networks: “Distributed Mobility Management for future 5G networks: overview and analysis of existing approaches”, Luca Cominardi, Fabio Giust, Carlos J. Bernardos.</li> <li>• Submission of the following article to IEEE INFOCOM 2015: “Distributed Mobility Management solutions for next mobile network architectures”, Luca Cominardi, Fabio Giust, Carlos J. Bernardos and Antonio de la Oliva.</li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Contributions to magazine article “Benefits and Impact of Cloud Computing on 5G Signal Processing</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Maintenance of the dissemination database</li> <li>• Inputs to the project Twitter account</li> </ul>

<b>IMC</b>	<ul style="list-style-type: none"> <li>An accepted paper for WP2 to be presented at ISWCS2014, titled “Robust Precoding for Network MIMO with Hierarchical CSIT”</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>Revision of accepted paper submitted to the Signal Processing Mag on the 5G revolution</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>SON and CLOUD RAN USA workshop final organization and chairmanship.</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>Contributions to magazine article “Benefits and Impact of Cloud Computing on 5G Signal Processing</li> <li>Preparation of paper on error resilient decoders</li> </ul>

Eighth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>Maintenance of the project Twitter account: @ict_ijoin</li> <li>Maintenance of the project website: <a href="http://www.ict-ijoin.eu/">http://www.ict-ijoin.eu/</a></li> <li>Maintenance of the CLEEN 2014 website: <a href="http://www.ict-ijoin.eu/cleen2014/">http://www.ict-ijoin.eu/cleen2014/</a></li> <li>News on iJOIN at EuCNC conference 2014: <a href="http://www.ict-ijoin.eu/ijoin-eucnc-2014/">http://www.ict-ijoin.eu/ijoin-eucnc-2014/</a></li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>Participation and contribution to the Virtual meeting (October 2014)</li> <li>Paper for IEEE Access (Energy Efficiency benefits of RAN-as-a-Service concept for a cloud-based 5G mobile network infrastructure):</li> <li>Contribution to rework of previous IEEE Network Magazine Paper for resubmission to IEEE Access;</li> <li>Contribution to the companion video under production for IEEE Access</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>Submission of two papers to IEEE Transaction on Wireless Communications:</li> <li>Preparation of contribution to IEEE Communications Magazine, Special Issue on Virtualization</li> <li>Invited presentation at Layer123 Webinar:</li> <li>Invited presentation at WWRF#33</li> <li>Invited presentation at 5G Global Conference (organized by METIS):</li> <li>Panel moderation at MONAMI 2014</li> <li>Invited presentation at ITG ZdN 2014</li> <li>Accepted paper in Springer Journal of Telecommunication Systems</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>An IEEE journal paper is currently under preparation based on UNIS work in WP2 on DL CoMP cluster / vNB size optimization taking into account the delay constraints and GPHW processing at RANaaS.</li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>Paper Accepted to IEEE Access “Energy Efficiency benefits of RAN-as-a-Service concept for a cloud-based 5G mobile network infrastructure”</li> <li>Paper Submission to ICC 2015 “Optimal Small Cell Control in Dual Connectivity Heterogeneous Networks”, A. De Domenico, V. Savin, and D. Kténas</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>Preparation of final version of paper “Distributed Consensus-based Estimation for Small-Cell Cooperative Networks” for BWA workshop at Globecom 2014.</li> <li>Preparation of paper “Distributed Augmented Lagrangian Method for Cooperative Estimation in Small Cell Networks” submitted SCC 2015.</li> <li>Preparation of IWCPM Workshop at ICC 2015 as Co-Chair</li> <li>Preparation of iJOIN school “5G Cloud Technologies: Benefits and Challenges” as local organizer</li> </ul>



<b>TUD</b>	<ul style="list-style-type: none"> <li>• Preparation of paper on error resilient decoders</li> <li>• Demonstrating the joint access and BH testbed at the opening of the 5GLab Germany and the Industry Partner Program event of the Vodafone Chair at TUD</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Acceptance of the following article to IEEE Communications Magazine special issue on Recent Advances in Technologies for Extremely Dense Wireless Networks: “Distributed Mobility Management for future 5G networks: overview and analysis of existing approaches”, Luca Cominardi, Fabio Giust, Carlos J. Bernardos.</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Fronthaul &amp; CRAN summit (Barcelona, 29 October 2014).</li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Contribution to paper submitted/accepted to IEEE Access</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Maintenance of the dissemination database</li> <li>• Inputs to the project Twitter account</li> </ul>

Ninth quarter:

<b>Partner</b>	<b>Achievements</b> <b>Milestones</b> <b>Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Maintenance of the project Twitter account: @ict_ijoin</li> <li>• Maintenance of the project website: <a href="http://www.ict-ijoin.eu/">http://www.ict-ijoin.eu/</a></li> <li>• Maintenance of the CLEEN 2014 website: <a href="http://www.ict-ijoin.eu/cleen2014/">http://www.ict-ijoin.eu/cleen2014/</a></li> <li>• News on iJOIN at EuCNC conference 2014: <a href="http://www.ict-ijoin.eu/ijoin-eucnc-2014/">http://www.ict-ijoin.eu/ijoin-eucnc-2014/</a></li> <li>• Preparation for the MWC demo.</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Revision of IEEE Transactions on Wireless Communications submission</li> <li>• Preparation of EuCNC contribution (3 papers)</li> <li>• Preparation and submission of IEEE ICC IWCPM contribution</li> <li>• Preparation and submission of IEEE Wireless Communications Magazine contribution</li> <li>• Preparation and submission of IEEE Communications Magazine contribution (standards supplement)</li> <li>• Presentation of paper at IEEE GC'14</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• A paper submitted to the iJOIN workshop in ICC.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Presentation of paper “Distributed Consensus-based Estimation for Small-Cell Cooperative Networks” for BWA workshop at Globecom 2014.</li> <li>• Preparation of final version of paper “Distributed Augmented Lagrangian Method for Cooperative Estimation in Small Cell Networks” accepted at SCC 2015.</li> <li>• Preparation of IWCPM Workshop at ICC 2015 as Co-Chair.</li> <li>• Contribution to IEEE Communications Magazine paper “Benefits and Challenges of Virtualization in 5G Radio Access Networks”</li> <li>• Contribution to IEEE Wireless Communications Magazine paper “Fronthaul Requirements for a Flexible Functional Split in Cloud Radio Access Networks”</li> <li>• Preparation of iJOIN school “5G Cloud Technologies: Benefits and Challenges” as local organizer.</li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Paper Accepted to VTC2015 / 5G-Arch workshop, “Benefits and challenges of cloud technologies for 5G architecture”</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Maintenance of the dissemination database</li> <li>• Inputs to the project Twitter account</li> <li>• Contribution to IEEE Communications Magazine paper “Benefits and Challenges of Virtualization in 5G Radio Access Networks”</li> </ul>

<b>TI</b>	<ul style="list-style-type: none"> <li>• Presentation at IWPC workshop on “Network Virtualization” (Dusseldorf, 20-21 January 2015)</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Presentation of paper on error resilient decoders at WONC@Globecom’14</li> <li>• Preparation of paper “Quantizer optimization for Cloud-based Mobile Networks with Imperfect Fronthaul”</li> <li>• Contributions to magazine article “Fronthaul Requirements for a Flexible Functional Split in Cloud Radio Access Networks”</li> <li>• Preparation of video on joint access and backhaul testbed (ongoing)</li> </ul>
<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Contribution to two papers to be submitted to EuCNC 2015. Status: ongoing.</li> <li>• Preparation of final proofs and publication of the following article to IEEE Communications Magazine special issue on Recent Advances in Technologies for Extremely Dense Wireless Networks: “Distributed Mobility Management for future 5G networks: overview and analysis of existing approaches”, Luca Cominardi, Fabio Giust, Carlos J. Bernardos.</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Presentation of an iJOIN paper "Reducing the Energy Consumption of Small Cell Networks Subject to QoE Constraints" in Globecom December-2014, Texas</li> </ul>

Tenth quarter:

<b>Partner</b>	<b>Achievements Milestones Work items in progress</b>
<b>IMDEA</b>	<ul style="list-style-type: none"> <li>• Maintenance of the project Twitter account: @ict_ijoin</li> <li>• Maintenance of the project website: <a href="http://www.ict-ijoin.eu/">http://www.ict-ijoin.eu/</a></li> <li>• News on iJOIN at MWC conference 2015: <a href="http://www.ict-ijoin.eu/eu-commissioner-digital-economy-society-visits-ijoin-mwc-5gpppmwc/">http://www.ict-ijoin.eu/eu-commissioner-digital-economy-society-visits-ijoin-mwc-5gpppmwc/</a></li> <li>• Preparation and presentation of the MWC demo (22-25 February, Barcelona)</li> </ul>
<b>CEA</b>	<ul style="list-style-type: none"> <li>• Presentation on joint RAN/BH optimization at iJOIN winter school in Bremen</li> <li>• Submission of a paper to IEEE Globecom 2015 “Fuzzy Q-Learning based Small Cell DTX in Dense Heterogeneous Cellular Networks”</li> <li>• Submission (and acceptance) of a paper to IEEE SPAWC 2015 “Uplink Capacity and User Association for Cooperative Heterogeneous Cellular Networks”</li> </ul>
<b>UniS</b>	<ul style="list-style-type: none"> <li>• A journal paper (from WP2 work) was submitted to IEEE Wireless, this was resulted from UNIS work in WP2.</li> <li>• A paper that was submitted to the iJOIN workshop in ICC in last quarter (from WP3 work) was accepted.</li> <li>• A paper (from WP4 work) was submitted to EuCNC 2015 conference. Paper has been accepted for publication.</li> </ul>
<b>TID</b>	<ul style="list-style-type: none"> <li>• Maintenance of the dissemination database</li> <li>• Inputs to the project Twitter account</li> <li>• Contribution to the preparation of D7.2</li> </ul>
<b>TUD</b>	<ul style="list-style-type: none"> <li>• Preparation of video on joint access and backhaul testbed <a href="http://www.youtube.com/watch?v=TctCMAE1dmI">www.youtube.com/watch?v=TctCMAE1dmI</a></li> <li>• Presentation of joint RAN/BH testbed at iJOIN winter school</li> </ul>
<b>NEC</b>	<ul style="list-style-type: none"> <li>• Revision of IEEE Communication Magazine paper</li> <li>• Preparation and submission of EuCNC contribution (3 papers)</li> <li>• Preparation and contribution to two IEEE GLOBECOM papers</li> <li>• Preparation of IEEE TWireless submission</li> <li>• iJOIN winter school talks on functional split (WP3 related) and system-wide overview</li> <li>• Contribution to D7.2</li> </ul>

<b>UC3M</b>	<ul style="list-style-type: none"> <li>• Contribution to two papers to be submitted to EuCNC 2015. The paper “SDN-based Joint Backhaul and Access Design for Efficient Network Layer Operations” has been accepted for oral presentation.</li> <li>• Submission of the paper “An SDN-based architecture for 5G networks: design and proof of concept” to IEEE Communications Magazine.</li> </ul>
<b>UoB</b>	<ul style="list-style-type: none"> <li>• Presentation of paper “Distributed Augmented Lagrangian Method for Cooperative Estimation in Small Cell Networks” at SCC 2015.</li> <li>• Organization of iJOIN Winter School in Bremen.</li> <li>• Preparation of videos of talks at iJOIN Winter <a href="https://www.youtube.com/channel/UCZGFxh6FvGW3-C7Xvft6vPw">https://www.youtube.com/channel/UCZGFxh6FvGW3-C7Xvft6vPw</a></li> <li>• Presentation of Cloud-RAN scheduling demo at iJOIN Winter School</li> <li>• Preparation and submission of final version of paper “Implementation and Analysis of Forward Error Correction Decoding for Cloud-RAN Systems” to IWCPM Workshop at ICC 2015</li> <li>• Contribution to IEEE Transactions on Wireless Communications paper “Performance Analysis and Optimal Cooperative Cluster Size for Randomly Distributed Small Cells under Cloud RAN Benefits and Challenges of Virtualization in 5G Radio Access Networks”.</li> <li>• Organization of IWCPM Workshop at ICC 2015 as Co-Chair <a href="http://www.ict-ijoin.eu/iwcpm2015/">http://www.ict-ijoin.eu/iwcpm2015/</a></li> </ul>
<b>SCBB</b>	<ul style="list-style-type: none"> <li>• Submission to IEEE Globecom</li> </ul>
<b>IMC</b>	<ul style="list-style-type: none"> <li>• Submission of a paper to Globecom 2015</li> </ul>
<b>TI</b>	<ul style="list-style-type: none"> <li>• Participation to the iJOIN winter school in Bremen</li> <li>• Organization of CLEEN2015 workshop</li> <li>• Contribution to deliverables D7.2 and D7.3</li> </ul>
<b>HP</b>	<ul style="list-style-type: none"> <li>• Participation and contribution to the PMB meeting sessions (Bremen, February 2015; Dresden, April 2015)</li> <li>• Authoring contribution as main editor of deliverable D7.2</li> <li>• Peer review of deliverable D7.2 (with a person different from the editor)</li> </ul>

### 3 Status of Deliverables and Milestones

#### 3.1 Deliverables

As shown in the table below, all deliverables have been completed in time.

<b>Deliverables Progress</b>			
	<b>On schedule</b>	<b>Delayed</b>	<b>Completed</b>
<b>D1.1</b>			X
<b>D1.2</b>			X
<b>D2.1</b>			X
<b>D2.2</b>			X
<b>D2.3</b>			X
<b>D3.1</b>			X
<b>D3.2</b>			X
<b>D3.3</b>			X
<b>D4.1</b>			X
<b>D4.2</b>			X
<b>D4.3</b>			X
<b>D5.1</b>			X
<b>D5.2</b>			X
<b>D5.3</b>			X
<b>D6.1</b>			X
<b>D6.2</b>			X
<b>D7.1</b>			X
<b>D7.2</b>			X
<b>D7.3</b>			X

##### 3.1.1 Corrective actions in case of delay

Not required.

#### 3.2 Milestones

The objective of all Milestones has been completed.

<b>Milestones Progress</b>			
	<b>On schedule</b>	<b>Delayed</b>	<b>Completed</b>
<b>MS1</b>			X
<b>MS2</b>			X
<b>MS3</b>			X

##### 3.2.1 Corrective actions in case of delay

N/A.

## **Acknowledgements and Disclaimer**

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