Xhaul: the 5G Integrated fronthaul/backhaul

H2020 5G PPP Xhaul Project
Grant No. 671598

D7.1 PROJECT HANDBOOK

Abstract

This handbook details management bodies, documents, and procedures which are described in the Description of Action , Grant Agreement and Consortium Agreement. It also includes the Quality Plan to be followed by the project to ensure timely delivery of all results to the European Commission.

Document Properties	
Document Number:	D7.1
Document Title:	**Project Handbook**
Document Responsible:	Antonio de la Oliva
Document Editor:	María Florencia Giunta
Authors:	
Target Dissemination Level:	PU
Status of the Document:	Preparation
Version:	0

Production Properties:	
Reviewers:	Kaan Bür Gino Carrozzo

Document History:

Revision	Date	Issued by	Description
1	2015-07-16	María Florencia Giunta	Initial release
2	2015-07-29	Kaan Bür	Reviewed
3	2015-07-29	Gino Carrozzo	Reviewed

Disclaimer:

This document has been produced in the context of the XHAUL Project. The research leading to these results has received funding from the European Community's H2020 Programme under grant agreement N° H2020-671598.

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1. Introduction

The aim of this document is to set-up and explicitly describe the different management procedures to be applied during the project lifetime. All these contents largely defined also in their legal terms in the Consortium Agreement signed by all the Xhaul partners. Summary guidelines are reported in this document for a quicker operative consultation by project participants. Following this idea, this document starts by describing the different Management Bodies and the organization of the Management Team in Section 2. It is important to highlight that, due to the large scale of the project, we have opted for a two tier hierarchy of partners represented in two different boards. The Core Members Board is in charge of the decisions regarding consortium membership, budget, and work plan direction. The companies belonging to the Core Members Board have been selected according to their specific weight in the proposal and the market. The Project Board includes a representative of each partner on the consortium and takes all the rest of decisions.

Once the key management and organizational bodies are presented, this deliverable tackles the different procedures required for the organization of meetings and audio-conferences in Section 3, defining the mechanisms to be followed while organizing a project meeting.

During the physical meetings and specific audio-conferences, there may be some situations when a voting is required to decide on a certain matter. This document explains in Section 4 the different voting rules and mechanisms for the decision process.

Following with the different rules that apply to the work of partners in Xhaul, Section 5 specifies the obligations on the communication and dissemination of results, including the different rules for the approval of scientific contributions to public dissemination venues.

Section 6 specifies the different management reports due during the lifetime of the project. This section is complemented by Annex I and Annex II, which include the templates to be followed for quarterly management reports and technical deliverables, respectively.

Finally, considering the Management of Risks and Contingency Plan sketched in Section 7, Section 8 presents the Quality Plan for the project. The Quality Plan will be enforced by the mechanisms defined in the whole Project Handbook, effectively making this document the set of rules to be followed in order to ensure the quality across the project activities. In order to maintain always the highest levels of quality in the execution of this project, we will periodically review internally the Quality Plan (therefore this complete document) and update it if needed.

2. Management Bodies and Organization

The management bodies employed in Xhaul include persons, committees and other entities that are responsible for making management decisions, implementing management actions, and their interrelation.

The management bodies include:

Management Body	Responsible person	Email
Project Coordinator (PC)	Arturo Azcorra	azcorra@it.uc3m.es
Technical Manager (TM)	Xavier Costa	xavier.costa@neclab.eu
Innovation Manager (IM)	Paola Iovanna	paola.iovanna@ericsson.com
Core Members Board (CMB)	one representative of Core Partners in the Consortium	TBD
Project Board (PB)	one representative per partner, administrative management	TBD
Technical Management Team (TMT)	TM + IM + leaders from WP1-WP6 work packages, for technical management	xavier.costa@neclab.eu paola.iovanna@ericsson.com andrea.digiglio@telecomitalia.it (WP1) fabio.cavaliere@ericsson.com (WP2) dirk.tiegelbekkers@nokia.com (WP3) Xi.Li@neclab.eu (WP4) thomas.haustein@hhi.fraunhofer.de (WP5) Alain.Mourad@interdigital.com (WP6) aoliva@it.uc3m.es (WP7)

Their detailed role and duties are described in the next subsection.

2.1. Project Coordinator (PC)

The Coordinator shall be the intermediary between the Parties and the Funding Authority and shall perform all tasks assigned to it as described in the Grant Agreement and in the Consortium Agreement.

The PC is, in particular, in charge of ensuring effective communication, collaboration and cooperation within the Consortium by laying down and monitoring document, reporting and control procedures, in collaboration with the TM (Technical Manager). The PC will also organize meetings, providing a document reference list and partners' contact information. For each Core Consortium Board or Project Board meeting, the PC will propose the agenda and make available the minutes of the meeting. Regarding progress reporting, the PC is responsible of producing formal periodical progress reports (Quarterly Management Reports, QMR, and Periodic Project Reports, PPR). These reports will be forwarded to the EC on their due date. The PC will also make sure that all audit certificates are obtained and delivered to the EC when required. To ensure the project progress adequately, the PC will monitor and control the time schedule and the timing of the different activities of the project, and also act as main point of contact between the 5G PPP Infrastructure Association, that leads the 5GPPP, and the project, ensuring the project coordinates

and integrates in the overall 5G PPP European roadmap. The PC will also coordinate with the other PCs of projects within the 5G PPP, to ensure the harmonic achievement of the common objectives, in addition to achieving the individual project objectives. In summary, the PC is the legal, contractual, financial and administrative manager of the project.

2.2. Technical Manager (TM)

The TM is in charge of the overall technical management of the project. He is responsible for the correct execution of the technical activities of the contract. His tasks include in particular the leading of the Technical Management Team, ensuring timely release, technical high quality and accuracy of technical deliverables.

2.3. Innovation Manager (IM)

The role of the Innovation Manager is to understand both market and technical problems, and bridge the project research achievements to a successful implementation and deployment in the real world.

The Innovation Manager will assist and advise the project in best responding to emerging market opportunities. In turns, by thoroughly following the evolution of the sector, the new emerging technologies and products, and the mutating needs, the Innovation Manager will help bringing all this inside the project, and will assist the project in identifying changes in strategies and re-planning of technical activities to best fit the evolving sector.

2.4. Core Members Board (CMB)

Managing a project the size of Xhaul is complex and requires low overhead and much focused management mechanisms to orchestrate the interests of the different partners towards a common goal. For this reason, the approach considered in Xhaul is based on the split of the management decisions in two categories. All major decisions will be taken by a reduced number of members of the consortium, called Core Members. These partners have been selected according to their relevance in the proposal and the market. The Core Members of Xhaul are the following: UC3M, ATOS, EAB, FhG-HHI, NEC, NOK-N, ORANGE, TI and TID. The CMB will be responsible for decisions that affect the whole project, and that are particularly relevant to the following:

- Composition of the Consortium .
- Composition of the Core Member Board.
- Budget redistribution.
- Major decisions on the work plan.
- Approving changes to WP leaders and/or the TM.

The Core Member Board (CMB) is composed of one representative from each Core Member partner. The CMB will meet at every physical meeting. The PC may also call CMB meetings on demand, usually by teleconference, to address important issues that may arise.

2.5. Project Board (PB) and Partner Representative (PR)

The Project Board (PB) is the decision body of the project for project wide decisions (except the ones reserved to the CMB). It is composed of one representative of each full partner, being chaired by the PC. Its purpose is to set and review the project direction, ensure that the project fulfils its

commitments and meets the stated objectives, continuously evaluate the project performance and results, and to supervise and coordinate the technical work performed by all consortium partners. This includes:

- Tracking the progress and results of the project, assuring they meet the contractual obligations.
- Identifying innovation and market opportunities, taking the necessary steps so that participating companies can take advantage of these.
- Identifying risks and defining contingency plans.
- Promoting project visibility, dissemination and exploitation of the project results.
- Approving the QMRs.
- Managing the efforts towards the correct use and reporting of resources in order to meet schedules and goals and implementing the corrective action if needed.
- Financial monitoring throughout the project life to obtain a timely and complete control of the financial situation of the project and its participants.
- Ensuring quality management of the project.

The PB will meet at the project scheduled events in face-to-face meetings. Emergency meetings and/or teleconferences may be called to address important issues that may arise. Each partner will appoint a Partner Representative (PR) to represent the partner within the consortium in the Project Board. The PR will be responsible for the work and activities of the researchers belonging to her/his institution. The PR will be the interface between her/his organisation and the PC, and between her/his organisation and the other organisations of the consortium. In particular, the PR is responsible for identifying individual or collective innovation and marketing opportunities related to his/her organization, and communicating them to the IM in order to discuss their implementation in the best possible way. The PR is also responsible for providing to the project all the administrative information pertaining to her/his organisation, respecting the deadlines and information format specified by the project, by the Commission regulations or by the European Commission representatives.

2.6. Technical Management Team (TMT)

The Technical Management Team (TMT) is composed of the TM, the IM, the WP leaders from WP1-WP6 and is led by the TM. This team is in charge of supervising the technical progress of the project and solve any technical issue that might arise between WPs during the project lifetime.

The TMT responsibilities include the supervision of the technical progress of the project, including resolution of technical problems. The TMT is led by the TM, which ensures that any technical issue requiring inter-WP coordination is handled correctly.

In case a technical issue cannot be resolved by the TMT, it will be passed over to the PB.

2.7. Work Package Leaders (WPLs)

Each work package is led by the Work Package Leader (WPL), who is responsible for making the day-to-day technical and management decisions that solely affect their work package. The WP leader' responsibilities include:

- Leading and coordinating the task activities involved in the WP through the Task Leaders.
- Initial quality checking of the WP work and deliverables.
- Handling resource/skills balance within the WP subject to agreement of the PB to changes.
- Participating in the TMT.

- Highlighting to the TMT of potential threats to the technical success of the project.
- Reporting progress to the PB and raise amendments, issues and red flags to the TM if needed.

WP7 is the work package in charge of the management and is led by the PC.

The following table presents the different WP leaders and emails:

WP #	WP Leader name	Email
1	Andrea Di Giglio (TI)	andrea.digiglio@telecomitalia.it
2	Fabio Cavaliere (TEI)	fabio.cavaliere@ericsson.com
3	Dirk Tiegelbekkers (NOK-N)	dirk.tiegelbekkers@nokia.com
4	Xi Li (NEC)	Xi.Li@neclab.eu
5	Thomas Haustein (FhG-HHI)	thomas.haustein@hhi.fraunhofer.de
6	Alain Mourad (IDCC)	Alain.Mourad@interdigital.com
7	Antonio de la Oliva (UC3M)	aoliva@it.uc3m.es

2.8. Task Leaders (TLs)

Each Task is led by the Task Leader (TL), who is responsible for the activities performed in his/her task coordinating the technical work, and making the day-to-day technical decisions that solely affect his/her Task. It should be stressed that task leadership is partner based.

TLs should report (internally) to the WPL every quarter on the progress of their task.

3. Management Information and Procedures

The large size of Xhaul requires specific mechanisms to assure the coordination among the partners and the consecution of the objectives. The Xhaul management will be based on the following recurring events;

- **Plenary meetings**, regularly held with a 3 month period, for a total of 10 meetings throughout the whole 30 months project duration. Plenary meetings are dedicated to discuss the advances in all the project work-packages and to transfer knowledge and achievements across work-packages. Whenever more extensive per-WP discussion is needed, separate per-WP sessions will be deployed.
- **5G PPP integration meetings.** We have allocated resources to attend the Steering Board, Technology Board and 6 Technical Working Groups. For each activity we have planned 2 travels per year.
- **Virtual WP meetings,** regularly held every two months with 1-day duration. To minimize the required traveling, we will organize interim virtual meetings for each WP. The virtual meetings will use an online meeting tool such as Webex.
- **Monthly management phone calls**. The PMT will schedule a regular monthly phone call, to be held in a fixed date (e.g., an established week day in the first week of each month). The phone call will also be open to the rest of the participants, for broader and faster alignment of the work. The monthly project conference call will be organised and chaired by the Project Coordinator to review the status of each work-package one-by-one, the global project status and to discuss possible issues.

Reports and minutes will be provided by the Project Coordinator for all the conference calls and meetings. Of course, supplementary ad hoc physical meetings or dedicated per-WP phone calls will

also be organised upon need, and for specific reasons between working parties in the same or different work-packages. Efficient communication flows between participants will be guaranteed by the mechanisms described above and also by the communication facilities defined below. A further source of internal project monitoring and synchronization are the quarterly progress reports to be delivered by each project partner to the coordinator 10 days after the end of each three-month period.

3.1. Representation in Meetings

Any Party which is a member of a Consortium Body (hereinafter referred to as "Member"):

- should be represented at any meeting of such Consortium Body;
- may appoint a substitute or a proxy to attend and vote at any meeting;
- and shall participate in a cooperative manner in the meetings.

3.2. Preparation and Organisation of Meetings

Technical meetings will be held every 3 months and convene by the PC of the project. Technical meeting venues and dates will be decided on each physical meeting, hence no special deadlines or actions are required to convene them. For the PC and CMB meetings, due to the need of the presence of a representative of each partner we have set up some rules on timing requirements to convene them. These rules are described in the following sections.

3.2.1. Convening Meetings

	Ordinary meeting	Extraordinary meeting
PB – Project Board	At least once a year	At any time upon written request of the CMB - Core Members Board or 1/3 of the Members of the PB – Project Board
CMB - Core Members Board	At least quarterly	At any time upon written request of any Member of the CMB - Core Members Board. The PC may also call CMB meetings on demand, usually by teleconference, to address important issues that may arise.

The chairperson of a Consortium Body shall convene meetings of that Consortium Body.

3.2.2. Notice of a meeting

The chairperson of a Consortium Body shall give notice in writing of a meeting to each Member of that Consortium Body as soon as possible and no later than the minimum number of days preceding the meeting as indicated below.

PB – Project Board	45 calendar days, 15 calendar days for extraordinary meetings
CMB - Core Members Board	21 calendar days14 calendar days for extraordinary meetings

3.2.3. Sending the agenda

The chairperson of a Consortium Body shall prepare and send each Member of that Consortium Body a written (original) agenda no later than the minimum number of days preceding the meeting as indicated below.

PB – Project Board	21 calendar days, 10 calendar days for extraordinary meetings
CMB - Core Members Board	7 calendar days

3.2.4. Adding agenda items

Any agenda item requiring a decision by the Members of a Consortium Body must be identified as such on the agenda.

Any Member of a Consortium Body may add an item to the original agenda by written notification to all of the other Members of that Consortium Body up to the minimum number of days preceding the meeting as indicated below.

PB – Project Board	14 calendar days, 7 calendar days for extraordinary meetings
CMB - Core Members Board	2 calendar days

During a meeting the Members of a Consortium Body present or represented can unanimously agree to add a new item to the original agenda.

Any decision may also be taken without a meeting if the Coordinator circulates to all Members of the Consortium Body a written document which is then agreed by the defined majority of all Members of the Consortium Body. Such document shall include the deadline for responses.

Meetings of each Consortium Body may also be held by teleconference or other telecommunication means.

4. Decision Process

Technical and operative decisions will be taken as far as possible informally, and through achieving consensus. For either i) technical or operative decisions for which no consensus can be reached, or ii) administrative decisions out of the Core Members Board competences (such as QMR approval), the project will rely on the Project Board. For decisions regarding budget redistribution, consortium composition or major decisions on the work plan, the Core Member Board is the highest decision making body in the project. Any project management decision, either technical or administrative, taken by the Project Board or Core Member Board is mandatory for all project members, and may not be overruled within the project. In case of any overlapping decision between the Project Board and the Core Members Board, the CMB has precedence. The Project Management Board and Core Members Board is not intended for ordinary management procedures of the project, and is defined as an extraordinary means, and last resort, for solving conflicts. The ballot mechanism in the PB and CMB is based on approval of a two-third majority of the Board. The exact mechanisms for the procedures for making decisions on management level, and conflict resolution, to be taken by the consortium, are in detail in the Consortium Agreement. Motions and documents are considered approved if there is no explicit objection or dissent.

4.1. Voting Rules and Quorum

A Consortium Body shall not deliberate and decide validly unless two-thirds (2/3) of its Members are present or represented (quorum).

If the quorum is not reached, the chairperson of the Consortium Body shall convene another ordinary meeting within 15 calendar days. If, in this second meeting the quorum is still not reached, the chairperson shall convene an extraordinary meeting, which shall be entitled to decide even if fewer than the quorum of Members are present or represented.

Each Member of a Consortium Body present or represented in the meeting shall have one vote.

Defaulting Parties may not vote. Defaulting Partner is defined in the CA.

Decisions shall be taken by a majority of two-thirds (2/3) of the votes cast in the first ballot. In a second ballot and any subsequent ballots which may be necessary, a simple majority of the votes cast shall be required.

4.2. Veto Rights

A Member which can show that its own work, time for performance, costs, liabilities, intellectual property rights or other legitimate interests would be severely affected by a decision of a Consortium Body may exercise a veto with respect to the corresponding decision or relevant part of the decision.

When the decision is foreseen on the original agenda, a Member may veto such a decision during the meeting only.

When a decision has been taken on a new item added to the agenda before or during the meeting, a Member may veto such decision during the meeting and within 15 calendar days after the draft minutes of the meeting are sent.

In case of exercise of veto, the Members of the related Consortium Body shall make every effort to resolve the matter which occasioned the veto to the general satisfaction of all its Members.

A Party may not veto decisions relating to its identification as a Defaulting Party. The Defaulting Party may not veto decisions relating to its participation and termination in the consortium or the consequences of them.

A Party requesting to leave the consortium may not veto decisions relating thereto.

4.3. Minutes of Meetings

The chairperson of a Consortium Body shall produce written minutes of each meeting which shall be the formal record of all decisions taken. He shall send the draft minutes to all Members within 10 calendar days of the meeting.

The minutes shall be considered as accepted if, within 15 calendar days from sending, no Member has sent an objection in writing to the chairperson with respect to the accuracy of the draft of the minutes.

The chairperson shall send the accepted minutes to all the Members of the Consortium Body and to the Coordinator, who shall safeguard them.
If requested the Coordinator shall provide authenticated duplicates to Parties.

All minutes released after each CMB – Core Members Board and sent within the terms previously specified will be shared within the same terms with the members of the PB – Project Board.

5. Communication and Document Management Facilities

The project has set up the following mailing lists:

- xhaul-all
- xhaul-admin
- xhaul-netmaster
- xhaul-dissemination
- xhaul-legal
- xhaul-wp1
- xhaul-wp2
- xhaul-wp3
- xhaul-wp4
- xhaul-wp5
- xhaul-wp6
- xhaul-wp7

The global mailing list will be used for issues affecting several WPs and for other issues requiring global communication, such as dissemination activities. This mailing list was composed by all the members of the consortium. Concerning the technical mailing list per WP, for such a big project as Xhaul, where each WP can be understood as a subproject, we advocate the use of separate mailing lists per WP. Although the use of a single list for all WPs improves the interaction between the different researchers working on each WP, we think that due to its dimension, the project needs an approach limiting the amount of emails received by each researcher.

All technical mailing lists involve the TM, and will be open to any other additional employee the project partners will wish to include.

All the information related to the project, including all draft deliverables, the final deliverables, the shared documentation, the source code, the meeting reports, the updated project time-table, and so on, will be normalised in a common format according to defined templates to maintain homogeneity in the project, and will be stored in a common central facility. To keep control and confidentiality of the storage, the project **will not adopt common cloud-based public services** (e.g., Dropbox, GoogleDrive, etc) but will deploy its own storage facility, in the form of an SVN server, inside the coordinator's premises. Access will be restricted to the project members (eventually with further access control restrictions for documentation strictly restricted to the PB). Centralized maintenance and housekeeping of all the project documentation will be guaranteed by the Project Coordinator, and by the WP leader for the internal WP documentation. Documents will be organized in sub-folders related to project activities or information, as well as dedicated folders for work-packages and task.

The choice of SVN will also provide a convenient platform for collaborative software development over the same storage facility. The deliverables will be managed and released under the responsibility of the editor, after a well-defined review procedure.

5.1. Obligation to Disseminate Results

Unless it goes against their legitimate interests, each beneficiary must — as soon as possible — 'disseminate' its results by disclosing them to the public by appropriate means (other than those resulting from protecting or exploiting the results), including in scientific publications (in any medium).

This does not change the obligation to protect results, the confidentiality obligations, the security obligations or the obligations to protect personal data, all of which still apply.

A beneficiary that intends to disseminate its results must give advance notice to the other beneficiaries of — unless agreed otherwise — at least 45 days, together with sufficient information on the results it will disseminate.

Any other beneficiary may object within — unless agreed otherwise — 30 days of receiving notification, if it can show that its legitimate interests in relation to the results or background would be significantly harmed. In such cases, the dissemination may not take place unless appropriate steps are taken to safeguard these legitimate interests.

If a beneficiary intends not to protect its results, it may — under certain conditions— need to formally notify the Commission before dissemination takes place.

5.2. Open Access to Scientific Publications

Each beneficiary must ensure open access (free of charge online access for any user) to all peer reviewed scientific publications relating to its results.

In particular, it must:

i. as soon as possible and at the latest on publication, deposit a machine-readable electronic copy of the published version or final peer-reviewed manuscript accepted for publication in a repository for scientific publications;

ii. Moreover, the beneficiary must aim to deposit at the same time the research data needed to validate the results presented in the deposited scientific publications.
ensure open access to the deposited publication — via the repository — at the latest:

iii. on publication, if an electronic version is available for free via the publisher

5.3. Dissemination of Another Party's Unpublished Results or Background

In case a Party wishes to include in a Dissemination activity another Party's Results (which are not publically available), Background and/or Confidential Information, it needs to first obtain that Party's prior written approval.

6. Reports

The action is divided into the following 'reporting periods':

- RP1: from month 1 to month 12
- RP2: from month 13 to month 30

6.1. Periodic Reports

The coordinator must submit a periodic report within 60 days following the end of each reporting period.

The periodic report must include the following reports.

(a) 'Periodic technical report' containing:

- an explanation of the work carried out by the beneficiaries;
- an overview of the progress towards the objectives of the action, including milestones and deliverables. This report must include explanations justifying the differences between work expected to be carried out and that actually carried out. The report must also detail the exploitation and dissemination of the results and an updated 'plan for the exploitation and dissemination of the results';
- a summary for publication by the Commission;
- the answers to the 'questionnaire', covering issues related to the action implementation and the economic and societal impact, notably in the context of the Horizon 2020 key performance indicators and the Horizon 2020 monitoring requirements;

(b) 'Periodic financial report' containing:

- an 'individual financial statement' from each beneficiary, for the reporting period concerned. The individual financial statement must detail the eligible costs (actual costs, unit costs and flat-rate costs). The beneficiaries must declare all eligible costs, even if — for actual costs, unit costs and flat-rate costs — they exceed the amounts indicated in the estimated budget. Amounts which are not declared in the individual financial statement will not be taken into account by the Commission. If an individual financial statement is not submitted for a reporting period, it may be included in the periodic financial report for the next reporting period. The individual financial statements of the last reporting period must also detail the receipts of the action.
  Each beneficiary must certify that:
  - the information provided is full, reliable and true;
  - the costs declared are eligible;
  - the costs can be substantiated by adequate records and supporting documentation that will be produced upon request or in the context of checks, reviews, audits and investigations ,
  - for the last reporting period: that all the receipts have been declared;
- an explanation of the use of resources and the information on subcontracting and in-kind contributions provided by third parties from each beneficiary, for the reporting period concerned;
- a 'periodic summary financial statement', created automatically by the electronic exchange system, consolidating the individual financial statements for the reporting period concerned and including — except for the last reporting period — the request for interim payment.

6.2. Quarterly Reports

In addition to the reports defined in the contract with the EC, the Coordinator will collect from partners, and integrate supplementary quarterly management reports (QMR), to be submitted by each project partner to the coordinator 10 days after the end of each three-month period. These reports will be delivered to the EU Project Officer, and will at least include:

- management data for the considered quarter (persons-month spent per each active WP, major travels and other resources deployed),
- predicted management data for the next quarter,
- report on the technical work and related accomplishments carried out in the quarter,

- dissemination accomplishments,
- major issues or problems encountered and/or foreseen in the next quarter.

6.3. Final Report

In addition to the periodic report for the last reporting period, the coordinator must submit the final report within 60 days following the end of the last reporting period.

The final report must include the following:

(a) a 'final technical report' with a summary for publication containing:
- an overview of the results and their exploitation and dissemination;
- the conclusions on the action, and
- the socio-economic impact of the action;

(b) a 'final financial report' containing:
- a 'final summary financial statement', created automatically by the electronic exchange system, consolidating the individual financial statements for all reporting periods and including the request for payment of the balance and
- a 'certificate on the financial statements' for each beneficiary , if it requests a total contribution of EUR 325 000 or more, as reimbursement of actual costs and unit costs calculated on the basis of its usual cost accounting practices.

7. Management of Risks and Contingency Plans

There are a number of contingencies that can negatively impact on the ambitious Xhaul roadmap. The risks can be classified into three different categories: i) Consortium risks, ii) Management risks and iii) Technical risks.

Xhaul has conceived a number of structural mechanisms to reduce the probability of these events and to contain their effects in case they cannot be avoided.

i. **Consortium risks**: These include conflicts between partners, partner withdrawal or inability of one partner to perform the planned activities e.g., because a key person leaves the company. The relationship between the Xhaul partners is fully regulated by the CA, which specifies a complete conflict resolution procedure. The possibility that key researchers leave the project and the partner in question cannot find a timely replacement or a partner withdraws will have a small impact on Xhaul results because of the critical mass, expertise and strong commitment of the consortium. In such a case, the consortium is committed to identifying the best-matching replacement partner to take over the work. To enforce structural robustness, each task to be developed in Xhaul falls within the expertise area of at least two partners.

ii. **Management risks.** These are related to problems in workload estimation, budget allocation or time schedule. Potential problems will be early identified by the continuous monitoring of activities carried out by the Project Board, which will dictate appropriate corrective actions to prevent deviation from the original work plan.

iii. **Technical risks.** The main technical risks for each specific technical WP and the corresponding contingency actions are shown in the following Table 7a.

Table 7a: Critical risks for implementation

Description of risk	Work package(s) involved	Proposed risk-mitigation measures	Likelihood & Update plan
Available switching technology does not meet the stringent 5G transport requirements, such as bandwidth and latency on CPRI	WP2, WP3	Bandwidth is not expected to be a major problem, given the capacity of optical fibre and WDM, recently boosted by coherent detection. However, Xhaul is aware of the technological challenge posed by CPRI latency and jitter requirements not realizable with regular packet switches. Xhaul preliminary analysis and lab tests show the feasibility of microsecond-order forwarding, and further research by Xhaul on forwarding elements is expected to meet the jitter/latency challenge at extremely low cost. Nevertheless, the Xhaul solution will be complemented and backup, on the one hand, by the usage of more expensive all-optical SDN-enabled ROADMs and, on the other hand, by involving the distance RRH-BBU as a design variable in order to trade off round-trip latency for cost by using less expensive and more versatile electronic switching when the scenario permits.	Likelihood: Low Update Plan: As WP2 and WP3 continue their work we will extract the requirements on bandwidth and jitter. Based on that and the technologies down selected to be used by WP2 we will re evaluate this risk.
Additional analysed technologies (e.g., mmWave, free space optics, copper, etc.) for fronthaul	WP2	Alternative technologies to optical access/transport will be explored and analysed in WP2 given their reduced deployment cost. These alternative technologies are not key for the success of Xhaul and may be employed	Likelihood: Low Update Plan: Currently packetized versions of the fronthaul are already been considered in standardization bodies, considering the technologies assumed by Xhaul. Once clear idea of the

do not meet the requirements for packetized versions of fronthaul technologies		in the final design to carry backhaul traffic if not suitable for fronthaul. New technologies proposed by the research community during the project lifetime may also be taken into consideration.	technologies to be used in WP2 is gathered we will re evaluate this risk.
Xhaul Packet Forwarding Elements(XFE) are not able to provide a common and unified frame format and forwarding logic preserving the traffic requirements.	WP2, WP3	Xhaul will explore multiple alternative framing and multiplexing techniques. Depending on the specific physical layer constraints, the forwarding element designed will also consider hybrid circuit-packet switching schemes.	Likelihood: Medium Update Plan: The unified data plane is one of the major challenges of the project. We will constantly evaluate this risk and consider alternative technologies that can be used in a unified way.
Xhaul Control Infrastructure (XCI) development takes longer than expected.	WP3, WP4	Xhaul partners have a solid background in software and/or hardware design and development, what makes this risk small. The partners will adequately prioritise the XCI modules to be implemented, monitor the development progress, and devote the right effort on the right targets to get the overall plan through. The technical management might consider reducing the number of use cases or requirements for XCI, or launch parallel development threads if any delayed component is essential.	Likelihood: Medium Update Plan: The XCI is also a major challenge of the project. We will continuously evaluate the progress of the design and implementation of the XCI.
SLAs might be affected by Multi-tenant XFE.	WP2, WP3	The Partitioner Component at each XFE empowers the concept of multi-tenancy and full isolation, even at forwarding engine level. Monitoring techniques will be applied to supervise the	Likelihood: High Update Plan: The Xhaul project focuses more on the technology aspect of the multi-tenancy but we should not forget that SLAs are a critical

		negotiated SLA with each tenant, and trigger the request for additional SLA enforcing mechanisms or additional resources.	aspect of the business model. We will consider SLAs application in the design of the multi-tenancy solution. Operators in the consortium will make sure the multi-tenancy SLA aspects are included in Xhaul and update this risk as the technical solution evolves.
Xhaul Processing Unit (XPU) becomes a bottleneck due to the concentration of too many network services.	WP3/ WP4	The Xhaul architecture will be flexible enough to allow for load balancing and redundancy techniques, as well as seamless virtual machine migration between XPUs.	Likelihood: Low Update Plan: We will consider this risk while doing the scalability analysis of the solution. Based on that we will propose mechanisms to deal with possible bottlenecks detected.
Stringent 5G transport requirements block efforts to minimize the energy consumption of the Xhaul network.	WP2/ WP3/ WP4	The proposed Xhaul network will provide the necessary re-configurability to take full advantage of energy saving mechanisms during low-load periods. Energy-efficient algorithms might be considered on top of XCI. It is expected that these algorithms will compensate the energy spent to meet the performance requirements.	Likelihood: High Update Plan: Although Xhaul energy efficient approaches is based on the decommission of hardware, it may be possible that the requirements in terms of capacity rule out the possibility of switching off elements of the infrastructure. We will analyse this problem to obtain a view on how much energy is saved using the Xhaul approach.
Xhaul Advanced services (i.e., broadcast, VoD, Cloud services) cannot be provided on top of proposed XPU.	WP4	Xhaul might consider the usage of large interconnected and geographically distributed Data Centres to fulfil the processing power requirements for Xhaul advanced services and preserve the XPU for closer-to-user real-time processing.	Likelihood: Low Update Plan: We will evaluate the requirements on the XPUs of new services provided by Xhaul and update this risk accordingly.

Xhaul proposed technologies do not meet functional requirements or underperform in the experimental testbed.	WP5	The fulfilment of functional requisites will be enforced by all means by the technical management. If needed, a software-based subcomponent might be used as a backup for a hardware component. If a specific subsystem or prototype does not provide the expected performance, technical management will seek a replacement or a subset of functionalities will be selected in a way that does not impact the target concept being demonstrated.	Likelihood: Medium Update Plan: We will start the experimental phase as soon as possible to detect this kind of issues. The risk will be updated based on the performance measurements obtained.
A product with far superior characteristics goes to market	WP6	Implementing an integrated architectural concept such as Xhaul requires the involvement of a large number of stakeholders. Partners in the Xhaul consortium have a solid presence in other on-going research initiatives, industrial fora and standardization bodies, hence covering most of the potential market segments and initiatives running in parallel to the Xhaul proposal. Hence, the risk that another industrial consortium develops an independent product outperforming Xhaul is very low. Nevertheless, Xhaul plans to permanently monitor the market and the relevant SDOs, so that proper adjustments can be timely made to keep the competitive advantage of our outcomes.	Likelihood: Low Update Plan: Xhaul is permanently looking at standardization bodies and other projects in the area. As soon as a competing project is detected we will contribute to it in order to provide the Xhaul view and known-how.

8. Quality Plan

The quality management of the project will be led by the PC, TM and IM, who will be responsible for the review and assessment of the project progress according to:

- correspondence of the solutions to the objectives;
- accuracy and quality of the deliverables, and
- adherence to time and cost constraints planned for the project.

The Quality Plan will be updated every six months, if necessary. All the Project Handbook is a Quality Plan itself.

The principal objective of the plan is to ensure the quality across the different activities of the project, including the responsibilities within the team to achieve and maintain the quality, the monitoring and control procedures, the reporting procedures and the document procedures standards and control.

The PC, in close cooperation with the TM, will provide overall monitoring and coordination of each activity and milestone from a time perspective, paying special attention to the impact if any of changes in the schedule on other related items. In parallel, the IM will check that all possible mechanisms to increase the impact of the project are taken, and will advertise partners of potential impacts identified during the project lifetime.

Finally, two deliverable reviewers will be identified for each deliverable, which will be subject to an internal approval procedure prior to release (and public dissemination, in case of public deliverables). Quality control metrics will be defined to measure the progress of the work being achieved. Each Work-Package Leader will be responsible for assuring the quality of their deliverables and for adopting the most appropriate quality-assurance measures to contribute to the fulfilment of the WP targets.

9. Annex 1. Template for Deliverables

Xhaul: the 5G Integrated fronthaul/backhaul

H2020 5G PPP Xhaul project
Grant No. 671598

DOCUMENT TITLE

Abstract

……

……

……

Document Properties	
Document Number:	….
Document Title:	**…..**
Document Responsible:	….
Document Editor:	….
Authors:	

Target Dissemination Level:	….
Status of the Document:	….
Version:	0

Production Properties:	
Reviewers:	…….

Document History:

Revision	Date	Issued by	Description
….	2015-07-09		

Disclaimer:

Table of Content

List of Figures

……

List of Acronyms

……

1. Executive Summary

……

2. Key Achievements

……..

3. Introduction

……..

4. Section Title

.....

4.1. Subsection Title

Table 4.1a: Title

10. Annex 2. Template for Quarterly Management Reports

Xhaul: the 5G Integrated fronthaul/backhaul

H2020 5G PPP Xhaul project
Grant No. 671598

QMR TEMPLATE

Abstract

……..

Document Properties	
Document Number:	WP7.2
Document Title:	**QMR TEMPLATE**
Document Responsible:	……
Document Editor:	….....
Authors:	……
Target Dissemination Level:	…….
Status of the Document:	Preparation
Version:	0

Production Properties:	
Reviewers:	…….

Document History:

Revision	Date	Issued by	Description
0	……		

Disclaimer:

This document has been produced in the context of the XHAUL Project. The research leading to these results has received funding from the European Community's H2020 Programme under grant agreement N° H2020-671598.

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For the avoidance of all doubts, the European Commission has no liability in respect of this document, which is merely representing the authors view.

How to fill out the individual sections:

For All:

- **Fill out for each Task where you are involved:**
  - **Any particular achievements (finished algorithm description, simulation development, particular problems which were solved, etc.),**
  - **Achieved Milestones (with reference to the "Description of Work"), or**
  - **Work items you were involved with (developing a specific algorithm/simulation code/…, preparing presentations/meetings/…, and also definition of requirements/architecture/…)**
  - **In all the cases, include always a reference to a document (Audio conference minutes, deliverable, internal report, submitted paper…)**
  - **Highlight important outputs, especially in the summary (publications, patents, standardisation proposal, workshops…)**
- **List the individual persons which were involved in this task,**
- **List the amount of man months that you are claiming.**
- **Regarding the travel reporting; only travels that are charged to the project must be included.**

For Task Leaders:

- **Trigger input from all partners that are involved in your task,**
- **Fill in the table under "Summary" which gives a short impression whether you are on-track or not, whether there deviations or not, … Note: Deviations are not a problem as long as we keep track of them and adjust the project plan accordingly in time! The more details you provide us with your report, the better we can adjust the project plan, report to the EC, and get feedback from the PO with respect to proposed deviations.**
- **Harmonize the input from you partners based on the discussion etc. that you had during the reporting period.**

For Work Package Leaders:

- **Trigger input from all tasks and monitor the progress,**
- **Review deviations and find solutions for the next steps (together with the TLs),**
- **Provide one paragraph with a summary for the reporting period,**
- **Harmonize the input from all tasks.**

1. Executive Summary (Resp:…)

……

2. Technical Progress and Achievements (Resp:….)

……..

2.1. WP1: System Requirements, Scenarios and Economic Analysis (WP Leader)

2.1.1. Summary (WP Leader)

.....

Task	Status[1]	Variance[2]	Cause/Wayforward[3]	Expected deadlines[4]	Affected partners[5]
Task 1.1					
.....					

2.1.2. Task 1.1: Use cases and requirements (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.1.3. Task 1.2: XHAUL system design (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

[1] Red = Major deviations and objectives may not be achieved; Yellow = Small deviations but objectives will be met; Green = On-track, no major deviations; Fill in "Completed" if the task is completed

[2] Variances could be expected delays for milestones or could be topic-deviations, i.e. topics changed such that additional topics are covered while others are not. If you describe variances, please always also refer to the original description in order to know what the baseline for this variance is. Please also mention expected variances, which did not take effect yet but are already anticipated.

[3] Please explain the cause for the variance and the way forward, i.e. which implications will the variance have. Note that you can also propose actions that should be taken to handle the variance or problems you are facing.

[4] Each task is supposed to contribute to project milestones, internal reports, and deliverables. If your input to any of these reports may be delayed, please fill it in here. Note: an expected deadline extension has less impact than a "surprise delay." Hence, please fill in the next deadline that is approached by your task and when it is going to be achieved.

[5] Please list the partners, work packages, or even standards where we planned contributions, which are affected by this variance, e.g. delayed input to other WPs, partner X/Y who is now involved with other topics, or standards consortia where we now contribute differently than planned.

2.1.4. Task 1.3: Economic analysis (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.2. WP2: Physical and Link Layer of XHAUL (WP Leader)

2.2.1. Summary (WP Leader)

(Same as 2.1.1)

2.2.2. Task 2.1: Technology assessment and evolution toward XHAUL (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.2.3. Task 2.2: Technology integration, network architecture and southbound interface (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.2.4. Task 2.3: Interface towards control layers (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.2.5. Task 2.4: Novel technologies for XHAUL (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.3. WP3: Xhaul Control and Data Planes (WP Leader)

2.3.1. Summary (WP Leader)

(Same as 2.1.1)

2.3.2. Task 3.1: XHAUL data plane (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.3.3. Task 3.2: XHAUL control plane (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.4. WP4: Enabled Innovations Through XHAUL (WP Leader)

2.4.1. Summary (WP Leader)

(Same as 2.1.1)

2.4.2. Task 4.1: Enabling methods (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.4.3. Task 4.2: Context-aware XHAUL resource orchestration (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.4.4. Task 4.3: XHAUL-aware media distribution (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.5. WP5: Validation and Proof of Concept (WP Leader)

2.5.1. Summary (WP Leader)

(Same as 2.1.1)

2.5.2. Task 5.1: Test-bed definition and setup (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.5.3. Task 5.2: Integration and proof-of concept (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.5.4. Task 5.3: Evaluation and experimentation (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.6. WP6: Dissemination and Communication Activities (WP Leader)

2.6.1. Summary (WP Leader)

(Same as 2.1.1)

2.6.2. Task 6.1: Communication and public relations (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.6.3. Task 6.2: Dissemination and exploitation (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.7. WP7: Project Management (WP Leader)

2.7.1. Summary (WP Leader)

(Same as 2.1.1)

2.7.2. Task 7.1: Project, administrative, financial, and legal management (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.7.3. Task 7.2: Technical coordination, innovation and quality management (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

2.7.4. Task 7.3: Interaction with other projects of the H2020 5G Infrastructure PPP (Resp: each partner fills in its information in a row)

Partner	Achievements Milestones Work items in progress	Involved persons
Name		

3. Status of Deliverables and Milestones (Resp:….)

.....

3.1. Deliverables (Resp: Editor)

.....

- started, delayed, finished?

Deliverable Progress			
	On Schedule	Delayed	Completed
D1.1			
D1.2			
D2.1			
D2.2			
D3.1			
D3.2			
D4.1			
D4.2			
D5.1			
D5.2			
D6.1			
D6.2			
D6.3			
D7.1			

D7.2			
D7.3			

3.1.1. Corrective Actions in Case of Delay (Resp:….)

.....

3.2. Internal Reports (Resp: Editor)

.....

- started, delayed, finished?

Deliverable Progress			
	On Schedule	Delayed	Completed
IR1.1			
IR1.2			
IR1.3			
IR1.4			
IR2.1			
IR2.2			
IR2.3			
IR2.4			
IR3.1			
IR3.2			
IR3.3			
IR3.4			
IR4.1			
IR4.2			
IR4.3			
IR4.4			
IR5.1			
IR5.2			
IR5.3			
IR5.4			
IR6.1			
IR6.2			
IR6.3			

3.2.1. Corrective Actions in Case of Delay (Resp:….)

.....

3.3. Milestones (Resp:….)

.....

- started, delayed, finished?

Milestones Progress			
	On Schedule	Delayed	Completed
M1			
M2			
M3			
M4			
M5			
M6			
M7			

3.3.1. Corrective Actions in Case of Delay (Resp:….)

……

4. Resources and Expenses (Resp:….)

……

4.1. Figures for this Quarter (for: every partner)

Partner	WP1		WP2		WP3		WP4	
	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned
Name								
TOTAL								

Partner	WP5		WP6		WP7		TOTAL	
	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned
Name								
TOTAL								

4.2. Cumulative Figures since the Beginning of the Project (for: every partner)

Partner	WP1		WP2		WP3		WP4	
	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned
Name								
TOTAL								

Partner	WP5		WP6		WP7		TOTAL	
	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned
Name								
TOTAL								

4.3. Travel and Other Expenses (for: every partner)

The estimation of travel expenses is provided below, based on the accounting data available at the time of elaboration of this preliminary management report. Exact final data will be provided at the end of the reporting periods defined in the Grant Agreement.

Table 1. Travel expenses

Partner	Meeting	People	Cost
Name			
TOTAL:			

Table 2. Other direct costs

Partner	Meeting	Cost
Name		
TOTAL:		

5. Annex. Description of any Problem, Delay or Deviation from the Planned Work Schedule, and the Corrective Actions Taken (Resp:…)

……