



Nov. 9, 2020

Mobislice III Workshop

5Growth

Network slicing in practice through service federation

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Abstract

Network service federation is fundamental for the true realization of end-to-end network slicing



Outline

- Slicing
- Network evolution
- Network service federation
- 5Growth take on federation
- Network service federation in action



Slicing

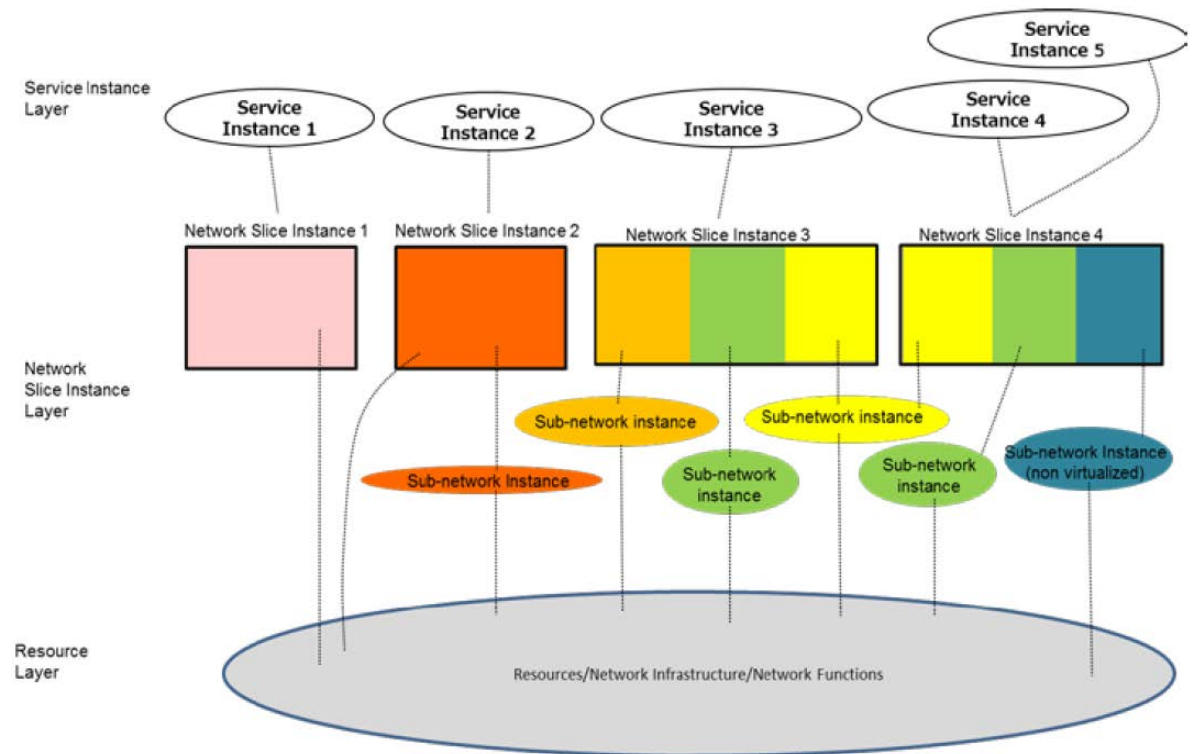
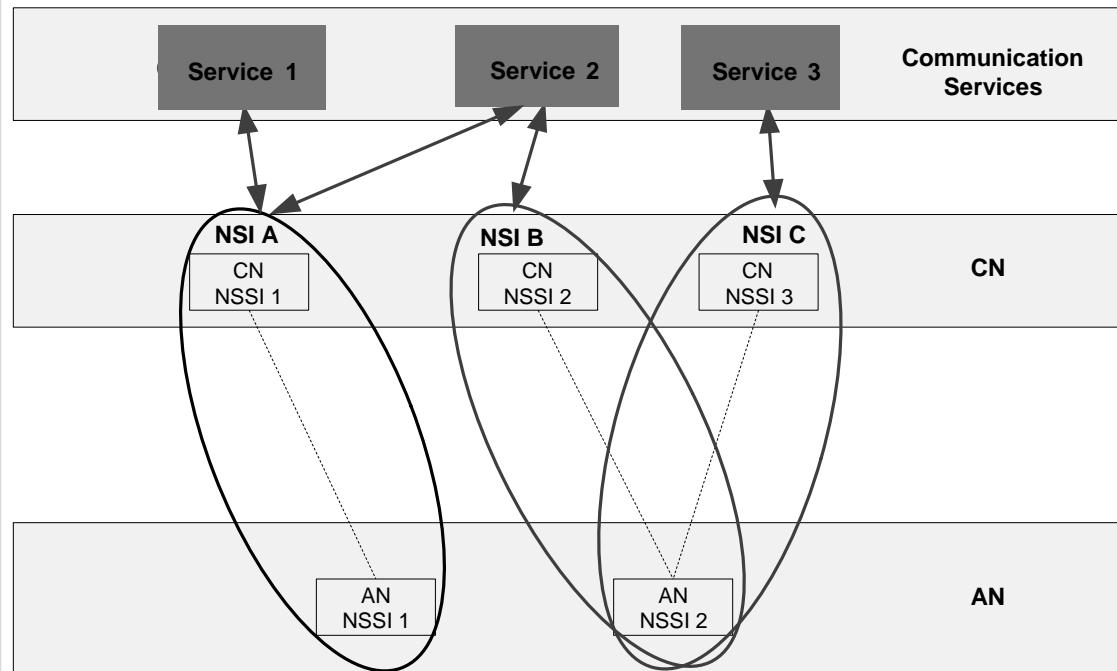
3GPP

- A network slice instance (NSI) is complete in the sense that it includes all functionalities and resources necessary to support certain set of communication services thus serving certain business purpose.
- A Network Slice Subnet Instance (NSSI) may be shared by two or more NSIs, this is called a shared constituent of NSI.

NGMN

- Network Slice Instance: a set of network functions, and resources to run these network functions, forming a complete instantiated logical network to meet certain network characteristics required by the Service Instance(s).

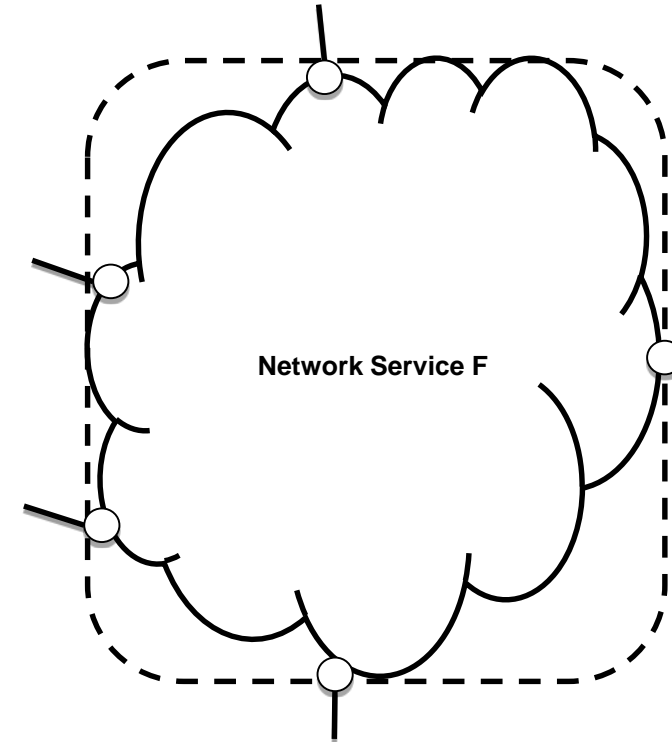
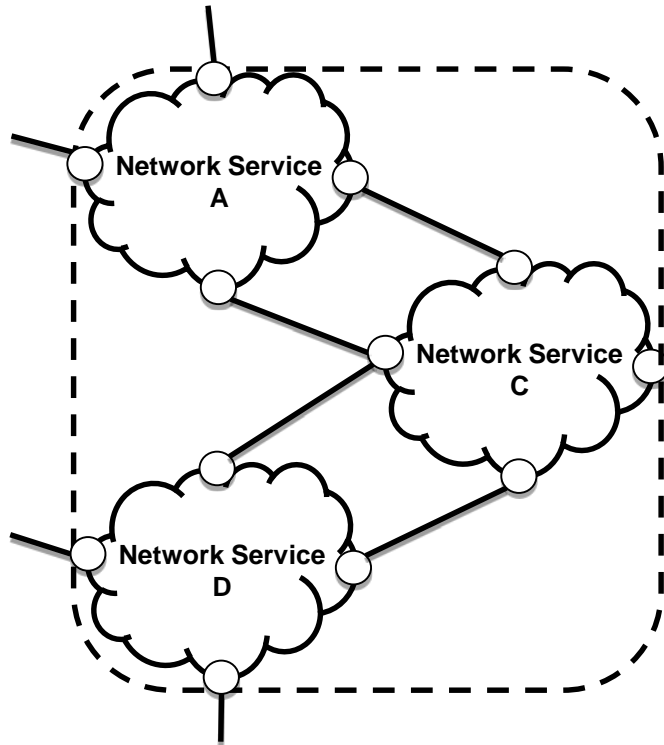
How is slicing implemented?



3GPP TR28.801. Study on management and orchestration of network slicing for next generation network

NGMN. Description of the network slicing concept.

How is slicing implemented? Composite Network Service



ETSI NFV IFA012. Report on Os-Ma-Nfvo reference point - application and service management use cases and recommendations

J. Baranda, J. Mangués, L. Vettori, R. Martínez, G. Landi, K. Antevski, Demo: Composing Services in 5G-TRANSFORMER, in Proceedings of The Twentieth ACM International Symposium on Mobile Ad Hoc Networking and Computing, 2-5 July 2019. Catania (Italy).





Network evolution

Softwarization

- Increasing number of interfaces
- Increasing number of stakeholders

Ubiquitous computing

- Distribution/Decentralization in general brings heterogeneity

Deployment heterogeneity

- Different nature of verticals
- Access and transport network variety

But slicing requires E2E control of services and resources

5Gr Stakeholders model

Service instance layer

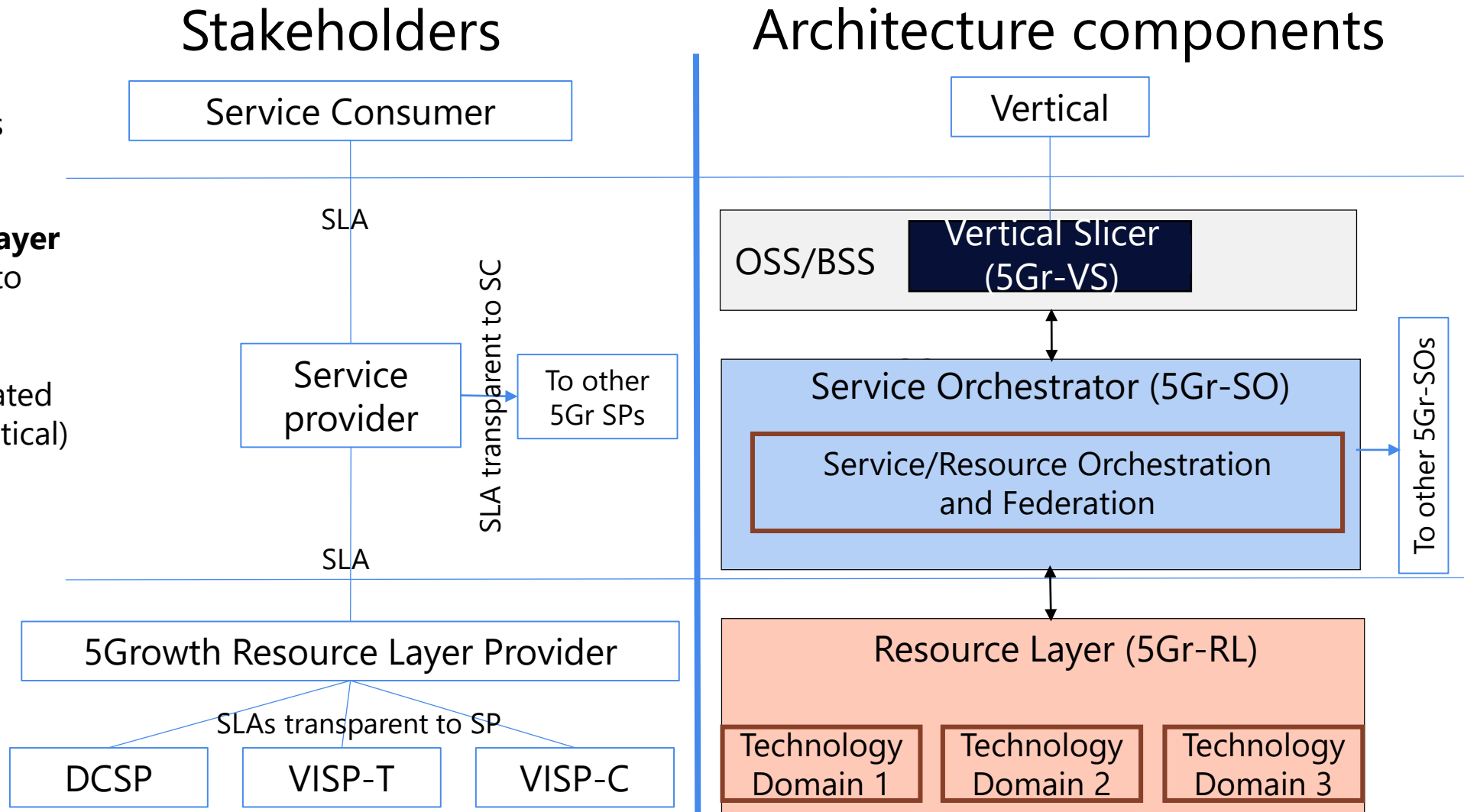
- consumes 5Gr services

Network slice instance layer

- provides E2E services to verticals
- multi-domain vertical-oriented slices are created (transparent to the vertical)

Resource layer

- provides virtual infrastructure to 5Gr service provider
- provides single admin domain resources to network slice instance layer



Federation (information technology)

- A federation is a group of computing or network providers agreeing upon standards of operation in a collective fashion
- The term may be used when describing the inter-operation of two distinct, formally disconnected, telecommunications networks that may have different internal structures

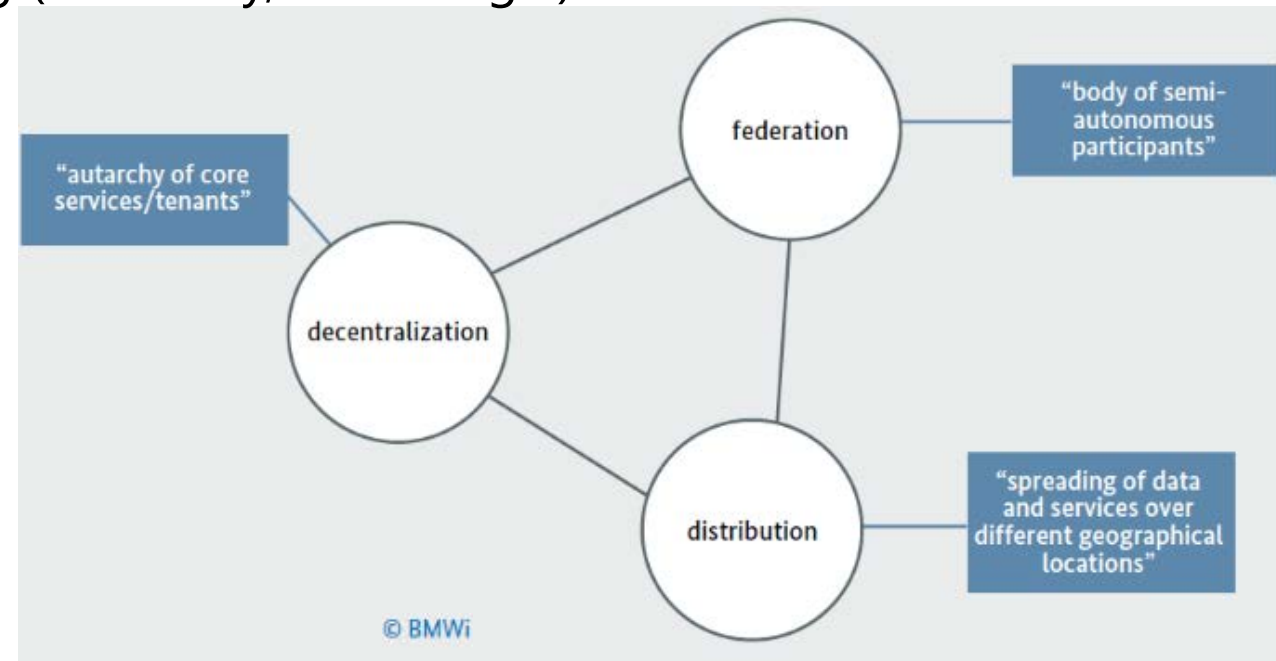


Source: Wikipedia

Cloud federation and Network federation

Cloud federation

- Focuses on computing service offering (discovery, brokering...)
- Builds a common service catalog
- GAIA-X



Network federation

- The Internet (thru autonomous systems)
- Testbed federation



Network service federation (NSF) in 5Growth

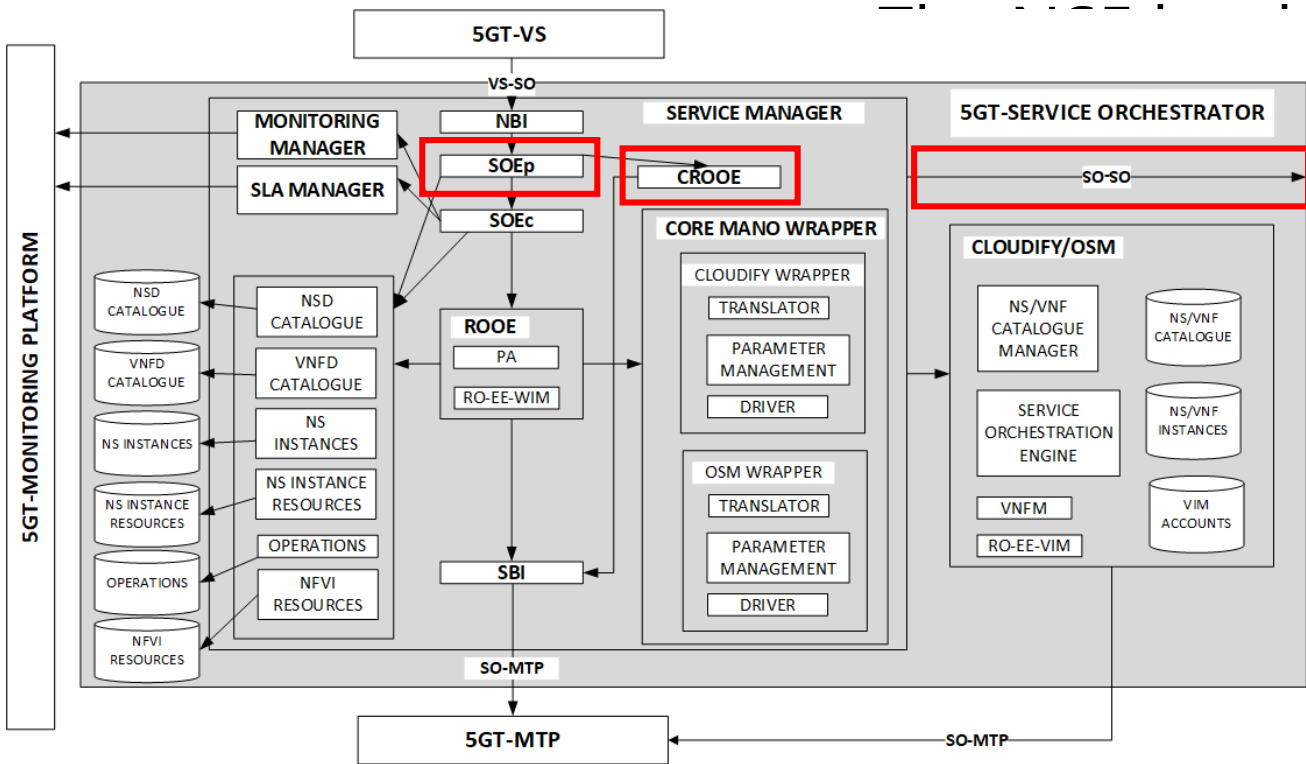
E2E network service catalog

Built through composite network services

5Gr-SO as the central component because

- E2E service view
 - Integrated nested NSs from other domains
- Resource view
 - Local
 - Remote (partially)
- Enables federation of domains with heterogeneous MANO platforms (e.g., Cloudify, OSM)

NSF: Workflow (I)

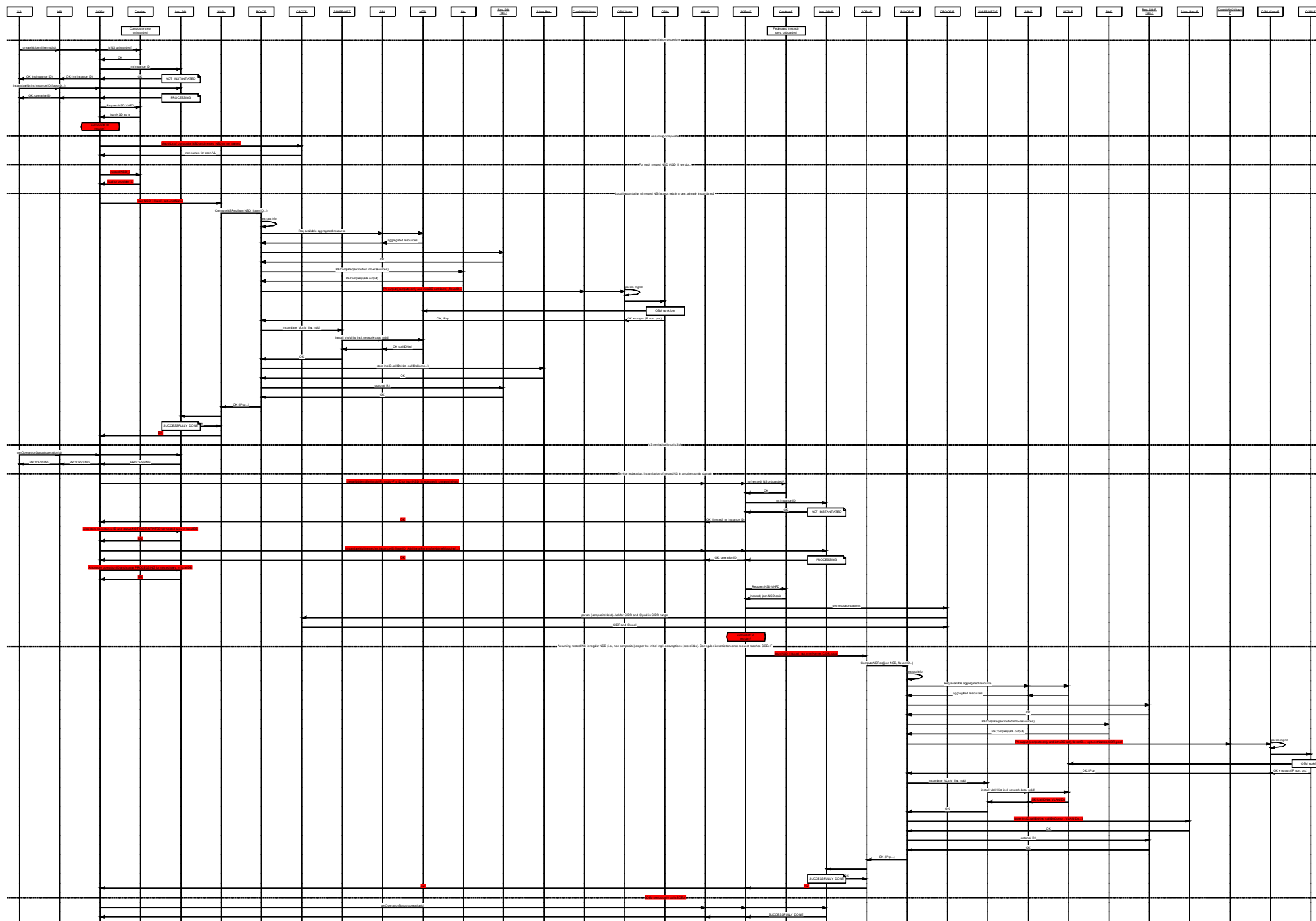


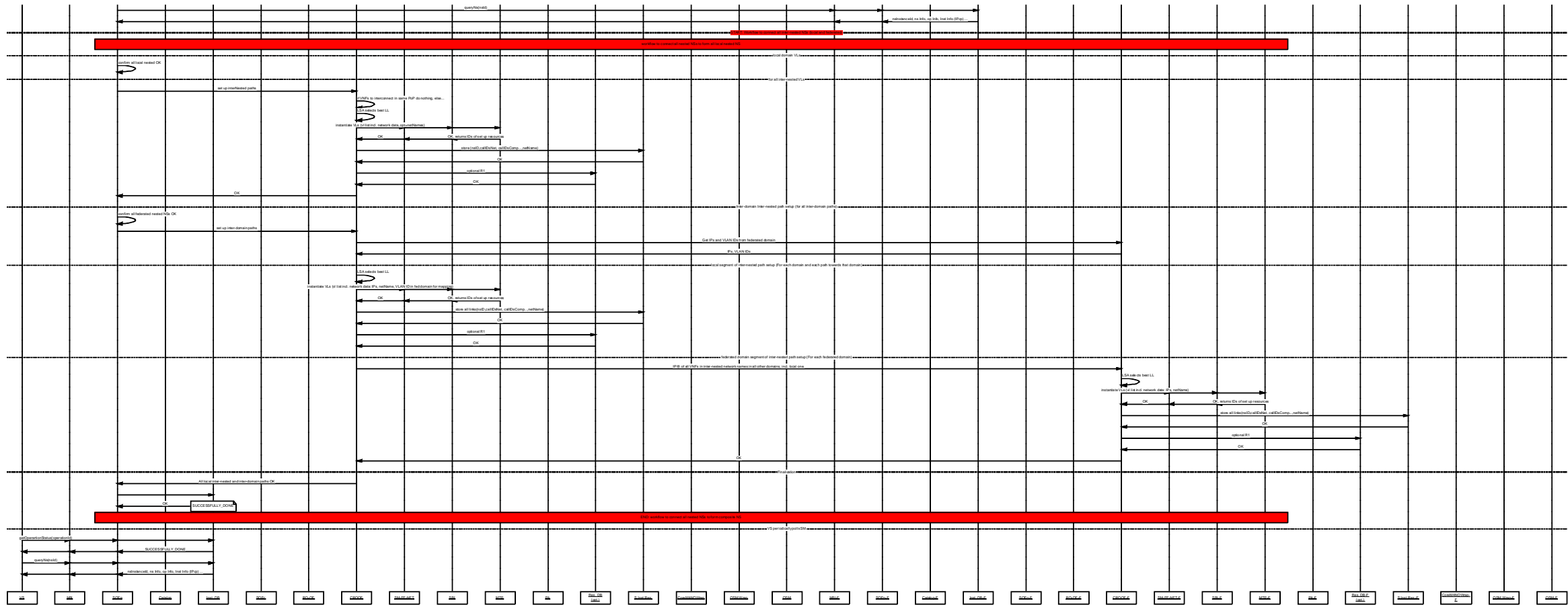
been included on top
 e single-domain
 thanks to two
 SOEp and CROOE
 NSF is inspired in
 30 work but
 to deal with resource
 operations enabling
 ection between
 different ADs

process, we distinguish
 between consumer domain (CD)
 and the provider domain/s (PD/s)

J. Baranda, J. Manges, R. Martínez, L. Vettori, K. Antevski, C. J. Bernardos, X. Li, 5G-TRANSFORMER meets Network Service Federation: design, implementation and evaluation , in Proceedings of the 6th IEEE International Conference on Network Softwarization (NetSoft'20), 29-3 July 2020, Ghent (Belgium).

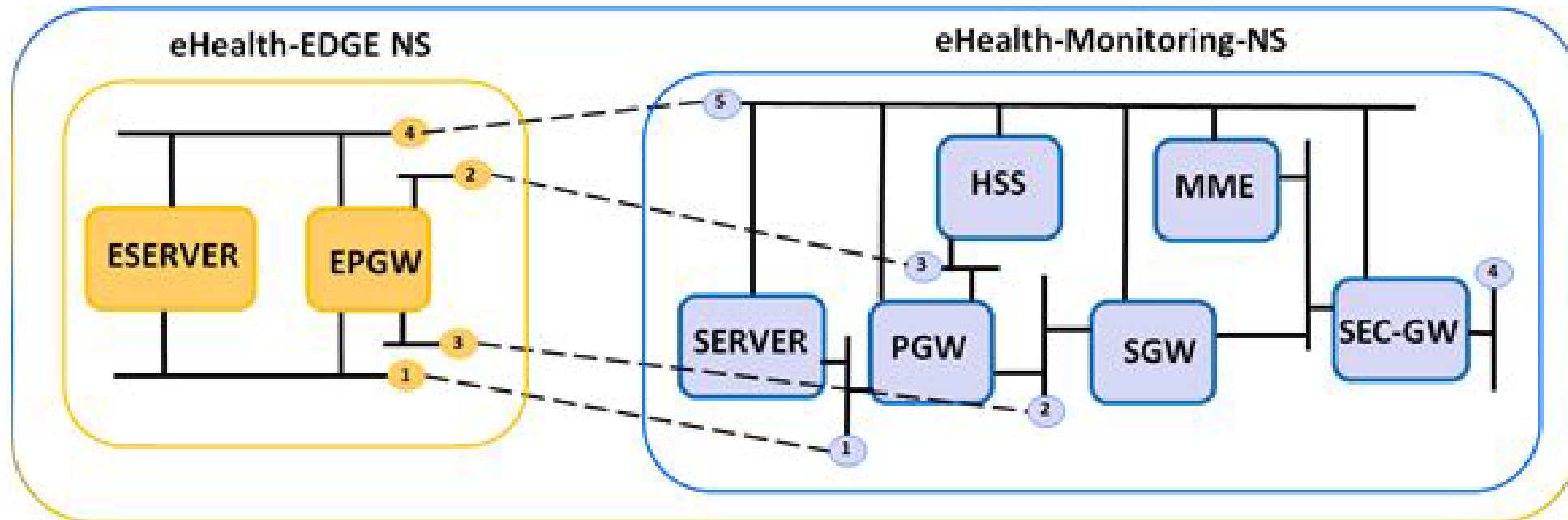
[1] J. Manges et al., "5G-TRANSFORMER Service Orchestrator: Design, Implementation and Evaluation", EUCNC'19





Federation in action

eHealth use case



J. Baranda, J. Mangues, L. Vettori, R. Martínez, K. Antevski, L. Girletti, C.J. Bernardos, K. Tomakh, D. Kucherenko, G. Landi, J. Brenes, X. Li, X. Costa-Pérez, F. Ubaldi, G. Imbarlina, M. Gharbaoui, NFV Service Federation: enabling Multi-Provider eHealth Emergency Services , in Proceedings of the International Conference on Computer Communications (INFOCOM'20), 6-9 July 2020, Toronto (Canada).



eHealth Monitoring service

SEBASTIAN | VS Descriptors

5GT/SO - Databases

MTP CTTC - Databases

10.0.200.227:8080/databases/ns

5GT/SO

SO Databases

NS List

| NS Name | NS Id | Status | NSD Id | Sap Info |
|---------------------|---|--------------|----------------|------------------------------|
| NFV-NS-MonitoringNS | fgt-7cadd44-39eb-45ec-a184-731e0ce5e1b1 | INSTANTIATED | eHealth-Mon-NS | {mgt_v '10.202 '10.203 |

NS Composite List

| NS Name | NS Id | Status | NSD Id | Sap Info |
|---------|-------|--------|--------|----------|
|---------|-------|--------|--------|----------|

View of NS: *NFV-NS-MonitoringNS*

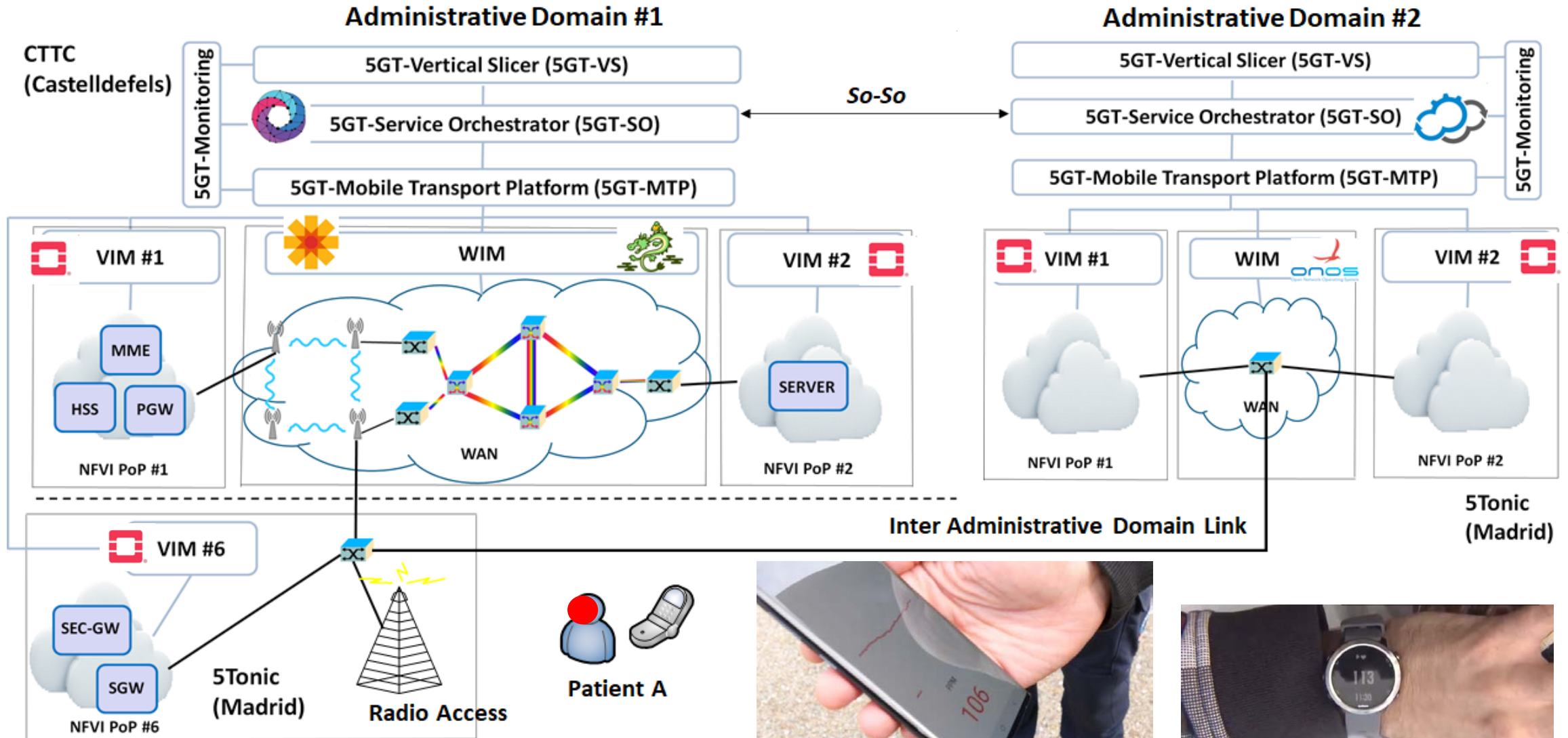
- VNFD ●
- VLD ●
- PoP_6 ●
- PoP_1 ●
- PoP_2 ●
- LLID_151515_b ●
- LLID_616161_b ●
- LLID_626262_f ●

Close

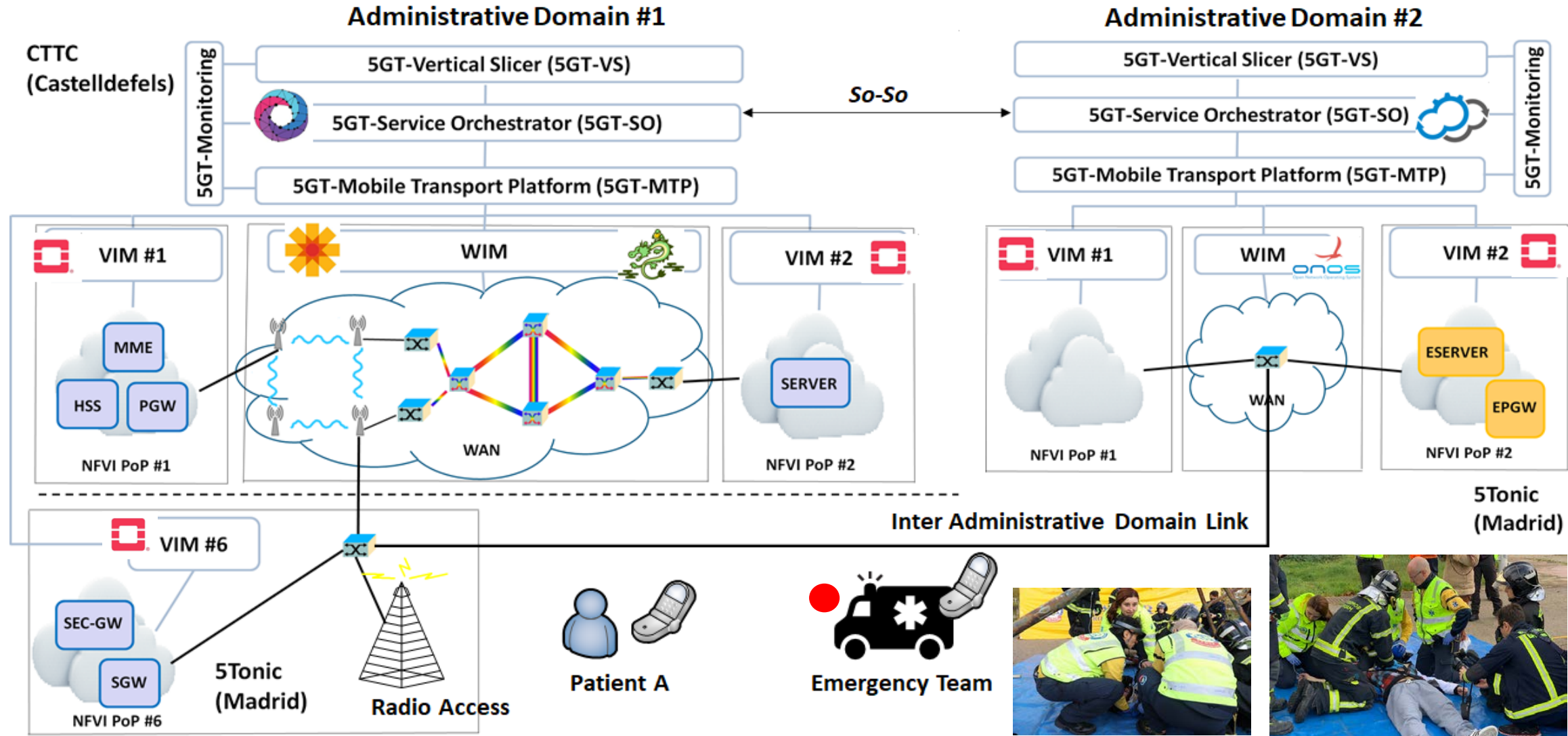
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5G TRANSFORMER

eHealth Monitoring Service



eHealth Emergency Service



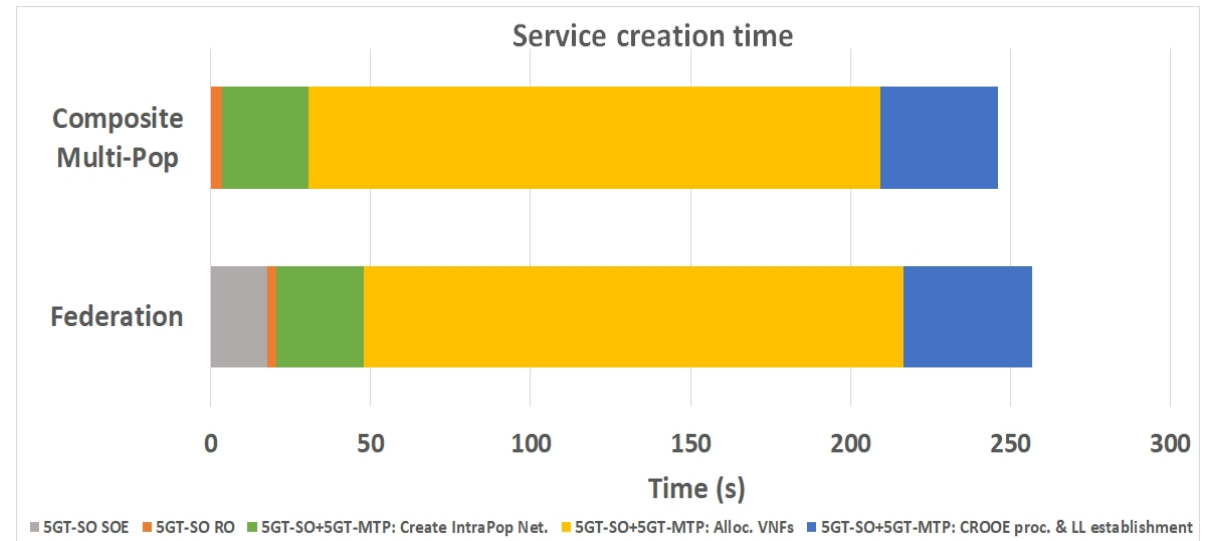
Service Creation Time Profiling

The biggest contribution to SCT comes from resource allocation operations:

- VNF allocation (yellow), configuration of LL (blue), creation of IntraPoP Network (green)
- 98.5% for Composite Multi-Pop (245s)
- 92% for Federation (257s)

A polling operation (grey) impacts in the SCT of Federation

- 7% of total SCT
- Time to process, decompose, interaction between sub-modules and ADs is on the order of ms



J. Baranda, J. Mangues, R. Martínez, L. Vettori, K. Antevski, C. J. Bernardos, X. Li, 5G-TRANSFORMER meets Network Service Federation: design, implementation and evaluation, in Proceedings of the 6th IEEE International Conference on Network Softwarization (NetSoft'20), 29-3 July 2020, Ghent (Belgium).



What's next?

Adding dynamicity and trust in inter-domain service discovery

Adding intelligence in selection of provider of nested NS



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