5G CLARITY

Newsletter #2

Beyond 5G Multi-Tenant Private Networks Integrating Cellular, Wi-Fi, and LiFi, Powered by Artificial Intelligence and Intent Based Policy
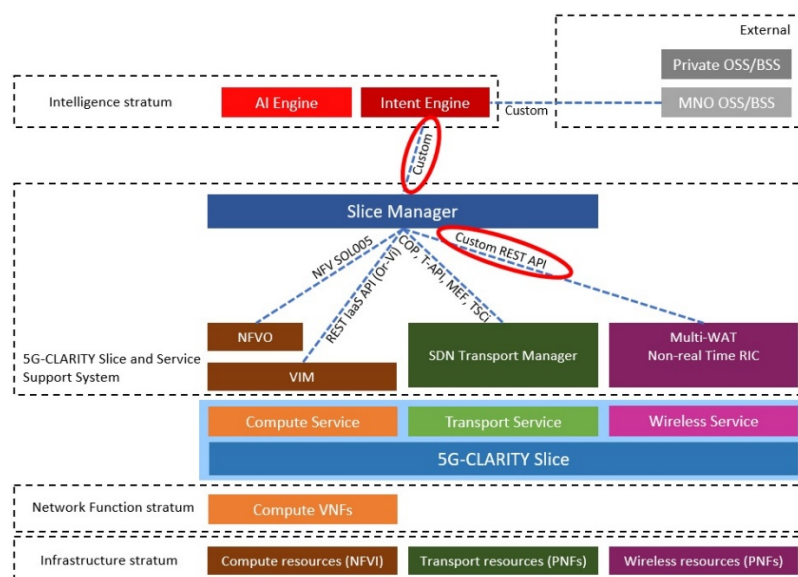
5G-CLARITY Slice Service and Support System

The internal architecture of the 5G-CLARITY slice and service support system proposed in 5G-CLARITY D4.1 is depicted in this figure. In this section, two of the main MFs within this architecture, namely the Slice Manager and the multi-WAT non-RT RIC, are described in more details by looking at the interfaces they offer. For further reading refer 5G-CLARITY D4.1 and 5G-CLARITY D4.2:
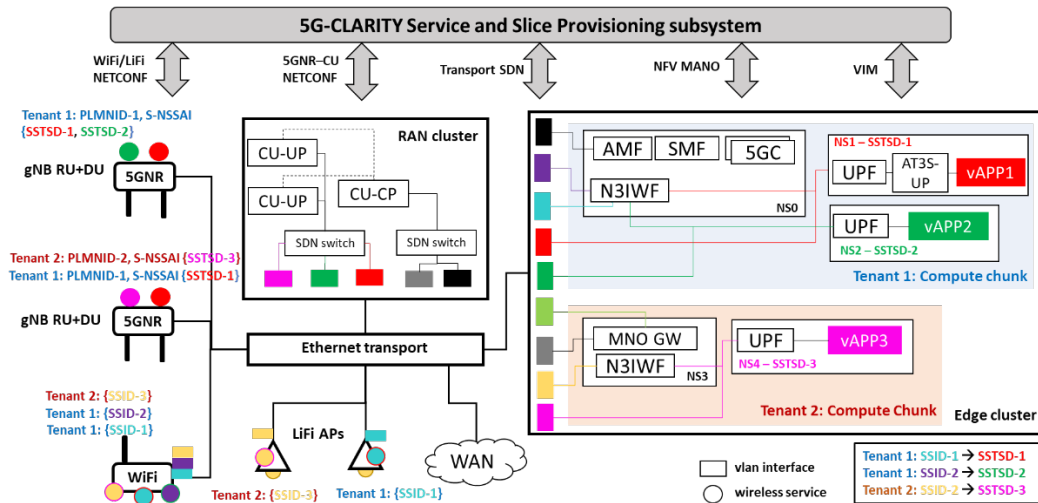https://www.5gclarity.com/wp-content/uploads/2021/11/5G-CLARITY_D42.pdf

5G-CLARITY Service and Slice Provisioning Subsystem

The 5G-CLARITY service and slice provisioning subsystem, included in the management and orchestration stratum of the 5G-CLARITY architecture, allows to provision slices on top of the 5G-CLARITY infrastructure stratum. As introduced in 5G-CLARITY D2.2 and 5G-CLARITY D4.1, 5G-CLARITY slices explicitly consider multi-tenancy to provide infrastructure slicing and deliver isolation among tenants. Notice that this differs from 3GPP slices that take a multi-service approach. An illustrative example that describes the concept of 5G-CLARITY slices is described in the figure below (built upon the preliminary example provided in 5G-CLARITY D4.1), including: i) 5GNR, Wi-

Fi and LiFi access nodes; *ii)* network functions instantiated in the RAN compute cluster, such as the control and user plane functions of the CU; and *iii)* an edge compute cluster with network function virtualization (NFV) functionalities hosting virtual network and application functions.
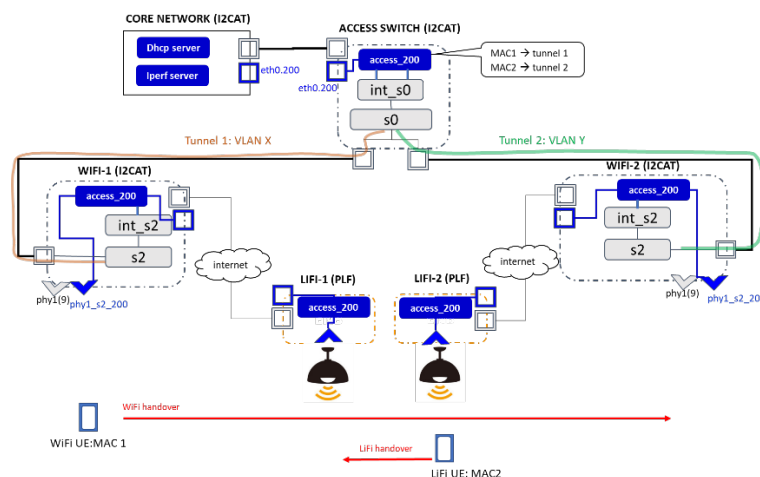

5G-CLARITY uses the concept of resource chunks to provide isolation among slices: in the figure we can see two compute chunks in the edge compute cluster serving two different tenants. Each chunk is composed of specific compute, storage and memory resources. Isolation in the Ethernet transport domain is achieved using virtual local area networks (VLANs), whereas in the wireless domain isolation is achieved through technology specific quotas consisting of physical resource blocks (PRBs) for 5GNR, airtime for Wi-Fi, and a combination of airtime and wavelength for LiFi. For further reading refer to 5G-CLARITY D4.2 downloadable:

https://www.5gclarity.com/wp-content/uploads/2021/11/5G-CLARITY_D42.pdf

Wi-Fi and LiFi Integration in 5G-CLARITY Multi-Connectivity Framework

The 5G-CLARITY SDN enabled L2 network framework integrating Wi-Fi and LiFi, which allows UEs with Wi-Fi and/or LiFi interfaces to freely roam across Wi-Fi and LiFi access points while maintaining their IP address is proposed in 5G-CLARITY D3.1 (Section 6.2).
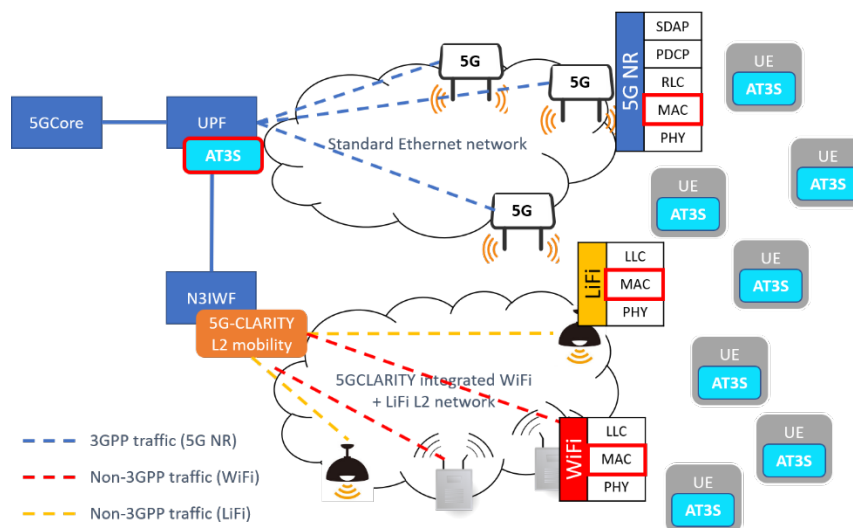
The figure depicts a testbed that has been setup between 5G-CLARITY partners i2CAT and pureLiFi to validate the integrated Wi-Fi and LiFi SDN enabled L2 network. The testbed consists of two LiFi access points and two Wi-Fi access points connected via an L2 internet tunnel to the corresponding LiFi access points. An access tunnel switch connected to the Wi-Fi access points interfaces to the core network (using two separated backhaul tunnels) where the DHCP and an *iperf* server reside. For further details on 5G-CLARITY multi-connectivity framework (including 5GNR) and its evaluation refer to WP3 publications, e.g. 5G-CLARITY D3.2:

https://www.5gclarity.com/wp-content/uploads/2021/06/5GC-CLARITY_D32.pdf

5G-CLARITY System Architecture Evaluation

The proposed traffic routing and resource scheduling techniques, using the corresponding telemetry and performance measurements to route the traffic across 3GPP/non-3GPP networks in near real-time (near-RT) while 5G-CLARITY eAT3S ensures quality-of-service (QoS) is introduced in 5G-CLARITY D3.2 Section 3. In 5G-CLARITY, the resource management will be considered as a two-stage process, i.e., i) traffic/packet routing, and ii) gNB/AP-level resource scheduling, as depicted in the figure below. For further details on this refer to project's deliverables from WP3, e.g., 5G-CLARITY D3.2:

https://www.5gclarity.com/wp-content/uploads/2021/06/5GC-CLARITY_D32.pdf

5G-CLARITY System Architecture Evaluation

The initial evaluation of the key features of the 5G-CLARITY system architecture (already reported in reported in 5G-CLARITY D2.2) is derived, specifically this analysis includes modelling of the 5G-CLARITY architectural functional elements. These are organised according to the overall architectural structure proposed by the project, i.e., *Infrastructure* stratum, *Network and Application Function* stratum, *Management and Orchestration* stratum, and *Intelligence* stratum. The reported models rely on the development of both theoretical and simulation tools describing the performance of the corresponding elements as well as experimental profiling of specific architectural elements where this has been feasible. The architecture evaluation is done using the developed end-to-end models with the selected simulation and optimisation tools. This allows assessment of 5G-CLARITY system architecture through representative use cases, indicating clear benefits with respect to the relevant state-of-the-art as well as associated trade-offs. Further details are available in the downloadable 5G-CLARITY D3.2:

https://www.5gclarity.com/wp-content/uploads/2021/10/5G-CLARITY_D23.pdf

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5G-CLARITY Deliverable D2.3

Primary System Architecture Evaluation

5G-CLARITY News

Deliverables

The project submitted a number of technical deliverables in 2021 which describe the project latest innovations and implementations, as well as developments in the project's vision and system architecture, and the evaluations of the technical solutions.

All deliverables are publicly available from the project's webpage at:
https://www.5gclarity.com/index.php/deliverables/

Here is a list of recently submitted deliverables:
- 5G-CLARITY D5.1, "Specification of Use Cases and Demonstration Plan," February 2021.
- 5G-CLARITY D3.2, "Design Refinements and Initial Evaluation of the Coexistence, Multi-Connectivity, Resource Management and Positioning Frameworks," May 2021.
- 5G-CLARITY D4.2, "Validation of 5G-CLARITY SDN/NFV Platform, Interface Design with 5G Service Platform, and Initial Evaluation of ML Algorithms," July 2021.
- 5G-CLARITY D2.3, "Primary System Architecture Evaluation," July 2021.

Publications

The updated list of all accepted publications can be found on the project webpage, in the Publications part:
https://www.5gclarity.com/index.php/publications/

5G Non-Public Networks: Standardization, Architectures and Challenges

JONATHAN PRADOS-GARZON[1,2], PABLO AMEIGEIRAS[1,2], JOSE ORDONEZ-LUCENA[3],
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Talks and Presentations

Find more on project presentations in 'Talks and Panels' section of the webpage:
https://www.5gclarity.com/index.php/talks-and-panels/

YouTube Channel

5G-CLARITY YouTube channel is up and running and more project related video will be uploaded soon. Subscribe to the channel to updated on the new videos:

https://www.youtube.com/channel/UCtAZgpXA-Ud-l8TMfTBPxxw

Contribution to Standardization

5G-CLARITY has made further considerable impact on the standardization of related technologies. Read about the SDO Impact of 5G-CLARITY success story here:

https://global5g.org/online-tool-standards-tracker/sdo-impacts-5g-clarity

Table below shows the list of such contributions made during the second year of the project lifetime:

Standard	Work Item	ID	Title	Date
3GPP SA5	OAM_NPN (Rel-17)	S5-211479	pCR 28.557 Add CAG management	Jan-21
ETSI ISG ZSM	ZSM003	ZSM(21)00002 3r2	ZSM003 Clarify network slice as a service	Jan-21
3GPP SA5	OAM_NPN (Rel-17)	S5-212360	pCR 28.557 Add 5GLAN group management in UE related management aspects	Mar-21
3GPP SA5	OAM_NPN (Rel-17)	S5-212361	pCR 28.557 Applicability of management modes considering the deployment options of individual NPN functions	Mar-21
3GPP SA1	FS_Resident (Rel-18)	S1-210016	pCR 22.858 Resolving the Editor's note on the use case of seamless switching to a service hosting environment via an evolved residential gateway	Mar-21
IETF	OPS Area WG		Service Assurance for Intent-based Networking Architecture	Apr-21
3GPP SA1	FS_Resident (Rel-18)	S1-211443	pCR 22.858 Replacing the term service hosting environment	May-21

3GPP SA1	FS_Resident (Rel-18)	S1-211442	pCR 22.858 Resolving the Editor's note on the term service hosting environment for the use case of seamless switching between service hosting environment and application server via an evolved residential gateway	May-21
3GPP SA1	FS_PALS (Rel-18)	S1-211479	pCR 22.844 Use case on managing a high number of UEs returning from a local hosting network to home network	May-21
3GPP SA2	eNA_Ph2 (Rel-17)	S2-2104850	pCR 23.288 Addition of sets of NWDAF identifiers involved in analytics aggregation	May-21
3GPP RAN3	FS_NR_ENDC_data_coll ect (Rel-17)	R3-212868	TP for TR 37.817 Mobility Optimization Use Case	May-21
3GPP SA1	FS_TACMM (Rel-18)	S1-211497	pCR 22.847 New use case on Haptic feedback for a personal exclusion zone	May-21
3GPP SA5	OAM_NPN (Rel-17)	S5-213483	Pcr 28.557 Add NG-RAN related management requirements	May-21
3GPP SA1	FS_TACMM (Rel-18)	S1-212142	pCR 22.847 Alignment of the scope with the SID	Jul-21
3GPP SA5	FS_NSCE (Rel-17)	S5-215526	Key issues relative to network slice management capabilities exposure	Oct-21

5G-CLARITY Project

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