3GPP SA Rel.18 Workshop
9-10 September 2021

SP-210620

Qualcomm

System Architecture (SA2) Rel-18 priorities

Source: Qualcomm

Outline

- Expected rel.18 timeline and principles
- Qualcomm inputs and priorities

Expected rel.18 timeline and proposed planning

Rel.18 proposed timescales

- Rel-18 should start the “2nd cycle” of 5G evolution

- Our proposal for rel.18 schedule is for “18 months release”:
  - Stage-1 freeze: Dec. 2021 (as of current plan)
  - Stage-2 freeze: Dec. 2022 (NEW) (*)
  - Stage-3 freeze: Sep. 2023 (NEW)(*)

- Transition from SA2 study to normative work (typically 6mo gap)
  - New rel.18 studies, start: January 2022 SA2 meeting, end: June 2022
  - New rel.18 work item (after study), start: June 2022, end: Dec. 2022

(*) Mostly physical meetings are assumed in 2022. If this is not the case the timescales may have to be further revised

Principles for 5G evolution

Working towards 2nd cycle of 5G

- Sustain a healthy evolution path for Mobile Broadband
- Expand into new use cases
- Balance the needs of the increasing number of actors participating in 3GPP and/or committed to the 3GPP ecosystem

Principles for 5G evolution

Balance continued evolution + ability of market to absorb + longer-term!

- Almost all of the Rel-17 items have continuation proposals into Rel-18

- <u>However</u>, for some items we should ask ourselves the following:
  - *Is a continuation project in Rel-18 worth it?*
  - *If the targeted gain of a "continuation project" is minimal/incremental, does it justify the time to be spent in 3GPP?*
  - *Does a "continuation project" create the risk of slowing adoption of Rel-16/17 as customers might then prefer to "wait"?*
  - Bottom line: avoid auto-pilot continuation projects

- For some items we should consider "taking a break" to ensure that the market can "absorb" the R16+17 content
  - Avoid that standards get too far ahead of product roadmaps
  - Need to identify items that can be considered "completed" & will not have a continuation, so to open capacity for new items
  - **If every single Rel-17 project had a "continuation", it would be impossible to open new areas!**

Qualcomm inputs and priorities

QC high interest SA2 Rel-18 topics (new areas)

Network as a Service (PALS in SA1)

- Flexible configuration of temporary and localized 3rd party services
- 5GS Standard APIs to 3rd party
- Service discovery mechanisms
- In venue manual/automatic selection
- Online signup.

XR System architecture

- App Data Unit based QoS and content policy
- App assisted RAN awareness of Burst start/end
- RAN requested Burst timing offset
- RAN reports to App: supported burst rate, degradation

Vehicle Mounted Relays

- System architecture design for network of vehicle mounted relays
- Incentive schemes and corresponding mechanisms for configuration and authorization of relays
- Support service continuity during mobility of UEs and/or relays

Fixed Wireless Access

- 5G access in home and 5G backhauling (FWA)

UE policy enhancements

- Roaming support
- New trigger for policy provisioning
- Nw detection of URSP enforcement
- Interworking with EPS

Disclaimer: The topics listed correspond to general technical areas and we are open to discuss how to map to SA2 SIDs

QC high interest SA2 Rel-18 topics (continuation)

Aerial Vehicles

- Integrate the following 5G features into aerial vehicles scenarios:
  - Networked UAVC in the cloud
  - PC5 for Remote Identification and DAA
  - Multi-PLMN support for C2 reliability
  - Data collection and generation
  - Exposure function (NEF/CAPIF)
  - Edge

5G V2X and Sidelink enhancements

- Sidelink Positioning
- Sidelink enh.: power saving, small data and security.

PC5 & Non-3GPP Relays

- Commercial/PubS centric Sidelink Relay: emergency services, MBS, unidirectional relay
- Non-3GPP access to Relay

eRedCap/small data

- GUTI reallocation optimization
- NR RRC inactive with CM IDLE

5G MBS enhancements

- EnTV connected to 5GC

Disclaimer: The topics listed correspond to general technical areas and we are open to discuss how to map to SA2 SIDs

Other expected SA2 Rel-18 SI/WI's

QC to contribute but not high priority

Network Analytics & AI/ML
- New output types provided by NWDAF
- Data exposure to UE
- Network assisted information for AI/ML

Network slicing enhancements
- RAN slicing further enhancements
- Enhanced NS configuration, control and prioritization based on radio resources availability and restrictions (SA1)
- Human readable name for slices

Edge enhancements
- Roaming deployment
- Federated Edge deployments (in relation to GSMA OPG work)

5G MBS enhancements
- Roaming architecture
- Ethernet broadcast optimisations

IIoT
- Integration with IETF DetNet

Monitoring / Evaluating

NPN enhancements
- Leftovers from rel.17
- NPN IoT enhancements

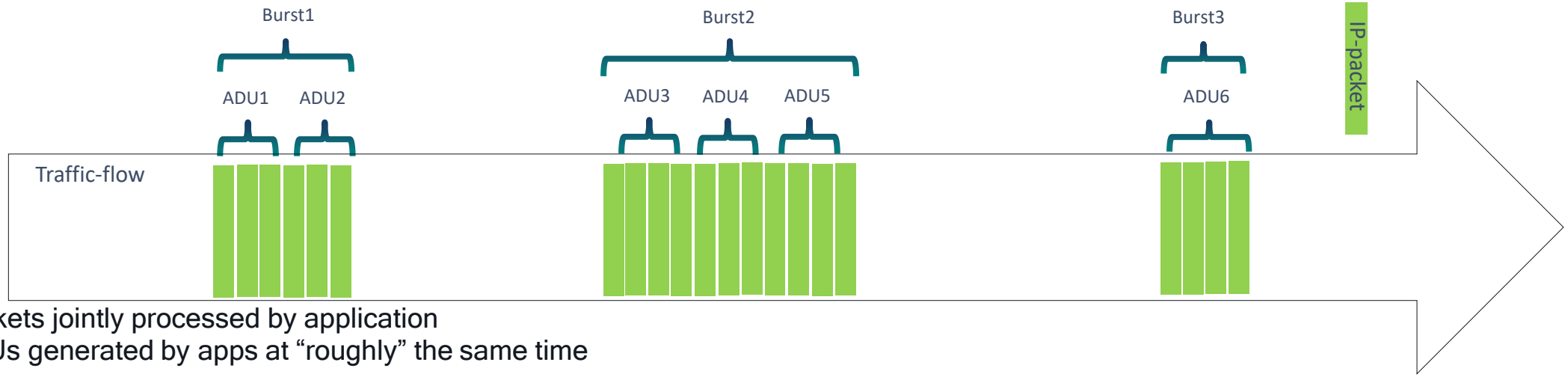
Rel-18 SA2 topics: QC to drive / high interest

- System enhancements for XR
- Network as a Service (PALS)
- RedCap optimisations
- 5G V2X and Sidelink enhancements
- PC5 and non-3GPP Relay (System Architecture)
- Further enhancements for UAVs
- Vehicle Mounted Relays
- FWA
- UE policy enhancements

New topic

System enhancements for XR

Application awareness at RAN: Application Data Unit (ADU) and Data Burst



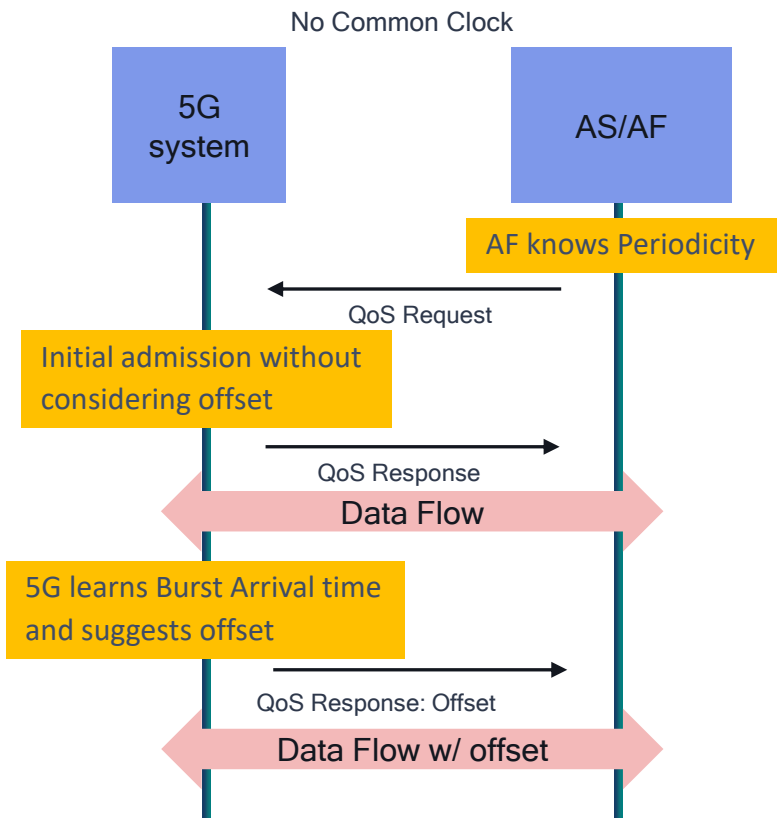
ADU: Set of packets jointly processed by application
Burst: Set of ADUs generated by apps at "roughly" the same time

- Applications consume data in ADUs which are bigger than IP packets
  - E.g.: One video frame per burst, "slices" of a video frame per burst, etc.
- ADU aware communication systems can improve performance
  - Reliability ➔ ADU error rate vs. packet error rate improves reliability
  - Power ➔ ADU delivery in time continuous ON slots to maximize modem OFF time
  - Latency ➔ Meet ADU delay budget instead of packet delay budget that is less meaningful to application
  - Capacity ➔ Loss of information when ADU requirements translated into PER, PDB can result in lowered capacity
- Data burst awareness at 5G can lead to better device power management
  - End of burst information feeds into algorithms for sending device to sleep (CDRX off or Low-power Bandwidth Part)

New topic

RAN awareness at Application

- **Expose RAN information to the Application** to enable codec adaptation
  - **RAN reports** – RAN performance metrics including supported Burst-rate and notification of temporary degradation
  - **Burst timing offset** – Application awareness of RAN scheduling timing for traffic synchronization to better allocate resources



New topic

Network as a Service

5G Networks Providing Access to Localized Services (PALS)

- Flexible Event Services Configuration

1 3rd Party Provider services over Hosting Network configuration

- Standard APIs: QoS, slicing, discovery, etc.
- 5GC Event configuration
- NG-RAN event configuration

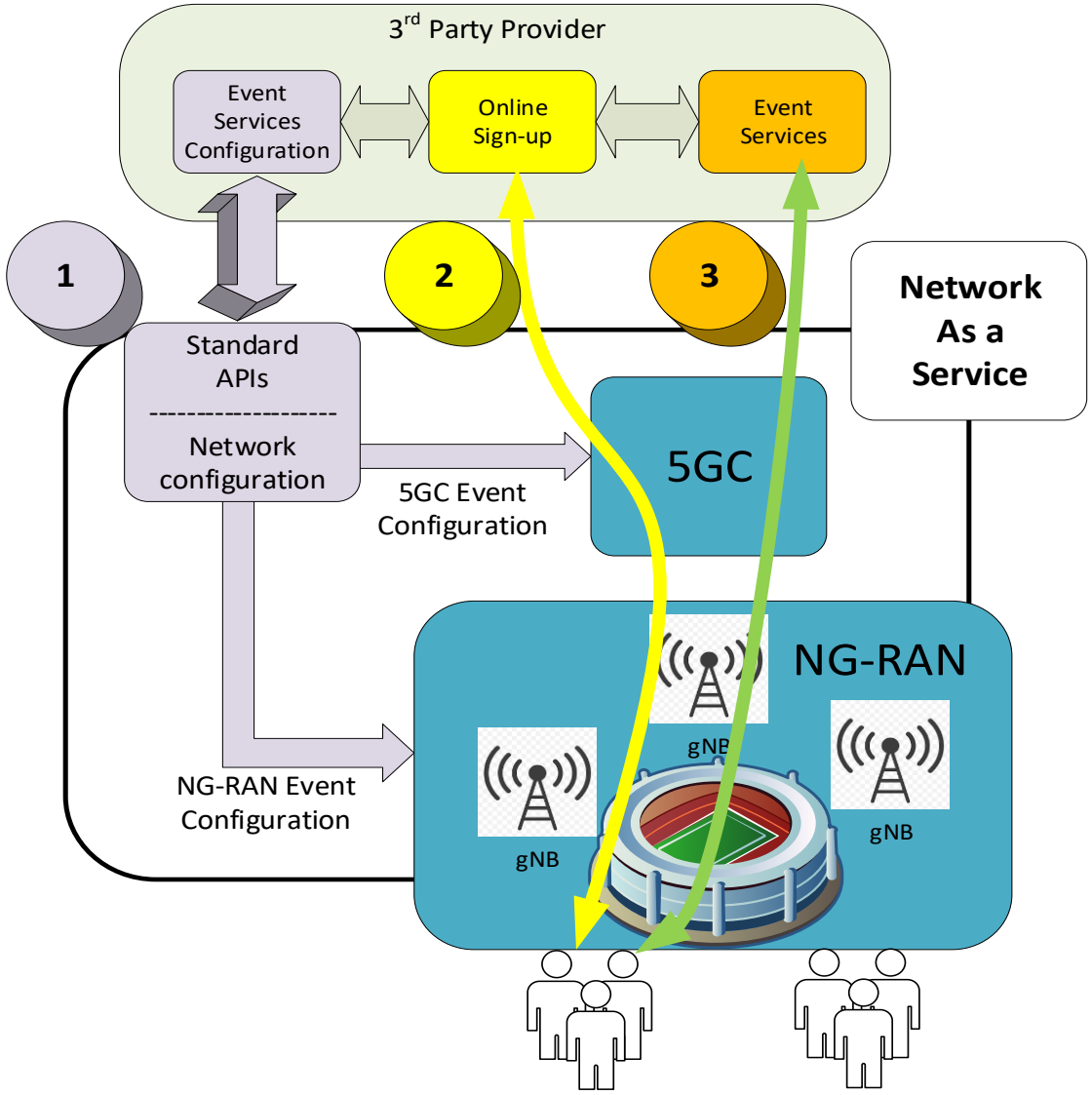
2 Online Sign-up

- User discovery and manual selection of event services
- Restricted access for online signup, valid credentials

3 Event Services

- Temporary access to 3rd party event services
- With valid (temporary) credentials.

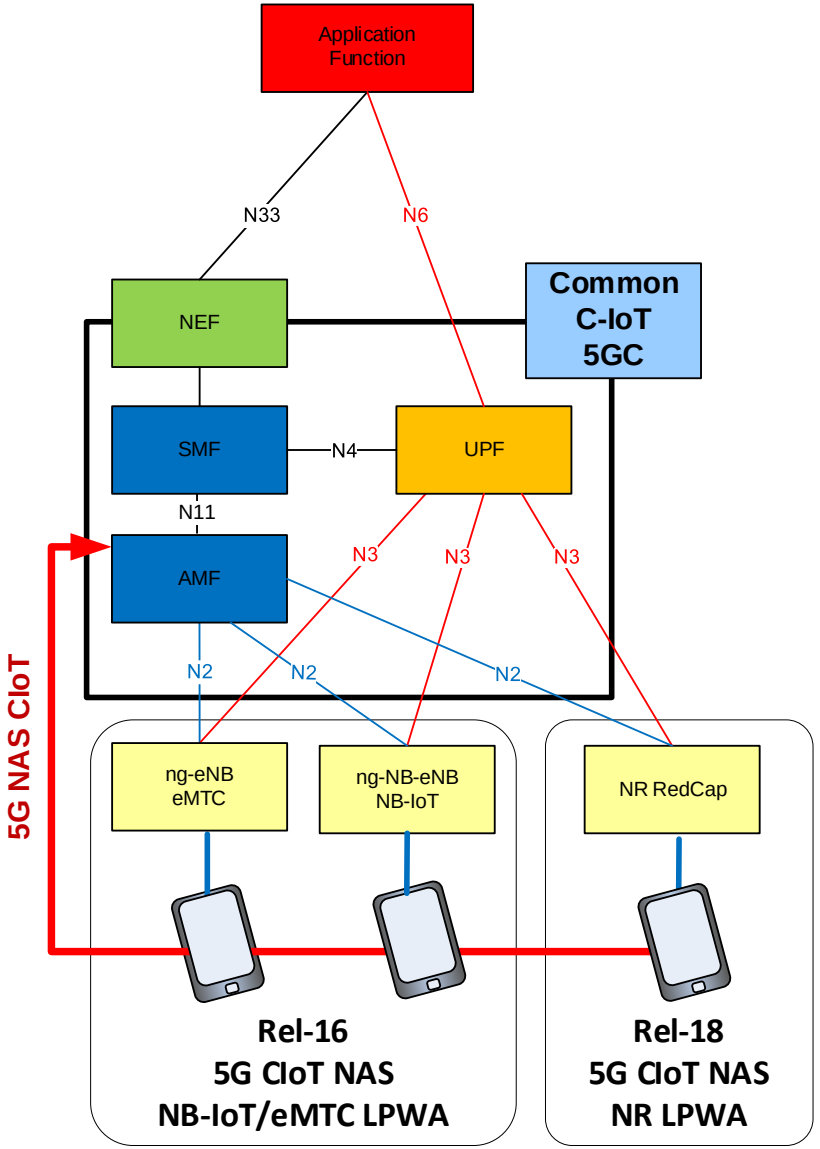
- SA2 work be done in “umbrella” NPN enhancement SID



New topic

RedCap- enhancements: 5GS CIoT over NR

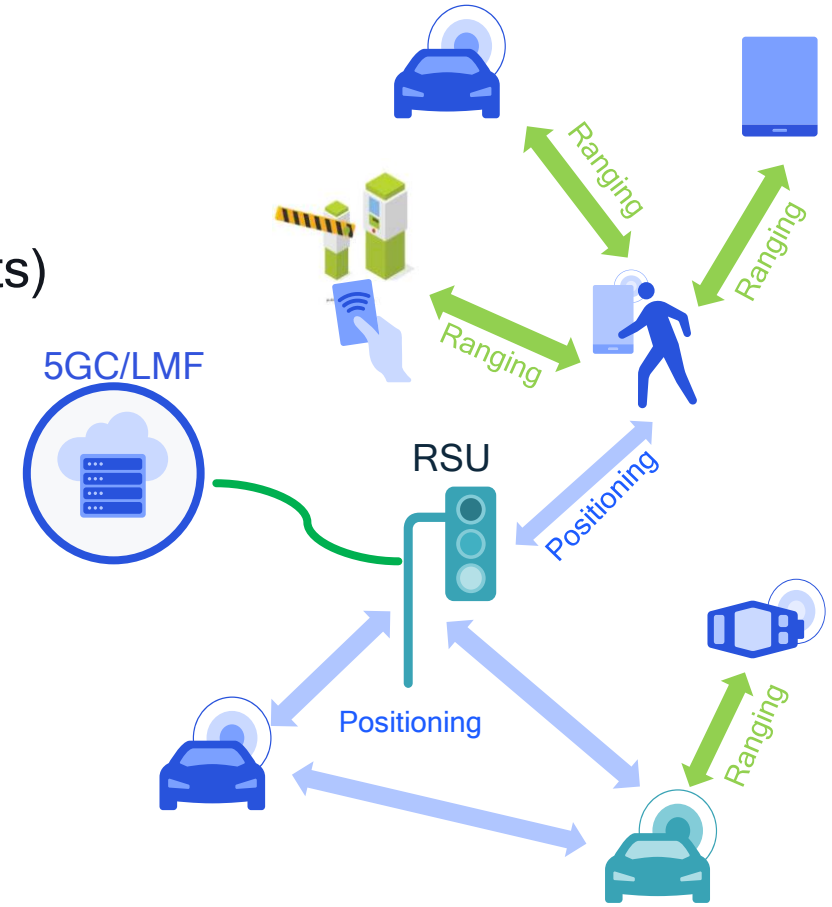
- Common 5G CIoT NAS and 5GC procedures for NB-IoT/eMTC and NR for RedCap
- NR RedCap as LPWA RAT for 5G CIoT NAS and 5GC.
  - Mostly achieved in rel.17
- Further enhancements:
  - Enhanced GUTI reallocation for MT small data / NW initiated procedures.
  - NR RRC inactive with CM IDLE
    - To enable power saving in RRC inactive (long eDRX) and full reusability of HLCom.



5G V2X and Sidelink enhancements

Continued from Rel-17

- RAN support of the Sidelink enhancements
  - Including RSU manage/controls other UEs
  - Performance Information collection & control (PC5 components)
- (Leftover from Rel-17) DRX design for power saving



New features

- Sidelink Positioning framework and protocol support based on
  - Rel-17 RAN plenary study (V2X, PubS); and
  - Rel-18 SA1 study (Ranging service, and Personal IoT)
- Sidelink enh. SA2 features
  - Extended power saving (e-DRX / MICO sidelink equivalent)
  - Small data + security

NR PC5 Relay (System Architecture)

Continued from Rel-17

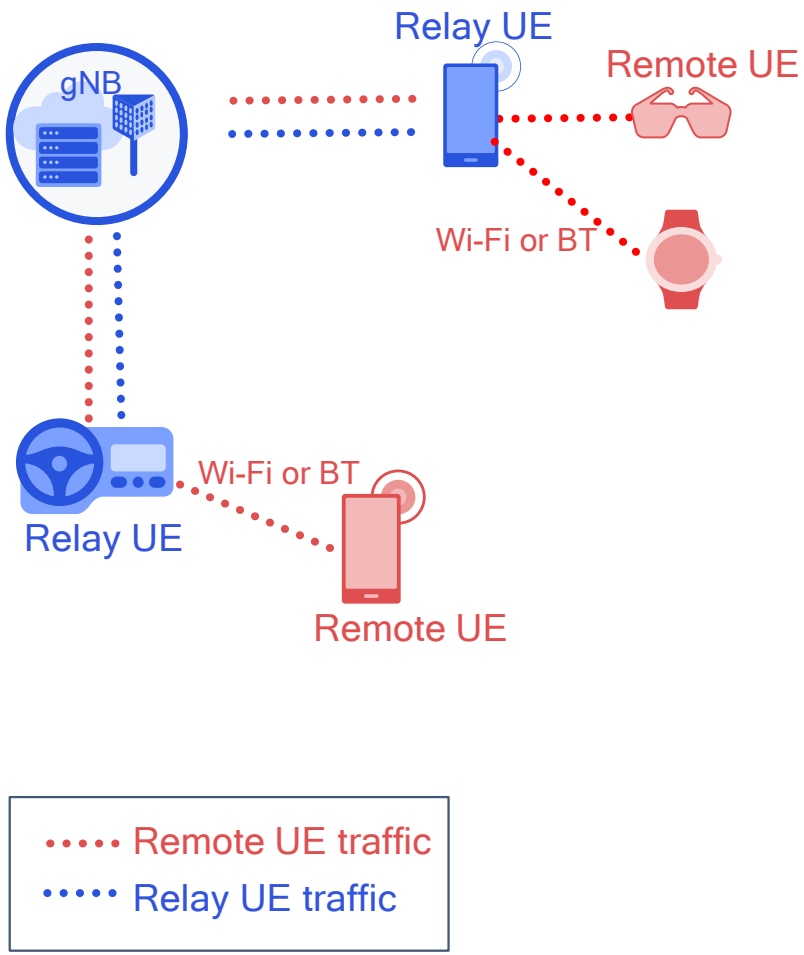
- Leftover from Rel-17 Relay design
  - Path switch for L3 and L2 UE-to-NW relays (PC5 <--> Uu, PC5 <-->PC5)
  - Service continuity during path switch
  - UE-to-UE relay & path switch

New features

- Commercial/PubS centric Sidelink Relay features
  - Emergency service support over Relay connection
  - Multicast/broadcast traffic relaying (PubS)
  - Unidirectional Relay & reduced capability devices support (for small data)
- Industrial centric Sidelink Relay features
  - Multi-hop Relay support
  - High reliability (multipath, dual connectivity, network coding, etc.)

NR PC5 Relay- Extending to non-3GPP access

PC5 U2N relay architecture extended to support a non-3GPP RAT access for tethered devices

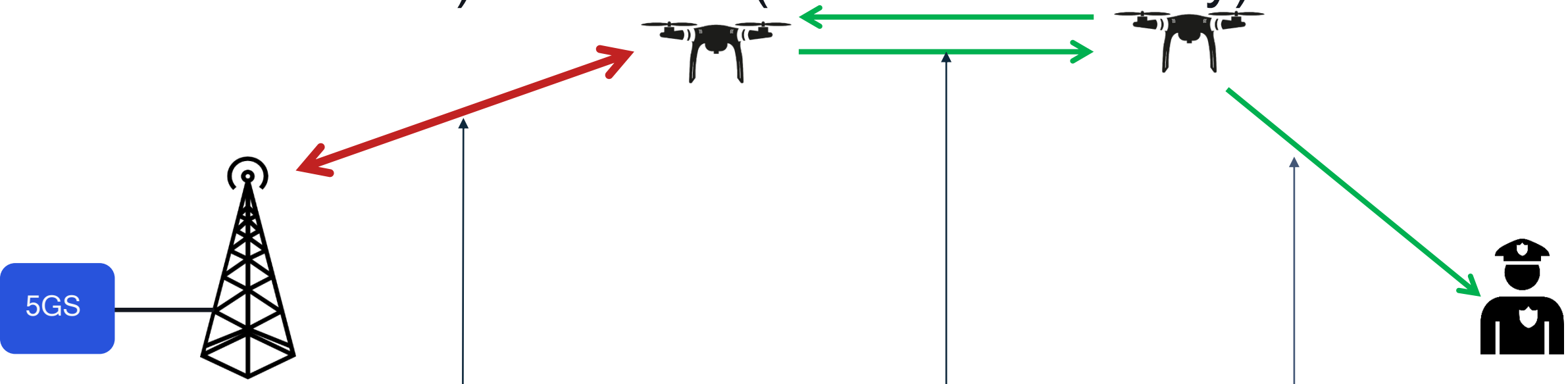


Joint SA2/RAN2 topic

- **Motivation:** Improve user experience for Wi-Fi or BT tethered wearables such as smart glasses or smart watches using U2N relaying
  - XR services on smart glasses have stringent performance requirements for throughput, latency, and reliability
  - Using U2N relaying provides better support for remote UE QoS and service continuity necessary to meet the performance requirements
- **Proposal:** Extend Rel-17 U2N PC5 relay operation to non-3GPP access for tethered devices
  - Study solutions to support U2N relaying operation for remote devices connected over non-3GPP access (e.g., WiFi or BT)
  - Consider Rel-17 U2N Relaying study scope as baseline, i.e., support security, QoS, and service continuity for remote devices connected over non-3GPP access
  - Consider solutions with minimal impact at the RAN for WiFi or BT connected remote device support investigate mechanisms for WiFi or BT related mobility)
- Solutions could also apply for automotive use cases
  - Smartphone connected to the network via Vehicle as a relay UE

Continued from Rel-17

Further Architecture Enhancement for UAV (Un-crewed Aerial Vehicles) and UAM (Urban Air Mobility)



Uu/5GS enhancements (UAV-Network)

- Distributed and localised USS/UTM
- Optimized C2 performance management (multiple PLMNs)
- Integration with crewed Air Traffic Management
- Provisioning of services to UTM/USS with MNO as a Supplementary Data Service Provider of NAS UTM model
- Support of networked UAVC in the cloud

Use case: various applications (video, remote C2 etc.)

PC5 enhancements (UAV-UAV)

- Use PC5 broadcast for detection and collision avoidance

Use case: U2X-DAA (detect and avoid)

PC5 enhancements (UAV-Authority)

- Use PC5 to broadcast
  - UAV ID
  - Flight info

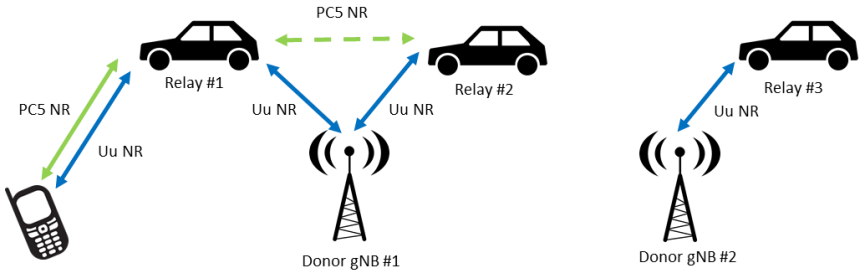
Use case: U2X-ID (remote identification)

- Assumes law enforcement has a dedicated device that can receive PC5 broadcast

New topic

Vehicle Mounted Relays

- What is it?
  - System architecture for network of vehicle mounted relays
    - Vehicles with known path (buses, tramways) or variable paths (taxis, end-user cars)
  - Relays get coverage from stationary gNBs from the macro network (= “donor gNBs”)
  - Relays provide coverage to neighboring UEs (which can be in the vehicle or in its vicinity)



- Possible objectives
  - Basic architecture design for vehicle mounted relays
  - Define incentives schemes for vehicle mounted relays and corresponding relay configuration and authorization mechanisms
  - Evaluation of protocol options to support end-to-end service continuity during mobility of UEs and/or relays

New topic

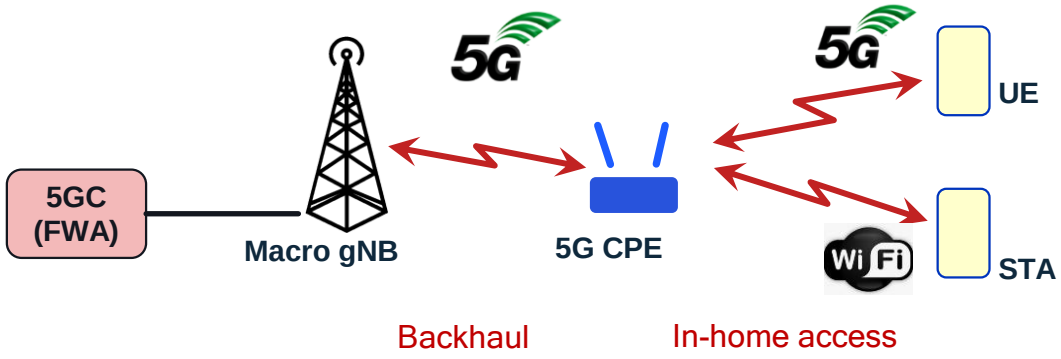
5G CPE/Fixed Wireless Access

Building on SA1 study and requirements

CPE & Fixed Wireless Access

Motivation: 5G access in home and 5G backhauling (FWA), following SA1 work and including support for

- E2E QoS per flow for macro & local services (E2E latency, GBR)
- Backhaul aggregation (wired + wireless access)
- Local networking among 5G devices and between 5G and WiFi connected devices



Technical challenges include:

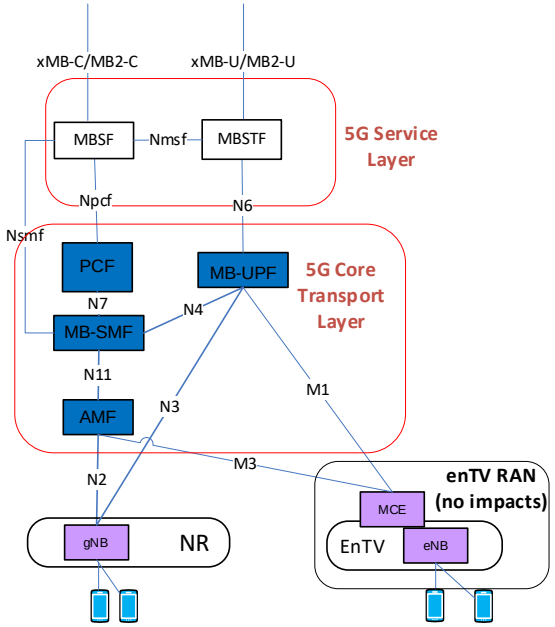
- ✓ Architecture aspects: Layer 2 and layer 3 relay-like approaches are possible (including IAB)
  - ✓ Impact and suitability analysis of different options including system and CN impacts
- ✓ Support for flexible end-to-end QoS management (including local RAN, backhaul, relay function)
- ✓ Transport aspects including backhaul aggregation
- ✓ Mobility aspects
- ✓ Interference / radio resource management

In a first phase, study needed in both SA2 and RAN3

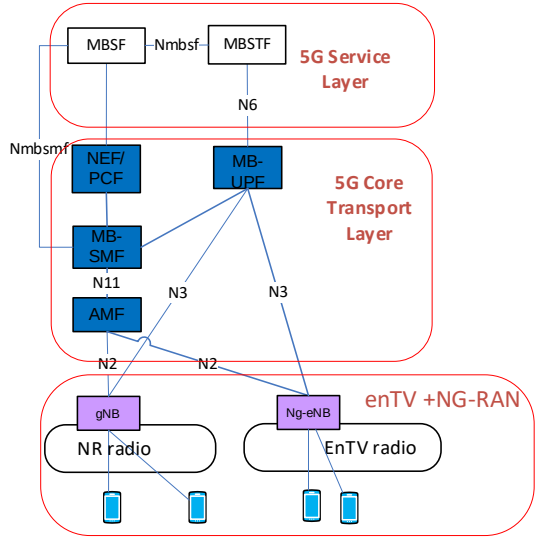
Continued from Rel-17

EnTV connected to 5GC

- Motivation:
  - LTE-based 5G broadcast (currently connected to EPC) is the only 3GPP solution to terrestrial broadcast TV.
  - NR broadcast lacks many key AS/RAN features to support 5G terrestrial broadcast TV use case, and would require major redesign, not an option in Rel-18.
  - enTV connected to 5GC is viable option for a Rel-18 5G terrestrial broadcast TV solution.
- It is proposed:
  - In SA2, introduce support for “terrestrial broadcast” connected to 5GC
  - In RAN3, do the necessary changes to connect 5G broadcast to the 5GC.
- The main RAN impact is in RAN3
  - Need to define RAN architecture to support MBSFN
- **Proposal: Introduce necessary changes to connect LTE-based 5G broadcast to 5GC**
  - This requires work in both RAN3 and SA2.



Option with no RAN impacts



Option with RAN impacts

New topic

Enhancement of 5G UE Policy

- Based on study item (eUEPO) objectives that were deprioritised from rel.17

- QC interests
  - URSP rule provisioning and updating procedures for roaming scenario (e.g. different rule handling for different VPLMNs)
  - Investigating whether new triggers for UE Policy (e.g. URSP, ANDSP, etc.) provisioning procedure and whether new procedures are needed, and study the new triggers and new procedures if needed
  - Optimization of the UE Policy (e.g. URSP, ANDSP, etc.) requesting and distribution procedure
  - Investigate if enhancements are needed for provisioning UE with consistent policies across 5GC and EPC when no ANDSF is deployed in EPC.

Other Rel-18 SA2 topics:
QC to contribute if approved

- Enhanced Network Analytics & AI/ML
- 5G MBS
- Enhanced Network Slicing / RAN slicing
- Edge Computing enhancements
- ATSSS enhancements
- NTN IoT
- 5G MBS enhancements

Continued from Rel-17

NTN IoT

- RAN#93 approved rel.17 WID RP-211601
- Satellite IoT access **connected in EPC** will be the scope of rel.17 alignment work
- Possible rel.18 enhancements
  - Enhancements required to support discontinuous radio coverage to enable power efficient operation, including stationary and non-stationary devices, e.g. enhancements to PSM/MICO mode/HLCOM.
  - Enhancements required to support discontinuous backhaul
  - Paging for enhanced coverage, WUS and discontinuous radio coverage, including paging retransmission strategy
  - Impacts in UE signalling procedures due to additional delay (e.g. propagation delay or access stratum delay, such as GNSS fix acquisition) compared to terrestrial NB-IoT and eMTC or due to discontinuous radio coverage
  - Additional power saving functions except those are supported for EPS and 5G system

Continued from Rel-17

Enhanced Network Analytics & AI/ML

- Leftovers of Rel-17 Network Analytics and previously de-prioritized topics
  - New types of outputs provided by NWDAF
  - Possible mechanisms for improved correctness of NWDAF analytics
  - NWDAF-assisted application detection
- New features for UE data collection
  - UE data collection at slice level.
  - UE data collection solution for multiple AF deployment scenario.
- Further NWDAF architecture enhancements
  - May include multiple NWDAF interworking, roaming architecture, data collection from UPF
  - Potential interaction between NWDAF and Non-RIC, RIC that defined in RAN.
- Network analytics assisted steering of roaming for “global SIMs”

Continued from Rel-17

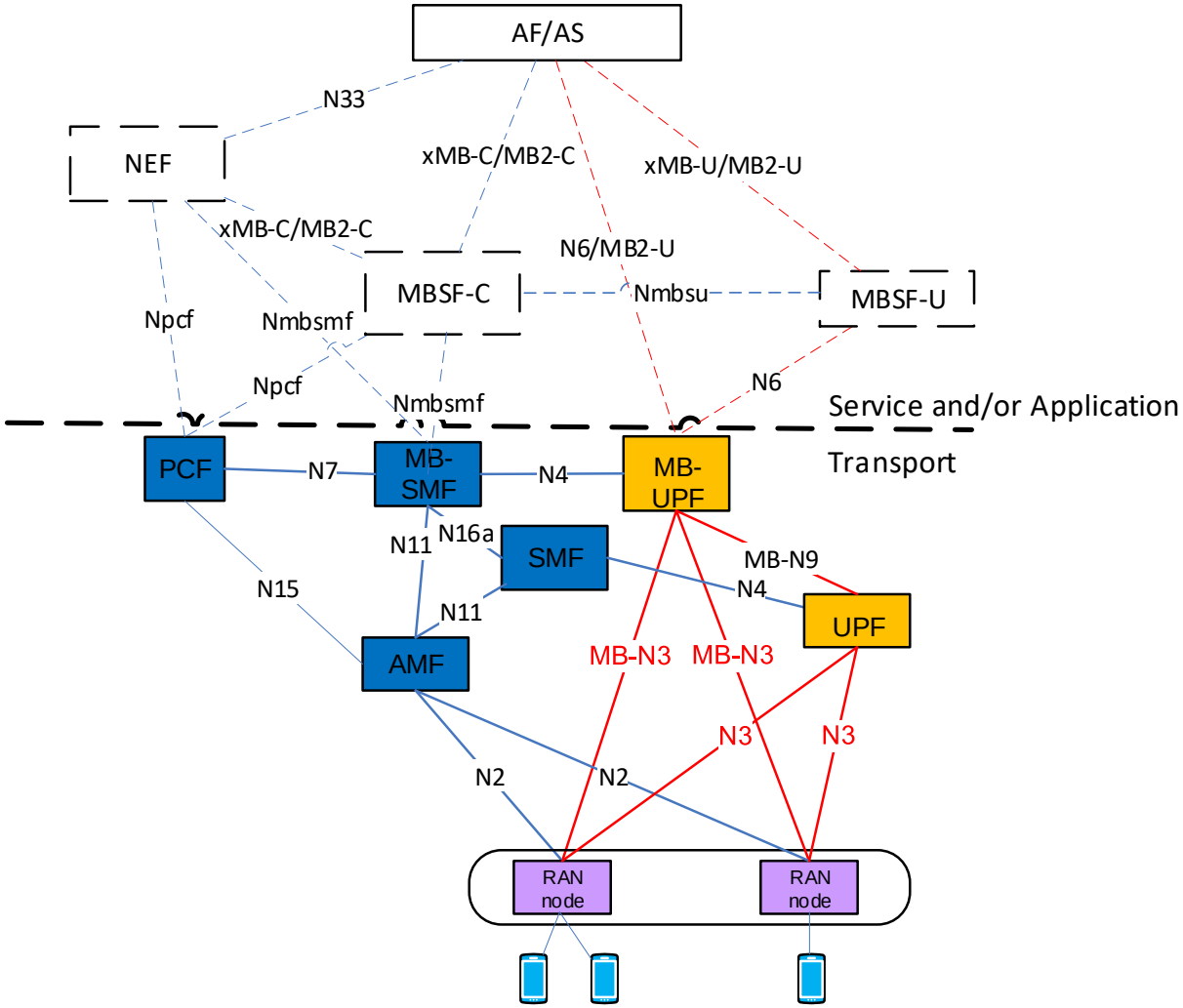
5G Multicast Broadcast Service

Rel-17 MBS

- System Architecture for Multicast Broadcast service.
- Multicast and Broadcast support in 5G
- Service layer based interworking with LTE MBMS

Rel-18 MBS

- Potential continuations from Rel-17
  - Roaming architecture
  - Ethernet broadcast optimizations for IIoT



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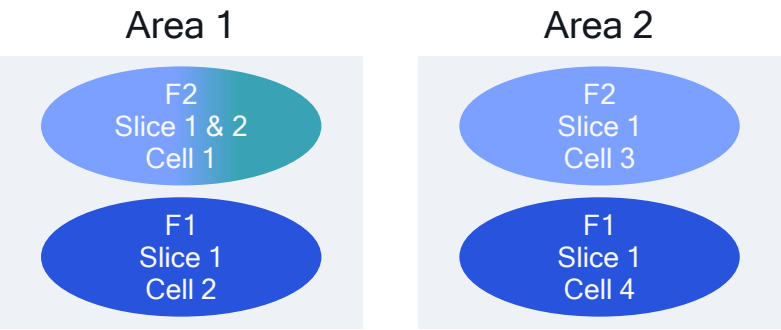
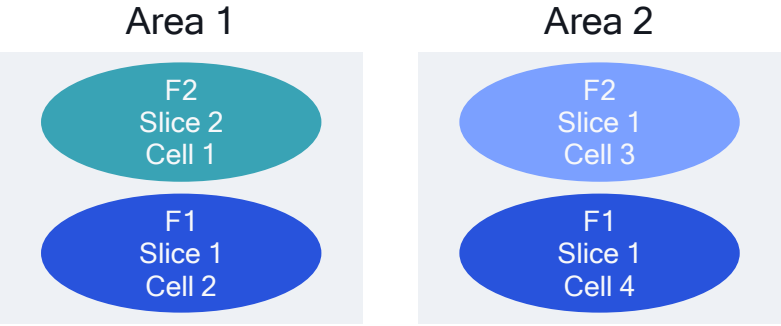
Enhanced Network slicing

Rel-17 RAN Slicing



- RAN centric handling of mobility
  - Allow non-homogeneous support of slices within a registration area
  - Allowed NSSAI based on Rel-17 RAN slicing support
  - NW configuration

Rel-18 RAN Slicing

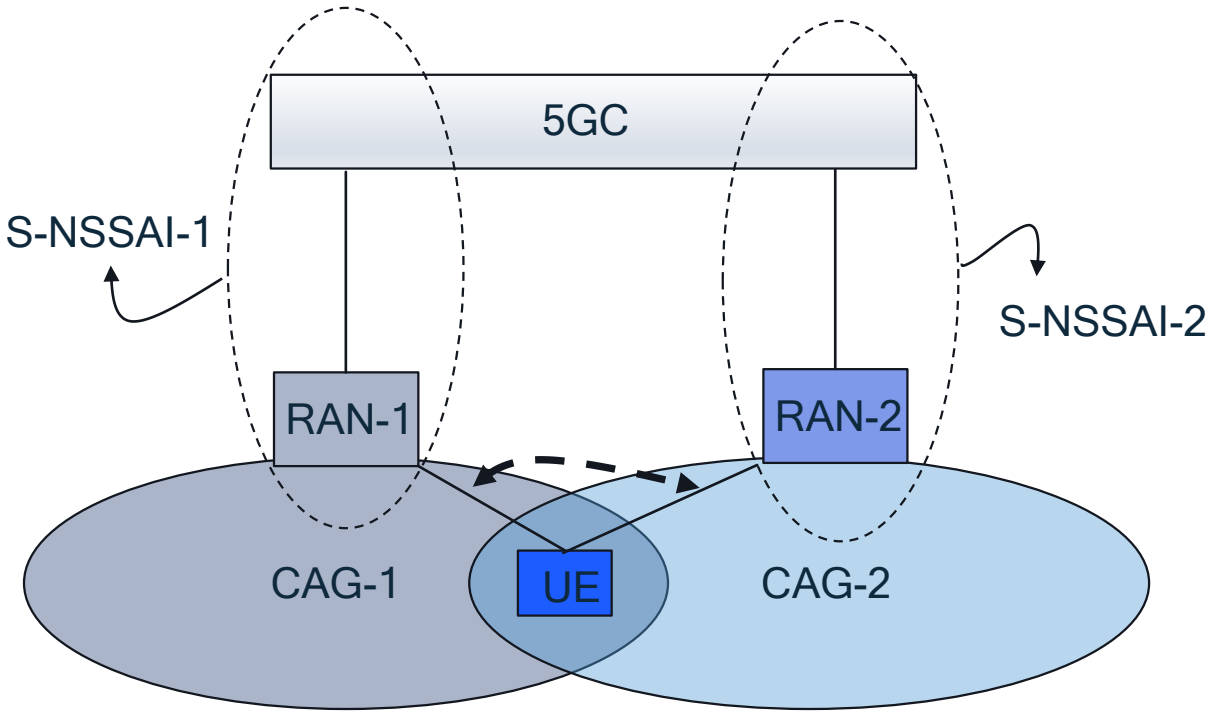


- (Potential) Non-compatible slice support
  - We need to understand impacts to MM/SM from the rel.17 RAN design of non-compatible slice support
    - Slice priority identification and configuration
    - PDU session suspend (as opposed to Rel-17 PDU Session release)
    - Make before break handling of non-available slices
    - Checking of UE radio capabilities vs. compatible slices
- Slice-based NW selection (automatic)
- Human readable name for slice (manual)

Continued from Rel-17

Enhanced Network slicing

Human readable name for slices



Which S-NSSAI is the user connected to?

- User wants to do inventory check in large business park with multiple warehouses each belonging to different business
- Each warehouse has its own PNI-NPN from the same PLMN identified by CAG and S-NSSAI
- Each slice (S-NSSAI) is isolated from each other and gives access to network belonging to specific enterprise
- Overlapping coverage between CAG-1 and CAG-2
- Problem statement
  - How the UE user knows to which PNI-NPN (CAG and S-NSSAI combination) is connected at the time?

Source sample text

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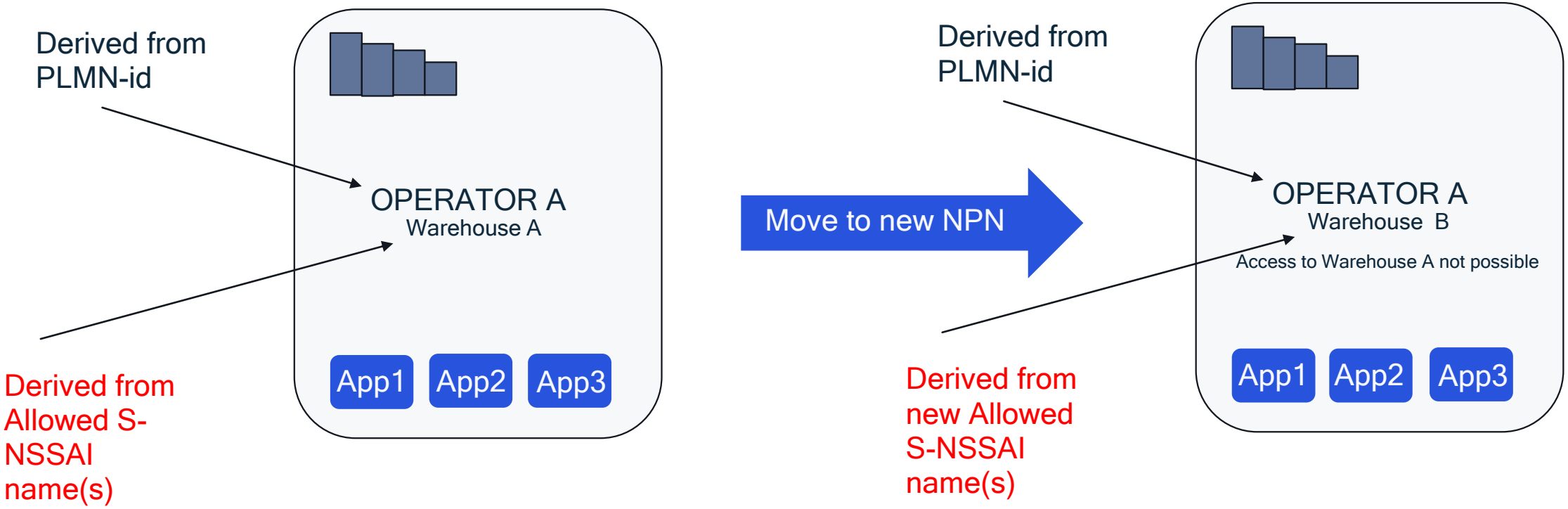
Enhanced Network slicing

Human readable name for slices



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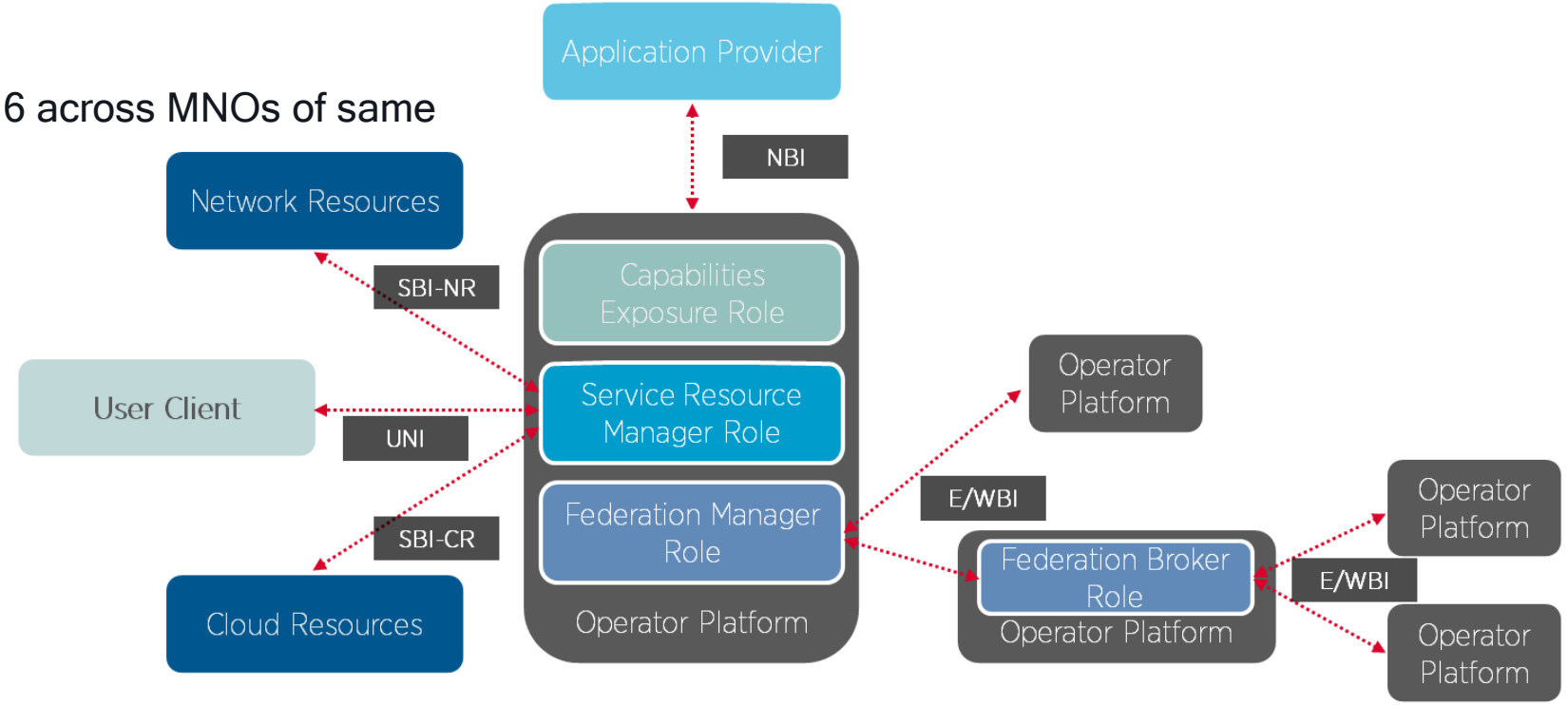
Edge computing enhancements

- QC interests
  - Roaming deployment
    - Extends enhanced support to Home Routed scenario
  - GSMA OPG related work
    - Federated Edge deployments
    - Transport interconnection at N6 across MNOs of same country



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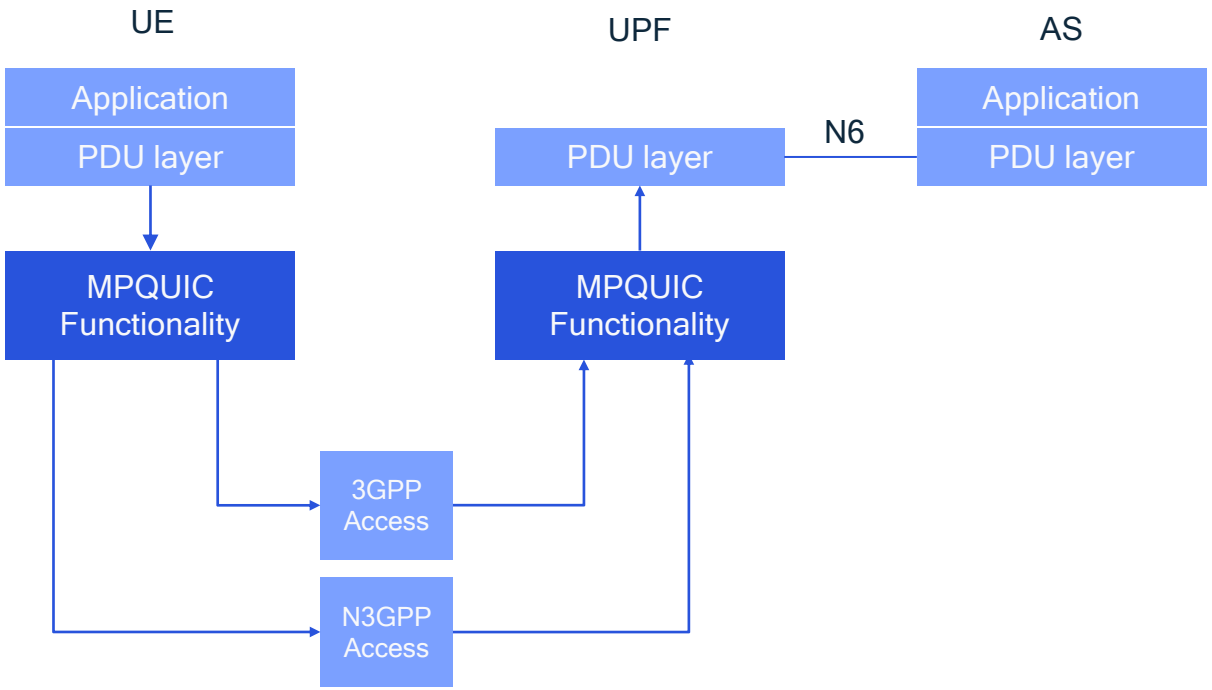
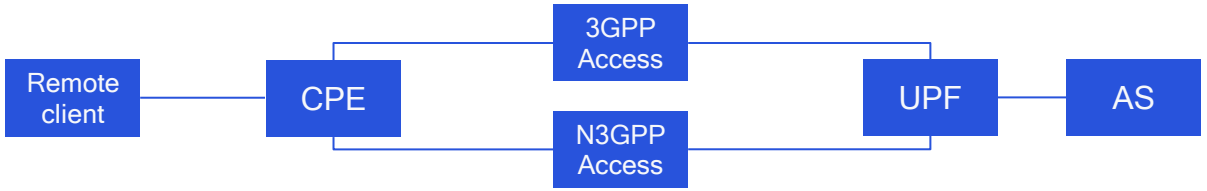
ATSSS – Access Traffic Steering, Splitting, Switching

- QC interests
  - ATSSS support for 2 3GPP accesses from same PLMN or 2 PLMNs or PLMN+SNPN
  - Details of Lower Layer MPQUIC steering functionality (from Rel-17)
    - Analysis of PMF measurement requirements
    - Reflective QoS
  - Potentially, ATSSS for Customer Premises Equipment (CPE)
    - Steering methods to consider also measurements on leg behind CPE?





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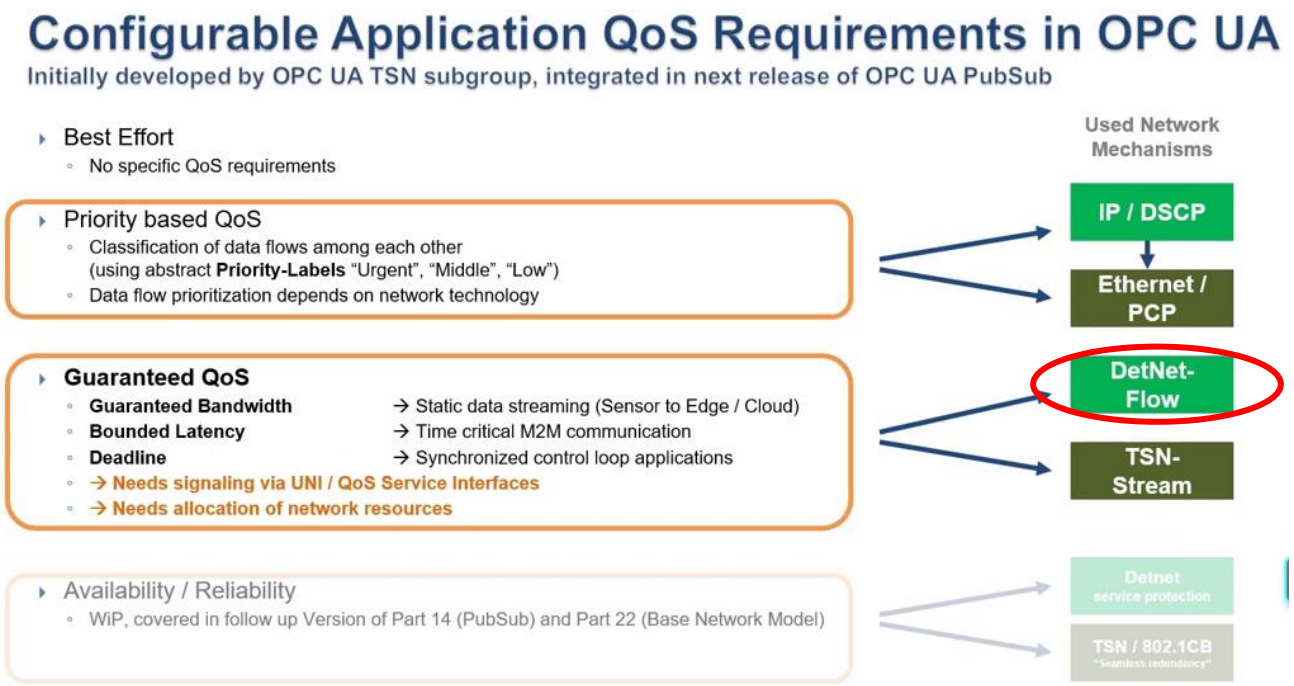
5GS integration with IETF DetNet

- OPC Foundation foresees DetNet to enable IP-based QoS for OPC UA PubSub, e.g., for heterogenous network deployments (see also https://opcfoundation.org/about/opc-technologies/opc-ua/opcua-roadmap/)
- DetNet support can be added to 5GS by
  - reusing Rel-17 enhancements for time sensitive communication (no additional user-plane functionality needed)
  - mapping from DetNet control-plane to 5GS control-plane (mapping of traffic profile and flow specification to 5GS QoS parameters and TSCAI)