中国移动 China Mobile

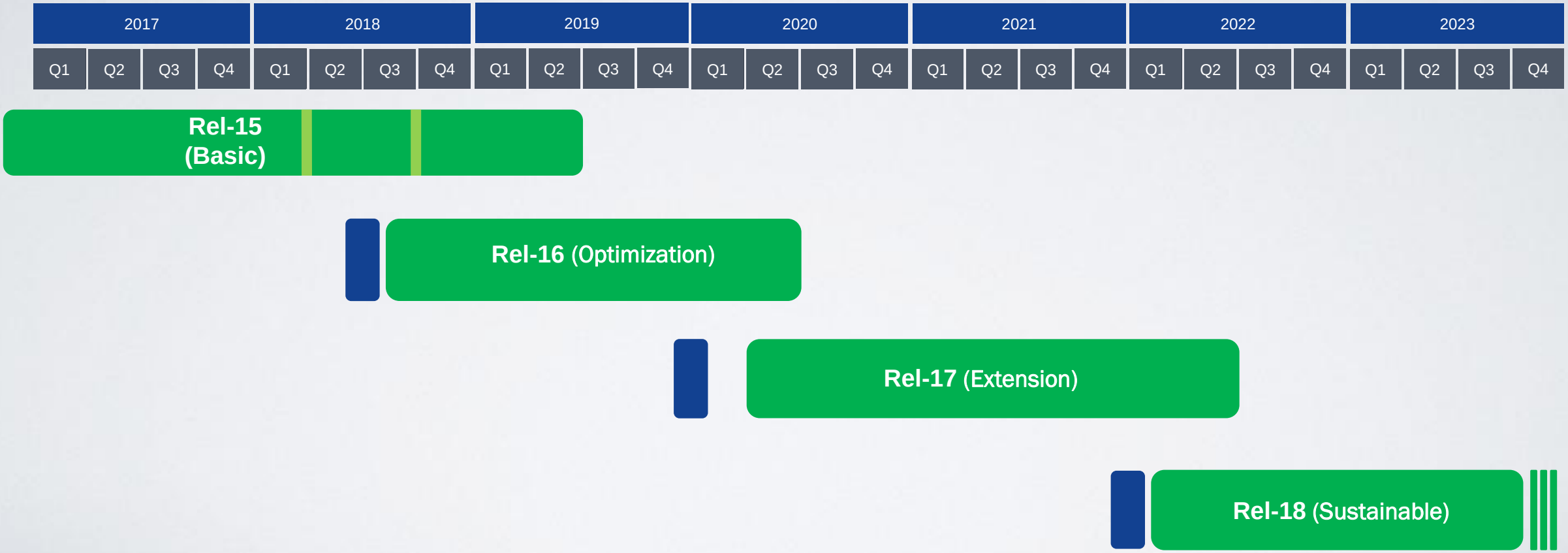
3GPP TSG RAN Rel-18 workshop
Electronic Meeting, June 28 - July 2, 2021

RWS-210342

CMCC views on Rel-18 Non-eMBB-driven Functional Evolution

Agenda Item: 4.2
Source: CMCC

R18 EVOLUTION: 5G ADVANCED



R18 Evolution	
eMBB	Frequency combination based elastic cell, MBS enhancement, SON/MDT further enhancement, ATG, HBS (Home Base Station), Smart repeater
Non-eMBB	URLLC through dual UEs, RSU-like network node, Inter-UE Handover or Replication for Same User, Further enhancement of RAN slicing, Requirements from automotive industry
Cross-Functionalities	Full duplex, UE aggregation, Network energy saving, AI/ML enabled RAN

Outline

- URLLC through dual UEs
- RSU-like network node
- Inter-UE Handover or Replication for Same User
- Further enhancement of RAN slicing
- Requirements from automotive industry

URLLC through dual UEs(1)

Scenarios

- One important objective of 5G is to enable connected industries are as follows,
  - Motion control
  - Control-to-control communication for industrial controller communication for industrial controller
  - High data rate video for monitoring/ diagnostics
- The scenarios are prevalently exist in factory automation, transport industry and Electrical power distribution automotive

PLC

Freight Forwarding

AGV

Motivations

- To ensure the high reliability, URLLC was introduced in Release 15, further enhanced in Rel-16/Rel-17
  - But it still faces the challenge of failing to meet the high reliability depends on the successful reception just relying on only one terminal in real scenarios, e.g. sudden machine breakdown, or suffering intensive interference
- Therefore, actually, multiple terminal is deployed and utilized to receive repetitive content to ensure the reliability as backup
  - This results in high cost of existing backup mechanism for high reliability, e.g., battery consumption, radio resource, transport resource, and processing resource and redundant signalling/data overhead

URLLC through dual UEs (2)

Potential Enhancements

- The UEs are deployed as real-time backup to each other
  - The UEs can determine whether to take over or start/activate the data/signalling transmitted/received by associated UE for backup
    - Depending on the associated terminal's state
      - i.e. whether the data/signalling can be still successfully received by the associated terminal or not
  - Under normal circumstances, UE and paired UE are responsible for different services respectively
  - If the data/signalling can not be successfully received by the UE, then the subsequent paired UE action is that the paired UE is to take over or start/activate the service(s) of the terminal1 declaring in abnormal state
  - In this case, how to ensure the minimal UP interruption and rapid completion of data forwarding between Ues and reduce the transmission overhead will become an issue to be addressed

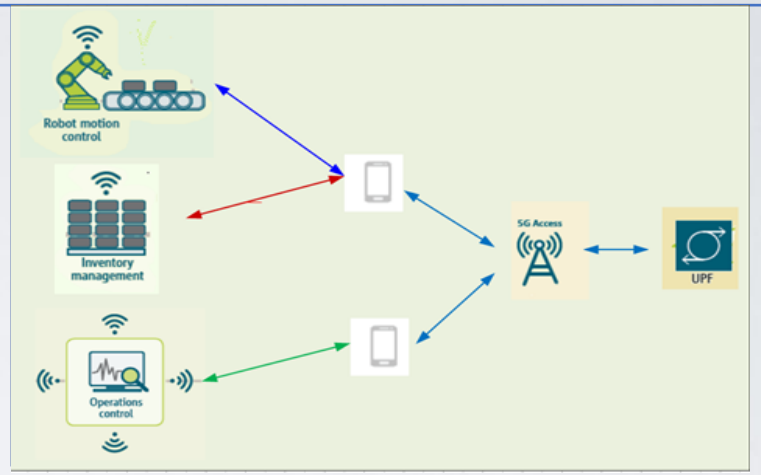


Fig. Real time multiple-UE backup in normal case

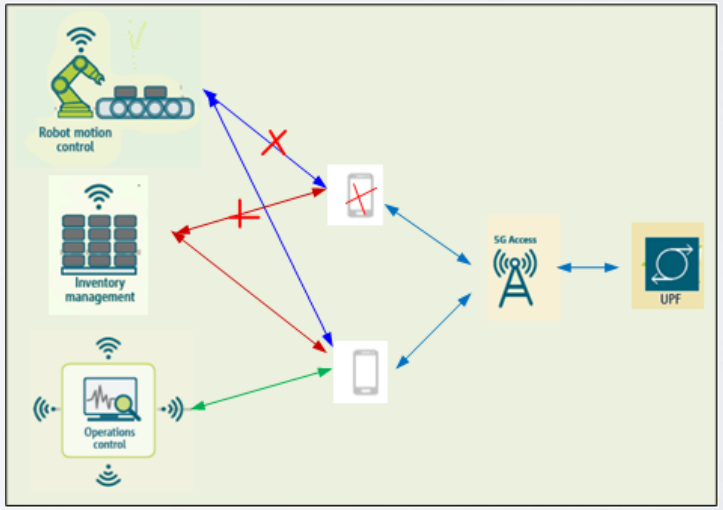


Fig. Real time multiple-UE backup in abnormal case

URLLC through dual UEs(3)

Potential Objectives

- Study the use cases and benefits of real-time multiple-UE backup
- Study necessary procedures and/or information to support for real-time multiple-UE backup of data/signalling delivery and reception (e.g. how a given UE to determine whether to take over or start the data/signalling transmitted/received by associated UE for backup) without data disorder or data duplication
- Identify required specification changes on the group scheduling options to allow multiple UEs to receive signalling/data in Multicast mode
- Study the support for basic mobility with service continuity
- Identify required specification changes on the RAN that the necessary coordination function (e.g., heartbeat packet between the involved terminals, if any) amongst the associated UEs for backup, considering the results of the NR Sidelink

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RSU-like network node

Motivations

- To ensure the network coverage, especially for indoor scenario, pico-RRU-BBUs are deployed, which is not cost effective. Instead, we could consider RSU-like network node plus lite gNB to support low cost flexible deployment and reduces the air interface latency, achieves network controlled traffic balance/local breakout between PC5 link and uu connection.

Potential Objectives

- NR sidelink relay in Rel 16 and 17 can be reused as baseline
- Serving RSU-like node / gNB selection criterion and procedure
- Connection establishment procedure (PC5 and connection between RSU and gNB)
- Network Interface design between RSU and gNB
- Service continuity (mobility between RSUs and direct Uu) and dual connectivity
- Network controlled traffic balance/local breakout between PC5 link and uu connection

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Inter-UE Handover or Replication for Same User(1)

Motivations

- User are no longer just own smart phone and computer, but are now owns several devices for communication for various requirement in different scenarios
- This requires the network can enable the users to initiate, handover (transfer/ switch), or sometimes replicate communication streaming (e.g. video, speech, audio) between multiple devices of the same end-user for a variety of reasons
- Moreover, this requires the service/traffic/packet can be switched among different type devices of a same end-user
  - in seamless and lossless mode

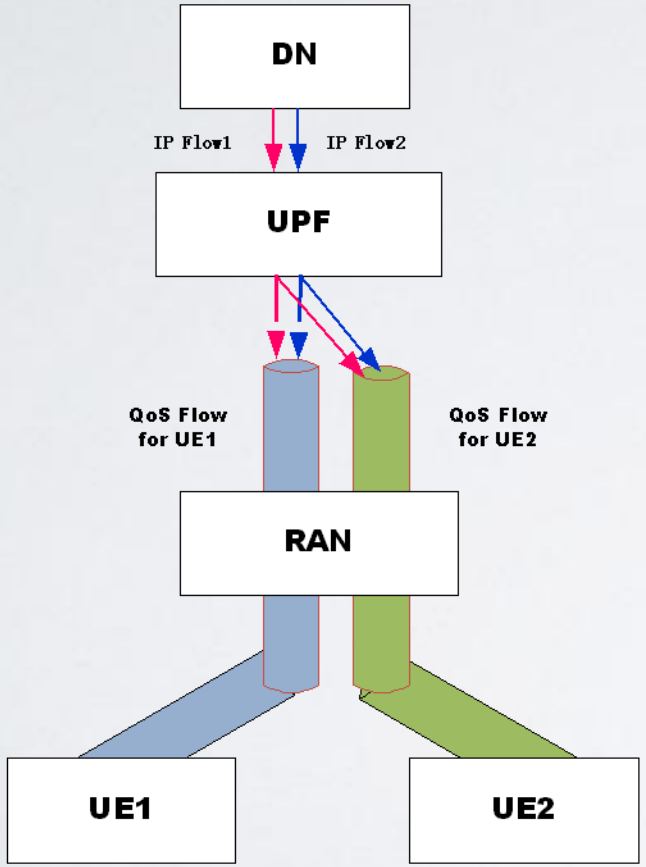
Use cases

- A User is having a call (audio/video stream) on his mobile while he is goanna to get on a car. After getting on the car, then he would like to switch the connection with the network for the video stream from his mobile to another device equipped in the car that belongs to him, and transfer the data of audio/video steam from his mobile to another device equipped in the car as well.
- A User is listening to his favorite music on line on his mobile while he is goanna to a jog. After start the jog, then he would like to switch the connection with the network for the music stream from his mobile to the smart watch, and transfer the data of music steam from his mobile to smart watch as well.
- A User is watching a video on her mobile while coming home. After arriving at home, he starts to clean the rooms and need to frequently moving amongst the rooms in the house. In this case, the user starts the replicate the data of video steam on her mobile to the other devices located in each room in the house, and keep the synchronization of the data of video steam amongst the other devices.

Inter-UE Handover or Replication for Same User(2)

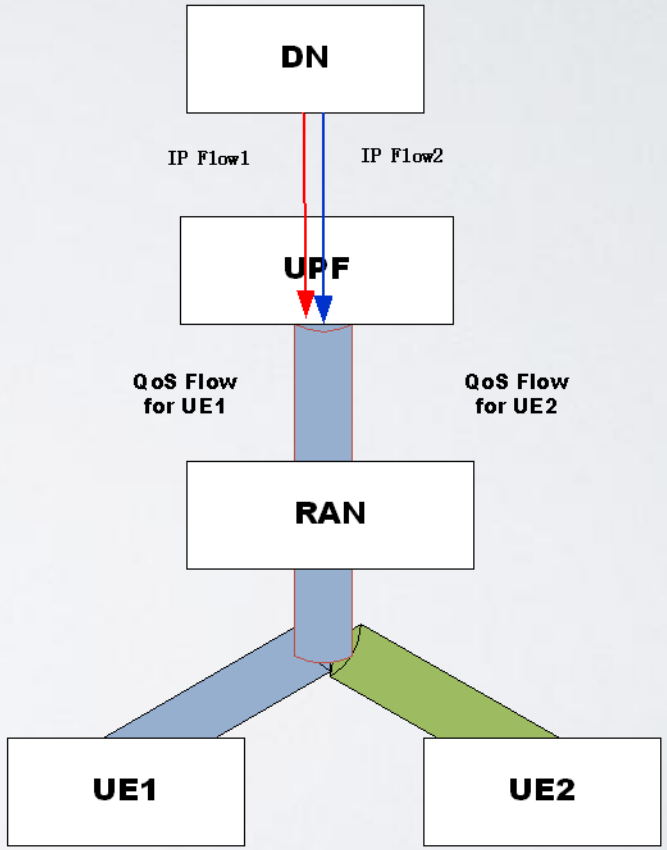
Potential Enhancements

- CN is response for the transfer/replication of the data via the separate tunnel to the associated devices



CN-based approach

- RAN is response for the splitting/ transfer/replication of the data from the shared tunnel with separate DRB to the associated devices



RAN-based approach

Inter-UE Handover or Replication for Same User(3)

Potential Objectives

- The objective of this SI is to investigate how to handover/replicate at the RAN-level or Core Network level of all or some of the services between UEs under the control of the same end-user while maintaining service continuity. The specific objectives of this study item are as follows
  - Target device(s) discovery [RAN2]
  - Study the control plane procedure design, including RRC connection management, paging mechanism and access control for initiating inter-UE handover and replication for the same end-user. [RAN2, RAN3]
  - Study user plan functionalities that will support data forwarding/data replication of communication data amongst multiple devices of the same end-user. [RAN2, RAN3]

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Further enhancement of RAN slicing--Motivation

There is ongoing WI of *"Enhancement of RAN slicing for NR"* in RAN. RAN2 is discussing on the slice specific cell reselection and RACH configuration. And RAN3 objectives which are related to slice service continuity are to be added according to the SI conclusions in Jun 2021. In this contribution, we share some initial thinking and may be updated based on the outcome of Rel-17 WI.

It can be foreseen that, some R17 leftover issues can be further discussed in Rel-18. In RAN2, MO triggered slice based reselection was de-prioritized and can be further studied. In RAN3, solutions for slice remapping decisions in NG-RAN may be considered in next release.

SA1 also working on an WI "*Enhanced Access to and Support of Network Slice"* which captures some consolidated potential requirements to meet Rel-18 new use cases. One of the requirements that UE fast access to suitable slices when multiple slices are deployed on different frequencies, is currently under discussion in RAN2 slicing WI. After RAN2's stage 3 specification becomes more clear, we can check whether SA1's requirement can be met by RAN2 specification or need further enhancement in Rel-18.

SA2 also have several SID proposals on Rel-18 slicing enhancement but haven't been approved for now. We think Rel-18 slicing enhancement in RAN should also take SA2's new SID into consideration.

Further enhancement of RAN slicing--Objectives

Further enhancement of RAN slicing for NR in Rel-18

- Leftover issues in Rel-17
  - MO triggered slice based cell reselection, which was de-prioritized in Rel-17 RAN Slicing WI. [RAN2]
  - For non-supported slice by target NG-RAN node in case of inter-RA mobility scenario, the solutions to support slice remapping for which the remapping decision is made in NG-RAN node as described in TR 38.832, section 6.2.1 can be considered if end-to-end feasibility is addressed. [RAN3]
  - For non-supported slice by the serving cell, the solutions to support UE to access to the intended slice by setting up DC or CA can be considered.

- Corresponding work to meet SA1 R18 requirements to enhance UE access to the slices, such as
  - UE fast access to the slices that deployed on different frequencies, and minimize service interruption time when UE changes the access from one slice to another.
  - Note: This part can be reviewed after R17 RAN slicing WI is concluded.

- Potential RAN impacts of SA2 slicing enhancement in Rel-18
  - To be added after SA2 Rel-18 proposals are approved.

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Requirements to URLLC, Positioning and Perception for Automotive Industry

Automotive industry expects to deploy one single 5G network to provide capabilities of URLLC connection, positioning and material perception.

	Requirements for 5G Advanced
URLLC	• **Low latency and high reliability at high density factory:** 4ms, 99.9999% @ 400UE/5000m^2
Positioning	• **Accuracy for NLOS indoor scenario:** 0.1m(Horizontal)@90%, 0.5m(Horizontal)@99.99% • **Battery life:** ~ 1 year • Low positioning interruption time when switching from indoor cellular positioning to outdoor GPS positioning.
Perception (passive IoT)	• **Coverage capability:** communication distance should support more than 30 meters to construct a feasible network coverage in the 5000 m^2 warehouse. • **UE power consumption:** <0.1mW to support working without battery. • **Low cost:** <0.1 ¥ (~0.02$) to meet cost-sensitive applications. • **Positioning accuracy**： 3~5m(Horizontal&Vertical) @90% for positioning .

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THANK YOU !