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RWS-210016

3GPP TSG RAN Rel-18 workshop

Electronic Meeting, June 28 - July 2, 2021

Agenda Item: 4.2

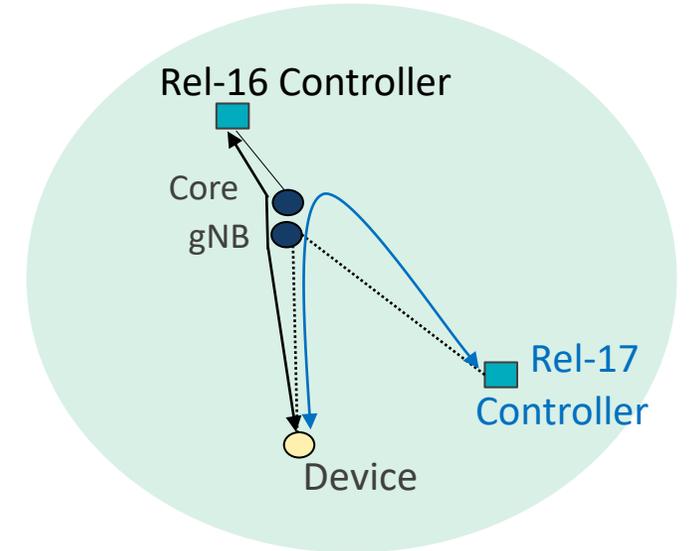
On NR for Wireless Controller and Other IIoT Services

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5G

Background: Rel. 16/17 NR support for Industrial IoT

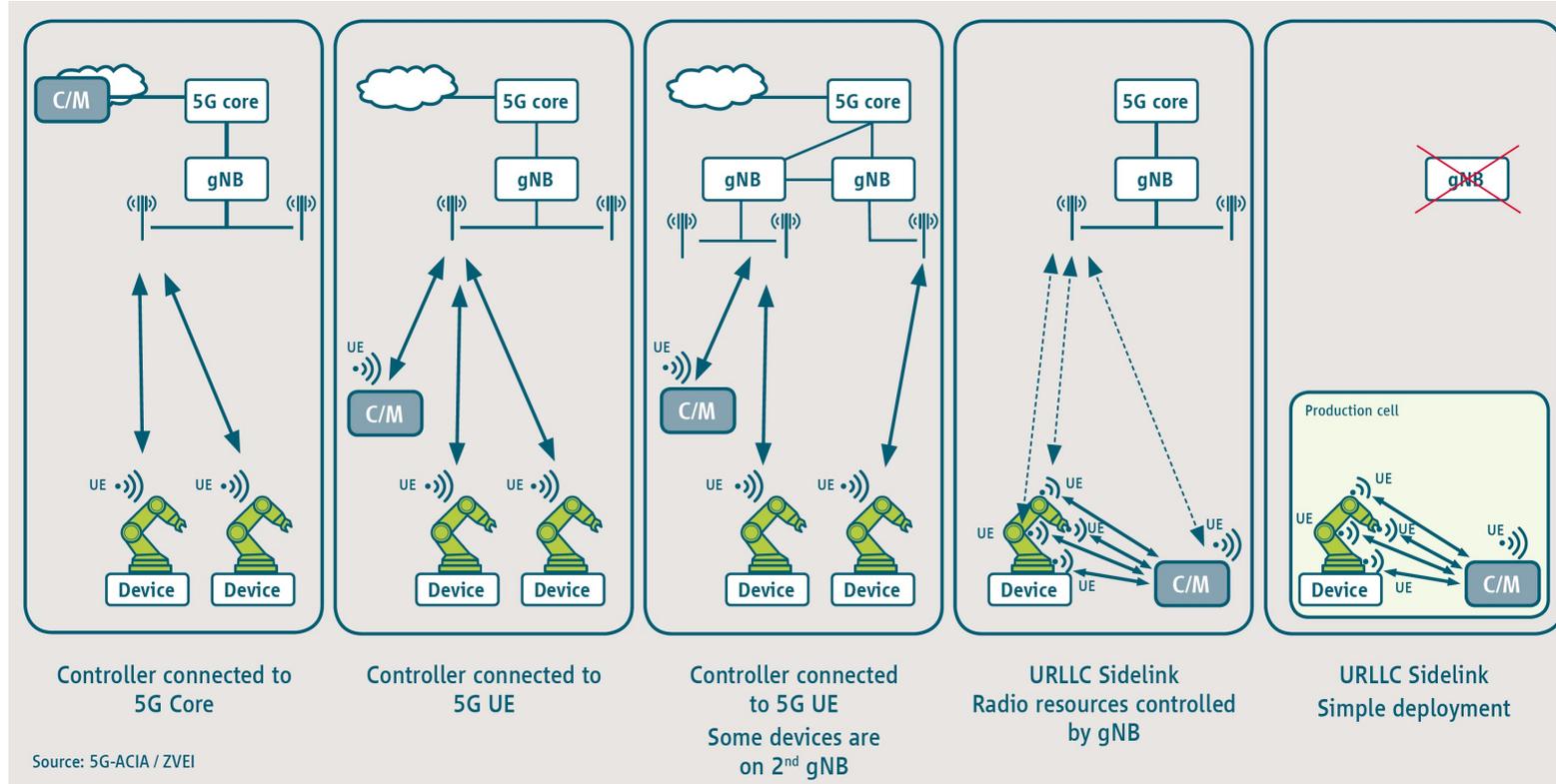
- Stringent requirements for Controller–Device communication over 5G URLLC
 - E2E Latency as low as 0.5ms with strict reliability targets
 - NR Rel-16 and Rel-17 provide support for this use-case
- Rel-16
 - Controller is wired to data network above Core
 - Time synchronization can be delivered from controller to device in downlink direction
- Rel-17
 - Both controller and device connected via 5G wireless links
 - Controller and device can communicate via two hop wireless communication via 5G network
 - Time synchronization can be delivered from controller to device (one uplink hop and one downlink hop)



Motivation-1: Direct link for Controller-Device communication

Sidelink for Wireless Industrial Controller is an evolutionary step

- Direct link was considered in 5G-ACIA
 - Figure from [5G-ACIA](#) shows potential evolution in Rel-18
- Direct link can utilize spectrum more effectively
 - Reuse spectrum across different controllers
 - Greater delay budget per link allows more efficient rate control and HARQ (2-hop communication via gNB has only half the delay budget)
 - Reliability via use of Uu or direct link based on link conditions



- Key Principle: Introducing sidelink based Controller-device communication improves spectrum utilization

Rel-16

Rel-17

802.1AS timing source connected to UE
Routing 802.1 frames from one UE to another UE

Rel-18

(Proposed)

Better efficiency and latency using sidelink gNB control to ensure reliability

Not a focus area

Challenge: Spectrum mgmt. and reliability assurance without gNB

Motivation-2: New IIoT Services based on Sidelink

- [TS 22.104](#) discusses new IIoT services enabled through ProSe (Proximity Services - Sidelink)
- Cooperative carrying: Multiple mobile robots need to coordinate moving large work piece (22.104, Section 7, A.2.2.5)
 - Stringent latency/reliability requirements
- URLLC-capable sidelink would allow direct communication/coordination among mobile robots
 - Allows better latency and higher efficiency, i.e., direct communication instead of 2-hop via gNB



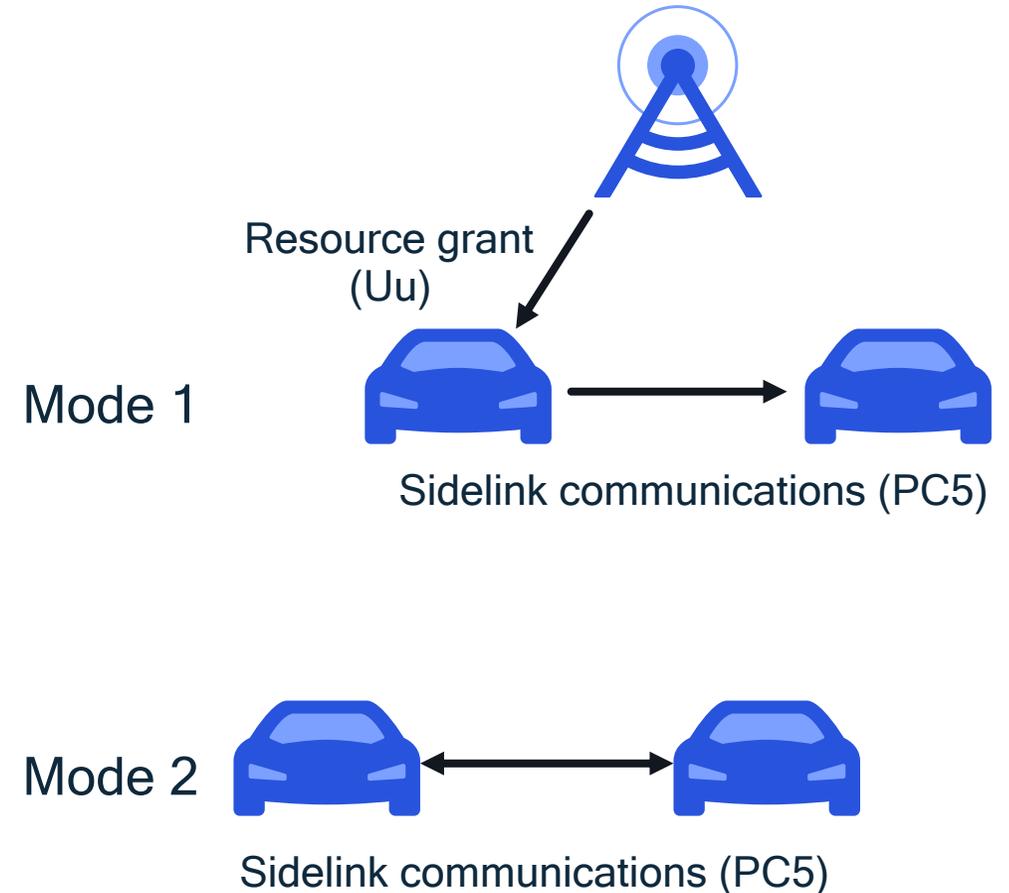
From Figure A.2.2.5-1 (22.104)

	UE to UE
E2E latency	5ms, 2.5ms, 1.7ms
Reliability	1e-6 with survival time up to 2 packets
Pkt Size	250-500 bytes
Max UE speed	6-12 Km/h

From Table 5.2-1 (22.104)

Background: 3GPP Status of Sidelink

- Rel. 16 Sidelink predominantly driven by C-V2X
- Two modes of operation:
 - Mode 1: gNB controlled
 - gNB resource allocation to SL-Tx through DCI 3_0 for DG, CG
 - Open-loop power control
 - Mode 2: autonomous operation
 - Sensing for occupied resources
 - Resource selection for new SL-Tx
 - Common signaling across 2 modes
 - Support for broadcast, groupcast, unicast
- Rel. 17 expands to other use-cases: Public safety, commercial, Relaying
 - However, Rel-17 did not consider: Ultra-reliability with low latency, Time-sensitive communication with precise time synchronization



Conclusions

Proposed new study item for RAN Rel-18

- Study NR enhancements to support direct link for Industrial IoT use-cases
 - Study spectrum utilization and other performance aspects
 - Baseline Rel-17 Uu with two-hop communication via gNB (which can utilize higher antenna-count and power available at gNB)
 - Potential enhancement where flows with good sidelink quality utilize one-hop sidelink communication
 - Support features needed to support new Cooperative Carrying use-case from SA1
 - Study feature gaps in supporting time-sensitive communication over sidelink
- Identify scenarios and requirements from a RAN perspective
- Identify & evaluate solutions



Thank you!

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