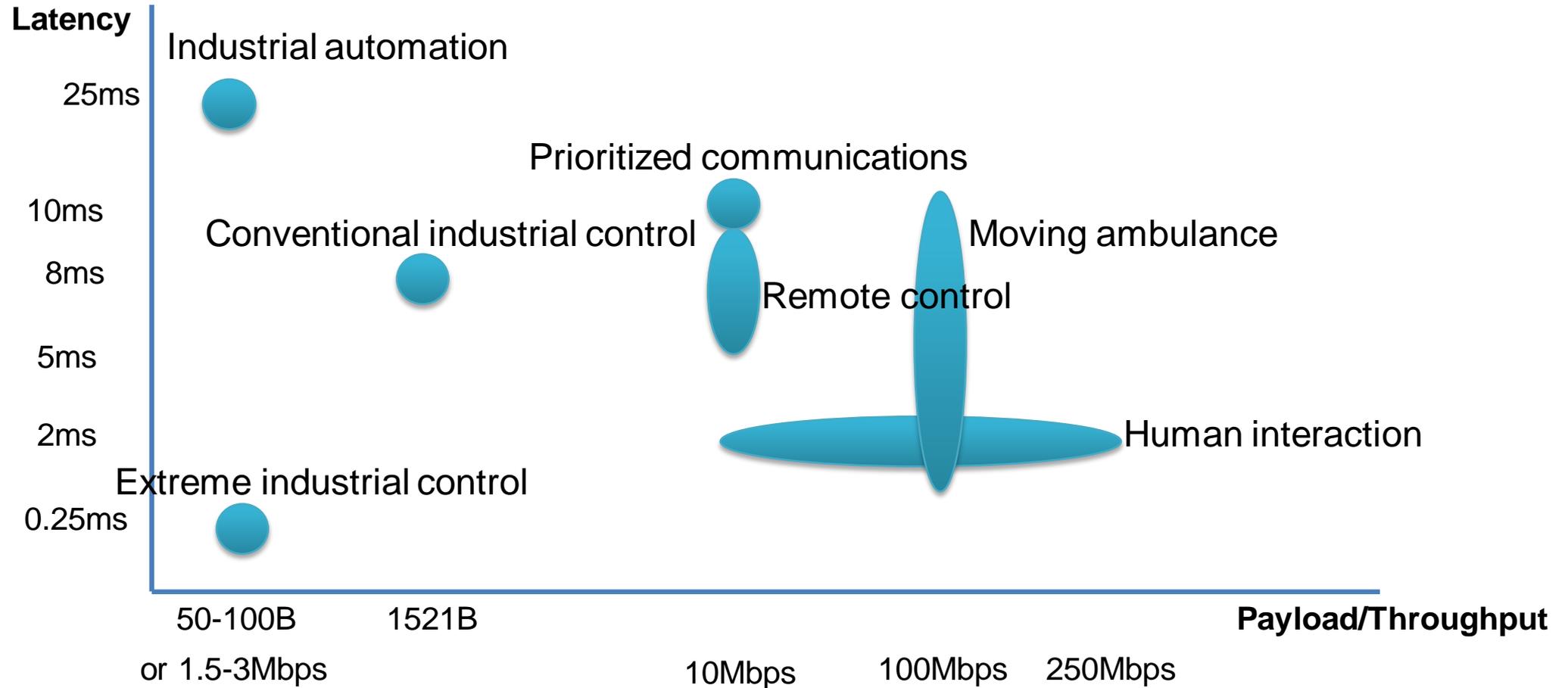




RP-162206

**Motivation for new work item on LTE enhancements for
high reliability with low latency
Huawei, HiSilicon**

URLLC Use Cases in 3GPP (22.862)



URLLC requirements for the target use cases



■ Characteristics of URLLC use cases

- Higher Reliability (>99.999%) & lower E2E latency for both UL & DL
- Mainly medium-small packets <100B
- Coverage everywhere
- Fast connection setup required

■ Requirement: A general URLLC reliability requirement for one transmission of a packet is 1-10-5 for 32 bytes with a user plane latency of 1ms. [38.913]

- Reliability can be evaluated by the success probability of transmitting X bytes within a certain delay, which is the time it takes to deliver a small data packet from the radio protocol layer 2/3 SDU ingress point to the radio protocol layer 2/3 SDU egress point of the radio interface, at a certain channel quality (e.g., coverage-edge).

High reliability with low latency in LTE

- As a candidate technology for ITU Submission, LTE evolution is expected to meet the key IMT-2020 requirements including the one for URLLC.
- The Rel-14 WI on “L2 latency reduction” and the ongoing WI on “shortened TTI and processing time for LTE” provided the solutions for L1/L2 latency reduction. These solutions can be used in URLLC for low latency.
- URLLC related study is ongoing in NR SI and is expected to be completed by the Rel-14 time frame. It is recommended to reuse the evaluation results and the agreements which are suitable for LTE. Solutions identified in the NR URLLC study can be used in this WI if they meet the following conditions:
 - The solutions do not require the change of key LTE feature such as the frame structure and the numerology
 - The solutions are backward compatible with existing LTE system

Design Requirements

- **Resource efficiency is an important metric**
 - Repetition transmission is one direct way to improve the reliability but it may consume large resources
 - Solutions with higher efficiency can be considered, such as
 - HARQ with fast feedback
 - fast retransmission
 - exploiting frequency/spatial/time/carrier/site diversity
 - accelerated SDU delivery
 - potential enhancement of ARQ mechanism
- **The design should support the multiplexing of URLLC and eMBB in the same carrier**
 - URLLC itself can have different QoS requirements
 - Resource efficiency for eMBB and URLLC should be jointly optimized
- **Communication reliability depends on all involved physical channels**
 - The correctness of DL data reception is related to DL control channel/ DL data channel/ HARQ feedback (if any)
 - The correctness of UL data reception is related with UL data channel/ Scheduling Request/ UL grant channel (if any)

Objectives

- **Support higher reliability transmission of all the related channels within low latency restriction (RAN1, RAN2)**
 - HARQ mechanisms to enable fast scheduling, feedback and retransmission
 - The selected data channel coding schemes should either be the channel coding schemes that have been supported in the existing LTE system, or if needed, reuse the data channel coding schemes to be specified for 5G NR system.
 - Necessary mechanisms to exploit the full diversity in frequency, spatial, time, carrier (by carrier aggregation), site (by dual connectivity) domain within delay bound
 - Enhancements on control channels and physical layer procedures to accelerate the transmission, such as:
 - Enhancements on scheduling request for quick data processing
 - Grant-free for both UL and DL, with semi-static resource reservation.
 - Statistical multiplexing with restricted resource sharing can also be considered.
 - The mechanisms should consider all the involved channels in both DL and UL, e.g., PDSCH, PDCCH, HARQ feedback, PUSCH, SR, etc.
- **Support multiplexing of eMBB and URLLC on the same carrier (RAN1)**
 - The multiplexing manner should guarantee the URLLC requirements and minimize the impact on eMBB performance
 - It should be taken into account that URLLC can have different QoS requirements
- **Related user plane enhancement, e.g. accelerated SDU delivery, potential enhancement of ARQ mechanism etc**
- **Potential measurement enhancements for supporting URLLC in the system (RAN1, RAN2, RAN4)**

Thank You

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