

RAN #72, Busan, Korea, June 13 - 16, 2016

AI 10.1.1

RP-160871



MOTIVATION FOR WORK ITEM ON SHORTENED TTI AND PROCESSING TIME FOR LTE

Ericsson

WHY LATENCY?



› Latency important KPI and requirement:

- **Monitored** by users just as throughput
- Enabler for Critical MTC (**C-MTC**), e.g. smart grid and robotics
- Important during **TCP slow start**: during this phase the TCP rate is determined by the number of TCP ACKs → High ACK rate gives high rate
- **5G requirement**: LTE-evo needs low latency to fulfil 5G requirements (**3GPP 38.913**)
 - › User plane latency **<0.5ms** end-to-end
 - › **Reliability 99.999%** in **<1ms**



LATENCY REDUCTION SI



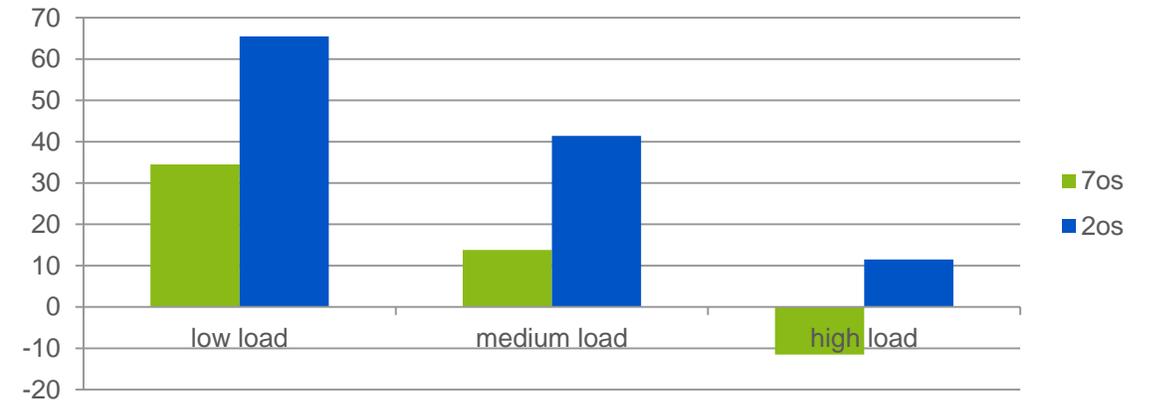
- › SI on Latency reduction ([TR 36.881](#)) finalized in RAN1 until RAN #72
- › Conclusion:
 - Significant latency reduction can be achieved by a combination of [shortened TTI](#), [fast control and feedback](#), and [reduced processing time](#)
 - Throughput gains can be observed for e.g. FTP download
 - [For FS1, TTI length of 2 and 7 symbols](#) recommended for DL, and 2, 4, and 7 symbols for UL
 - [For FS2, TTI length of 7 symbols](#) recommended for DL, and 7 symbols for UL

LATENCY PERFORMANCE

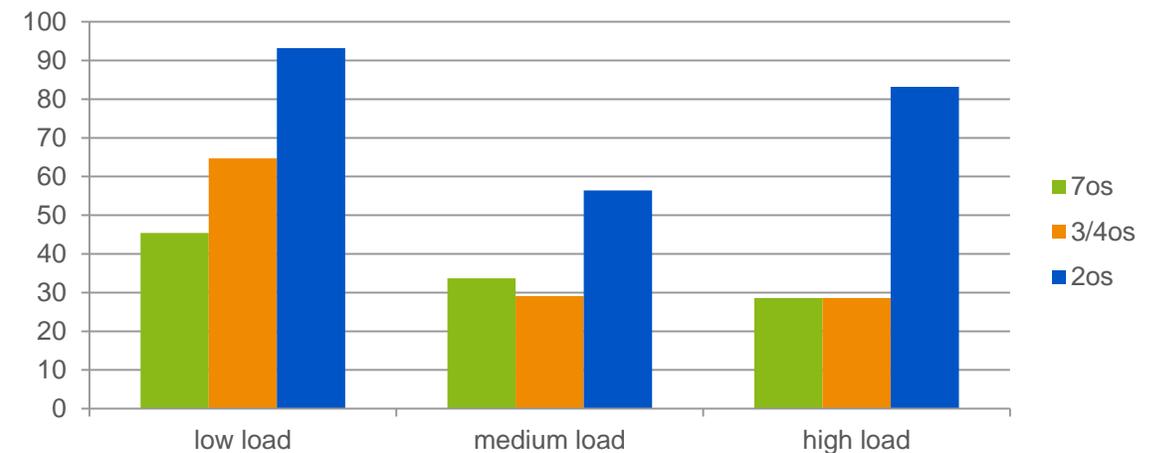


- › Significant throughput gains are achieved with both reduced latency and reduced processing time
 - Evaluated scenario according to TR 36.881 (FS1)
 - › Median user throughput
 - › Linearly decrease in processing time

DL throughput [%]



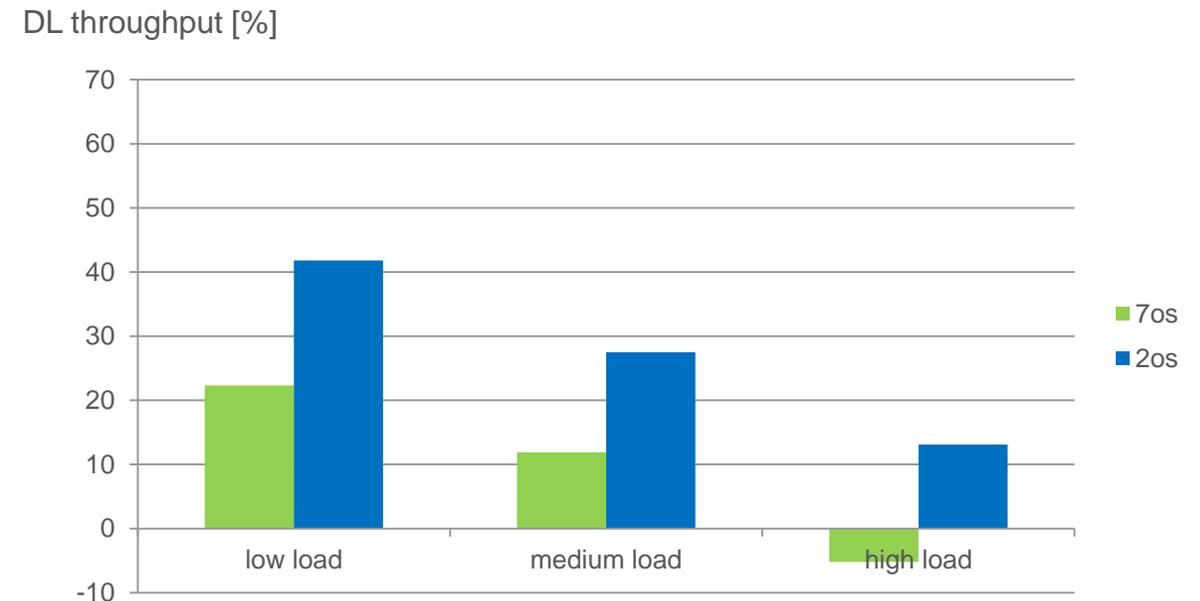
UL throughput [%]



LATENCY PERFORMANCE



- › Significant throughput gains are achieved with reduced latency even if processing time cannot be linearly scaled
 - Evaluated scenario according to TR 36.881 (FS1)
 - › Median user throughput
 - › Non-linearly scaled processing time
 - 70 os HARQ RTT for slot based TTI
 - 32 os HARQ RTT for 2 symbol TTI



LATENCY PERFORMANCE



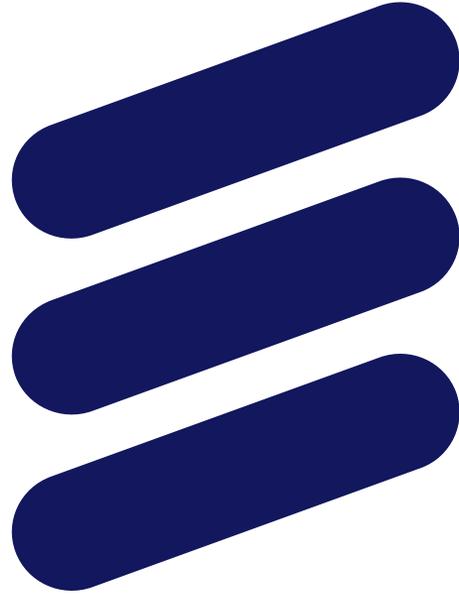
- › Minimize one-way end-to-end latency:
 - TTI alignment + transmission = 1.5 TTI
- › Aim with TTI of 2 symbols to fulfil the 5G requirement

WORK ITEM OBJECTIVES



› The objectives of the WI are:

- Specify support for **shorter TTI** for unicast transmission in **DL and UL** and corresponding **fast control and feedback** based on the recommended TTI lengths from SI.
- The specified solution should cover **FS1, FS2 and FS3**.
- For the specified shorter TTIs the **processing time and TA should be reduced** according to the recommendations from SI.
- Note that the specified solutions shall preserve **backwards compatibility** (thus allowing normal operation of pre-Rel 13 UEs on the same carrier).



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