3GPP TSG RAN Meeting #101
Bangalore, India, September 11--15, 2023

Agenda Item: 8A.2.15
Source: Siemens
Document for: Discussion

RP-232529

Vertical Requirements on RAN Rel-19 for Industrial 5G – **Time Synchronization**

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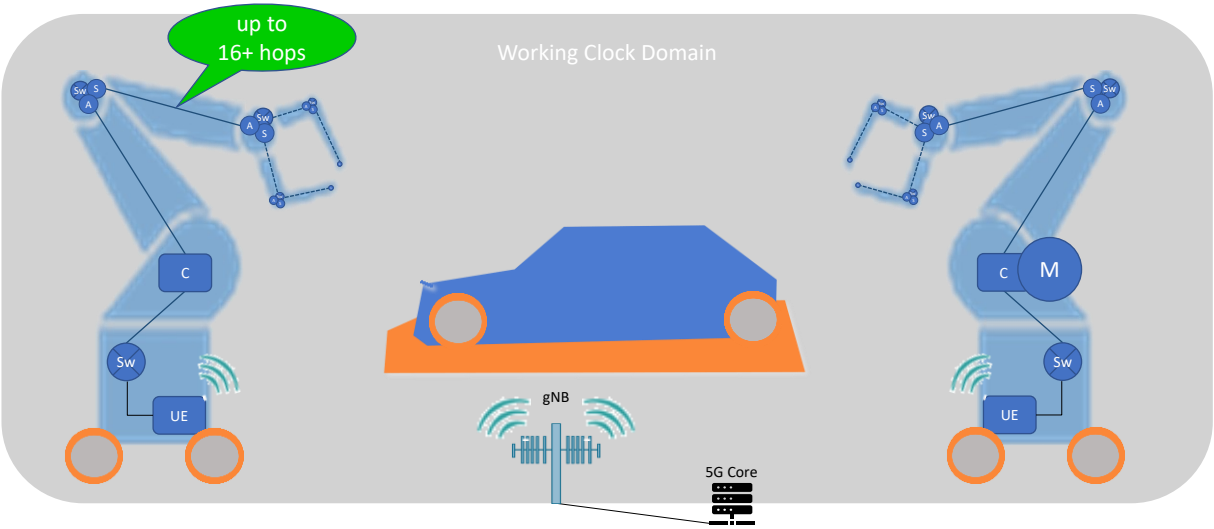
RAN enhancements related to Industrial IoT – Time Synchronization

- Improved time synchronization (smaller 5G time sync budget)
  - The current required 5G time sync budget of 900 ns leaves only a very small number for further TSN devices outside the 5G system within the overall time sync budget of 1 µs in integrated TSN-5G networks.
  - Two manufacturing robots, both connected to the 5G network with a wireless 5G link (two wireless links on the path of the time synchronization messages), require up to 16+4 TSN hops external to the 5G system, resulting in a smaller 5G time sync budget of approx. 700-800 ns (local working clock domain).
- → stable time synchronization accuracy of the 5G system of 700-800 ns with two (2) wireless links on the path of the time synchronization messages (local working clock domain).
  - Note: Time Sychronization of the industrial communication is done with IEEE 802.1AS
- RAN should consider further enhancements in Rel-19 to support the IIoT time synchronization requirements.



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Overall View on Rel-19 Content

Title	Brief Description and Key Objectives	Potential RAN WGs	Respective SA1 Requirements	Further dependencies on SA groups
IIoT: Improved TSC Time Sync	Smaller 5G time sync budget 700 ns with two (2) wireless links on the path of time synchronization messages (local working clock domain).	At least RAN1	TS 22.104	Potentially SA2

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Summary

- Rel-19 expected to further improve 5G-Advanced for Industrial 5G, including
  - Study and enhance existing time synchronization mechanisms in RAN
    - achieve 700 ns time synchronization budget for the industrial requirement
    - with two (2) wireless links on the path of time synchronization messages
    - local working clock domain
  - Note: IIoT Time Synchronization enhancements can be specified in an individual WI or a potential TaaS (Timing as a service) / High Accuracy Timing Service WI

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