Background infos for IIoT & objectives for IIoT security study

Nokia

S3-201337

SA3#99-e

IIoT study in SA2

- Rel-16 introduced some generic enablers (e.g. TSCAI) for native Time Sensitive communication using 5G System (as part of Vertical LAN study)
- The integration of 5GS was specifically introduced for IEEE TSN networks. TSN relies on the application layer protocol and TSN translaters on device and network side: DS-TT/NW-TT
- DS-TT/NW-TT support certain functionalities (e.g. appropriate routing and delivery of packets, synchronization)
- Rel-17 IIoT study focus is on enhancements to Time sensitive communication

3GPP S3-201337: Background infos for IIoT study

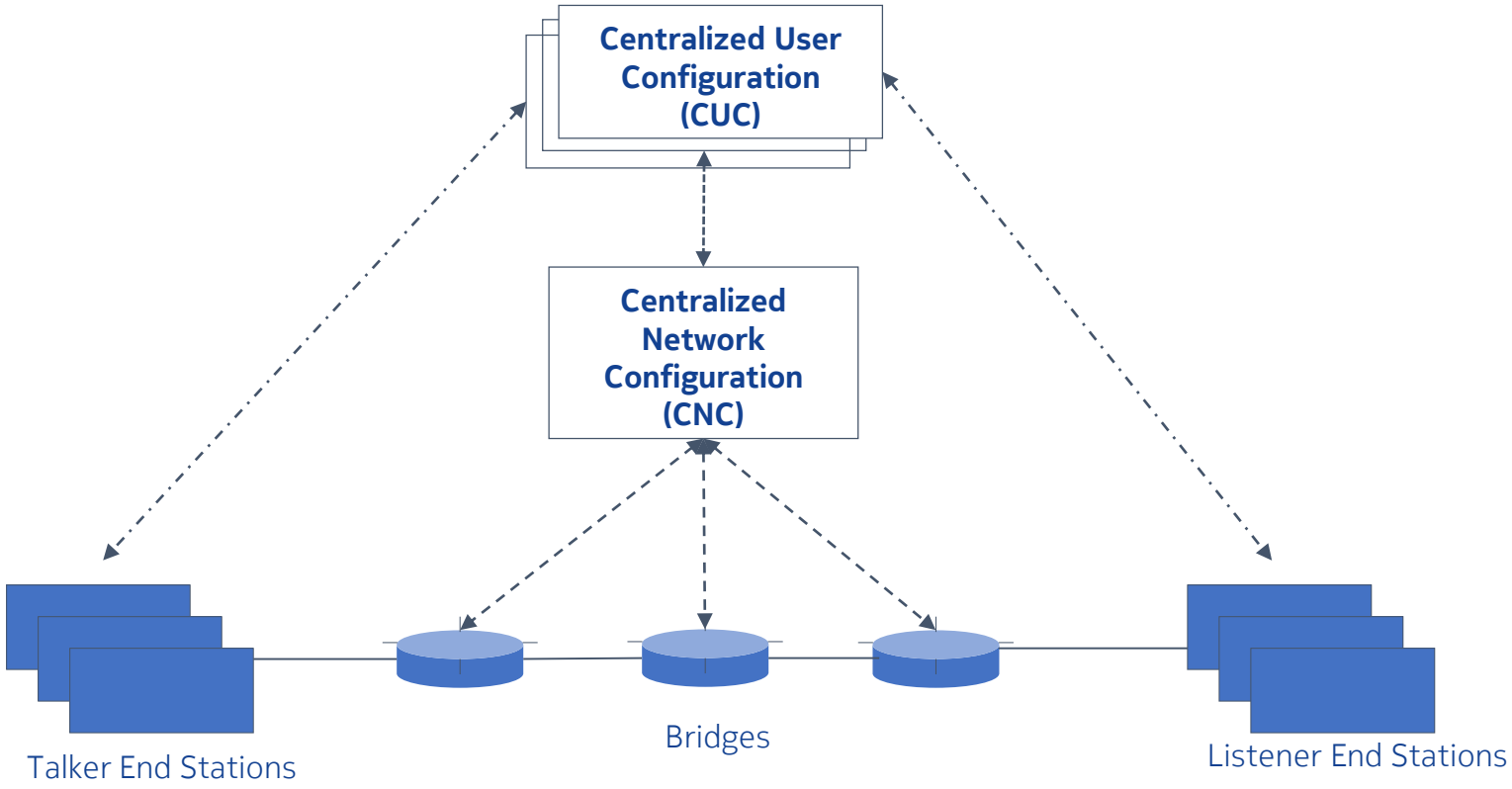
Background information:
IEEE TSN (time sensitive network) – IEEE 802.1 specs

3 different models

- distributed,
- centralized network distributed user,
- fully centralized.

The IEEE TSN set of specifications is considered the convergence technology that will enable deterministic and low-latency communication in the factories of the future.

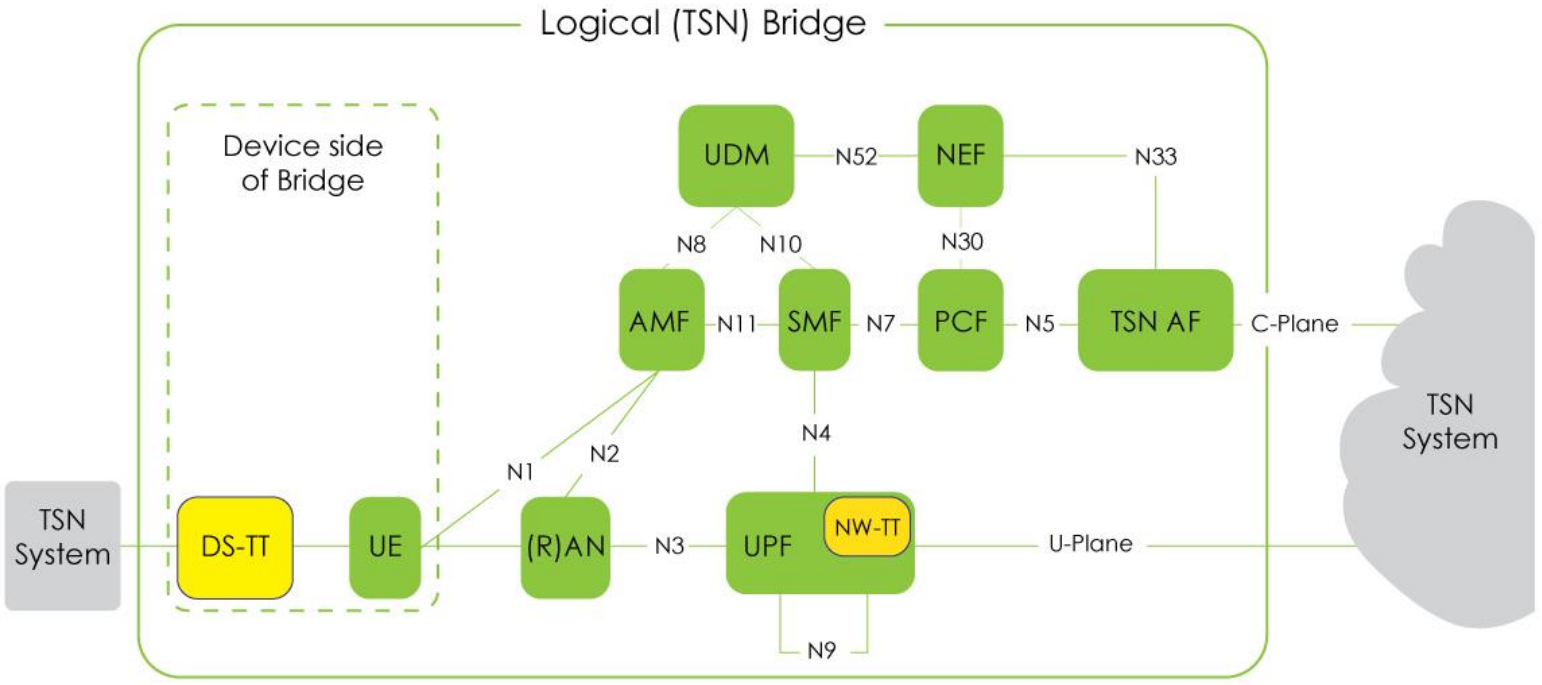
Integration of the 5G system with IEEE 802.1 by modelling 5GS as a bridge



3GPP S3-201337: Background infos for IIoT study

Rel 16: Time Sensitive Communication feature

Integration of the 5G system with IEEE 802.1 working group specifications covering Time Sensitive Networking (TSN)



System architecture view with 5GS appearing as a Time-Sensitive Networking bridge

TS 23.501

The TSN Translators fulfil all functions related to IEEE 802.1AS.
Time sensitive communications (TSC) assistance information has been introduced to provide the deterministic traffic pattern to the 5G RAN and to facilitate optimized scheduling of time sensitive traffic.

Source: https://www.3gpp.org/news-events/2122-tsn_v_lan

3GPP S3-201337: Background infos for IIoT study

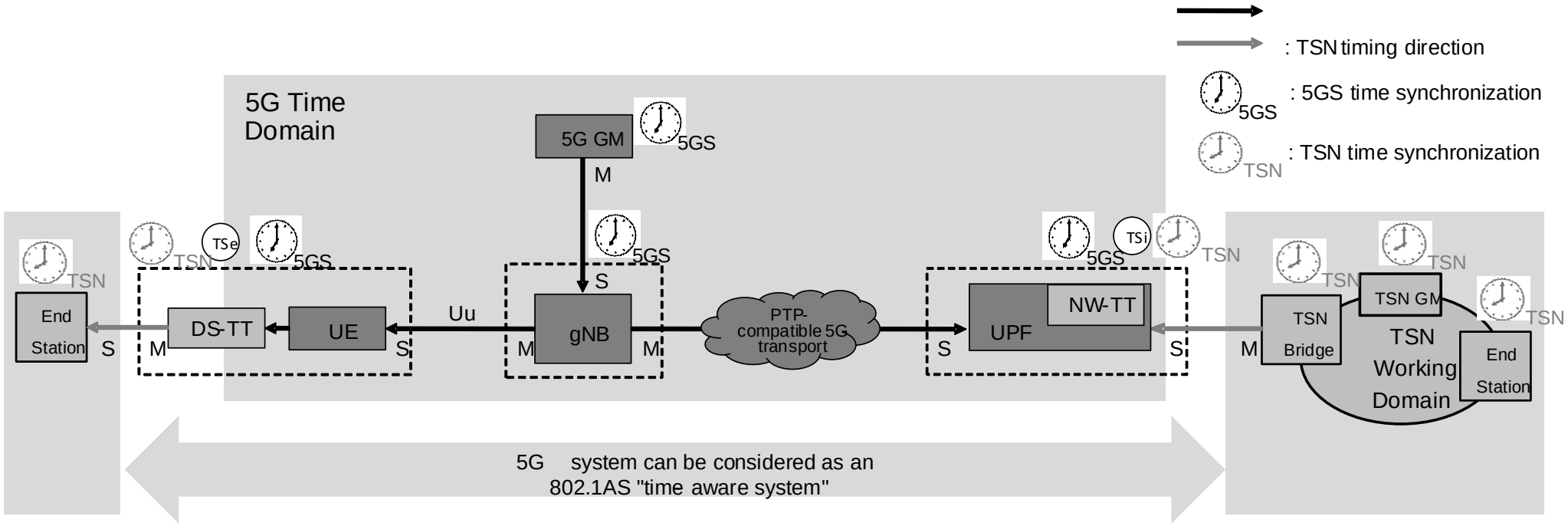
IEEE TSN support by 5G TSC service

- 5G Time Sensitive Communication is a service that supports deterministic and/or isochronous communication with high reliability and availability. It provides packet transport with Quality of Service (QoS) characteristics such as bounded latency and reliability, where end systems and relay/transmit nodes can be strictly synchronized.
- 3GPP supports TSN time synchronization, by considering the entire end-to-end 5G system as an IEEE 802.1AS "time-aware system".
- Only the TSN Translators (TTs) at the edges of the 5G system need to support the IEEE 802.1AS operations. UE, gNB, UPF, NW-TT and DS-TTs are synchronized with the 5G GM (i.e. the 5G internal system clock) which keeps these network elements synchronized.

Source: https://www.3gpp.org/news-events/2122-tsn_v_lan

3GPP S3-201337: Background infos for IIoT study

5G system is modelled as IEEE 802.1AS compliant time aware system for supporting TSN time synchronization



Source: 23.501, Figure 5.27.1-1

3GPP S3-201337: Background infos for IIoT study

Enhanced support for Industrial IoT in Release-17

- 3GPP Release-16 specifications support key enablers for Industrial IoT in 5G system. 3GPP has also informed IEEE about the maturity of IEEE TSN integration in the 3GPP specification via a recent liaison statement (S2-2003508).
- Release-17 work aims to define further enhancement for integration with IEEE TSN including support for uplink synchronization via 5GS, support for multiple working clock domains connected to the UE, and support for Time Synchronization of UE(s) with the TSN GM attached to the UE side via 5G System.
- Release-17 will also introduce enhanced support of deterministic applications (beyond IEEE TSN) by exposing network capabilities to support Time Sensitive communication services and optimizations for UE-UE Time Sensitive Communication.
- Furthermore, Release-17 also aims to support further enhancements for SNPN along with subscription/credentials owned by an entity separate from the SNPN, UE onboarding and provisioning for SNPN, and support for voice/IMS emergency services for SNPN. (This is part of eNPN study).

Source: https://www.3gpp.org/news-events/2122-tsn_v_lan

Rel-17 study objectives in SA2

Enhanced support of integration with IEEE TSN

- Support for uplink synchronization via 5GS.
- Support for multiple working clock domains connected to the UE (considering uplink synchronisation with UE as master).
- Support for Time Synchronization of UE(s) with the TSN GM attached to the UE side via 5G System.

Enhanced support of deterministic applications

- UE-UE TSC communication via same UPF
- Exposure of network capability to support Time sensitive communication, more specifically deterministic services and Time synchronization.

Specific TSC related requirements needed for Audio Visual Service Production

3GPP S3-201337: Background infos for IIoT study

Proposed scope of SA3 IIoT study

Security for enhanced support of integration with IEEE TSN:

- Support for uplink synchronization via 5GS.
- Support for Time Synchronization of UE(s)
  - Support for uplink time synchronization (GM clock connected to DS-TT) and downlink time
  - synchronization via 5GS (GM clock on N6 or NW-TT generates PTP messages).
- Support for multiple working clock domains connected to the UE (considering uplink synchronisation with UE as master).

Security for enhanced support of deterministic applications:

- UE-UE TSC communication via same UPF
- Exposure of network capability to support Time sensitive communication, more specifically deterministic services and Time synchronization.

Specific TSC related security requirements needed for Audio Visual Service Production which are only taking SA2 WI aspects in scope.

3GPP S3-201337: Background infos for IIoT study