Configuration Enhancements for 5G as TSN Bridge

János Farkas, Balázs Varga, György Miklós
janos.farkas@ericsson.com; balazs.a.varga@ericsson.com; gyorgy.miklos@ericsson.com
References

[4] 3GPP Liaison Statement S2-2003508, “TSN support in 3GPP Release-16” (5G) (802.1 response)
[6] Solution #21 in 3GPP TR 23.700-20 V0.5.0, “Study on enhanced support of Industrial Internet of Things (IIoT) in the 5G System (5GS) (Release 17)” (Solution #21 approved at SA WG2 Meeting #S2-140e)
5G Appears as TSN Bridge

- As per [1], 5G behaves seamlessly towards CNC as IEEE 802.1Q bridge

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**5G Bridge**

- UDM
- NEF
- TSN AF
- AMF
- SMF
- PCF

**5G control plane**

**5G user plane**

**e2e Ethernet**

**IO device** (sensor/actuator)

**TSN bridge**

**end station**

**DS-TT**

**UE**

**gNB**

**UPF**

**NW-TT**

**TTSN session**

**based on Figure 4.4.8.2-1 in [1]**

**CUC**

**CNC**

**NETCONF/RESTCONF**

**TSN control plane**

**TSN data plane**

**Controller**

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**AF**: Application Function

**DS-TT**: Device-Side TT

**gNB**: GNodeB (5G base station)

**NW-TT**: Network-side TT

**TT**: TSN Translator

**UE**: User Equipment

**UPF**: User Plane Function

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**Precious radio resources !!!**
3GPP Release-16 Reverse Engineering

- Stream information is needed for radio resource management and optimizations
- CNC does not provide all information, e.g., Stream traffic specification
- 3GPP Release-16 applies reverse engineering
- For instance, Annex I.1 “Determination of traffic pattern information” in [1]:
  - Periodicity from: PSFPAdminCycleTime, PSFPAdminControlList, timeIntervalValues
  - Burst Arrival time from: PSFPAdminBaseTime, timeIntervalValues, PSFPgateStatesValue
  - Burst Size from: PSFPAdminControlList, IntervalOctetMax, timeIntervalValue
  - Maximum Flow Bitrate from: timeIntervalValue, PSFPAdminCycleTime
- Reverse engineering has its problems; e.g., some information is not available at all, some are incidental
- Missing information, e.g.:
  - Stream characteristics if PSFP is on aggregate or not used
  - Mapping of PSFP information to ingress port (local information (e.g., local configuration) used [5])
Solution Proposal [6]

• Conceptually:
  1) 5G bridge subscribes to CNC for Stream information
  2) CNC notifies 5G bridge about Stream information

• Practically:
  • All can be encoded in YANG (like 802.1Qcc)
  • No new protocol
  • “subscribe” can be a Boolean flag
  • Example information to be provided by the CNC:
    • Stream ID
    • Ingress port number
    • Egress port number(s)
    • PCP
    • Periodicity
    • Burst Arrival Time
    • Burst Size
Summary

- Radio resource management is crucial in 5G
- 5G would benefit a lot if CNC provides Stream information to the 5G bridge
- Simple solution
  - YANG only
- Significant gain

- Generic use of the proposed solution
  - Can be useful for the establishment of inter-domain communication in case of multiple TSN domains
Thank You!