TSN Configuration Enhancements

Enhancements of the CNC North Bound Interface (NBI)

Stephan Kehrer, Hirschmann Automation and Control GmbH
Hesham ElBakoury, Huawei
Wayne Qiu, Huawei

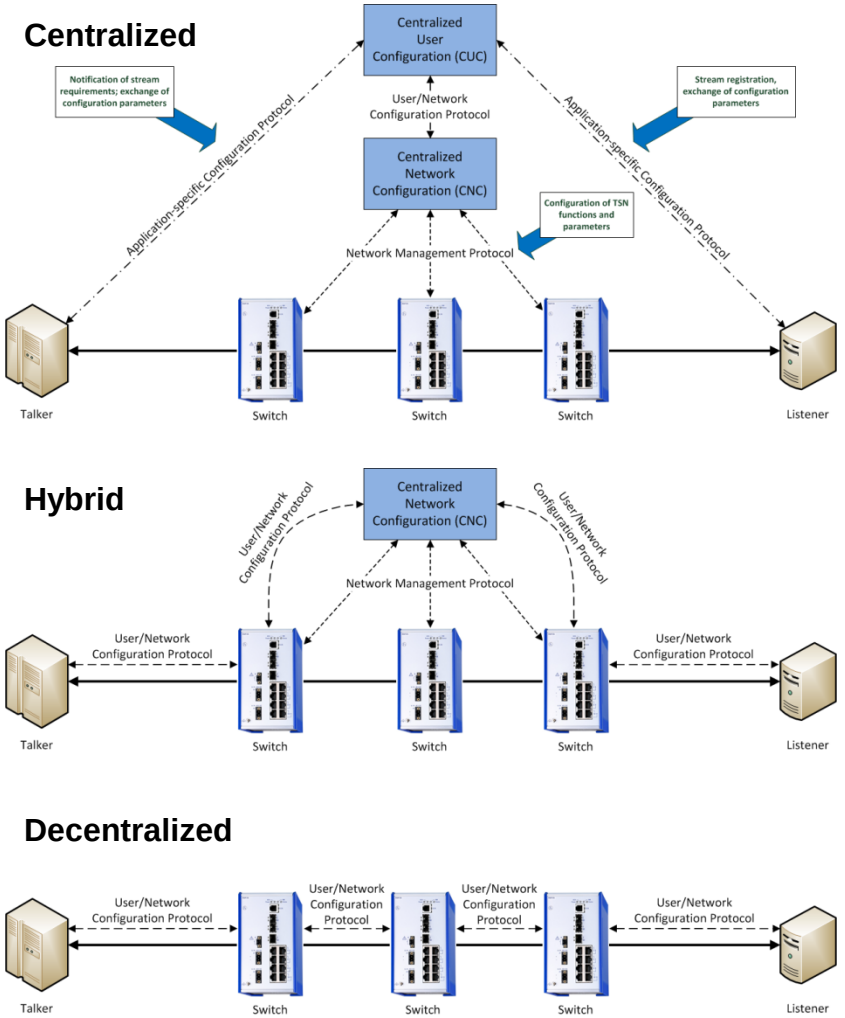
July 2018

Purpose of this presentation

- This presentation is a first step in the direction of defining the interface model for the User/Network Interface (UNI) North Bound Interface (NBI)
- Intention is not to have a motion for a PAR at this meeting
- Intention is to get a feeling whether the group agrees there is work to be done in this area and that we are the right group to do so
- If the group agrees to go in this direction, there will be follow up presentations at next meetings with more information describing what we think needs to be done as foundation for a discussion on what should be the scope for PAR and CSD for a new project

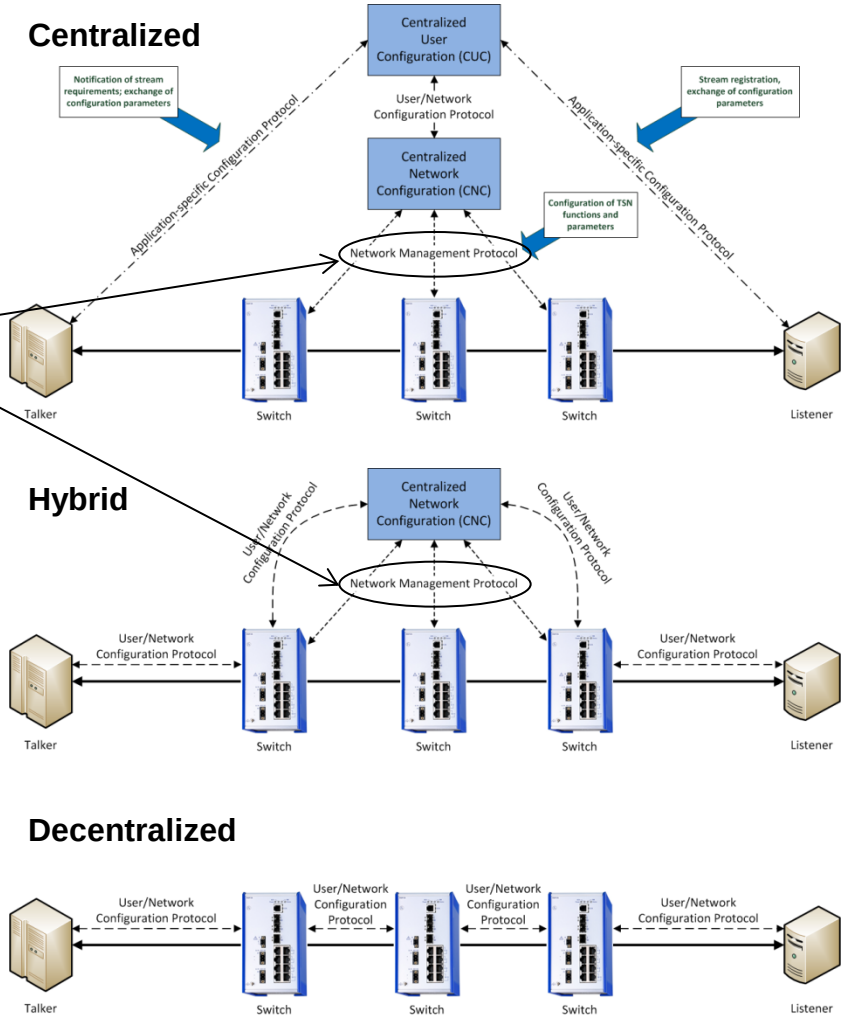
Situation of TSN configuration today

- Functionality from the TSN toolbox, provided by the different standards and standard amendments, is mostly not “plug-and-play”
- Configuration is needed, towards the network devices (e.g. bridges) and towards the end-stations
- Managed objects for configuring network devices are provided by the standard documents
- For user/network configuration some parameters are provided in IEEE Std. 802.1Qcc, clause 46:
  - 3 configuration models for TSN (decentralized, hybrid and centralized)
  - a User/Network Interface (UNI) for TSN configuration
  - TLVs for the distributed and hybrid models
  - a module with YANG structures for the centralized model



Situation of TSN configuration today

- Functionality from the TSN toolbox, provided by the different standards and standard amendments, is mostly not “plug-and-play”
- Configuration is needed, towards the network devices (e.g. bridges) and towards the end-stations
- Managed objects for configuring network devices are provided by the standard documents
- For user/network configuration some parameters are provided in IEEE Std. 802.1Qcc, clause 46:
  - 3 configuration models for TSN (decentralized, hybrid and centralized)
  - a User/Network Interface (UNI) for TSN configuration
  - TLVs for the distributed and hybrid models
  - a module with YANG structures for the centralized model



Problem

- The UNI provided by IEEE Std. 802.1Qcc is not comprehensive enough to perform a complete configuration of a TSN network and the end devices used on the network
- There are more comprehensive and systemic requirements/responses that can be defined between user/network configuration from an application point-of-view:
  - Additional network QoS requirements from the user, such as jitter requirements, reliability, including or excluding nodes, dynamic network configuration, …
  - More information about end devices capabilities
  - More response information from the network to the user (e.g. which shaper to use).
- For this reason, several groups are currently looking at TSN configuration and are trying to fill the gaps

  → This will most likely lead to different approaches and solutions that are not interoperable

- The best way to prevent this would be to enhance the work that has been started in IEEE Std. 802.1Qcc with the UNI and provide a comprehensive UNI to fulfill the needs of TSN network configuration

Example of incomplete UNI

- If a talker supports several transmission selection algorithms it currently selects which one is to be used for a stream originating from this talker
- This possibly constrains the network in the selection of a path for this stream as some devices in the network might not support this mechanism
- An alternative and beneficial approach could be[1]:
  - a talker can provide a list of supported transmission selection algorithms to the CNC
  - the CNC checks for possible paths in the network for these mechanisms, selects one and then gives back information to the talker which mechanism to use
  - This approach gives more flexibility to the CNC when utilizing network resources
- This was suggested already as comment #86 against draft D1.1 of 802.1Qcc
  - the comment was rejected as this was seen as a new feature and the group wanted to progress 802.1Qcc
  - however, during the discussion the feedback seemed to indicate that this might be interesting to be considered as a future enhancement

[1] Example is given for the centralized approach

Example of TSN NBI Enhancement

Traffic Path Constraints

- Node constraints for path computation:
  including or excluding some nodes/areas.

2.5.5 Use case 22: Energy Saving

Complete or partial plant components are switched off and on as necessary to save energy. Thus, portions of the plant are temporarily not available.

Requirement:

Energy saving region switch off/on shall not create process disturbance.

Communication paths through the energy saving area between end-stations, which do not belong to the energy saving area, shall be avoided.

Useful 802.1Q mechanisms:

- Appropriate path computation by sorting streams to avoid streams passing through energy saving region.

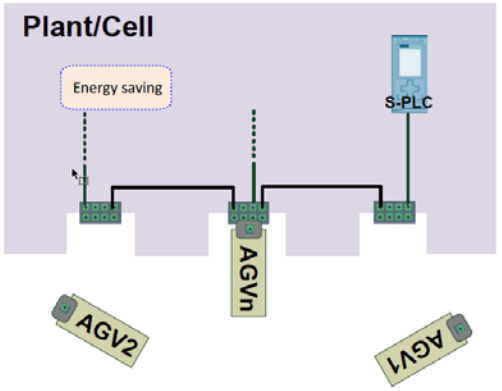


Figure 49 – energy saving

NBI Example: stream path constraints information: must pass or not pass through some node(s).

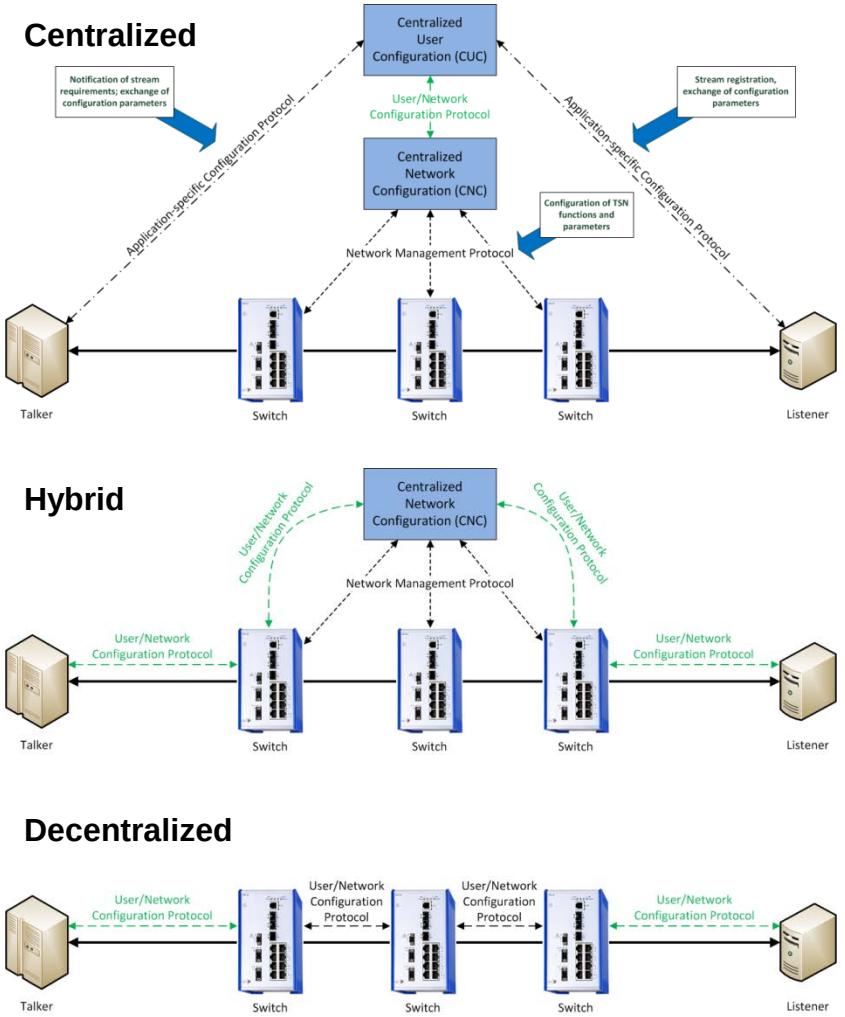
This example was extracted from the P60802 use case document [1] as an exemplary use case. However, the NBI should not be limited to be used in industrial automation.

[1] http://ieee802.org/1/files/public/docs2018/60802-industrial-use-cases-0418-v06.pdf

Alignment of all configuration models

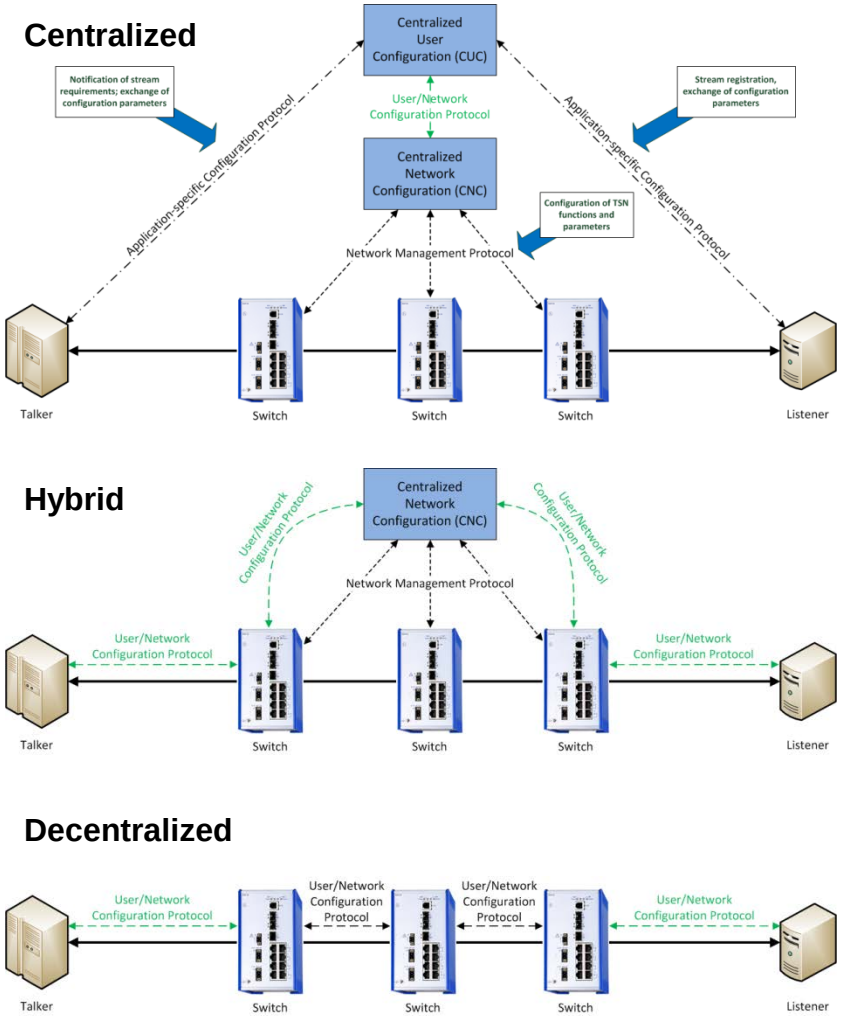
- In Section 46.1.3.2 IEEE Std. 802.1Qcc states:
  - NOTE 1 — If the Talker/Listener protocol of the fully distributed model is selected to be the same as the Talker/Listener protocol of the centralized network/distributed user model, end stations can support both models without explicit knowledge of how the network is configured.
- In order to achieve this, the user/network configuration interface needs to be aligned and broad enough to support the needs of all models

  → enables end devices to operate independent from network configuration models as long as IEEE 802.1 defined protocol is used



Summary of Objectives

- Develop a unified interface information model that can be used for the UNI/NBI in all 3 configuration models.
- The NBI should be broad enough to handle different mechanisms and protocols to automatically address user configuration requirements
- The NBI should address the IEEE/IEC JWG use cases
- The current interface provided by IEEE Std. 802.1Qcc started in this direction but more work needs to be done.
- If we do not address these issues, other organizations will do so in non-unified manner.
- The focus of this work would be the interfaces highlighted in green



Next actions – if we decide this is work we should do in the group

- Give additional presentations on details of what is currently missing
- Discuss how to proceed on the topics and issues presented in this slide-set
- Do we need a new PAR for this?
- Is some of the work already covered in existing PARs (e.g. IEEE 802.1Qdd)?

Thank you

Thank you!