60802 management

Analysis

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YANG

IA-station requirements

- 5.5.1 IA-station PHY and MAC requirements for external ports
  - e) ieee802-ethernet-interface module according to 6.4.9.2.1
    - (only?) 3 nodes, 1 node dependent on a feature (ethernet-pause)
    - Support of features not specified
- 5.5.2 IA-station topology discovery requirements
  - c) ieee802-dot1ab-lldp module according to 6.4.9.2.2
    - 38 nodes
- 5.5.3 IA-station requirements for time synchronization
  - j) i) ieee1588-ptp module according to 6.4.9.2.3.1
    - 2 features : cmlds, external-port-config
    - 31 nodes
  - j) ii) ieee802-dot1as-ptp module according to 6.4.9.2.3.2
    - 23 nodes
  - j) iii) ieee802-dot1as-hs module according to 6.4.9.2.3.3
    - 1 node

IA-station requirements

- 5.5.4 IA-station requirements for management
  - 5.5.4.2 Secure management exchanges
    - f) 1) ietf-keystore module according to 6.4.9.2.4.1
      - 2 features (*central-~~truststore~~keystore-supported)
      - 10 nodes
    - f) 2) ietf-netconf-acm module according to 6.4.9.2.4.2
      - 7 nodes, how many “groups”, rules in the “rule-list” ?
    - f) 3) ietf-truststore module according to 6.4.9.2.4.3
      - 2 features
      - 4 nodes, how many certificate bags, how many certificates ?

IA-station requirements

- 5.5.4 IA-station requirements for management
  - 5.5.4.3 IA-station management modules
    - a) ietf-system-capabilities module according to 6.4.9.2.5.1
    - b) ietf-yang-library module as according to 6.4.9.2.5.2
    - c) ietf-yang-push module according to and 6.4.9.2.5.3
    - d) ietf-notification-capabilities module according to 6.4.9.2.5.4
    - e) ietf-subscribed-notifications module according to 6.4.9.2.5.5
    - g) ietf-netconf-monitoring module according to 6.4.9.2.5.6
    - h) ietf-system module according to 6.4.9.2.5.7
    - i) ietf-hardware module according to 6.4.9.2.5.8
    - j) ietf-interfaces module according to 6.4.9.2.5.9
    - k) ieee802-dot1q-bridge module according to 6.4.9.2.5.10
    - l) iecieee60802-ethernet-interface module according to 6.4.9.2.5.11
    - m) ietf-netconf-server according to 6.4.9.2.5.12
    - n) iecieee60802-bridge according to 6.4.9.2.5.11
    - o) ietf-subscribed-notifications according to 6.4.9.2.5.13
    - p) iecieee60802-subscribed-notifications according to 6.4.9.2.5.13
    - q) iecieee60802-ia-station according to 6.4.9.2.5.11
      - All leaves = true ?

Bridge component requirements

- 5.7.1 Common bridge component requirements
  - m) ieee802-dot1cb-stream-identification module according to 6.4.9.2.5.14
    - 5 nodes
- 5.7.2 ccA Bridge component requirements
  - d) 3) ieee802-dot1q-sched(-bridge) module according to 6.4.9.3.2
    - 1 feature
    - 21 nodes
  - d) 4) iecieee60802-sched-bridge module according to 6.4.9.3.3
    - 1 node
  - e) 2) ieee802-dot1q-preemption(-bridge) module according to 6.4.9.3.4
    - 1 feature
    - 2 nodes
- 5.7.3 ccB Bridge component requirements
  - N/A

Bridge component options

- 5.8.1 Common bridge component options
  - ieee802-dot1q-cbsa(-bridge) module according to 6.4.9.3.5
    - 1 feature
    - 3 nodes
- 5.8.2 ccA Bridge component options
  - No specific YANG compared to ccA requirements
- 5.8.3 ccB Bridge component options
  - No specific YANG compared to ccB requirements

End station requirements

- 5.9.1 Common end station requirements
  - No YANG requirement
- 5.9.2 ccA end station requirements
  - c) 3) ieee802-dot1q-sched(-bridge) module according to 6.4.9.3.2
    - 1 feature
    - 21 nodes
  - c) 4) iecieee60802-sched-bridge module according to 6.4.9.3.3
    - 1 node
  - d) 2) ieee802-dot1q-preemption(-bridge) module according to 6.4.9.3.4
    - 1 feature
    - 2 nodes
- 5.9.3 ccB end station requirements
  - N/A

End station options

- 5.10.1 Common end station options
  - a) ieee802-dot1q-cbsa(-bridge) module according to 6.4.9.3.5
    - 1 feature
    - 3 nodes
  - b), c) ieee802-dot1cb-stream-identification module according to 6.4.9.3.6
    - 4 nodes
  - b), c) ieee802-dot1cb-frer module according to 6.4.9.3.6
    - 14 nodes
- 5.10.2 ccA end station options
  - c) 3) ieee802-dot1q-sched(-bridge) module according to 6.4.9.3.2
    - 1 feature
    - 21 nodes
  - c) 4) iecieee60802-sched-bridge module according to 6.4.9.3.3
    - 1 node
  - d) 2) ieee802-dot1q-preemption(-bridge) module according to 6.4.9.3.4
    - 1 feature
    - 2 nodes
- 5.10.3 ccB end station options
  - c) 3) ieee802-dot1q-sched(-bridge) module according to 6.4.9.3.2
    - 1 feature
    - 21 nodes
  - c) 4) iecieee60802-sched-bridge module according to 6.4.9.3.3
    - 1 node
  - d) 2) ieee802-dot1q-preemption(-bridge) module according to 6.4.9.3.4
    - 1 feature
    - 2 nodes

Triggers

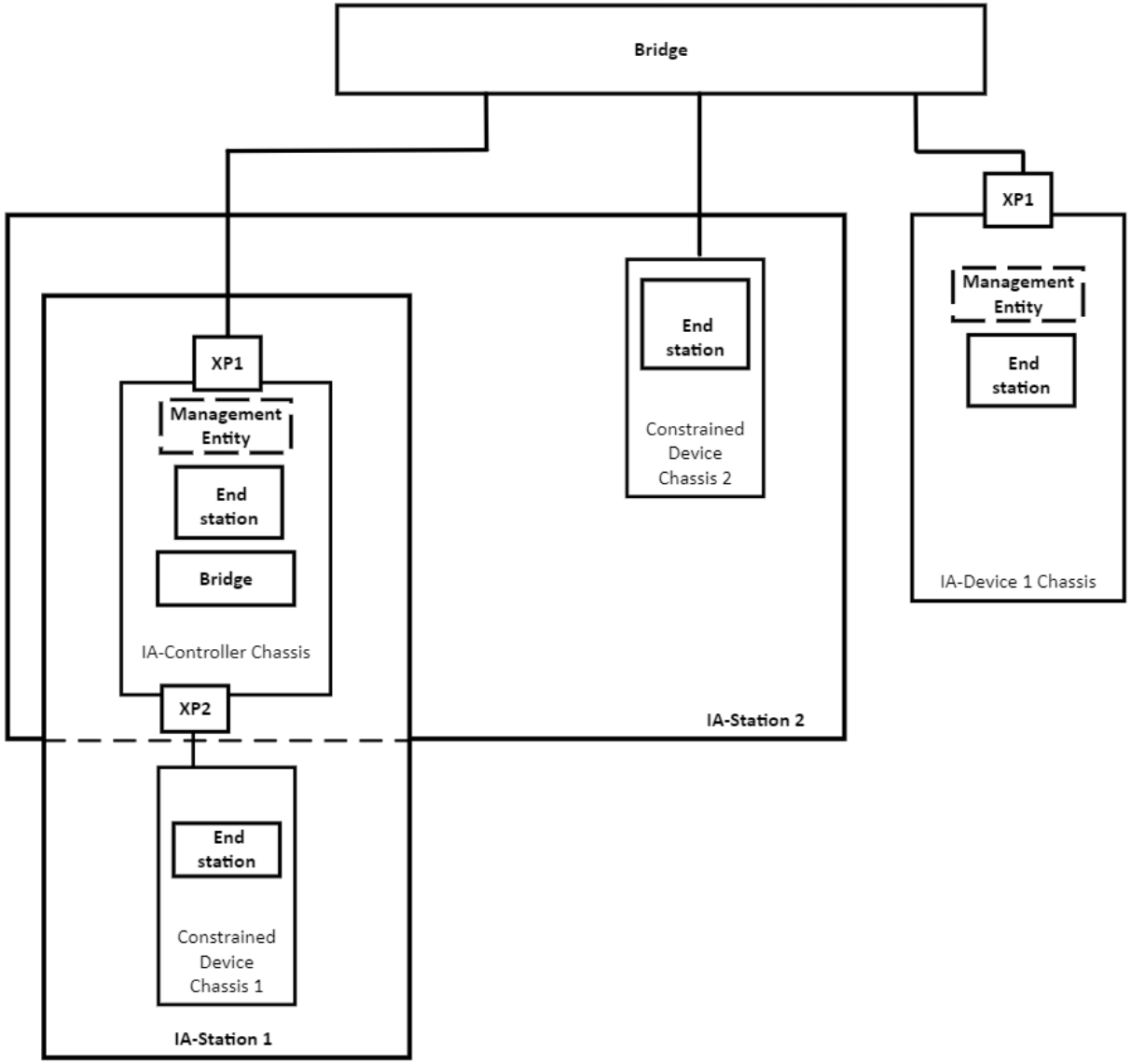
- Difficult (impossible ?) to reduce the set of required YANG features for a ccB bridge component or a ccB end station
  - Most of the YANG features are defined at the IA-station level
  - ccB mandates very few extra YANG features
- Issues rather rely in :
  - Mandating the support of a NETCONF server function in a device that certainly have to implement middleware and/or application functions that already require equivalent functions
  - Mandating the use of a datastore that may also be redundant with the application/middleware's
  - Datastore and management protocol footprint
- 802.1Q(dj) on fully centralized management model (46.1.3.3)
  - « The CNC uses remote management to discover physical topology, retrieve Bridge capabilities, and configure TSN features in each Bridge. Talkers and Listeners are not required to participate in this remote network management protocol. ».
  - « In [the] fully centralized model, a protocol is used between the CUC and end stations (Talkers and Listeners) to retrieve end station capabilities and requirements and to configure the end stations ».

Target

- Promote as many industrial automation devices as conformant members of a TSN configuration domain as possible, considering the timeline of the IEC/IEEE 60802
- Issue: constrained devices may not have enough hardware resources to support a Netconf server next to the needed application layer software
- Solutions
  - Solution 1: IA-Stations may expand outside one chassis
  - Solution 2: Create a conformance Class B for Network Management

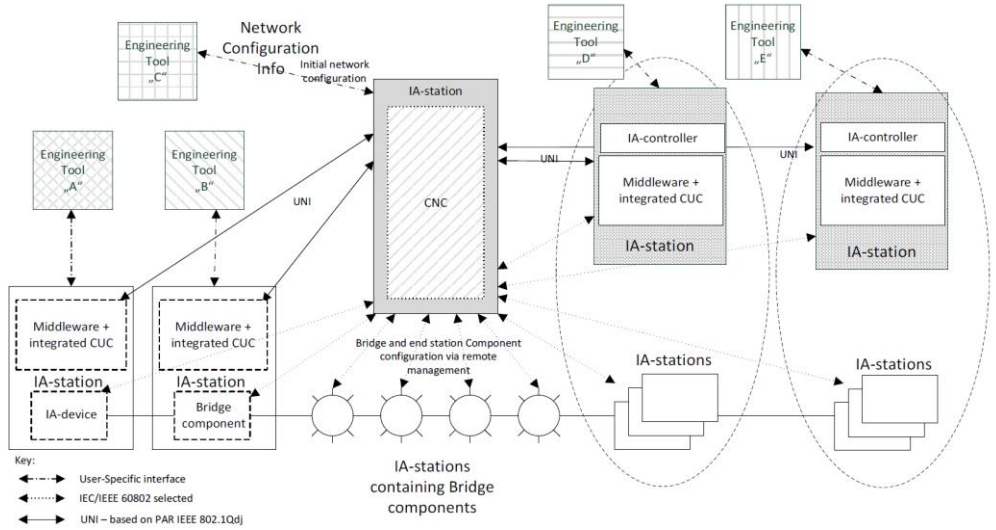
Solution 1

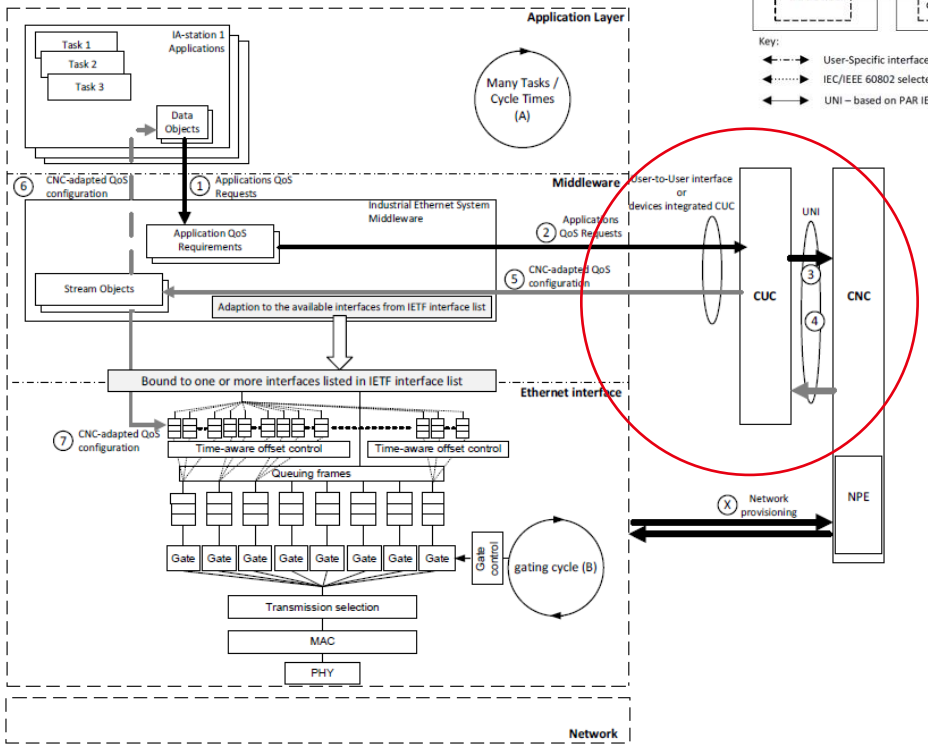
- Improve IA-Station definition
  - Today
    - 3.3.10 IA-station: material element or assembly of one or more end station components, and zero, one or more bridge components
    - Note 1 to entry: IA-controllers and IA-devices are industrial automation functions of IA-stations
  - Proposal
    - 3.3.10 IA-station: material element or assembly of one or more end station components, and zero, one or more bridge components
    - Note 1 to entry: IA-controllers and IA-devices are industrial automation functions of IA-stations.
    - **Note 2 to entry: An IA-station may be implemented in one or more chassis**
- Proposal for adding this section 4.3
  - After Figure 4, row 835
  - IA-Stations can also extend beyond one chassis, for example, as follows: One Functional Unit of the IA-Station could be an IA-controller within its chassis. Another chassis could contain a constrained device which cannot become an IA-station by itself, due to hardware resource limitations. The management entity of the IA-controller can be shared among different IA-stations. Each constrained device must adhere to all IA-station stream requirements applicable to its configuration domain.'
  - Add also Figure on the right here
  - Security considerations – potentially as a Note
    - All security management is insured to the constrained devices, by following 5.5.4.2. Secure management exchanges using the management entity for each such formed IA-Station
- The profile allows this today, however, these small additions will enhance interoperability.



Solution 2

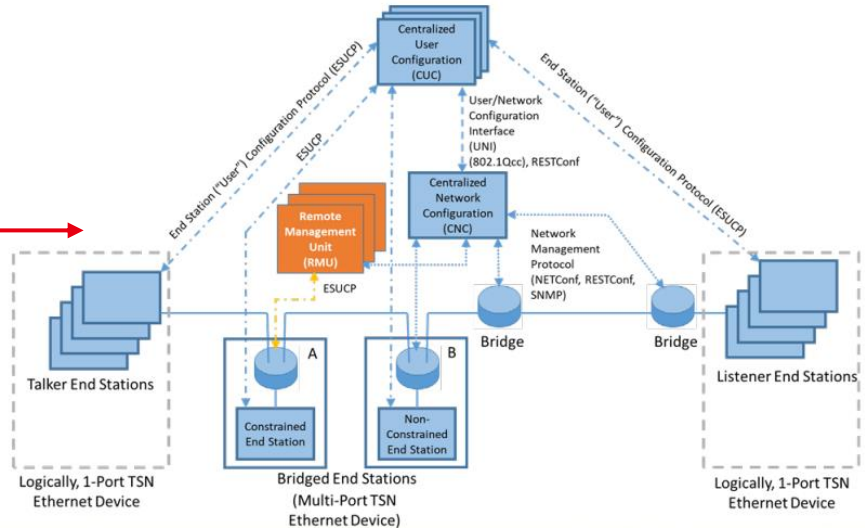
- 60802's centralized management model
  - The CUC takes its inputs from an engineering tool
    - Uses the « UNI » to negotiate the Streams with the CNC
    - Lesser role than in 802.1Q(dj)
  - The CNC configures the end stations and bridges (= IA-stations)
    - Bigger role than in 802.1Q(dj)





Solution 2

- Possible way out… (nothing new…) – introducing a « specific » (but interoperable) configuration domain that relies on a « basic » Network Management conformance class (vs. « full » in a 60802-compliant configuration domain)
  - Topic already suggested back in 2018
    - Steve Zuponcic on Remote Management Units https://www.ieee802.org/1/files/public/docs2018/60802-Zuponcic-Bridged-non-Bridged-End-Stations-1118-v01.pdf
    - Taro Harima on Constrained Bridges use case-> local domain https://www.ieee802.org/1/files/public/docs2018/60802-harima-industrial-use-case-0518-v04.pdf
  - CUC (à la 802.1Q(dj)) used as an access gate for the management of the specific domain
    - Conforms to cyber-security related requirements of 60802
    - Allows an additional, Qcc/Qdj-conformant CUC-based network management concept (not to be specified)
      - Where the CUC handles the specific-domain management protocol and information model implementation (e.g., through the « specific » middleware)
  - Stations can still be managed from 60802 TSN configuration domain (CNC)
    - Through the CUC
    - By keeping an interoperable information model
    - 2 conformance classes
      - In a 60802 domain -> Full : 60802 managed objects + NETCONF + YANG
      - In an independent domain -> Basic : subset(*) of 60802 managed objects
        - Same philosopohy as in 802.1Q
        - Interoperabilty with 60802 configuration domain kept



(*) subset = all 60802 managed objects except those related to management protocol (proposal)