YANG Models for CNC

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Fully Centralized Configuration

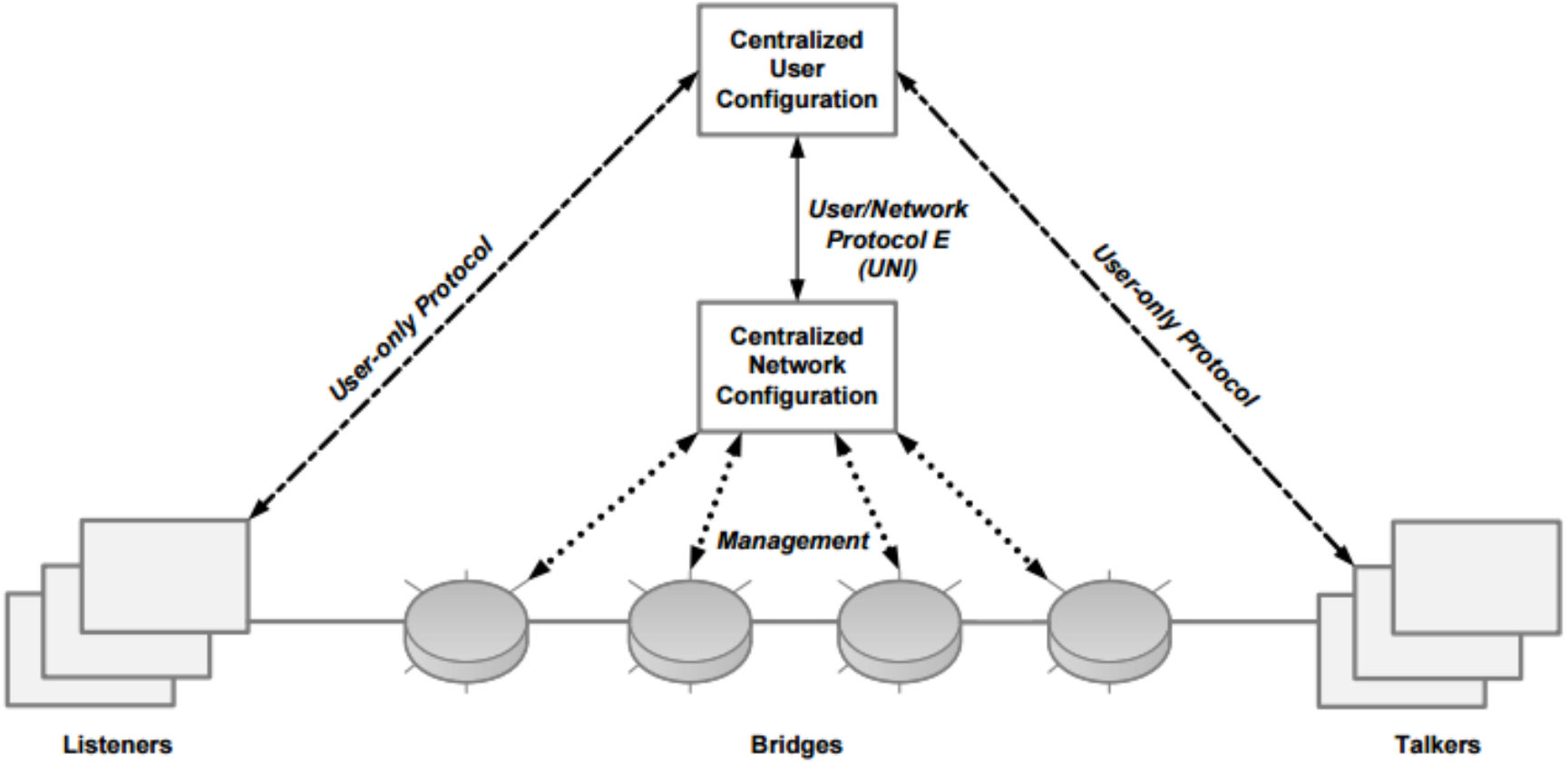
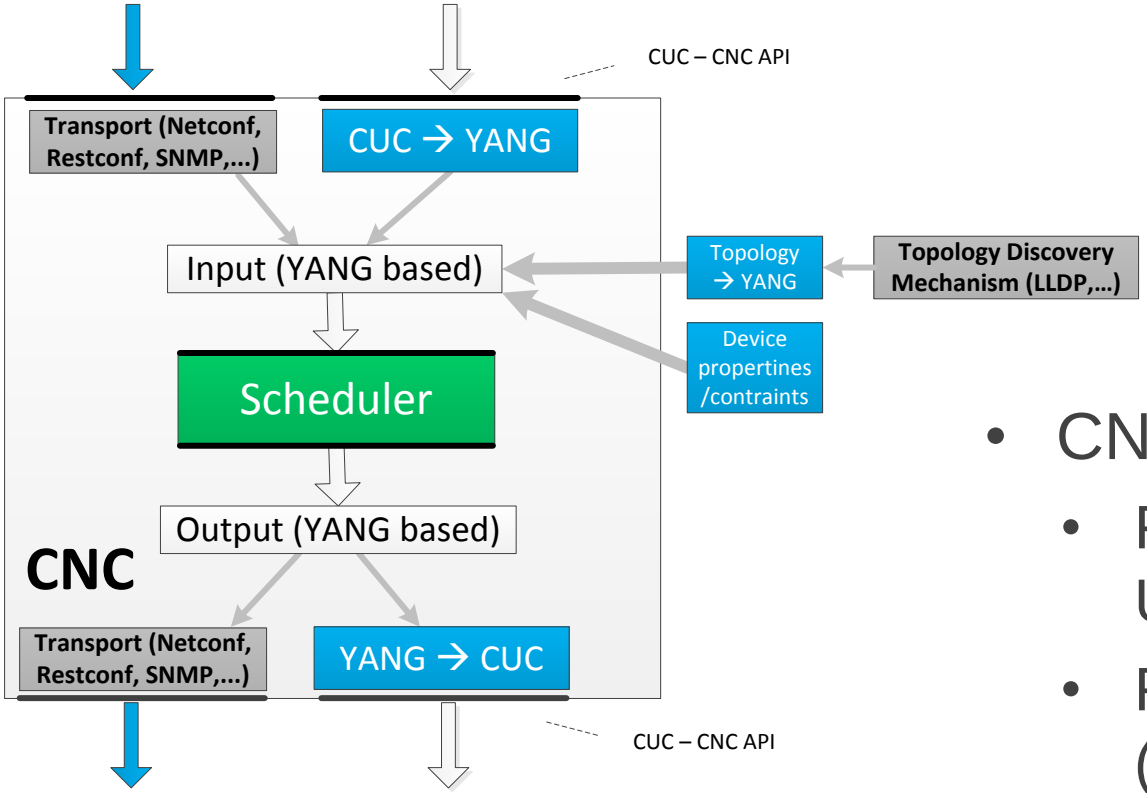


Figure 99-3 — Fully Centralized Model

CNC Input and Output Interfaces



- CNC gets input:
  - From CUC using the UNI
  - From network services (LLDP)
  - From user through given transport protocols

Scheduling Use Case

- Traffic
  - Audio/Video app (streaming) - engineered
  - Control app (synchronous) – engineered
  - Diagnostics/configuration (sporadic) - not engineered
  - Network management (sporadic) - not engineered

- Devices have following capabilities
  - Port speed,…
  - Preemption, FRER (802.1CB), Cut-Through
  - Specific number of queues/scheduling entries, buffer,…

Scheduling Use Case (2)

- Datastreams
  - Period, max size,…
  - Latency requirements for scheduled traffic
  - Precedence constraints
  - Availability
  - Bandwidth requirements for non-scheduled traffic, ….

- CNC
  - Talkers and listeners are sending configuration requests to CNC (tell the CNC what they want)
  - CNC is calculating the schedule for the whole network (including talkers)

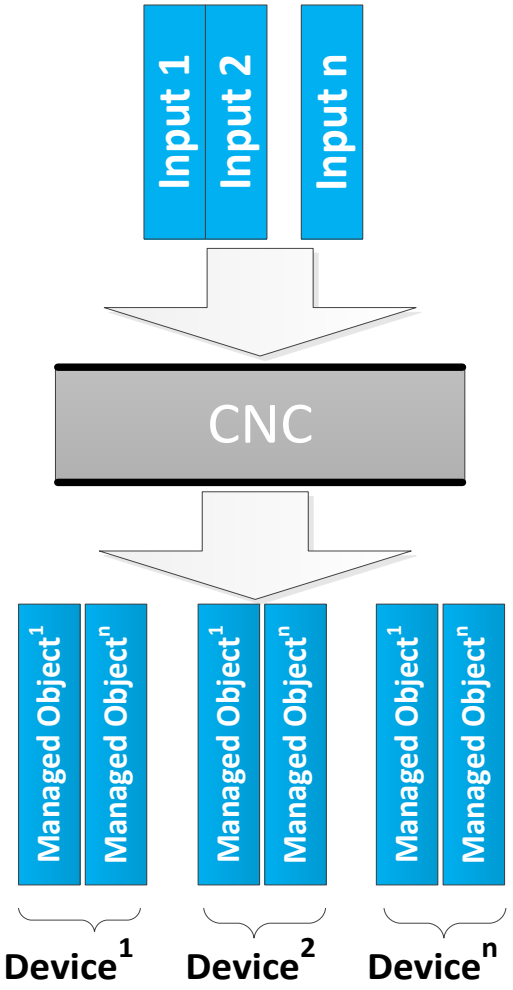
Scheduling Use Case (3)

- Scheduling configuration is changed (e.g., several times a week)
- Topology is detected with support of LLDP
- Requests for scheduling new datastreams
  - Optional request (depending on use case) - **preserve the timing properties (end-to-end latency) of existing datastreams**
  - E.g., requests for editing the list of listeners

CNC Input and Output based on YANG

- The CNC output is based on YANG
- The CNC input is based on YANG

- YANG model needed for:
  - API (UNI) part of Qcc
  - Input to the CNC
  - Output of the CNC



YANG Output Models

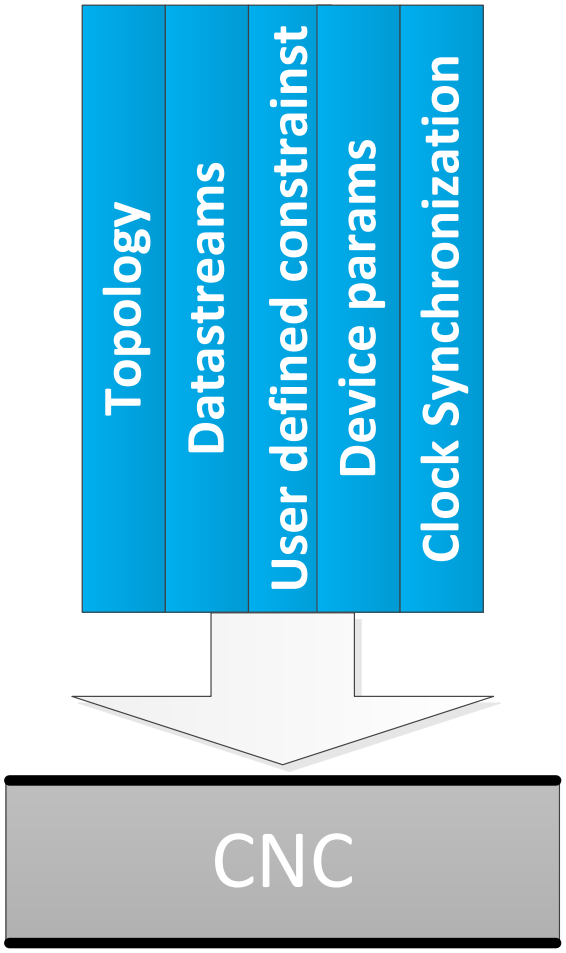
- **1Qbv** (MIB exists, experimental YANG modules)
  - Scheduling
  - Bridge internal routing - mapping of streams ID to queues
- **1CB** (neither MIB nor YANG model exists)

Not related to scheduling

- 1Qci (MIB exists, no YANG model exists)
- 1AS-rev (existing MIBs from 1588-2008, no YANG model exists)

YANG Input Models

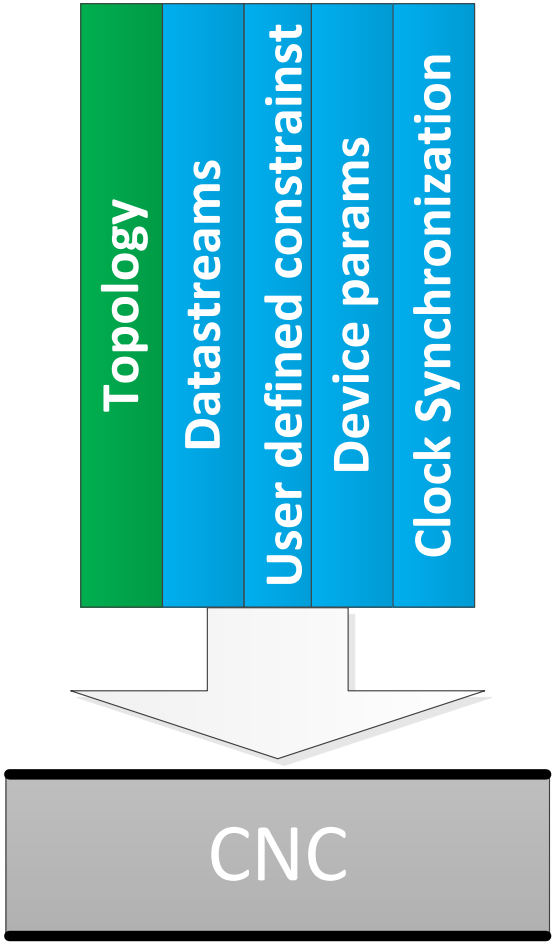
- Physical Topology (network)
- Device constrains and properties
- TSN datastreams (UNI)
- User defined constrains for datastreams
- Clock synchronization



YANG Input Models
Physical Topology

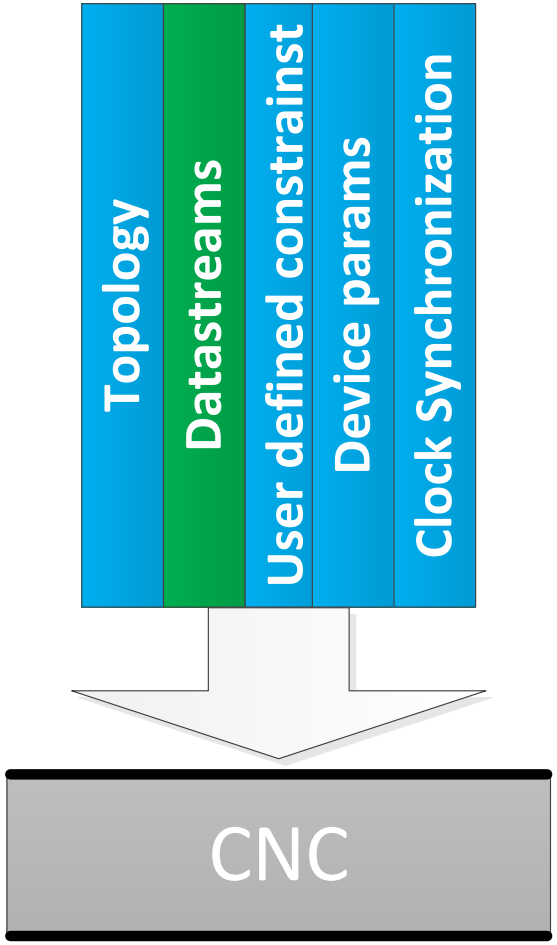
- Topology can be detected or given by the user
  - List of devices
  - Physical links
  - Link speed

- 802.1AB-2016 experimental module from Rodney Cummings (NI) is in work
- Clause 11 (MIB) of LLDP standard is used as a basis for YANG.
- PAR needed (and an editor as well)



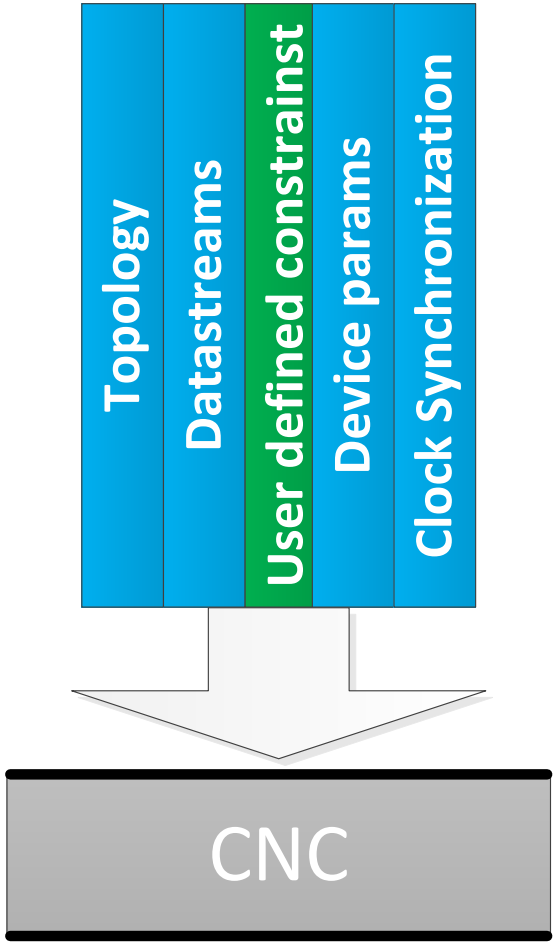
YANG Input Models
Datastreams

- Datastreams YANG model is covered by 802.1Qcc



YANG Input Models
User Defined Constraints

- CNC can support different *User Defined Constraints* (UDC)
- CNC implementation specific
  1. End-to-End Latency
  2. Send and receive time constrains (before, after, at specified time)
  3. Gap constraint between scheduled datastreams(DS)
     - receive DS1 and send DS2
  4. Non-scheduled traffic bandwidth reservation constraint

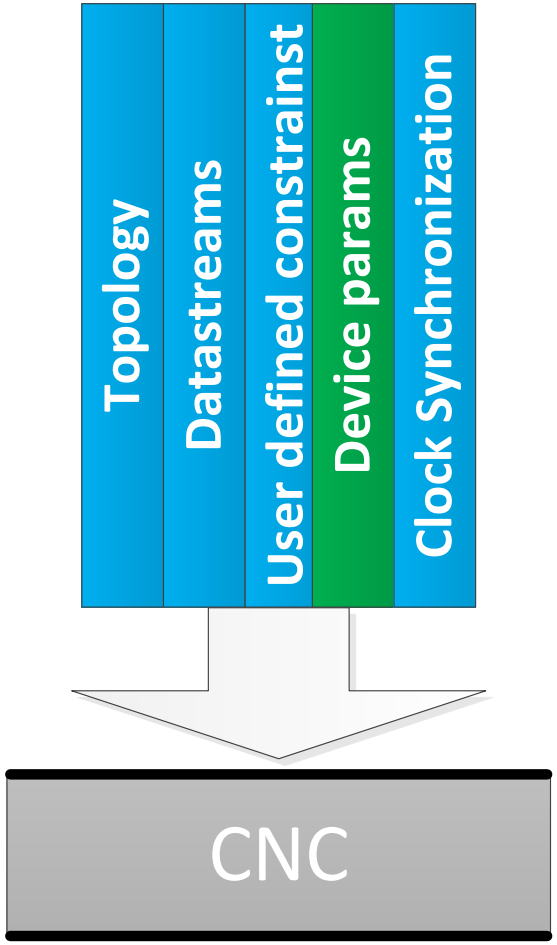


YANG Input Models
Device Parameters

In clause 12 of 802.1Q-2014, which is represented as YANG in the modules on GitHub for 802.1Qcp.

Switch delay

- That is being added as part of the clause 12 edits in 802.1Qcc. In Qcc D1.1, this is 12.31.2, but that will be changing in the next Qcc D1.2, because 802.1 voted to remove cut-through



Standard TSN and 802.1Q Device Properties

TSN standard mechanisms

- **1Qbv**
  - Number of queues for scheduled traffic
  - Number of scheduled entry points
  - Switch delay
  - Clock synchronization
  - Synchronized sending
- **1AS-rev related**
- **1CB**
- **1Qbu**

802.1Q related

- Port speed
- Number of queues

Implementation specific

- **Cut-through**

Which YANG snippets to use?

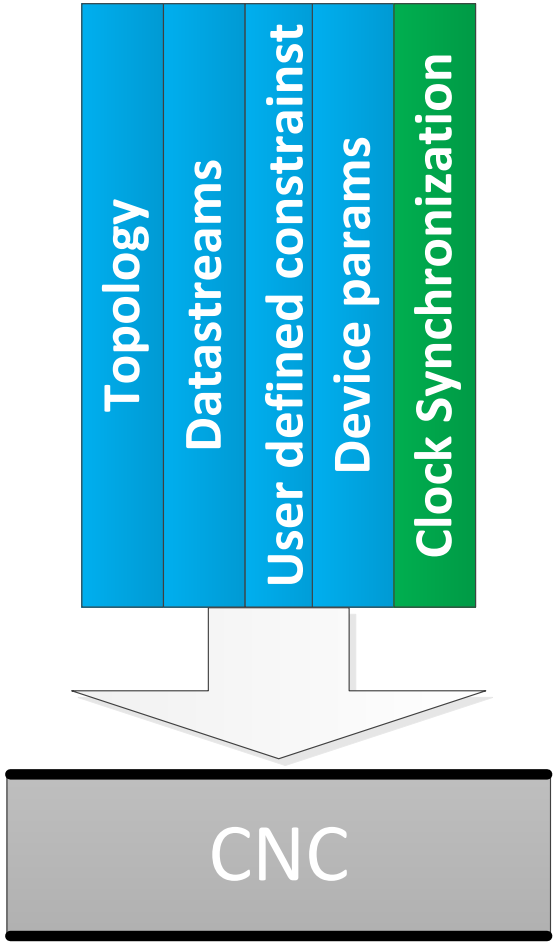
Avnu prefers

- to references to IEEE standards with respect to YANG models

YANG Input Models
Clock Synchronization

- 1588-2008: This module will be used as the base module for 802.1AS-rev. It is an approved project in IETF TICTOC (and 1588)

- **In addition we need a parameter which specifies the clock synchronization precision**



New YANG Models Needed

- For somebody that implements CNC/CUC based on YANG, it is very hard to find the necessary YANG models

- Missing YANG Models
  - Physical Topology
  - User Defined Constraints
  - Clock Synchronization
  - Device parameters
  - FRER (802.1CB)

Discussion:
What to do next?

- Develop experimental Models by simply transforming MIBs to YANG:
  https://github.com/YangModels/yang/tree/master/experimental/ieee/802.1

- Create new PAR(s) for:
  1. TSN YANG models (covering 1Qbv, 1AS-rev, 1CB, 1Qbu)
  2. Topology (801.1AB)
- Add amendment to the Qcc for additional User Defined Constraints (UDC)