DETERMINISTIC6G

Some Thoughts on Multiple Configuration Domains

Kick-off for problem statement

János Farkas, Balázs Varga,

janos.farkas@ericsson.com, balazs.a.varga@ericsson.com,

DETERMINISTIC6G has received funding from the European Union's Horizon Europe programme under grant agreement No 101096504.

Disclaimer

- This presentation does not provide solution.
- The goal if this presentation is to provide some food for thought to kick-off the discussions

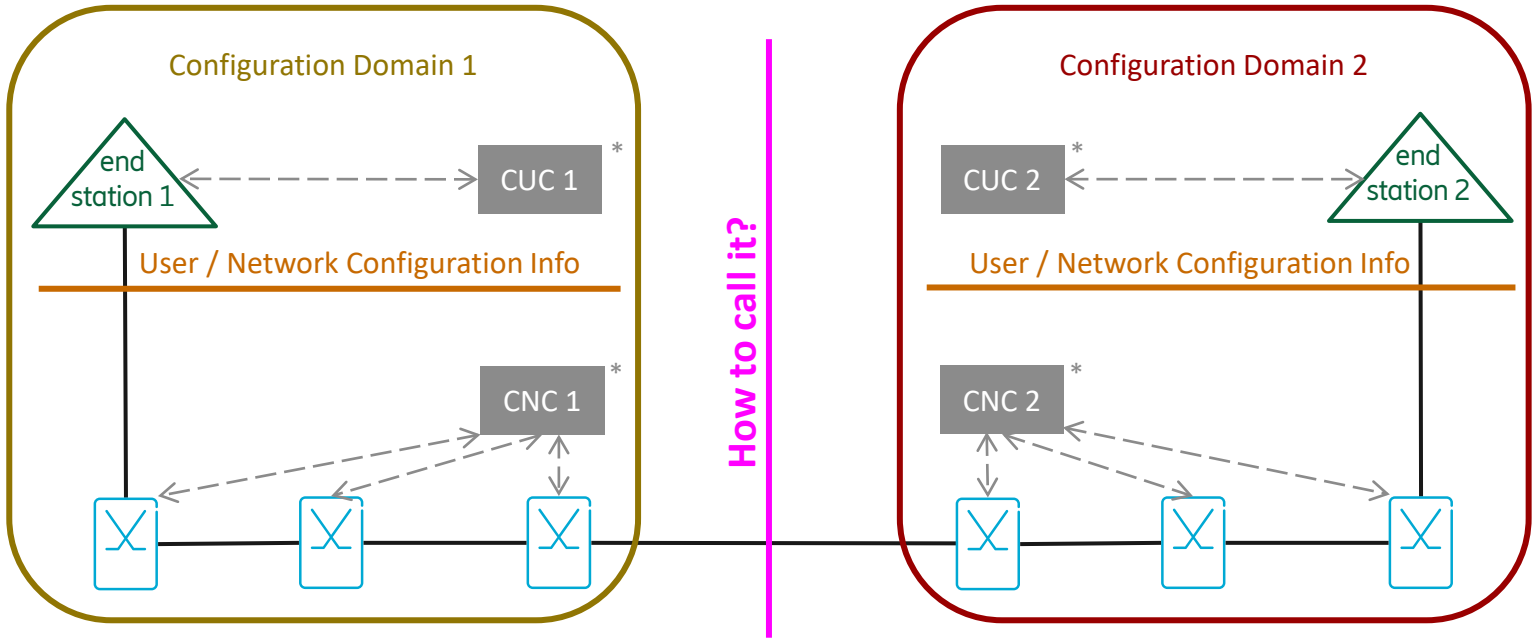
Background

- IEEE Std 802.1Qdj-2024:
  3.1 Configuration Domain: A set of stations that are under a common configuration and management scheme, and a single administration.

- Some earlier considerations:
  [1] https://www.ieee802.org/1/files/public/docs2021/new-farkas-inter-domain-considerations-0721-v01.pdf
  - **Consideration 1**:
    Ideally, inter-domain configuration would be specified such that if one choses a particular configuration model for intra-domain, then not mandated to implement features of another configuration model for inter-domain

High-level Illustration of Configuration Information

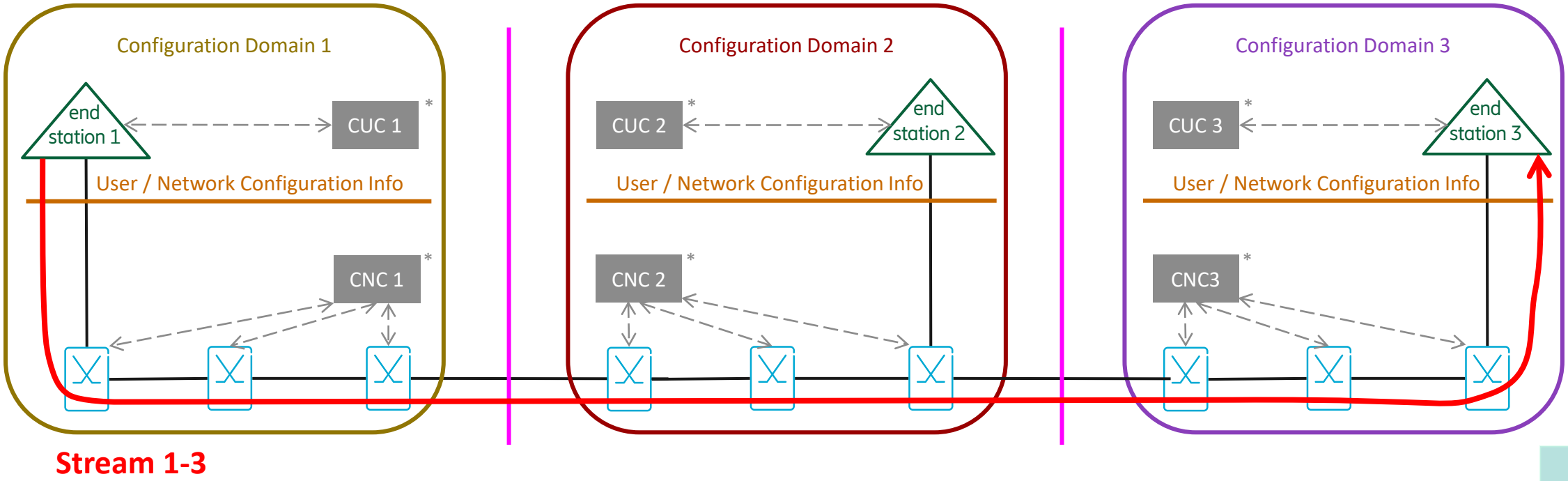
- Q1: How to call the configuration information between configuration domains?
  - Network / Network Configuration Info?
  - Inter-domain Configuration Info?
  - Something else?



* if present

Potentially: Transit Configuration Domain(s)

- For instance, Domain 2 is transit domain for Stream 1-3



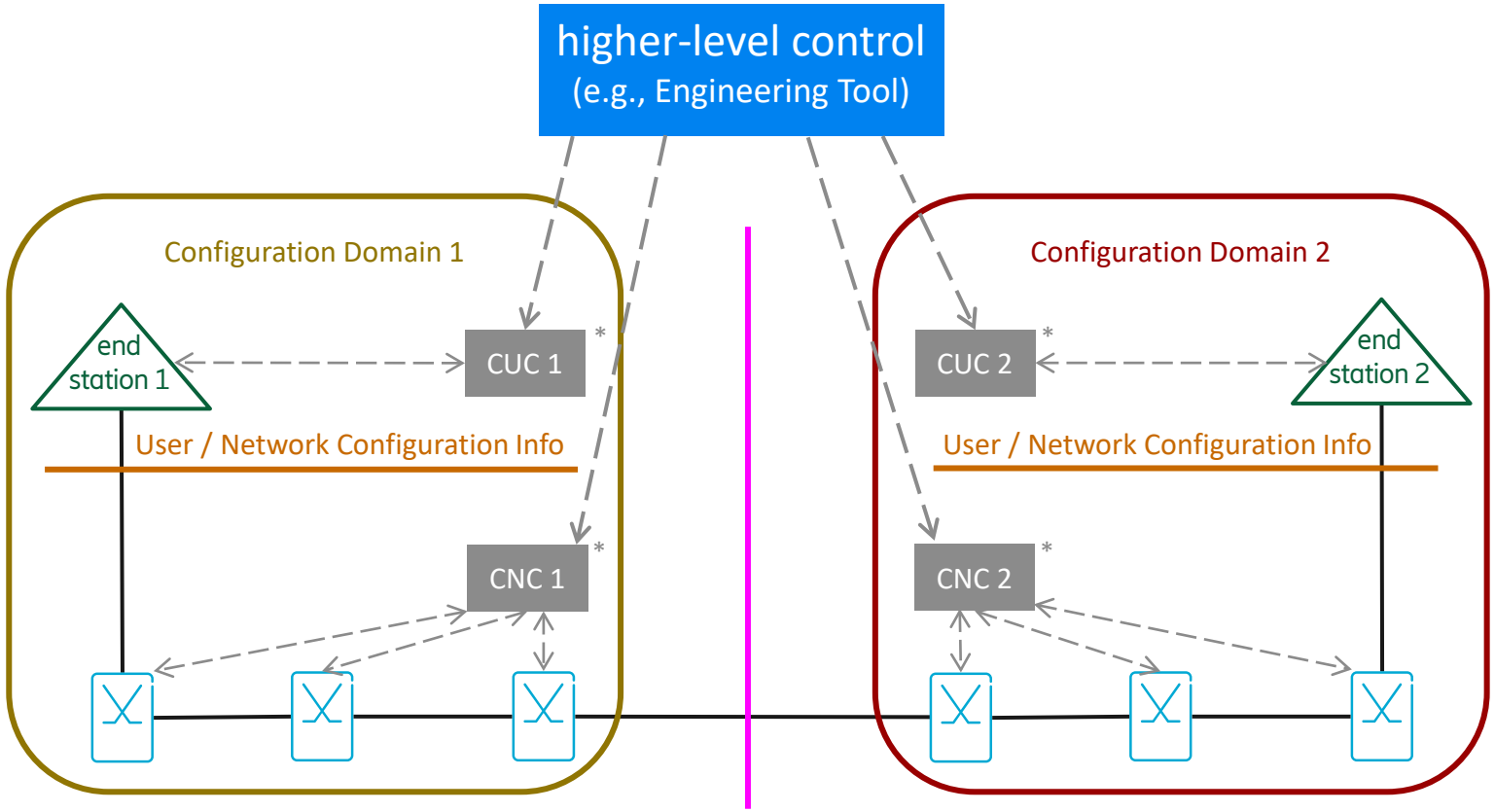
* if present

Some Questions

- Q2: Single vs Multiple administration for the different domains
  - Both should be addressed
- Q3: Configuration Domains vs MST Regions
  - See in the following
- Q4: How to figure out which end stations need to communication to each other?
  - See in the following
- Configuration Domains vs (g)PTP Domains ***– to be subject of a future presentation***
  - Note 1: Ultimately, irrespective of configuration domains, the corresponding end stations have to have the same notion of time as well as the bridges in between them if, e.g., Transmission Gates and/or Stream Gates operate in the bridges
  - Note 2: See 6.2.13 in IEC/IEEE 60802 for IA: “Any valid gPTP domain number as specified in IEEE Std 802.1AS-2020 can be used”

A Use Case: Industrial Automation (IA)

- Can be considered under single administration?
- A higher-level entity, e.g., Engineering Tool, can control which end stations communicate to each other



* if present

Configuration Domains vs MST Regions

- Bridges in an MST Region have the same MST Configuration Identifier (MCID), i.e., same VID → FID → MSTID allocation (otherwise, MSTP forms distinct MST Regions)
- If different VIDs are used in different Configuration Domains, then these Configuration Domains cannot be part of the same MST Region

- Basic Industrial Automation (IA) use case, as per IEC/IEEE 60802 (6.4.2.4):
  - Two MSTIs are required to be supported
    - CIST: MSTID = 0
    - TE-MSTID: 0xFFF
  - VIDs are assigned to the CIST by default
  - IA time-aware streams and IA-streams are assigned to the TE-MSTID

What Tasks To Be Solved?

- Task 1: Establish data communication
  - Stream Identification
  - (potentially, VID translation, priority regeneration at domain boundaries)
- Task 2: Meet QoS requirements
  - Task 2.1: meet delay requirements
    - Maximum delay
    - Maximum delay variation
  - Task 2.2: meet reliability/availability requirements
    - Potentially, establish redundant communications

Task 1: Establish data communication

- Stream identification
  - Stream identification should be set all right in each Configuration Domain a given Stream traverses
  - Stream transformation may be required if different stream identification is used in different configuration domains
  - VID is part of each stream identification method
- VID values
  - Different domains may use different VID values for a given Stream
  - VID translation or Stream transformation may be required
- Priority regeneration
  - Priority regeneration may be used at Configuration Domain boundary, see, e.g., IEC/IEEE 60802
- Q5: Who sets up VID translation, Stream transformation, priority regeneration, etc.?
  - Q5.1: Who communicates to the different Configuration Domains what values to use?
  - These questions apply both to centralized and distributed resource reservation approaches

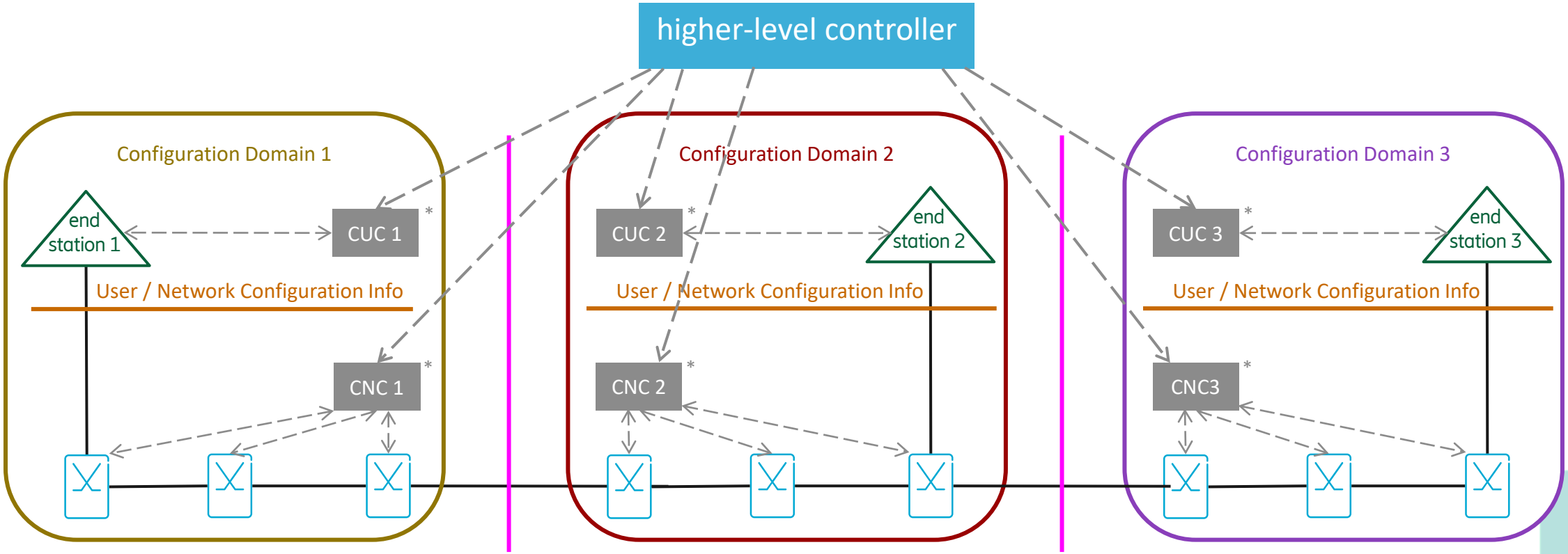
Task 2: Meet QoS requirements

- Task 2.1: meet delay requirements (e.g., maximum delay, maximum delay variation)
  - **Q6: Who divides the delay (delay variation) budget for the different configuration domains?**
    - especially in case of configuration domains under different administration

- Task 2.2: meet reliability requirements
  - If reliability requirements are so stringent, then “service protection”, e.g., FRER, needs to be set up in each Configuration Domain the given Stream traverses
    - This requires multiple boundary ports and coordinated set-up of FRER
  - Q7: How to set-up service protection, incl. maximally disjoint fixed paths and FRER?
    - especially in case of configuration domains under different administration

A Possibility In Case of Single Administration

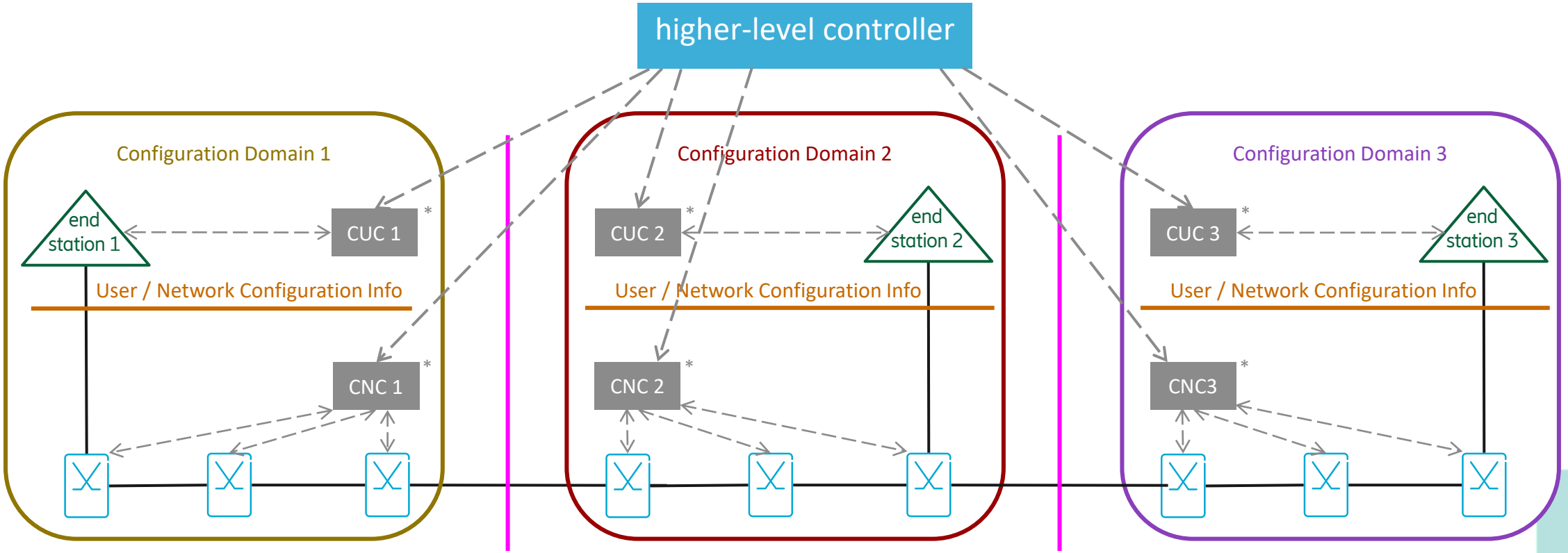
- A high-level controller could implement the tasks for multiple configuration domains
- (It is also called Hierarchical SDN if the configuration domains apply centralized approach)



* if present

A Possibility In Case of Single Administration

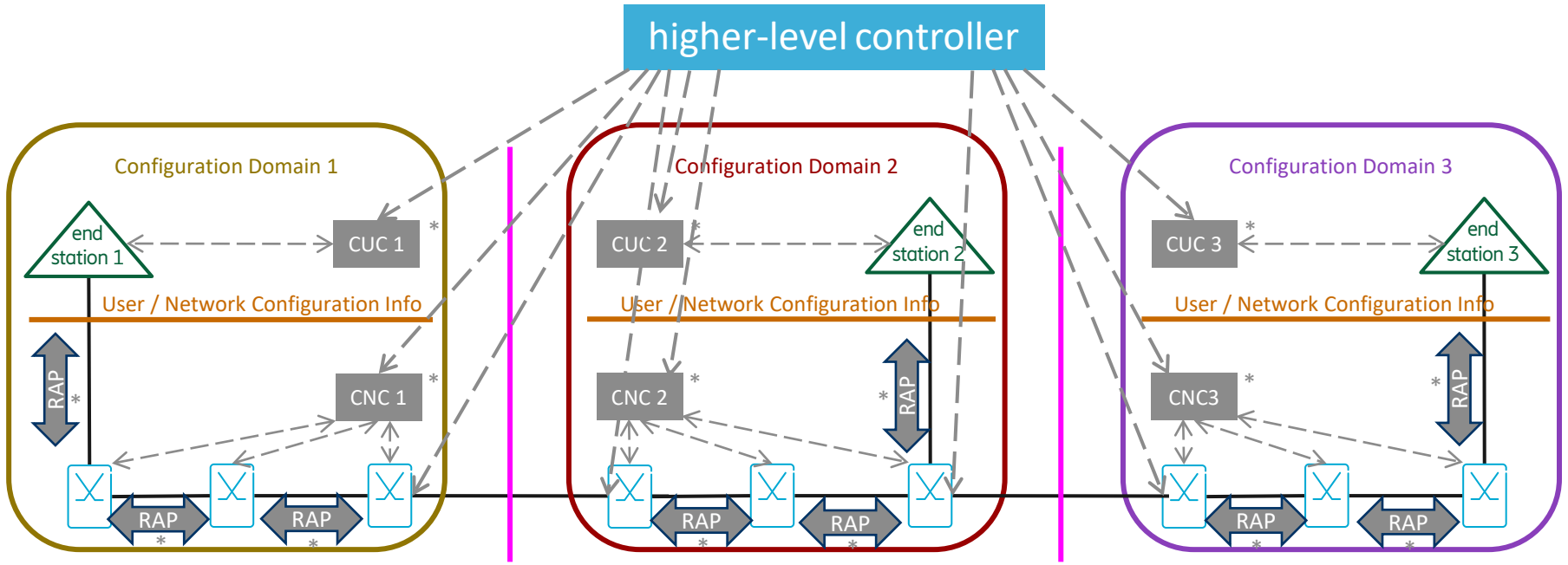
- A high-level controller could implement the tasks for multiple configuration domains
- (It is also called Hierarchical SDN if the configuration domains apply centralized approach)



* if present

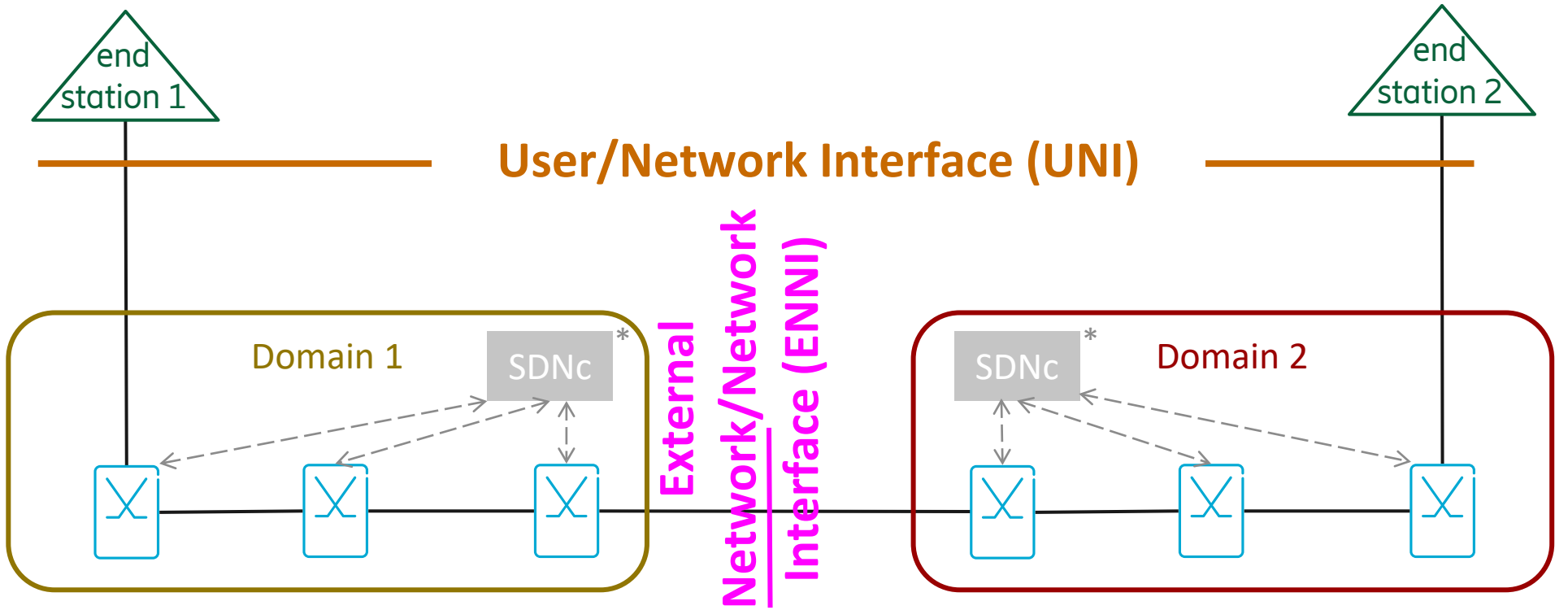
Is There Any Other Way for Industrial Automation?
(In case of Single Administration)

- In IA, some tasks are solved by a central entity even in case of distributed resource reservation in a single configuration domain, e.g., Streams use traffic engineered VIDs (allocated to the TE-MSTID), whose establishment requires a central entity, see more here (e.g., page 9)
- For instance, VID translation, Stream transformation **cannot** be set by a distributed protocol



What To Do In Case of Distinct Administration?

- Any other viable approach than Service Level Agreement (SLA)?
- Should we follow a model similar to Carrier Ethernet Service defined by MEF? (see, e.g., ENNI).



Further Thoughts?

DETERMINISTIC6G Grant Agreement No. 101096504

The DETERMINISTIC6G project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101096504.

If you need further information, please contact the coordinator:

János Harmatos, ERICSSON

E-Mail: coordinator@deterministic6g.eu

or visit: www.deterministic6g.eu

@DETERMINISTIC6G DETERMINISTIC6G