Additional features needed in RAP

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Clause 1 (concept and context of RAP – should be replaced)

- Focus should be RAP and not the comparison with CNC. The relationship to CNC and scheduled traffic should be explained in a short section.
- Figure 1 should be a little bit modified to avoid overlap of different use of single terms.

→ Suggest to redesign clause 1, pointing out the complexity of a totally flat model in a structured environment (this is related to any kind of approach discussed as of now).

Clause 2 (no)

- Deals with additional features of TSN compared to AVB and how to handle it in RAP.
But what means TSN in industrial area?

- Industrial means quite a few machines coupled (mostly by I/Os!):
  - A Maschine has
    - Controlling devices (typically 1)
    - I/O devices
    - Drives
    - local MMI (typically 1)
    - interface to the cell level.

Figure
Does not show Real Numbers!

Per Machine
500 I/O
30 I/O Terminals

Per Cell
20 Machines

Reverse roles:
Small Servers ➔ I/O
Large Client ➔ Controller

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What does it mean for TSN

- TSN can be used in machine level and cell level
- TSN shall be the bridge between machine level and cell level

- Configuration at machine level must not be changed by configuration cell level
  … but a schedule may be shifted as a whole
- A typical machine configuration is straightforward
  if the latency of the I/O devices to the controller is known centralized, decentralized approaches may produce the same results

- Minimum configuration effort within machine

- A resource allocation protocol shall be aware of resources in both ways
  - Resources are connected/ started
  - Resources are disconnected/ stopped

⇒ Any change can have impact to the operation of the machinery and shall be reported asap to the controller

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TSN-RAP support of „centralized“ functions

- A Controller should have all information about application and network within an isolated network.
  - done in case of application in many applications.
  - storage of configuration shall be concentrated for consistency.
  - Master-Slave type of configuration has all information in the master.

- Some components acting as server have several stream options that are selected by the controller.

- An isolated network requires a proxy function for the communication with external components.

- Gateway functions can result in a situation that a stream has subelements with different latency parameters.

- Non IEEE 802.1 network elements should be integrated.
  - this may require organizationally defined TLVs.
Additional rules for bundle of streams

- Stream 0 has a high degree of freedom - from the communication side
- Segment traffic depends upon the configuration of the underlying system
- Stream 1 has to follow Stream 0 and the segment traffic
- Stream 1 depends upon Stream 0 (may be configured after Stream 0)
  **Rule:** the client set up the streams the server follows if possible
- If there are multiple listeners in a station
  the arrival time should be coordinated
  ➔ do not scatter arrival over cycle

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TSN shall provide isolation

- **Today:**
  - **Physically isolated network**
    - Gateway function needed at the controller side
    - Limitation of the information exchange in both worlds
    - Poor communication resource utilization
      (multiple communication interfaces and multiple bridges)
  - But a very predictable communication cycle

- **Next:**
  - **Logically isolated network**
    - Data flow to devices could be done without controller interactions
    - Allows access to devices with a few restrictions
    - Just a single communication channel needed in
  - But a very predictable communication cycle

- **How:**
  - **VLAN usage for isolation**
    - Assign end nodes to a dedicated VLAN
    - Maybe better: mark exit ports
    - Reservation from outside with lower priority

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