Additional features needed in RAP

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RAP main clauses annotations

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

- Focus should be RAP and not the comparision with CNC
  the relationship to CNC and scheduled traffic should be explaint 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)

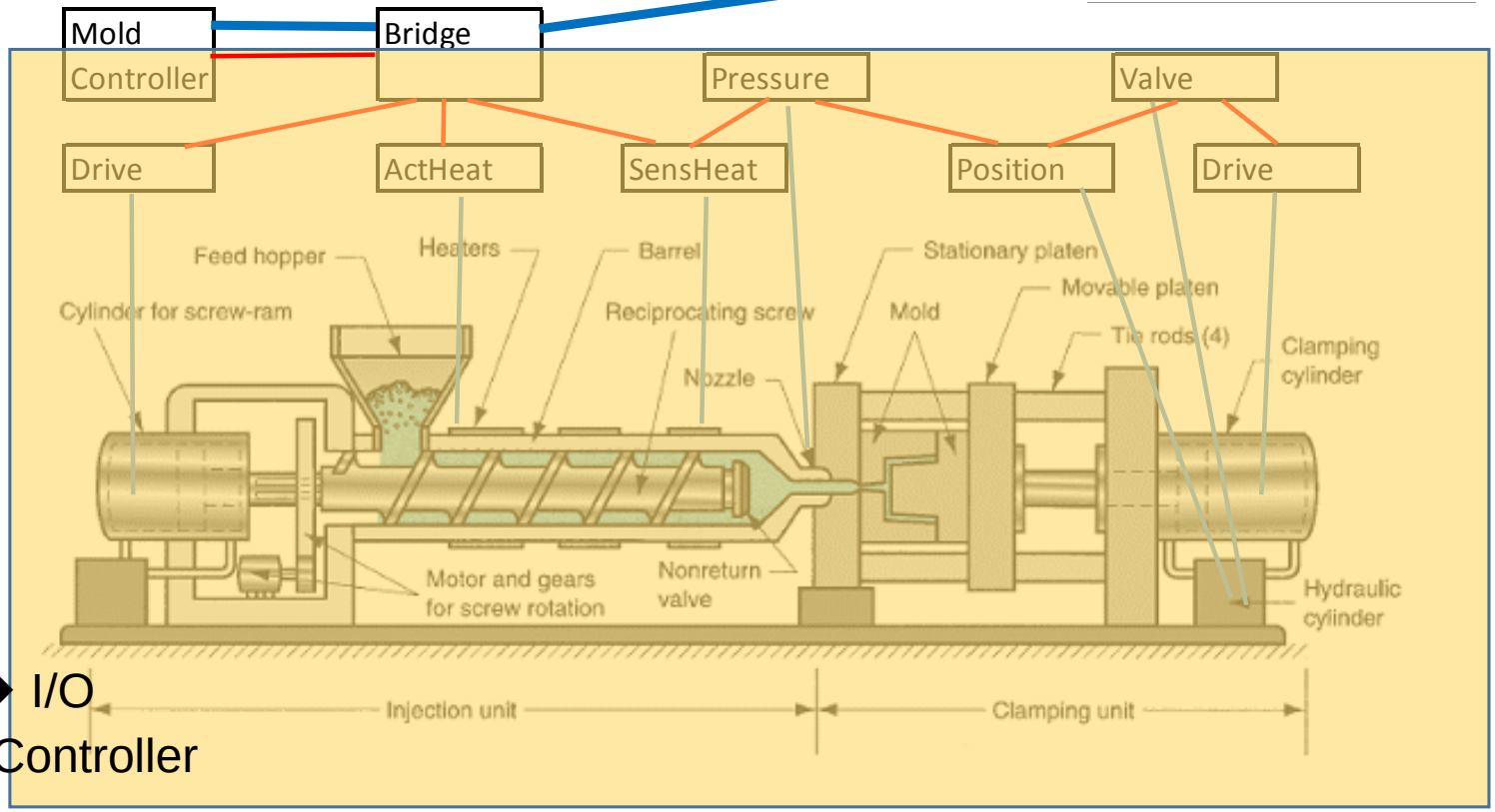
Clause 2 (no

- 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
    -Contolling 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

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
  - Automatic topology
  - Diagnosis with localization
  - No address setting required

- A resource allocation protocol shall be aware of recources 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

TSN-RAP support of „centralized“ functions

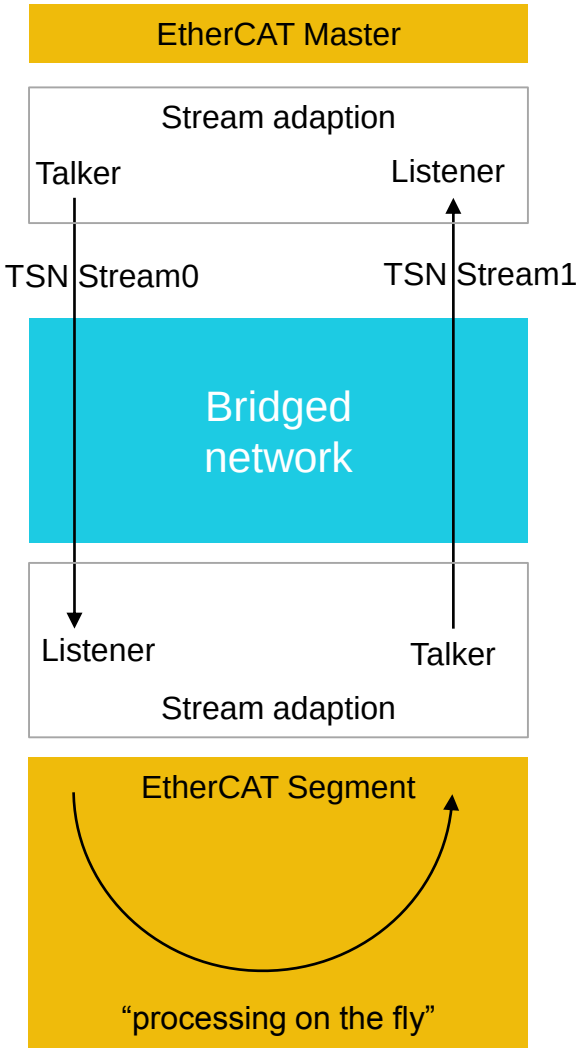
- A Controller should have all information about application and network within an isolated network
  =done in case of application in many applications
  =storage of configuration shall be concentrated for consistency
  =Master-Slave type of configuration has all information in the master

- 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

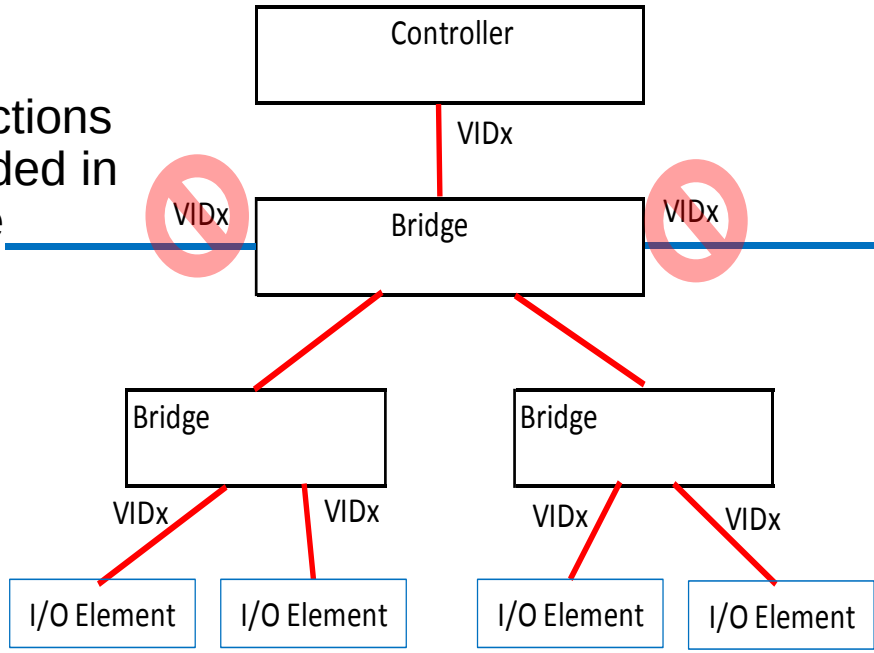
- If there are multiple listeners in a station the arrival time should be coordinated
  ➔ do not scatter arrival over cycle

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



We should try to use TSN in a structured way

NOW!

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