Additional features needed in RAP

Karl Weber
EtherCAT is:

- Faster
- Synchronization
- Industrial Ethernet
- Flexible Topology
- Easier to configure
- Cost effective
- Easier to implement
- Well proven
- Open
- Conformance
- Safety
- Redundancy
- Versatile

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
EtherCAT is:
 Faster
 Synchronization
 Industrial Ethernet
 Flexible Topology
 Easier to configure
 Cost effective
 Easier to implement
 Well proven
 Open
 Conformance
 Safety
 Redundancy
 Versatile

Mold Bridge
Controller Pressure Valve
Drive ActHeat SensHeat Position Drive

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

Nov 2017
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 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
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
EtherCAT is:
- Faster
- Synchronization
- Industrial Ethernet
- Flexible Topology
- Easier to configure
- Cost effective
- Easier to implement
- Well proven
- Open
- Conformance
- Safety
- Redundancy
- Versatile

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!