Impact of L2/L3 discussions on the direction and timing of TSN Gen 2 and 802.1CB

Markus Jochim
General Motors Research & Development

Content / Intention of this Slide Deck

➢ The author would like to discuss observations & concerns about the recent focus on L2/L3 layering in the TSN group.

➢ Intention: Discussion within the TSN group
   o   Are the concerns valid?
   o   Impact on the timing for TSN Gen 2
   o   Impact on the direction of TSN Gen 2
   o   Are we on the right track or do we need to adjust?

➢ I will use Seamless Redundancy (SR) as an example to explain my concerns!
   However: SR is just one example!

Markus Jochim, General Motors Research & Development, IEEE 802.1 TSN Meeting, 05/03/2014

Where are we with the work on TSN Gen 2

➢ **Until very recently. . . my impression was:**

- o We have been in a concept phase for a long time !

- o I perceived the wish of several members of the group to leave this concept phase and move on to the specification phase.

- o But there are still some topics (e.g. flexible traffic class), that require some more discussion / conceptual work before we can close the concept phase.

- o For other topics (e.g. Scheduled Traffic, Seamless Redundancy), the fundamental concepts are agreed upon. PARs are in place.
  What is missing in these cases, are detail that can be filled in during the specification phase!

Recent Layer 2 / 3 discussions   (1/3)

➢ Recently, a lot of material on "TSN and proper L2/L3 layering" was presented.

➢ Really **a lot !!!**

  o [Layering for the TSN Layer 2 Data Plane](#)   81 Slides

  o [Layering for the TSN Layer 3 Data Plane](#)   61 Slides

  o [A Day in the Life of a L2/L3 TSN Data Packet](#)   121 Slides

  o [How many VLAN IDs are required of 802.1CB?](#) 35 Slides

Recent Layer 2 / 3 discussions   (2/3)

➢ The author acknowledges and appreciates that a lot of thought, expertise and work has been invested into these presentations.

➢ At the same time it is obvious, that the focus on L2/L3 layering has now led to a situation, where we start over (not for the first time) with rather fundamental discussions about mechanisms (like Seamless Redundancy) we already reached fundamental agreement on / voted on in the past!

Recent Layer 2 / 3 discussions   (3/3)

➢ Earlier this year, we had discussions about start to looking for an editor for 802.1CB

➢ Now… it feels like we are further away from this point!

➢ In the case of 802.1CB (Seamless Redundancy) we already discussed the Layer 2 / Layer 3 question at length !
(E.g.: See following slides that have been copied from presentation from 2013.)

L2/L3 discussions for 802.1Qcb from 2013   (1/4)

The following 4 slides are an excerpt from a presentation in which several **users (Industrial & Automotive)** responded to L2/L3 questions that were raised. That was before the PAR!

IEEE 802.1 TSN

March 6, 2013

Discussion of Questions related to the proposed P802.1Qcb PAR:

"Frame Replication and Elimination for Reliability" (= Seamless Redundancy)

Christian Boiger, Deggendorf University of Applied Sciences
Franz Joseph Goetz, Siemens AG
Markus Jochim, General Motors
Oliver Kleineberg, Hirschmann Automation & Control
Johannes Specht, University of Duisburg-Essen
Karl Weber, Zurich University of Applied Sciences

IEEE 802.1 TSN   1
March 6, 2013

Seamless Redundancy on Layer 3 ?

Observation: "There is a market and a need for Seamless Redundancy on Layer 2"

➢ Several Ethernet variants that provide support for Seamless Redundancy on Layer 2 have been successfully introduced in the past

➢ The successful introduction of such proprietary solutions clearly underline the feasibility and the market potential of the Layer 2 based control use cases.

➢ Multiple use cases for Seamless Redundancy on Layer 2 have been presented several times within 802.1 TSN by the authors of this presentation.

IEEE 802.1 TSN
March 6, 2013

6

Markus Jochim, General Motors Research & Development, IEEE 802.1 TSN Meeting, 05/03/2014

Automotive: Main Focus is on Layer 2 !

➤ For time and safety critical in-vehicle control applications the clear focus on layer 2 solutions (e.g. L2 switches) is perceived to be very consistent across different companies within the automotive industry.

➤ For certain control applications Layer 3 protocols are not even required and protocol overhead and the use of routers are not justified!

➤ During the last 1 to 1.5 years we observed a significantly increased interest of automotive companies in Ethernet based time and safety critical control applications.

  This should be perceived as an opportunity!

➤ For that reason we have started to drive requirements for control applications into 802.1. The clear focus is on Layer 2 !

In the foreseeable future, Layer 3 routers will not play a significant role in architectures for time & safety critical in-vehicle control applications!

March 6, 2013

Industrial Control: Main Focus is on Layer 2 !

➢ Industrial control networks are often organized hierarchically in layer 2 and layer 3 domains (many mission-critical networks do the same thing)

➢ For highly time-critical motion control and industrial control applications the focus on mechanism is based on layer 2 networks. Time-critical traffic very rarely leaves a layer 2 domain.

➢ The intention of this group is to drive their requirements for control applications into 802.1. The clear focus of this group is on Layer 2 !
This should be perceived as an opportunity!

➢ Transmitting Control-Data-Streams over layer 2/3 router with a certain QoS is also an important feature, which will also play an important role in network architectures for industrial networks. However, this approach is not an adequate solution for e.g. highly time critical motion control applications!
A cost sensitive solutions for the highest industrial control requirements on guaranteed QoS, latency and synchronization can, in the foreseeable future, only be met by pure layer 2 networks.

IEEE 802.1 TSN
March 6, 2013

8

Automotive Market Potential & Availability of TSN

➢ There is a substantial market potential !

➢ Estimate: **400 Mio Ports by 2019/20** (see below).

➢ We see more and more Active Safety applications that can benefit from require TSN features!

➢ To have **TSN ready in the near future will be essential** for the success of Ethernet as a pervasive automotive network!

CFI Single Twisted Pair Fast Ethernet

Automotive Market Potential

Updated forecast from 2012 CFI for RTPGE
→ For RTPGE CFI we forecasted 270 Mio Ethernet Ports by 2019/20
→ We were wrong, sorry!
→ We now assume about 400 Mio Ports

Some numbers
→ In 2019 the automotive industry will produce 117 Mio vehicles
→ Up to 35 ports (20 avg.) in premium class vehicles and 20 (8 avg.) in medium class vehicles that have Ethernet

Ethernet increases creativity
→ Engineers become creative when technologies are available, we clearly see E/E-Architectures with way more Ethernet
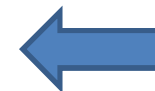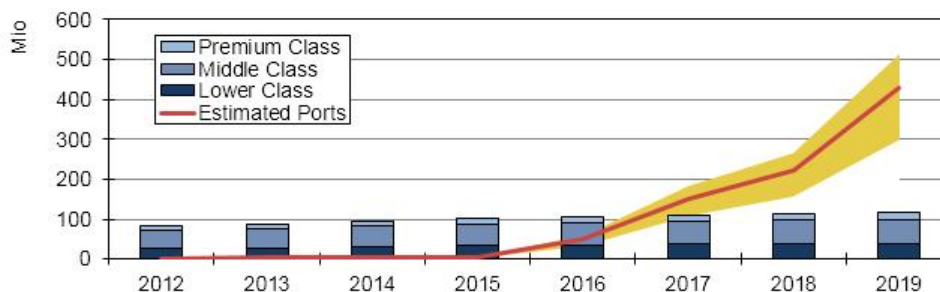
Slide copied from a preliminary version of the presentation for the upcoming "Single Twisted Pair Fast Ethernet CFI" (Thomas Hogenmüller – Bosch)

Markus Jochim, General Motors Research & Development, IEEE 802.1 TSN Meeting, 05/03/2014

Conclusions

➢ The L2/L3 discussion may be the right discussion at the wrong time.

➢ For 802.1CB, proceed with a specification towards the original goal: L2 solution for automotive & industrial !
➔ TSN Gen 2

➢ Since all possible layer 3 protocols are not represented in 802.1 meetings, defer those considerations to a subsequent version of 802.1CB.
➔ TSN Gen 3

➢ Short formula: TSN Gen 2 = L2,   TSN Gen 3 = L2/3.

Wait a minute… that wasn't the last slide ?

➢ I understand that most presentations end with the "Conclusion" slide….

➢ But I have one more (short) topic…

Who is / should be working on what ?   (1/2)

- Perspective of an automotive OEM:
  - Our core business is designing, building and selling vehicles !
  - It is not our core business to design, build and sell chips or network components!
  - As an automotive OEM we are willing to:
    - Discuss / explain our use cases and needs.
      (Examples: Seamless Redundancy, Ingress Policing, Flexible Control Traffic Class)
    - Work in industry and standardization forums.
    - Describe and even outline mechanisms we require.
    - Consider supporting editors for IEEE specifications that are of interest to us.

    We have done these things in the past and will continue doing this.

Who is / should be working on what ?   (2/2)

> ➢ Since it is not our core business to design chips / network components, we don't see our role in 802.1 in working on refining concepts to the level of detail required for a specification !

$\Rightarrow$ We are looking at those whose core business it is to design chips / network components to take a more active role in refining / specifying the proposed & required mechanisms in 802.1.