Urgency Based Scheduler

IEEE802.1 Motion Preparation

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Purpose of this Slide Set

- UBS is a real-time traffic class proposed for standardization in IEEE 802.1TSN
- Complements existing TSN Quality of Service projects (802.1Qbv, 802.1Qci, 802.1Qch) with properties not yet covered
- The technical core concept was widely developed outside of an official IEEE 802.1 project, the latest concept demonstrating technical feasibility was presented in May 2015
  (see http://www.ieee802.org/1/files/public/docs2015/new-tsn-specht-ubs-queues-0521-v0.pdf)
- This slide set serves for preparation of a motion in 802.1 to draft a PAR for standardization of UBS as a result of the discussion in September 2015
  (see http://www.ieee802.org/1/files/public/docs2015/new-tsn-specht-ubs-comparison-and-steps-0915-v01.pdf)

Properties of UBS

Real-Time Capability/QoS

- QoS in the magnitude of IETF IntServ, but at significant lower implementation complexity
- Low End-to-End delay guarantees, also in unfriendly networks, faster than CBSA with Qci
- Applicable for Periodic-, Rate-Constrained and Event-Driven Streams at close-to-zero bandwidth overhead
- Formal proofs and simulations available

Reliability

- Independent of Clock Synchronization, avoids Common Cause Failures of TDM alternatives
- Integrated permanent protection against babbling idiots/malicious traffic at high accuracy, avoids „safety margins“ which would decrease effective network utilization

Flexibility/Usability

- Talker driven transmission times, no application synchronization to network time required
- No setup and agreement on TDM parameters (cycle durations, time slots) required
- Simple delay analysis per hop, enables isolated analysis for partial networks
- Optional end-to-end delay guarantee tweaks by prioritization

Scalability

- The initial proposal in 2013 required per flow queues
- The May 2015 update massively reduced the number of queues to flow independent number
- Supporting the number of consistent streams per port can be adjusted via profiles (e.g. Automotive, Industrial Control, Aerospace)

See http://www.ieee802.org/1/files/public/docs2015/new-tsn-specht-ubs-comparison-and-steps-0915-v01.pdf for further details

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Primary Target Market

Automotive

- Primarily driven by Automotive needs for a Flexible Control Traffic Class
  See http://avnu.org/wp-content/uploads/2014/05/AVnu-AAA2C_Automotive-Requirements-for-a-Flexible-Control-Traffic-Class_Markus-Jochim-Johannes-Specht.pdf
- Large Market Volume
  See http://www.ieee802.org/3/RTPGE/public/mar12/CFI_01_0312.pdf
- Applicable in Active Safety and Automated Driving, Motion Control, Infotainment Domains and Ethernet Backbone Systems, potentially others
- Supports legacy low bandwidth real-time traffic (control loops, sensors, actuators), co-existent with new high bandwidth real-time traffic (Cameras, Radars, LiDARs, …)
- Enables modularized network architecture design involving different parties (OEM Divisions, TIER1-, TIER2-suppliers)
  See http://www.ieee802.org/1/files/public/docs2014/new-tsn-specht-ubs-automotive-1114-v01.pdf

Potential Target Markets

Industrial Networks

- Could be used in open systems for flexible applications
- Beneficial UBS properties
  - Asynchronous/non-TDM operation supports arbitrary mixed transmission periods
  - Not tied to particular clock sync domains
  - End-to-End latency can be re-computed easily during re-configuration
  - Non-prioritized or class-based priority setups maintain several plug-and-play characteristics from AVB Gen1
- See http://www.ieee802.org/1/files/public/docs2014/cb-kiessling-Industrial-networks-0514-v01.pdf

Aerospace

- Might extend the communication landscape in reliable avionics applications
- Beneficial UBS properties
  - Asynchronous/non-TDM operation provides high independence between components (simplifies safety demonstrations)
  - Protection against babbling idiots provides traffic enforcement
- See http://www.ieee802.org/1/files/public/docs2015/TSN-Schneele-AFDX-0515-v01.pdf