Avnu & Industrial Profiling for TSN

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January 24th, Geneva Switzerland
Agenda

- Avnu Introduction
- Avnu Goals and Objectives with TSN
- The Role of Avnu Alliance
- Current Roles of the Standards Organizations
- Avnu Conformance Testing for AVB
- TSN Theory of Operations
- Collaboration with IIC
- Future Activities
What is Avnu Alliance?

Creating a certified ecosystem to bring precise timing, reliability and compatibility to networks

• Team of 70+ companies promoting open standards for deterministic networking, such as AVB/TSN
• Spans many industries: pro A/V, consumer A/V, automotive, energy, industrial, and more
• Certifies products to ensure interoperability and compatibility among models and brands
Avnu Goals for TSN

Goal: Real-time Application Protocols Can Share the Wire With Standard IT Traffic

- OPC-UA
- OMG DDS
- PROFINET
- IEC 61850
- ODVA - EtherNet/IP
- EtherCAT w/ Stream adaptation
- SERCOS
- Automotive
- Professional AV
- Consumer
- Standard IT Traffic

Deterministic, Standard Network Foundation – shared among all nodes (HW, Driver, Timing, Interoperability, Network Configuration, APIs, etc)

Avnu Assures the Tested, Standard Network Foundation for Concurrent Applications
Avnu’s Role: Interoperability and Conformance

This platform consists of:
- Open Source Software
- Standardized APIs
- HW Reference Designs
- Test Plans
# Current Roles of the Standards Organizations

## Testbed and Reference Architectures
- Testbeds to evaluate “full stack” and provide feedback to members and liaison organizations
- Application specific architectures to aid in market adoption
- Outbound marketing to create awareness

## Application Layers
- Define data models for end-device communication
- Integration of TSN communications and configuration models into application tools
- Application flow for end-node configuration
- Conformance for data models and end node configuration

## TSN Transport Interoperability and Conformance
- Define network services needed by market
- Fill gaps in standards to provide interoperable network configuration services
- Conformance of transport and network services
- Establish certification services

## Network standards
- Define standard features to provide Time Sensitive Networking “deterministic communication” capabilities including updates to OSI Layers 1-4
- Assure proper operations and backwards compatibility with IT and OT

OPC Foundation, ODVA, IEC 61850, Sercos, ...
**Avnu Conformance Testing for AVB**

- AVB conformance tests since 2013
- Testplans for endpoints and bridges
  - gPTP
  - MRP, MSRP, and MVRP
  - FQTSS
  - ...
- Goal for TSN to extend on these testplans and testing experience, e.g.:
  - gPTP (to be published)
  - IEEE 802.1Qbv (in progress)
Avnu - Theory of Operations

- 71 Pages
- Provides an overview of how to use TSN features of Ethernet
  - Use Cases and Requirements
    - States the problem
  - Introduction to TSN Foundational Mechanisms
    - Describes tools used to solve the problem
  - System Architecture
    - Shows how to use tools to solve the problem
  - Examples
    - Shows how tools solve specific problems relevant to industrial use cases

http://avnu.org/knowledgebase/theory-of-operation/ (email and name required)
Current Industrial Configuration Model

- The current focus is on centralized configuration.
- Additional models can be supported and tested to support market needs.
Avnu Collaboration with IIC

Industrial Internet Consortium’s TSN for Flexible Manufacturing Testbed

Key Facts:
- >20 Vendors participating today
- 8 Plugfests conducted
- 2 Testbed facilities (US and Germany)
- Demonstrations at 6 major shows
- Collaboration with multiple standards organizations
# Traffic Types in Manufacturing/Industrial networks

<table>
<thead>
<tr>
<th>Types found in Network</th>
<th>Characteristics</th>
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<tbody>
<tr>
<td>Network Control</td>
<td>Data Transmission Periodicity (cyclic/periodic or acyclic/sporadic)</td>
</tr>
<tr>
<td>Voice</td>
<td>Period</td>
</tr>
<tr>
<td>Video</td>
<td>Application Synchronization</td>
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<tr>
<td>Configuration and Diagnostics (Excellent Effort)</td>
<td>Data Size</td>
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<tr>
<td>Best Effort</td>
<td>Delivery Guarantee (deadline, latency and/or bandwidth)</td>
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<tr>
<td>Isochronous</td>
<td>Tolerance to interference (network jitter)</td>
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<tr>
<td>Cyclic</td>
<td>Tolerance to loss (drop sensitivity)</td>
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<tr>
<td>Alarms and Events</td>
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Source: An IIC whitepaper describing Manufacturing/Industrial traffic types that require TSN capabilities
We Look Forward to Collaborating with IEC & IEEE In the Future

- Avnu is looking to work together with IEEE & IEC on requirements for the industrial profiling work to avoid fragmentation and to achieve a common test foundation
- Avnu currently has a liaison in place with IEC, and a relationship with IEEE
- We look forward to future collaboration!