Avnu & Industrial Profiling for TSN

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Joint IEEE 802.1 TSN & IEC 61784-6 meeting
January 24th, Geneva Switzerland

AVNU ®
RELIABLE SYNCHRONIZED NETWORKING

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**
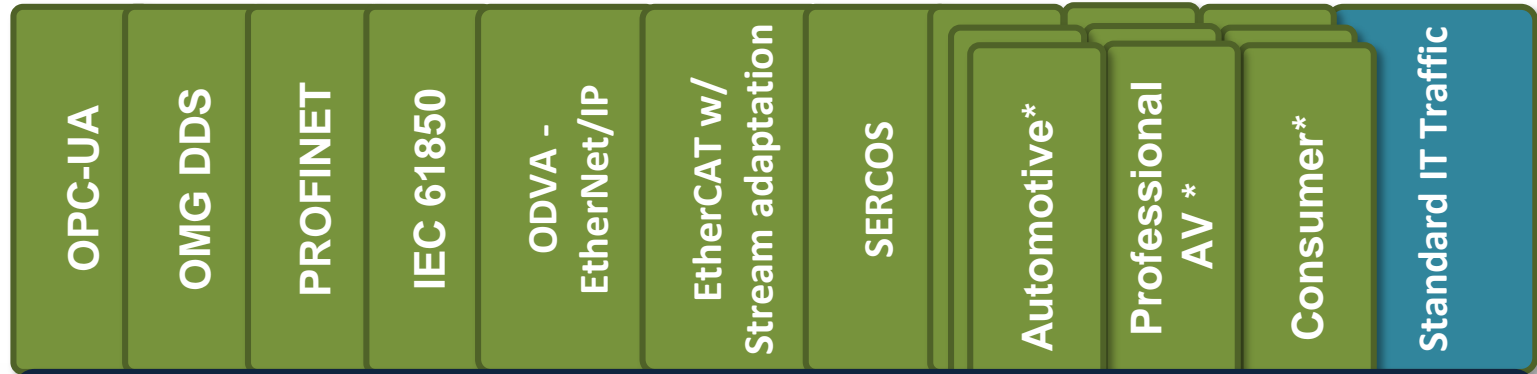
What is Avnu Alliance?

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
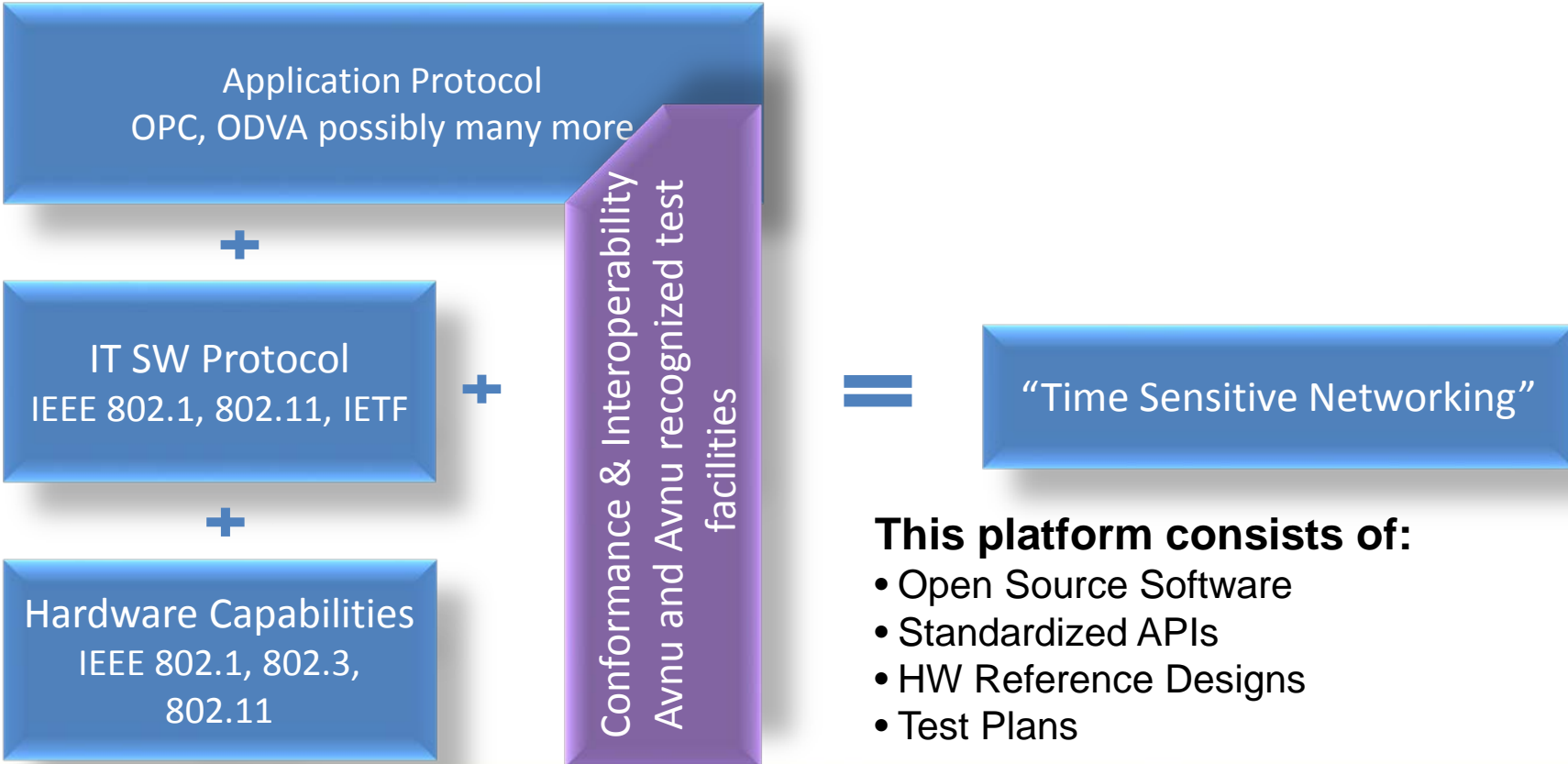
Avnu Goals for TSN

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

Application Protocol
OPC, ODVA possibly many more

+

IT SW Protocol
IEEE 802.1, 802.11, IETF

+

Hardware Capabilities
IEEE 802.1, 802.3, 802.11

+

Conformance & Interoperability
Avnu and Avnu recognized test facilities

=

"Time Sensitive Networking"

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

OPC Foundation, ODVA, IEC 61850, Sercos, …

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

Avnu Conformance Testing for AVB

Avnu Certification Profile: Pro AV Release 1.0

Device Category: Bridges

	Version	Last Update	Grace Period Ends
AS/gPTP Test Plan	0.4	9/8/2013	06/30/2017
BA Test Plan	0.4	9/8/2013	06/30/2017
FQTSS/Qav Test Plan	0.5	9/8/2013	06/30/2017
Interop Test Plan	0.3	2/28/2013	06/30/2017
MRP Test Plan	0.3	9/8/2013	06/30/2017
MSRP Application Test Plan	0.4	9/8/2013	06/30/2017
MVRP Test Plan	0.4	9/8/2013	06/30/2017
Bridges and Pro A Endpoint Errata	1.0	07/20/2015	06/30/2017

Device Category: Pro AV Endpoints

	Version	Last Update	Grace Period Ends
FQTSS Test Plan	0.1	8/21/2013	06/30/2017
gPTP Test Plan	0.4	9/5/2013	06/30/2017
Interop-io Test Plan	0.3	8/21/2013	06/30/2017
M*RP Test Plan	0.2	1/17/2014	06/30/2017
Media Clocking Interop Test Plan	0.0	8/21/2013	06/30/2017
1722 Test Plan	0.3	8/21/2013	06/30/2017
Bridges and Pro A Endpoint Errata	1.0	07/20/2015	06/30/2017

**Avnu Certification Profile: Pro AV Release 1.1**

Device Category: Bridges

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...

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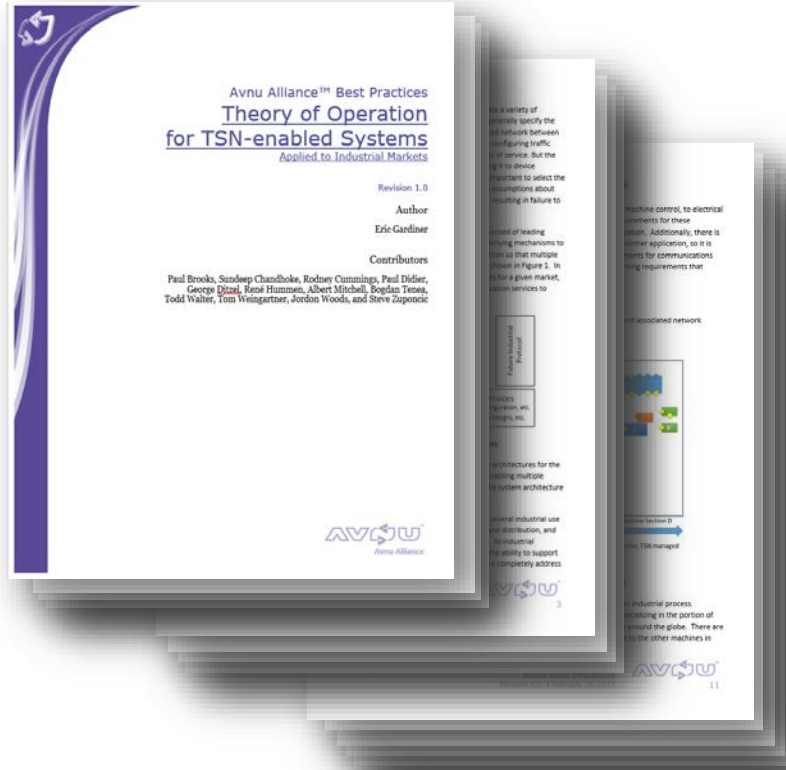
- 71 Pages
- Provides an overview of how to use TSN features of Ethernet
  - Use Cases and Requirements
    - States the problem
  - Introduction to TSN Foundational Mechanisms
    - Describes tools used to solve the problem
  - System Architecture
    - Shows how to use tools to solve the problem
 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

Engineering Tool

Centralized Network Configuration (CNC)

Talkers

Bridges

Listeners
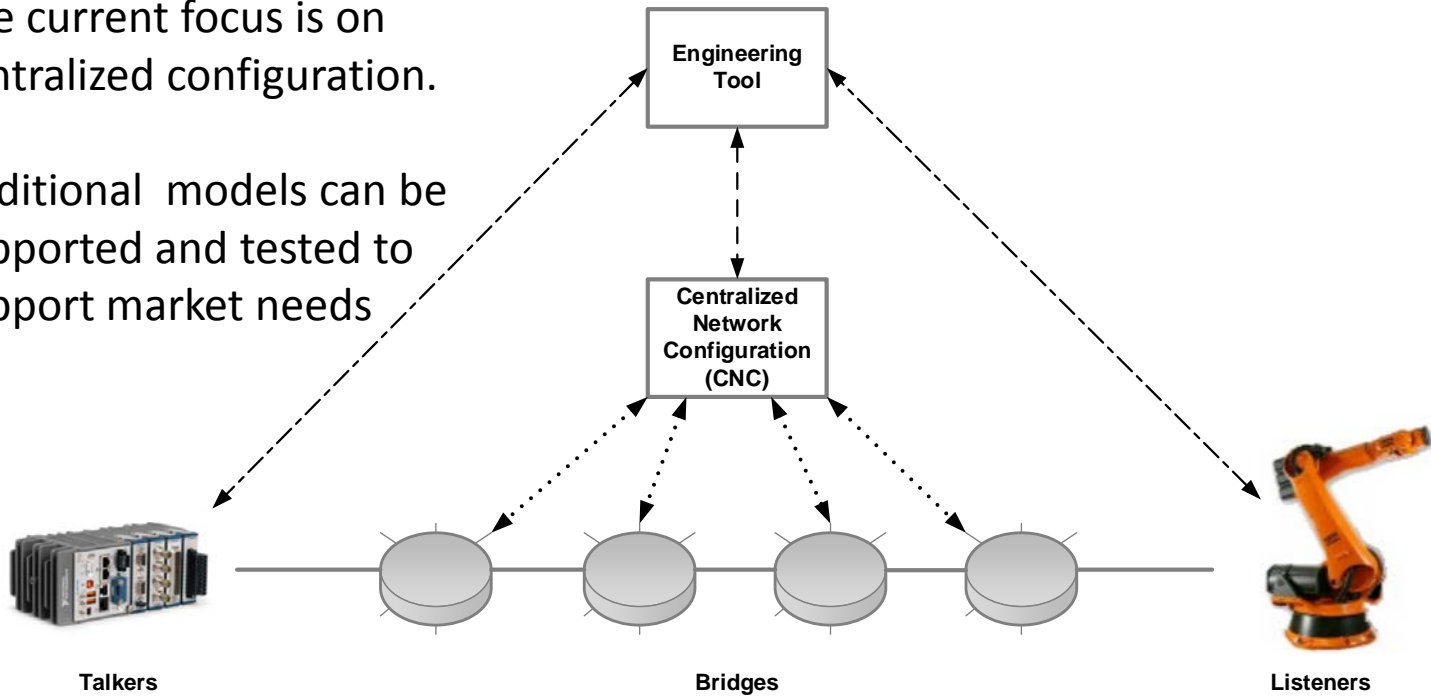
Avnu Collaboration with IIC

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**
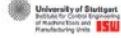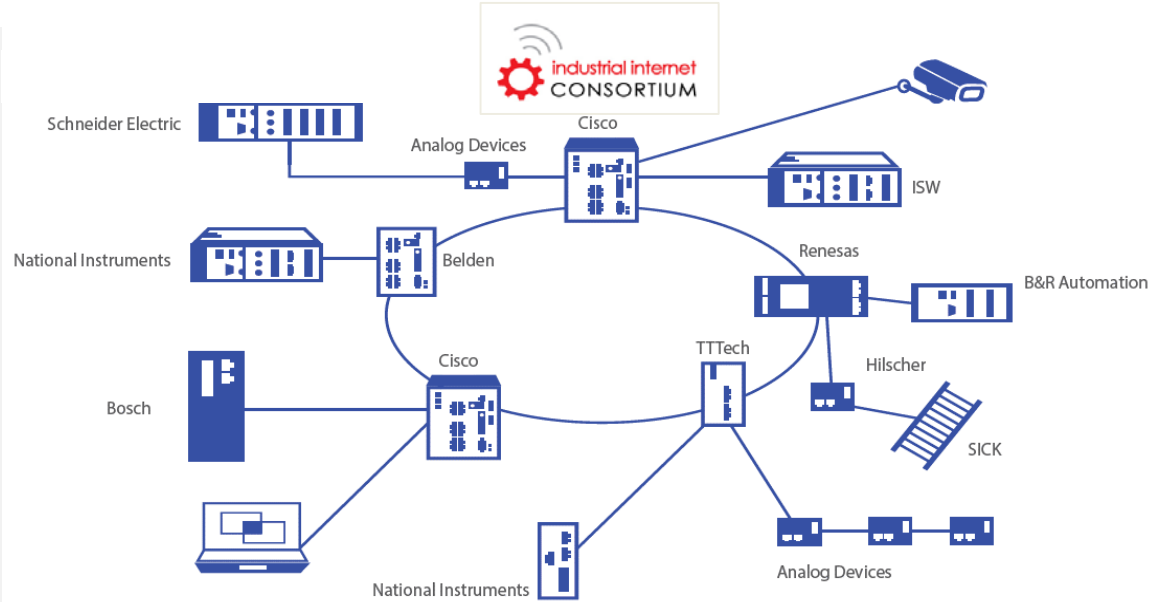
Traffic Types in Manufacturing/Industrial networks

Types found in Network
Network Control
Voice
Video
Configuration and Diagnostics (Excellent Effort)
Best Effort
Isochronous
Cyclic
Alarms and Events

May be sub-types of Critical Applications

Characteristics
Data Transmission Periodicity (cyclic/periodic or acyclic/sporadic)
Period
Application Synchronization
Data Size
Delivery Guarantee (deadline, latency and/or bandwidth)
Tolerance to interference (network jitter)
Tolerance to loss (drop sensitivity)

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!