Time Sensitive Networking for Synchronization and Deterministic Communication

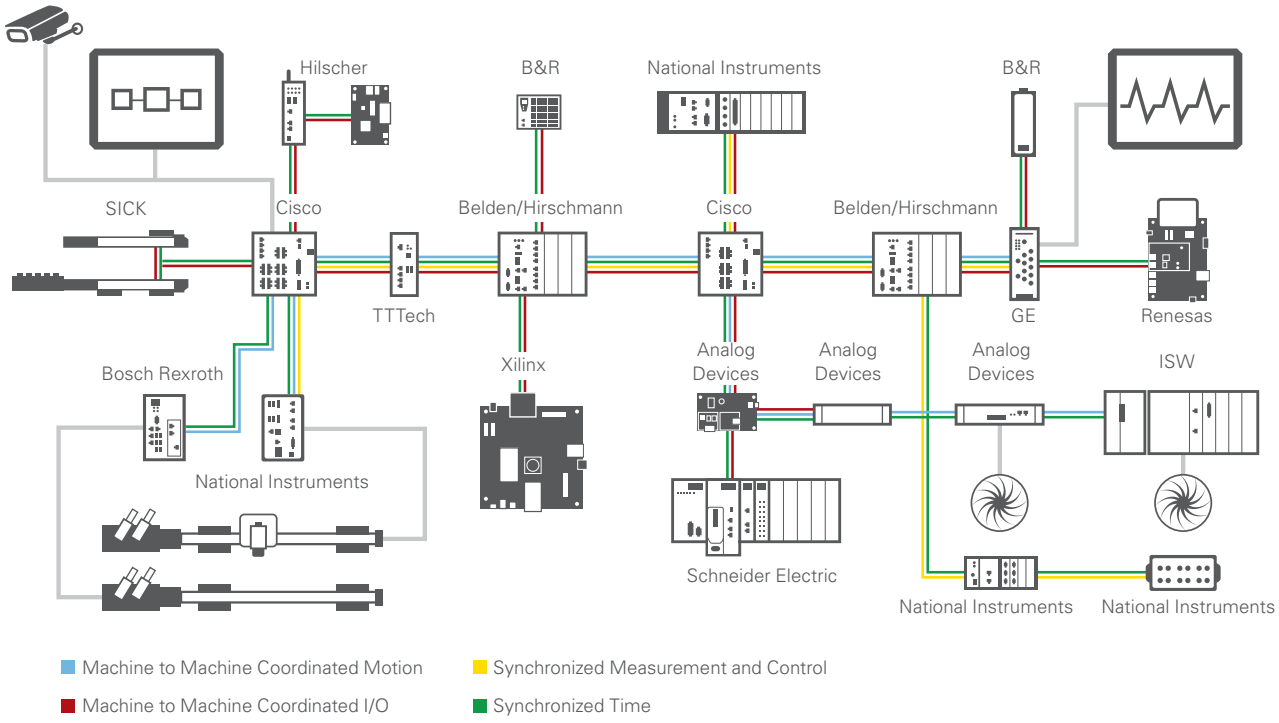
NI Industrial IoT Lab Demonstrations

The NI Industrial IoT Lab is home to multiple Time Sensitive Networking (TSN) demonstrations highlighting interoperability between suppliers, showcasing how operational technology (OT) and information technology (IT) networks can be successfully combined, and demonstrating the value of synchronized measurement and control.

TSN for Flexible Manufacturing Testbed

The TSN for Flexible Manufacturing IIC Testbed is being built by a number of industrial suppliers who are working on supporting TSN functionality. These vendors are combining early systems to ensure the creation of an interoperable ecosystem that meets the needs of next-generation manufacturing systems.

DEMO DIAGRAM



TSN FEATURES FOR FLEXIBLE MANUFACTURING

TIME SYNCHRONIZATION

IEEE 802.1AS, IEEE 1588

End nodes and switches have a common understanding of time.

TRAFFIC SCHEDULING

IEEE 802.1Qbv

Packet transmission from a sender to a receiver is scheduled end to end and follows a repeating cycle.

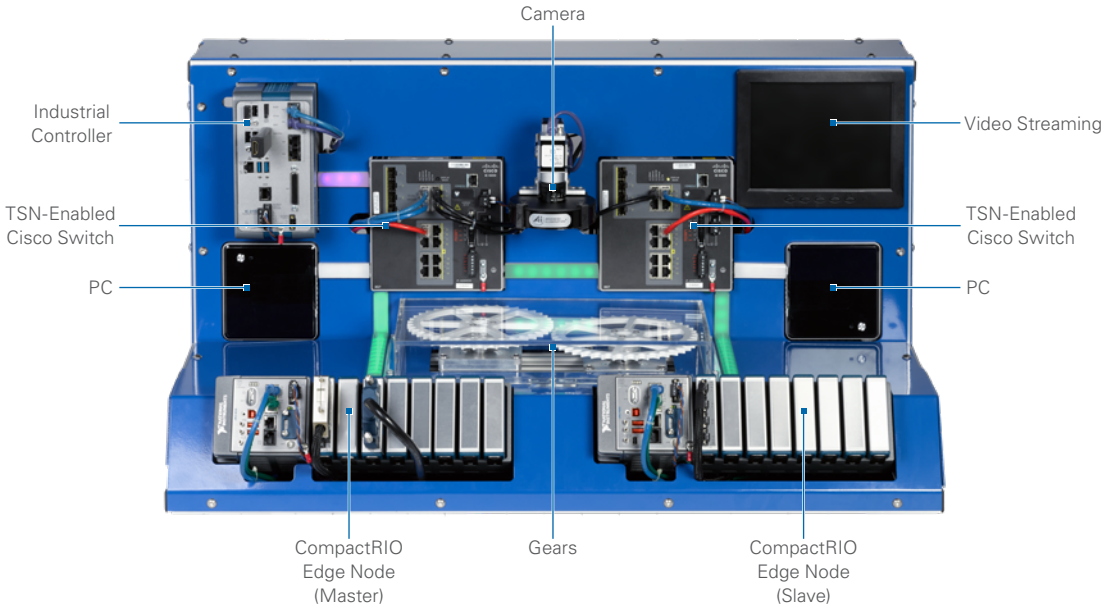
SYSTEM CONFIGURATION

IEEE 802.1Qcc

A consistent mechanism for network configuration helps meet application needs.

TSN Gears Demonstration

This demonstration uses coordinated vision and motion between control systems to demonstrate the key features of TSN. TSN networks use the 802.1AS protocol to synchronize targets across the network.



Theory of Operation

On each cycle of the TSN communication period (1 ms), the master CompactRIO transmits the current position of the master gear. The slave CompactRIO uses this information and controls the slave gear to keep the gears aligned. An industrial controller uses the TSN network time to trigger an industrial camera to visually check the alignment. The demonstration can also simulate network problems such as congestion. In this situation, the network is flooded with additional Ethernet traffic to demonstrate the ability for TSN to work even in situations where network bandwidth is fully consumed.

Industry Impact

TSN provides distributed time synchronization and deterministic communication using standard Ethernet networks. As such, any application requiring distributed measurements or control can benefit from TSN. It removes the need for external trigger lines that are traditionally laid between instruments in a distributed measurement system, which results in an immediate benefit to structural and other physical test installations. The scheduling and control aspects will enable the integration of OT and IT traffic on a single network, which will impact the manufacturing and automated production test industries.

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