

CAPABILITY BRIEF

Running RTI Connex Over TSN

HIGHLIGHTS

Enables deterministic communications in distributed systems using standards-based, commercially-available technologies

Improves system performance by preventing non-real-time traffic from interfering with deterministic real-time dataflows on the same network

Enables cost savings on hardware, system development and maintenance

Allows systems to be designed and optimized for common hardware platforms

Enables a flexible and scalable network infrastructure for greater agility and responsiveness to market changes

Both DDS and TSN standards provide the necessary building blocks for complex, advanced communications through an approach combining technologies at the application software and network hardware levels. Combined with TSN, RTI Connex[®] optimizes system performance by prioritizing dataflow throughout the system, based on user-defined QoS criteria within a modern architectural framework.

DDS MEETS TIME-SENSITIVE NETWORKING (TSN)

Time-Sensitive Networking (TSN) is a set of standards designed for real-time applications that demand consistent performance. Operating at the Data Link Layer, in the networking hardware, TSN ensures reliable packet delivery over regular Ethernet networks. It employs centralized resource management to achieve controlled levels of jitter and latency, as well as guaranteed bandwidth throughout the network. TSN is the networking equivalent of a Real Time Operating System (RTOS), spread across an entire system.

Data Distribution Service (DDS[™]) is an Application Layer communication standard used in mission critical and real-time distributed networks. DDS manages the data in the communication pipe to ensure that applications always have the right data at the right time, providing a reliable connectivity foundation for seamless system integration. Based on the open DDS standard, RTI Connex enables various critical elements of a complex distributed system to work as one.

Together, TSN and Connex provide the necessary building blocks for complex, advanced communications by combining technologies at the application software and network hardware levels. This approach delivers a complete distributed networking solution from hardware to applications.

Connex, combined with TSN, enables a software defined architecture that provides long-term agility. As the system requirements evolve, neither the networks nor the communication architecture needs to be re-designed - this is the power of data-centric architecture. And by combining TSN with Connex, developers can create a time-critical system all the way up to the cloud. As an added benefit, the ability to combine mixed-criticality signals on one network improves the flexibility of system architecture, while also reducing hardware costs and space requirements.

Layer	OSI Model	Standard	Content
7	Application Layer	OMG [®] DDS [™]	Information
6	Presentation Layer		Data with Context
5	Session Layer	OMG [®] RTPS	Data
4	Transport Layer	TCP/UDP	Segments
3	Network Layer	IP	Packets
2	Data Link Layer	TSN	Frames
1	Physical Layer	Ethernet	Bits

Figure 1: DDS-TSN real-time, deterministic, virtualized, data-centric architecture — applications subscribe to actionable information, not data.

By putting DDS on top of TSN, system architects and application developers gain a powerful, distributed data-centric real-time software integration framework that enables real-time applications to function predictably in shared network environments.

RTI CONNEXT: SUPPORTING THE DDS-TSN STANDARD

In April 2023, the Object Management Group® (OMG®) published the specification for a DDS-TSN standard. This new standard enables software applications using the DDS database to be deployed on, and leverage, TSN-enabled networks. It defines rules for mapping DDS features onto TSN concepts to support the design, deployment and execution of DDS systems over TSN networks in a standardized fashion. The DDS-TSN standard allows for highly secure communications with configurable Quality of Service (QoS) across complex, fast-moving systems.

With its powerful built-in QoS tools, the Connex product suite is able to support DDS-TSN capabilities “out-of-the-box” through simple QoS configurations. This capability allows existing Connex systems to take advantage of all that TSN has to offer with little or no changes to the application code. Even with high-volume traffic on the network, critical Connex communications are unaffected.

Running Connex over TSN enables a highly scalable network infrastructure that allows for expansion on the fly, providing greater flexibility to meet both future needs and react quickly to changes in the marketplace.

PARTNER NETWORK AND REFERENCE SYSTEMS

Our experience has taught us that every project is different. To support as many deployment scenarios as possible, RTI has partnered with leading vendors of TSN hardware. In addition to this, RTI has a consolidated ecosystem of Hardware platforms and Operating System partners, and supports multiple architectures and programming languages to ensure Connex and TSN are able to interoperate seamlessly. In addition, our Engineering Services team has the experience and expertise to help stand up the system and optimize communications around each customers’ use case.

USE CASES

Automotive

Running Connex Drive® over TSN provides the communications backbone for current and future software-defined vehicles. Together, Connex and TSN enable rapid, deterministic communication flow within and across complex distributed systems and subsystems — on a general purpose network to reduce cost and weight. This combination enables data in motion to flow correctly, reliably and with predictably low latency across domains, including Advanced Driver-Assistance Systems (ADAS) and Automated Driving (AD).

Defense

The NATO Generic Vehicle Architecture (NGVA) provides a highly reliable approach to platform design and integration for a new generation of military vehicles. NGVA systems require continuous access to new, real-time data that can also be delivered remotely and over long-distances. NGVA is able to use DDS and TSN to provide a simplified network structure that creates significant performance improvement by enforcing real-time QoS for critical traffic flows.

Avionics

Interconnected aircraft systems rely on various sensors, computers and actuators, posing challenges to network communication. To support autonomy, avionics systems necessitate deterministic and predictable communication within specified timeframes. Additionally, they require access to guaranteed and precisely timed system control. The combination of Connex and TSN successfully addresses these challenges by preventing non-real-time traffic from interfering with deterministic real-time dataflows.

Industrial Automation

Smart factories in the era of autonomy and Industry 4.0 require more than simply integrating data between industrial controllers, historians and HMI's. As the complexities of automation and the number of connected things continue to grow, so does the need for scalable, fast, reliable and interoperable communications. Connex with TSN leads to a converged approach for handling real-time communications in industrial applications.

For more information on Connex over TSN, please visit www.rti.com/tsn.

ABOUT RTI

Real-Time Innovations (RTI) is the largest software framework company for autonomous systems. RTI Connex® is the world's leading architecture for developing intelligent distributed systems. Uniquely, Connex shares data directly, connecting AI algorithms to real-time networks of devices to build autonomous systems.

RTI is the best in the world at ensuring our customers' success in deploying production systems. With over 2,000 designs, RTI software runs over 250 autonomous vehicle programs, controls the largest power plants in North America, coordinates combat management on U.S. Navy ships, drives a new generation of medical robotics, enables flying cars, and provides 24/7 intelligence for hospital and emergency medicine. RTI runs a smarter world.

RTI is the leading vendor of products compliant with the Object Management Group® (OMG®) Data Distribution Service (DDS™) standard. RTI is privately held and headquartered in Sunnyvale, California with regional offices in Colorado, Spain and Singapore.

Download a free 30-day trial of the latest, fully-functional Connex software today: www.rti.com/downloads.

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