RTI Connext® DDS Professional

Fast, scalable and resilient software connectivity platform

RTI Connext® DDS Professional is the first connectivity platform designed for the demanding requirements of the Industrial Internet of Things (IIoT). It delivers the low-latency and real-time QoS needed to monitor and control physical-world processes. It provides the non-stop availability and security essential for mission-critical systems. And it complies with the Data Distribution Service (DDS) standard to foster interoperability and an open architecture, slashing lifecycle costs.

Highlights:

Accelerated distributed application development and existing device integration

Interoperable across programming languages, operating systems and CPU families

Latency in tens of microseconds over Gigabit Ethernet

Throughput over millions of messages/second

Scalable to millions of tracked data values

Decentralized architecture with peer-to-peer communication

No message brokers or servers required

Non-stop availability with live upgrades and no single point of failure

Reliable multicast for efficient data distribution

Automatic discovery for self-forming and self-healing autonomous systems

C, C++, C#/.NET, Java and Ada Apps

Unmodified Existing Apps

RTI Connext DDS Library

RTI Adapter

Shared Memory, LAN, WAN, Internet

Connext DDS Professional provides a rich set of connectivity capabilities optimized for IIoT systems.

- Messaging libraries simplify distributed application development with high-level APIs for publish-subscribe, request-reply and point-to-point queues.
- An adapter framework with customizable examples eases integration of unmodified existing applications and devices.
- Powerful tools accelerate system integration, testing and debugging.

Connext DDS is well-suited for deployment in machines and in dynamic environments at the edge and in the field. Its architecture is completely decentralized. Applications automatically discover each other and communicate peer-to-peer. Unlike traditional IT-centric messaging and integration solutions, Connext DDS does not require any centralized message brokers, services or servers. This makes it easy to embed and deploy while eliminating bottlenecks and single points of failure.

Connext DDS is the ideal connectivity backbone for IIoT deployments. It provides a scalable, reliable and secure integration bus that connects new and existing assets. For new applications—such as analytics—it presents a unified API that decouples application logic from device-specific interfaces, protocols and data models. And it allows you to take advantage of fog computing and easily move applications between the cloud and edge.
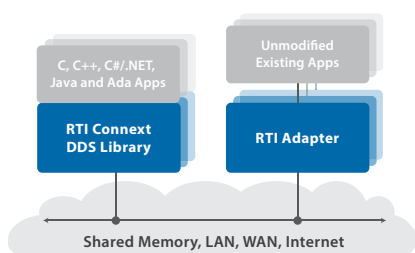
Most Comprehensive IIoT Connectivity Platform
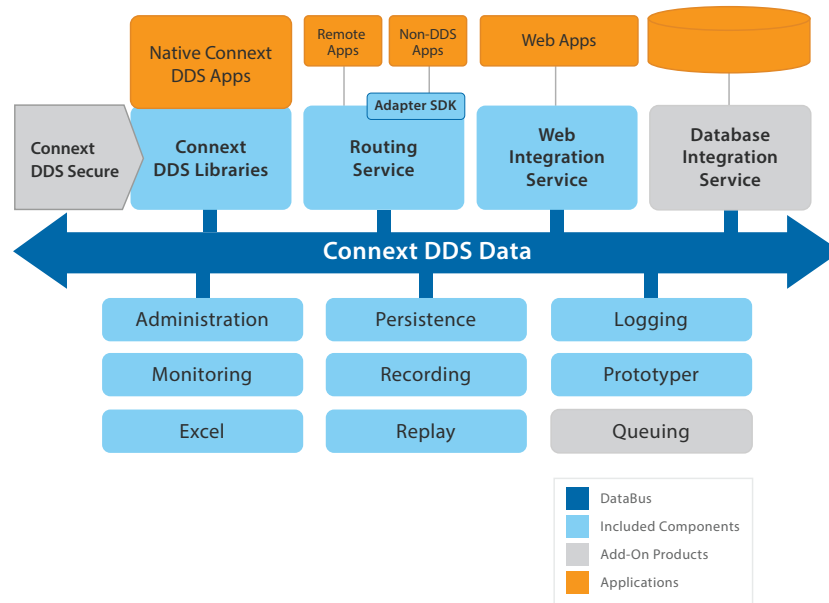
Connext DDS Professional includes a powerful set of capabilities to develop and integrate distributed applications.

Connext DDS Libraries implement the core communication capabilities and provide DDS and JMS programming interfaces. They support data-centric publish-subscribe and request-reply communication.

Connext DDS Secure, adds support for transport-independent authentication, cryptography, fine-grained access control and secure multicast.

Persistence Service makes data available to late-joining consumers even if the original producer is no longer accessible. It also offloads reliability protocol overhead from CPU-limited producers or those connected over bandwidth-constrained networks.

Routing Service bridges data across transport protocols, networks and security domains. It also mediates between applications that use incompatible data models. An included Adapter SDK integrates unmodified existing applications that use interface technologies other than DDS. It includes example adapters for JMS, network sockets and files.

Web Integration Service provides a REST/HTTP interface to enable easy integration with web applications and scripting languages.

Recording Service records high-throughput data for future analysis and debugging. Recorded data can also be replayed for testing and simulation.

Spreadsheet Add-in uses Microsoft Excel to display, visualize and write-back RTI Connext data.

Prototyper quickly simulates system components to test your applications and assess scalability before development is complete.

Administration Console monitors, controls and debugs from a centralized tool. It allows you to visualize data being distributed, administer run-time services and view system-wide logging messages. It also provides non-intrusive visibility into a running system — including nodes, participants, topics, types, QoS and configuration mismatches.

Monitor easily diagnoses performance problems and tunes your system. It displays comprehensive performance, health and resource utilization statistics.

Distributed Logging Library allows applications to publish log messages to RTI Administration Console and RTI Recording Service.

Powerful Data-Centric Paradigm

Connext DDS simplifies application and integration logic with a powerful data-centric communication paradigm. Instead of exchanging messages, software components communicate by sharing data objects. Applications operate directly on these objects (create, read, update and delete). Developers do not have to deal with low-level messaging or networking interfaces. Connext DDS handles the details of data distribution and management, including serialization and lifecycle management.

Connext DDS provides for data in motion what a database provides for data at rest:

- **Decoupling.** Data producers are agnostic to the number of consumers and the type of processing they do. This allows components to be added and changed without affecting those that are already deployed.
- **Easy integration.** The interfaces in a system—as defined by the data model—are explicit and discoverable. Integration requires no knowledge of a component's implementation and you do not need to reverse engineer protocols and messages.
- **Robustness.** Connext DDS maintains a system's shared state, providing a single source of truth. Late and re-joining applications automatically synchronize with the current state. This ensures applications have a consistent world view even in dynamic and large-scale environments.

Unlike a traditional database, Connext DDS is a completely decentralized software data bus. Data is cached in each application. Updates are published peer-to-peer to subscribing components. Applications can receive asynchronous update notifications or poll for the latest value as needed.

Enterprise Integration Patterns

In addition to data-centric publish-subscribe, Connext DDS supports additional patterns to ease development.

- **Request/Reply.** Connext DDS can issue a single request to multiple components and correlate multiple responses to a single request—for example, to track the execution status of a command.
- **Point-to-Point Queues.** With the optional Queuing Service, Connext DDS delivers each message to only one consumer, enabling efficient analytics load balancing and workload distribution.
- **Durable Subscriptions.** Connext DDS can retain all updates to a data object—not just the preconfigured history—until they are acknowledged by a specified set of subscribers.
- **Application-Level Acknowledgement.** Updates are not considered delivered until they are processed by the receiving application. This ensures critical data or commands are not lost if the recipient fails between receiving and processing the update.

DDS Compliance

Connext DDS complies with the Object Management Group (OMG) Data Distribution Service (DDS) for Real-Time Systems standard. It supports both the DDS application programming interface (API) and network interoperability protocol (DDSI-RTPS).

DDS is the only messaging standard designed specifically to meet the requirements of timing-critical systems. It can deliver over 50 times the performance of IT standards such as JMS, MQTT, AMQP, XMPP and Web Services. For applications with demanding requirements, DDS is often the only standards-compliant alternative to proprietary or custom integration approaches.

Connext DDS is the world's leading DDS implementation with more than 70% commercial market share. RTI has worked hand-in-hand with hundreds of customers to successfully deploy some of the world's most critical distributed systems. This unparalleled expertise in applying DDS to real-world problems makes RTI the best partner for your DDS project.

"RTI Connext DDS satisfies the demanding requirements of our devices and supports standardization on a single communications platform across product lines."
J. Gustavo Perez, General Manager for MI&CT Engineering, GE Healthcare

Optimized for Performance, Scalability and Availability

Peer-to-peer communication delivers:

- Minimum latency with no intermediate brokers or extra network hops
- Maximum throughput and scalability with no broker or daemon process acting as a choke point
- Non-stop availability with no single point of failure
- Easy embedding with no required services to deploy and administer
- Inherent security with support for operating system-level policy enforcement and no single point of vulnerability

Automatic discovery eliminates the need for deployment-time configuration. Applications are plug-and-play, facilitating use in dynamic networks. Connext DDS automatically discovers and routes data between matching producers and consumers at run-time; systems are self-forming and self-healing.

Transport protocol independence allows optimized and reliable communication over any network type, from the edge to the cloud, including:

- Shared memory within an intelligent machine
- UDP multicast on a LAN
- TCP or TLS over the Internet
- Non-IP radio or satellite links in the field

Reliable multicast provides scalable one-to-many and many-to-many data distribution. Messages only have to be sent over the network once, regardless of the number of subscribers. Connext DDS includes an optional multicast reliability protocol optimized for real-time behavior.

Smart filtering maximizes efficiency and scalability. Connext DDS can filter by specific content (not just metadata) and desired frequency of delivery, simplifying application logic. Filters are applied on the publisher's side to reduce network and processor overhead. In addition, when bridging networks, Routing Service only forwards currently subscribed data.

Quality of Service control eases integration of applications with disparate performance needs. The frequency, timeliness and reliability of data delivery are configurable per stream and per component. Applications are also notified if timing deadlines are missed so they can take remediating action.

Automatic failover between publishers and networks provides uninterrupted availability in the event of hardware and software failures.

Programming Interfaces

- DDS: C, C++, C#/.NET, Java, Ada
- Lua*, JavaScript (node.js)*, Python*
- Java Message Service (JMS)
- LabVIEW
- MATLAB*, Simulink*

Transports

- Shared memory
- UDPv4, v6 unicast and multicast
- TCP
- OpenSSL: TLS/SSL, DTLS
- Low bandwidth

Operating Systems

- Linux, Windows, Mac OS X, Unix
- VxWorks, INTEGRITY, LynxOS, QNX
- Android, iOS

Processor Families

- x86, x64
- ARM
- PowerPC / Cell
- SPARC

DDS Compliance

- DDS API 1.4
  - o Minimum, Persistence and Ownership profiles
  - o ContentFilteredTopic & QueryCondition
- DDS Interoperability Wire Protocol (RTPS) 2.2
- DDS Security*
- C++ Language DDS PSM
- XTypes: Extensible and Dynamic Topic Types 1.0 (partial)
- Remote Procedure Calls over DDS (partial)
- Web-enabled DDS*
- UML Profile for DDS*
- lwCCM: DDS for Lightweight CCM*

* Third-party product

About RTI

Real-Time Innovations (RTI) is the Industrial Internet of Things (IIoT) connectivity company. The RTI Connext® databus is a software framework that shares information in real time, making applications work together as one, integrated system. It connects across field, fog and cloud. Its reliability, security, performance and scalability are proven in the most demanding industrial systems. Deployed systems include medical devices and imaging; wind, hydro and solar power; autonomous planes, trains and cars; traffic control; Oil and Gas; robotics, ships and defense.

RTI is the largest vendor of products based on the Object Management Group (OMG) Data Distribution Service™ (DDS) standard. RTI is privately held and headquartered in Sunnyvale, California.

rti

Your systems. Working as one.

CORPORATE HEADQUARTERS
232 E. Java Drive
Sunnyvale, CA 94089
Tel: +1 (408) 990-7400
Fax: +1 (408) 990-7402
info@rti.com
www.rti.com