RTI Connext Professional

WORLD'S LEADING ARCHITECTURE FOR DEVELOPING INTELLIGENT DISTRIBUTED SYSTEMS

HIGHLIGHTS

DDS network protocol and API compliance

Powerful tools that accelerate integration, testing and debugging

Toolkit for integrating non-DDS systems

Interoperability across programming languages, operating systems and CPU families

Works over UDPv4, UDPv6, TCP, Shared memory, LAN and WAN

RTI Connext® Professional is the first software framework designed to meet the demanding connectivity requirements of autonomous systems. It delivers the low-latency, high reliability, scalability and security essential for mission-critical applications. The Connext® Databus significantly reduces development, integration and maintenance costs.

THE SOFTWARE FRAMEWORK FOR AUTONOMY

Connext Professional provides a comprehensive software framework that enables the modular development of distributed real-time systems. It includes connectivity libraries, a suite of development and monitoring tools, and infrastructure services. It integrates with a wide variety of third-party applications, operating systems and toolchains. It supports over 100 platforms and 12 transports, connecting them all transparently. Connext Professional is the solid foundation needed to support critical applications.

Connext Professional complies with the Object Management Group® (OMG®) Data Distribution Service (DDS™) standard. DDS is the only connectivity standard designed to support the demanding Quality of Service (QoS) requirements of autonomous systems.

Connext Professional includes:

- DDS libraries proven in more than 2,000 systems with the world's most demanding reliability, scalability and performance requirements

- Toolkit and adapters to ease integration of application and devices that do not natively support DDS

- Powerful tools that accelerate integration, testing and debugging

Connext Professional is built upon and supported by RTI's unparalleled expertise in architecting, developing and deploying autonomous systems.

NEW FOR CONNEXT PROFESSIONAL 6.1

Operate Seamlessly over WAN with Real-Time WAN Transport
Remote systems are now more easily connected than ever before with the new Real-Time WAN Transport and Cloud Discovery Service. Unlike other distributed software frameworks, Connext Professional 6.1 optimizes communications across both Wide Area Network (WAN) and Local Area Network (LAN) environments without the need for deployment-specific customization.

This add-on feature can accelerate system development and deployment, as Connext Professional 6.1 does not require software changes to accommodate disparate network types. Connext Professional 6.1 communication saves developers from needing to know or accommodate the capabilities of the underlying networks.

Integrate with the Latest Platforms

As systems become increasingly connected, they need to encompass a broader range of technology platforms. To help accomplish this goal, Connext Professional 6.1 supports .NET Core and more Linux ARM platforms, creating an opportunity for a broader base of software developers to build connected real-time control systems.

Plan for Advanced Autonomy and Future Capabilities

Autonomous systems must be designed to scale and incorporate higher levels of autonomy. To support these efforts, Connext Professional 6.1 features new tools and capabilities to accelerate development.

INDUSTRY'S MOST ROBUST AND PRODUCTIVE DEVELOPMENT ENVIRONMENT FOR AUTONOMOUS SYSTEMS

Connext Libraries provide a native, DDS-compliant interface to the Connext Databus for embedding directly into applications and devices.

Real-Time WAN Transport provides reliable and responsive communications across wide-area networks. It can traverse NATs and maintain consistent communication as endpoints move or IP addresses change.

Cloud Discovery Service enables discovery in environments where UDP multicast may not be available. Use Cloud Discovery Service with the Real-Time WAN Transport to create performant, scalable systems that span diverse public and private networks.

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

System Designer allows software architects and developers to easily define and configure a Connext system using an intuitive web-based interface. It can be used to generate a complete XML specification of a Connext system for use by Connext XML-based Application Creation.

Code Generator generates type-specific and type-safe DDS interfaces from IDL or XML data type descriptions. It generates example publishers and subscribers, makefiles and IDE projects.

Routing Service supports systems-of-systems or a layered databus architecture. It bridges data across transport protocols, physical networks and security domains. It monitors subscriptions and only forwards currently subscribed data for efficient bandwidth utilization. It can also transform data between applications that use incompatible data types.

Adapter SDK enables developers to create Routing Service adapters to easily integrate non-DDS applications. It includes the source code to several sample adapters (OPC UA, Modbus, MQTT) that can be customized to support a wide variety of standard and proprietary interfaces.

Monitor helps to optimize performance and identify problems using metrics emitted by Connext systems enabled with monitoring libraries. It displays comprehensive performance, health and resource utilization statistics in a graphical view.

Persistence Service makes historical data available to late-joining applications, even when the original publisher is no longer accessible.

Recording and Replay Service records high-throughput real-time data for future analysis and debugging. Recorded data can be replayed for testing and simulation using the original or modified QoS settings and data rates.

Ping and Spy are command-line utilities for checking system connectivity and inspecting packet contents.

PerfTest measures network throughput and latency for a given publisher and subscriber configuration and message size. It helps users understand network capabilities and the impact of different configuration settings.

Distributed Logger provides a high-level API for publishing log messages using the Connext Databus. Log messages can be visualized from RTI Monitor, Admin Console or subscribed from a custom tool.

Database Integration Service provides bi-directional integration between the Connext Databus and a relational database. It stores published data in the database and can publish database updates to subscriber applications.

Web Integration Service provides a RESTful HTTP interface to the databus for easy integration with web applications and scripting languages.

Limited Bandwidth Plugins allow DDS applications to run in severely bandwidth-constrained networks, such as satellite or radio links. It does not require use of the IP. The plugins include a simulator for emulating and testing behavior over low bandwidth networks.

Security Plugins included in Connext® Secure, support authentication, encryption, access control and logging based on the DDS Security™ standard. They provide fine-grained control over security policies and support any Connext transport, including multicast.

POWERFUL DATA-CENTRIC PARADIGM

The Connext Databus simplifies application and integration logic with a powerful data-centric paradigm. Instead of exchanging messages, software components communicate via shared data objects. Applications directly read and write the value of these objects, which are cached in each participant. Connext handles the details of data distribution, synchronization and management, including serialization and lifecycle management. Developers do not have to deal with low-level messaging or networking interfaces.

The databus provides for data in motion what a database provides for data at rest:

- **Decoupling:** Data producers are agnostic to consumers, their network location and the type of processing they do. This allows components to be added and changed without affecting those that are already deployed.
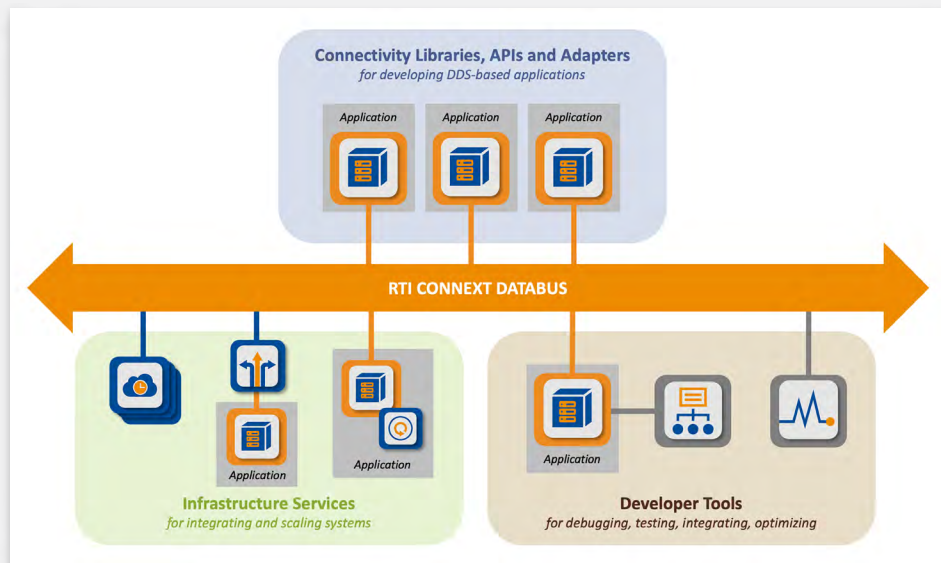
- **Easy integration:** The interfaces in a system — as defined by the data model — are explicit and discoverable. Integration requires no knowledge of a component's implementation; there is no need to reverse-engineer protocols and messages.

- **Robustness:** Connext maintains a system's shared state, providing a single source of truth. Late and rejoining 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, subscribers can receive asynchronous notifications when data objects are updated.

DECENTRALIZED ARCHITECTURE

While Connext provides many of the benefits of a database, its architecture is completely decentralized and optimized for real-time QoS. Publishers send data updates directly to subscribers' caches, peer-to-peer. Data is not routed through any intermediate database or message broker.

There are several benefits to this peer-to-peer architecture:

- Minimum latency with no intermediate brokers or extra network hops

- Maximum throughput and scalability with no broker acting as a choke point

- Non-stop availability with no single point of failure

- Easy embedding with no centralized services to deploy and administer

- Inherent security with no single point of vulnerability

Connext efficiently handles scenarios in which peer-to-peer communication is undesirable, for example when integrating a system of systems or implementing a layered databus architecture.

To support this, RTI Routing Service can be used as a bridge between networks. Routing Service only relays data that is needed on a remote network. Unlike a message broker, however, data flows on each network are still peer-to-peer. In addition, multiple Routing Service instances can be deployed for fault tolerance and load balancing.

FLEXIBLE COMMUNICATION PATTERNS

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

Historical Data Query: Applications can retrieve historical data from publishers' caches on demand, even if the data was not subscribed when originally written. This provides much more efficient and scalable access than speculatively subscribing to data that may not be needed.

Request/Reply: Connext 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.

Durable Subscriptions: Connext 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 an update.

Message Queuing: With the optional Queuing Service, Connext delivers each message to only one consumer, enabling efficient load balancing.

OPTIMIZED FOR PERFORMANCE, SCALABILITY AND AVAILABILITY

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

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

- Shared memory within a node

- UDP multicast on a LAN

- UDP unicast or TCP over a WAN or where multicast is unavailable

- Non-IP radio or satellite links in the field

Seamless device mobility automatically re-locates and re-authenticates participants without data loss when their IP address changes. This can occur when roaming across networks or when switching between wired, wireless and mobile networks.

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.

Smart filtering maximizes efficiency and scalability. Connext 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.

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.

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

Type extensibility allows data types to change over time without breaking interoperability with applications that use older or different versions of a type. This is essential for evolving intelligent distributed systems with long lifecycles and for those in which it is infeasible to update already-deployed applications.

PROGRAMMING INTERFACES
- DDS: C, C++, C#/.NET, Java, Ada
- Lua^, JavaScript (node.js)^, Python*^
- LabVIEW*, MATLAB*, Simulink*

TRANSPORTS
- Shared memory
- UDPv4, UDPv6 unicast and multicast
- TCP
- TLS#
- Low bandwidth

OPERATING SYSTEMS
- Linux, Windows, macOS
- VxWorks, QNX, INTEGRITY
- Android

PROCESSOR FAMILIES
- x86, x64
- ARM
- PowerPC

DDS COMPLIANCE
- DDS 1.4
  - » Minimum, Persistence and Ownership profiles
  - » ContentFilteredTopic & QueryCondition
- DDS Wire Protocol (RTPS) 2.2
- DDS Security 1.1#
- C++ Language DDS PSM 1.0
- XTypes: Extensible and Dynamic Topic Types 1.3 (partial)
- RPC over DDS 1.0 (partial)
- Web-Enabled DDS 1.0
- DDS XML Syntax 1.0
- IDL 4.2

^ Experimental product
* Third-party product
# Requires Connext Secure

ABOUT RTI

Real-Time Innovations (RTI) is the largest software framework company for autonomous systems. RTI Connext® is the world's leading architecture for developing intelligent distributed systems. Uniquely, Connext 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 Connext software today: **www.rti.com/downloads**.

**Your systems.
Working as one.**

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