RTI PROFESSIONAL SERVICES CUSTOMER SNAPSHOTS

Optimizing System Performance through Expert On-Site Consulting

RTI Professional Services helps organizations around the world to optimize their high-performance DDS-based systems. Our highly-experienced consultants deliver results ranging from architecture and design review to performance optimization to operational efficiency gains to locating problems in homegrown code. We work on site to provide a deep-dive analysis, recommendations and hands-on code changes to ensure systems work as intended. While each project is unique, they all achieve the same result: total client satisfaction.

The projects described below are a representative sample of recent client engagements. To learn how your project can benefit from RTI Professional Services, please contact info@rti.com.

YIELDING 30 PERCENT REDUCTION IN MEMORY CONSUMPTION THROUGH A SIMPLE CODE CHANGE

Challenge

A large European manufacturer reported high data discovery times and massive memory consumption in its distributed application. The company was migrating from another DDS product to Connext DDS and the project was on an accelerated timeline. The team was given a short timeframe to address the issues and stabilize the system.

Discovery

The RTI consultant found several instances in the code where the system was configured with sub-optimal QoS settings. Using a message-centric approach based on familiarity with client/server environments, the customer had created approximately 2,000 topics for each component and sensor in the system, instead of a data-centric design using a few topics with thousands of instances.

Results

After analyzing the network traffic, the RTI consultant changed a few lines of code and isolated certain nodes, which reduced the memory usage of the applications by one-third and shortened the data discovery times.

DELIVERING 4X FASTER PERFORMANCE THROUGH QOS TUNING

Challenge

An autonomous vehicle manufacturer required refresher training on RTI Connext DDS along with a system review to ensure the architecture was on track and at peak performance.

Discovery

The RTI consultant reviewed Connext DDS fundamentals with a focus on the QoS configuration file, which was written by the company's sister organization and deployed "as is." The QoS was disorganized and focused on fixing specific issues, rather than addressing the requirements of the broader use case. The RTI consultant resolved the configuration issues, and identified an additional problem related to QoS profiles being misconfigured.

Results

By removing unnecessary discovery properties and reducing the number of initial announcements, discovery traffic on the network was reduced by 50%. The discovery process went from 10-15 seconds per host with steady state traffic of 250kbps, to <5 seconds per host with steady state traffic of 150kbps. Further performance gains were obtained by

configuring network resources to support jumbo frames. This massively reduced the IP fragmentation, resulting in lower CPU, less data loss and higher throughput.

ACHIEVING 40 PERCENT REDUCTION IN ENDPOINT DISCOVERY TRAFFIC

Challenge

A very large systems integrator requested assistance to troubleshoot data disruptions it was experiencing with RTI Monitor. The team also had questions related to its evaluation of the Enhanced Limited-Bandwidth Endpoint Discovery (Enhanced LBED) plugins, an advanced DDS capability developed by RTI Professional Services that optimizes discovery bandwidth for constrained links.

Discovery

The RTI consultant quickly identified the source of the RTI Monitor issue, which required a simple update to the RTI Monitor configuration. He then helped the project team perform a thorough testing of a customized version of Enhanced LBED plugins, which had been enhanced through two customer-requested features. The plugins were extensively tested and performed without any issues. The RTI consultant conducted a series of test iterations, which involved analyzing the results and fine-tuning the plugin configuration, then re-testing until there were no additional performance gains. Once the Enhanced LBED plugin was fully optimized, the RTI consultant calculated the bandwidth savings by using Wireshark to measure and compare the standard discovery traffic against discovery with the plugins.

Results

The customer achieved a repeatable ~40% reduction in endpoint discovery traffic with the Enhanced LBED plugins, versus standard discovery.

DECREASING HEARTBEAT DATA BY 96 PERCENT FOR RAPID SYSTEM STABILIZATION

Challenge

A large European system integrator requested assistance with a complex system that provides surveillance and control across multiple application clusters organized into zones. RTI Connext DDS provides the connectivity framework for the layered architecture connecting applications within each cluster, with multiple RTI Routing Services acting as the data gateways between clusters. The company was experiencing non-reproducible, isolated functional and performance problems.

Discovery

The RTI consultant analyzed the system requirements, identified areas for required improvements, ran stress tests, performed code-reviews and suggested design improvements. The improvements included: data model modifications, improved failure handling, and recommendations to reduce application complexity by utilizing the Topic Query feature. In addition to the code review, all QoS policies relevant to the system configuration were reviewed then enhanced, which resulted in effectively a new version of their QoS policy configuration.

Results

In three days, the system was stabilized, discovery was improved, failure detection and recovery were handled correctly, and latency was greatly reduced. Packet heartbeat traffic went from 41% to <1.5%, resulting in a significant increase in system stability and performance. The lead project manager reported that “The system has never worked this amazingly well.”

SLASHING DATA DISCOVERY FROM 5 MINUTES TO <1 SECOND

Challenge

A large technology company needed assistance for a project to update a complex, customized system that uses RTI Connext DDS to integrate their Human Machine Interface (HMI) stations with embedded controllers. The project team was reporting sluggish data discovery times of up to five minutes. Its team of experienced DDS developers had self-diagnosed and reset some Quality of Service (QoS) settings in Connext DDS, which resulted in discovery times of 15 seconds on an intermittent basis. However, they were starting to see situations where the HMI consoles failed to initialize or embedded systems would intermittently start up, detect a failure and shut down. They also reported that data samples were unexpectedly lost.

Discovery

The RTI consultant reviewed the packet captures and identified a problem related to network stack limitations in the operating system. This was compounded by legacy QoS profiles that were originally designed for another use case within the company and copied – but not optimized – to this project. These were structured in a fragile way that could (and did) revert the system to default settings. The RTI consultant fixed this by refactoring the QoS configuration, modifying a few fields and adjusting the socket buffers for the operating system node. This resulted in immediate improvements to discovery stability and packet loss. By enabling monitoring with RTI Monitor, the RTI consultant discovered a critical QoS property controlling reliability behavior was not configured correctly, which had contributed to the inconsistent performance.

Results

By changing the QoS to account for limitations from the operating system, endpoint discovery time was slashed from the original 5+ minutes to a consistent 750ms – 1 second response time. A deep dive into the system identified other areas with inherited, inefficient settings that were reset, resulting in consistent, improved performance.

REMOVING REDUNDANCIES TO IMPROVE PERFORMANCE IN A CLIENT/SERVER ARCHITECTURE

Challenge

A midsized European software company requested assistance in reviewing how Connext DDS could replace and work alongside a legacy client/server-based application. Their objective was to identify areas for improvement and evaluate where DDS could be expanded into additional modules.

Discovery
The RTI consultant uncovered several areas where application logic was implementing capabilities already provided by Connext DDS. Simplifying the application logic to exploit Connext DDS functionality would cut data processing time and result in a more efficient system. For example, the program was creating its own copies of the data and checking queues manually, a function that DDS can perform automatically. A scalability analysis revealed a system with 200 endpoints in a 1GB network, all talking to a distributed database and connected to a centralized server, resulting in a discovery start time upwards of 30 seconds.

Results
The RTI consultant identified the optimal Connext DDS discovery configuration based on the scalability analysis, reducing startup times. The time to complete discovery was reduced from 45 seconds to under 5 seconds, a 10x improvement in performance.

CORRECTING CONFIGURATION ERRORS: SIMPLE CHANGES, RAPID RESULTS

Challenge
A large developer of mass transit systems requested a three-day visit to identify and fix issues it had detected in its distributed DDS-based monitoring and controlling system. The system is deployed over a large geographic area, with over 30 monitoring stations publishing information that is subscribed to by over 400 remote workstations.

Discovery
After spending time learning the details of the system behavior and the customer's requirements, the RTI consultant began with a review of the QoS configuration. During this review, the RTI consultant discovered an error causing data loss because the data was sent with "Best Effort" delivery rather than the intended "Reliable" mode. Additionally, further analysis revealed a weakness in the fault tolerance design, where a network connection loss could result in lost data – something that the use case could not tolerate. In just a few lines of code, the RTI consultant corrected for this by using an advanced feature of RTI Connext DDS: virtual identities. This change addressed the fault tolerance scenario and also assured the lowest latency and enhanced redundancy in case of service disruption. The RTI consultant also provided specific recommendations for how to improve scalability and stability by using RTI Routing Service to segment applications in the system.

Results
Step-by-step review of system problem areas led to simple corrections and adjustments to specific QoS settings, resulting in issue resolution in all areas of concern and the project achieving its desired functional and performance goals. Architectural improvements were identified to improve system stability and scalability.

DEVELOPING AN AWARD-WINNING ARCHITECTURE

Challenge
A large systems integrator requested RTI assistance in developing a fully data-centric architecture for a multi-year, complex custom project.

Discovery
The project represented a shift from previous use cases developed by the company, which were developed on a message-centric architecture. Over the course of seven visits spanning 18 months, the RTI consultant worked with the company to provide specific design recommendations; teach developers optimal design techniques and settings; and review, refactor, debug and troubleshoot. For example, the team was operating in a Linux environment, which introduced shared system limitations that led to erratic, inconsistent performance. The RTI consultant resolved the issues by increasing the kernel limitations. Constantly changing requirements made the project challenging, but following the RTI consultant's guidance in implementing a data-centric design with RTI Connext® DDS, the team was able to absorb many of the requests without architecture changes or the need to develop customized code.

Results
The project is ahead of schedule and performing as intended. The project team won a prestigious internal excellence award from senior management in recognition of its work. In accepting the award, the team lead credited their use of Connext DDS as a key success factor.

TURNAROUND FROM RELUCTANT USERS TO DDS CHAMPIONS IN ONE DAY

Challenge
The project team at a branch facility of large global manufacturer was instructed to use Connext DDS to replace a legacy protocol in a monitoring subsystem. The use case involved remote, mobile assets which contacted centralized servers every hour, publishing one or more large data files. The team did not think DDS was appropriate for the use case. The project lead stated "we don't understand why we are using DDS, it is not a fit for this use case" and requested a one-day customized training session to answer specific questions.

Discovery
The RTI consultant delivered training that provided an overview of Connext DDS and customized instruction based on what would be most valuable to the specific use case.

Results
In a turnaround, the project lead stated at the end of the day that "I am 100% convinced that DDS is the best system to use." This assessment was based on the extensive RTI Connext DDS features, ease of integration into other systems and the reduction of custom code that the project team would otherwise have to develop and maintain.

LEVERAGE RTI EXPERTISE

These client engagement successes are representative of RTI Professional Services capabilities. To discuss how we can help optimize results for your DDS-based project, please contact your RTI representative.

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 lives at the intersection of functional artificial intelligence and pervasive networking℠.

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, Calif.

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

Your systems. Working as one.

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