



RTI

Extreme Low-Latency

Real-Time Application Infrastructure

1 millionth of a second is a microsecond.

1,000 microseconds is a millisecond.

The human eye takes 300 milliseconds, or 300,000 microseconds, to blink.

Tabb Group¹ estimates that if a broker's electronic trading platform is 5 milliseconds, or 5,000 microseconds, behind its competition, it could lose 1% of its order flow. At 10,000 microseconds, the loss grows to 10%.

RTI, in a global investment bank, only needed 30 microseconds to get each message from the market data feed handler to its destination.²

Since 1996, RTI has helped military, medical and other mission-critical applications quickly organize, filter, and deliver torrents of data in time to protect and save lives.

RTI was developed for rugged environments in which hardware is unreliable, yet a sudden flood of essential information must get to key personnel in time to react.

For these environments RTI developed a unique, software-only, highly streamlined middleware architecture that is much faster and more reliable than traditional low-latency methods.

Innovative firms are discovering how getting market data faster, modeling on higher volumes of current information, and being able to turn positions even faster creates new profit opportunities.

30 microseconds versus 5,000 microseconds? What's it worth to you?

¹ *The Value of a Millisecond: Finding the Optimal Speed of a Trading Infrastructure.*
Tabb Group, April 2008

² For implementation details, please contact RTI.



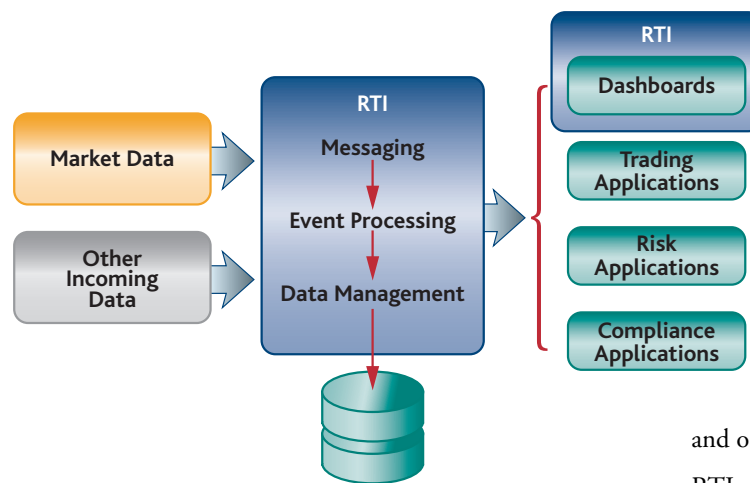
RTI was developed for environments in which a sudden torrent of data must get to key personnel in time to react.

Latency

Latency is the time it takes data to get from its source, such as a market data feed handler, to its destination, such as a trader's monitor or a computer model.

Because players in the global financial markets compete on how quickly they can act on market information, low-latency applications are critical to making sure the right information can get to the right users faster than the competition.

In financial services, firms are developing, deploying and capturing profit opportunities with high speed using RTI low-latency solutions.



RTI provides a comprehensive low-latency infrastructure.

Tabb Group defines latency as having three elements:

Jitter: how the system performs under sudden spikes of activity

Throughput: the volume of messages

Persistence: not losing data when networks fail

“ATD conducted extensive in-house testing of the leading messaging products targeted at market data distribution. We found that RTI provided the most consistent performance, with no latency spikes even under times of peak volume. In addition, we liked the fact that RTI was able to deliver the throughput and latency we needed with standards-compliant interfaces.”

Dr. Carlos O’Ryan, *Chief Technology Officer*, ATD

Because RTI was developed for rugged environments in which hardware is unreliable, yet a sudden flood of essential information must get to key personnel in time to react, the RTI approach to managing jitter, throughput and persistence is fundamentally different, and much faster than traditional so-called low-latency methods used in financial services today.

Jitter — Managing System Stress

Jitter requires managing sudden spikes in activity, such as the opening and closing bells or other sudden market movements. Spikes create noise and static in the system, causing it to slow down when it is needed the most.

For example, ATD, now owned by Citigroup, offers automated execution solutions in all domestic equity markets. ATD clients needed to manage growing trading volumes, smoothly handling jumps in activity without jitter.

ATD has updated its market data infrastructure to now use RTI to distribute real-time data from direct exchange and Electronic Communication Network (ECN) feeds to its price-prediction engines, automated trading applications and order-management system.

RTI manages jitter for ATD using the Data Distribution Service (DDS) standard the company co-authored with the Object Management Group (OMG).

DDS applications feature fine-grained and comprehensive Quality of Service (QoS) parameters, allowing the application to be tuned to its specific requirements.

RTI supplies over 400 of these QoS parameters. During sudden high-pressure times, RTI-based applications can prioritize key activity thus ensuring the system is always working at its peak for the users who need it most.

Automatic Discovery

RTI with OMG developed a standardized way for “publishers” and “subscribers” to automatically find one another, then tell their counterparts once, and only once, the type of data they use, the priority of that data, and its format. RTI applications enjoy extremely high performance because system overhead is reduced to a minimum.

Other messaging middleware is designed so that publishers and subscribers don't "remember" the format of data from one message to the next, nor are they able to automatically adjust to changes. The result is that applications have to send this information, called metadata, with every single message. Small messages with large "system envelopes" quickly overload their applications during peak times.

In the RTI model, publishers and subscribers automatically find one another and exchange information about message formats up front. Other messaging middleware does not provide automatic discovery so instead relies on large "system envelopes" to communicate routine information as well as changes every single time a message is sent.

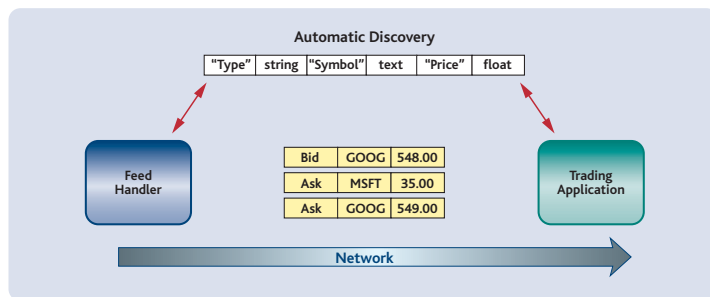
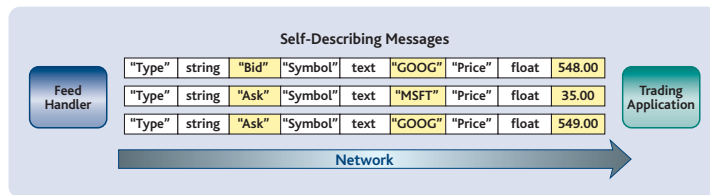
Throughput — High Message Volume

Throughput measures both the message size as well as number of messages a system can deliver. For trade execution, a high throughput application means being able to capture, then act on all the profit opportunities that emerge.

Imagine, though, an actual life-critical application. Nuclear Magnetic Resonance (NMR) and Magnetic Resonance Imaging (MRI) are used in diagnostic and research applications. When Varian needed new software to handle its expanding product line of NMR and MRI instruments, Varian chose RTI middleware to connect up to 16 receiver sensors, radio frequency (RF) generators, and user-interface and control computers. These machines capture images at nearly 1 Gigabyte per second, then send the data back to a console so a technician can view it in real-time.



Varian uses RTI-based software in diagnostic and research applications, managing up to 1 Gigabyte/second of data.



RTI and OMG have standardized a fast, flexible way for publishers and subscribers to exchange message definitions once, instead of with each message, for improved performance and efficiency.

RTI is a peer-to-peer based architecture that eliminates intermediate steps between sending and receiving applications, generating extremely fast and accurate throughput by avoiding network "hops."

Persistence — Managing Data

Persistence is the ability to save information during network failures so users can continue to work uninterrupted, or if necessary, receive replayed data to ensure the user can see interim activity.

Insitu Inc., is a pioneer developer of long-endurance, unmanned autonomous aircraft (UAV). UAVs designed and built by Insitu serve increasingly strategic roles in a broad range of applications, including military reconnaissance, border patrol, and search missions.

Multiple sensors onboard collect data on flight conditions, airframe configuration, instrument status, position and direction. Because air-to-ground links can be slow and unreliable, data must be persisted to guarantee its availability.

RTI supports both in-memory and disk-based persistence. And, RTI is architected for high availability, supporting fault tolerance, redundancy, load-balancing, and failover.

Proven Low-Latency Infrastructure

RTI brings to financial services the same advanced middleware technology that supports military and medical applications, where people rely on RTI-based software to monitor the environment for sudden dangers and actually save lives.

Because RTI uses technically sophisticated methods to manage jitter, throughput, and persistence—the 3 core elements of low-latency, RTI is able to deliver the lowest-latency solutions in Financial Services available on the market today.

Complex Event Processing

RTI offers Complex Event Processing to analyze sudden torrents of real-time data, then quickly offer up meaningful and actionable information. Common examples include pre-trade analysis, trade execution, risk management and compliance requirements.

Based on changing market conditions, business users can dynamically create and update real-time analyses to present opportunities in a clear and actionable format.

Real-Time Event Visualization

RTI's event visualization functionality allows the rapid development of graphical dashboards to monitor trading markets and system operations information.

Using a straightforward point-and-click interface, business users can access information in the way they prefer to see it—such as graphs, charts, or tables.

See for Yourself

To evaluate RTI in your business, please email low-latency@rti.com or call 408-990-7400.

About RTI

Real-Time Innovations (RTI) is a leading provider of extreme performance messaging, real-time data management, and complex event processing software.

RTI's middleware has been proven since 1996 in over 400 mission-critical applications in financial services, medical, transportation, communications, industrial control, aerospace and defense.

Customers include PIMCO, Automated Trading Desk, Varian, Nikon, Schneider, Lockheed Martin and Raytheon.

RTI is active in standards, participating as a member of the OMG Board of Directors. RTI has chaired the DDS working group since 2004.

RTI was founded by researchers from a Stanford University robotics research laboratory. The company is privately held and headquartered in Silicon Valley, California.

RTI is proud to partner with these organizations to provide complete low-latency solutions.



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