

Tactical Communications Group

RTI selected for Tactical Communications Manager product

Tactical Communications Group, LLC (TCG) provides the Tactical Communications Manager (TCM) product for low cost integration of digital datalinks into weapon, command and control (C2), and surveillance platforms. The latest front-end processor version is called the TCG-5000, LinkPRO. The TCM is a distributed real-time application that requires a scalable, reliable, high-performance inter-process communication (IPC) service. TCG selected RTI Data Distribution Service (formerly NDDS), with its data-centric publish-subscribe communications, as the best fit for its IPC requirements.

TCM Overview

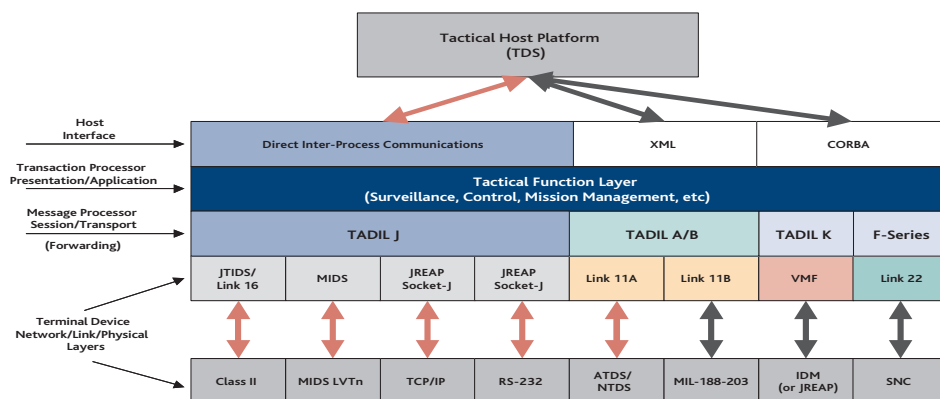
For the past five years, TCG has been developing this product line to support tactical datalink developers. Understanding how expensive and challenging it is to integrate datalinks into weapons, surveillance and command and control platforms, TCG developed TCM to reduce the complexity

datalinks may be configured to operate independently or combined. Development plans include interfaces for TADIL K (VMF), and Link-22.

The LinkPRO datalink processor consists of components that run as separate processes and threads. The built-in mechanisms for multi-tasking and multi-threading provide excellent scalability.

During integration, this provides the capability to efficiently balance input-output tasks with CPU intensive processes. The system is designed to facilitate distribution of processes on multi-processor computers and networks.

The current implementation uses TCP/IP “sockets” to facilitate distribution of processing within a local area network. On top of the standard IP networking, TCG integrated a publish-subscribe mechanism to support distributed multicast communications. This handles complex environments that need hot backup processors along with dynamic failover and reconfiguration.



The LinkPRO Communications Architecture

and cost of providing integrated datalinks. TCG employs commercial-off-the-shelf (COTS) software and hardware to produce a low cost, flexible, and reusable communications front-end processor for military digital datalink communications.

TCG’s LinkPRO is a suite of software components that operate as a “front-end” processor for multiple tactical datalinks. The implementation provides interfaces and processing for Link-16 and Link-11 using a variety of physical interfaces. The

RTI Publish-Subscribe Middleware enhances TCM’s Inter-Process Communications

For their inter-process communications, TCG needed:

- Performance:** real-time, high-performance distributed communications
- Flexibility:** scalability from single to multiple nodes
- Reliability:** reliable, tunable data distribution

Performance

TCG needed a high-performance publish-subscribe IPC solution. RTI Data Distribution Service was developed specifically for distributed real-time and embedded systems.

RTI supports multiple means for notifying a subscriber application that a message has been delivered and is ready for retrieval. TCM cannot rely on polling for this notification. RTI supports an asynchronous callback feature that TCM uses to receive the messages. This mechanism reduces the end-to-end message delivery latency in the TCM.



When sending messages, TCM cannot wait for reception status before continuing with its processing. RTI can publish data asynchronously, allowing control to return to the application program so the application can continue doing its other tasks. Asynchronous publishing is critical in real-time applications like TCM.

RTI supports both UDP unicast and multicast communications. TCG developed their IPC using unicast to start. Later, if network traffic is an issue, they have the option to convert those publishers with multiple subscribers to multi-cast ports. This decreases the load on the network and on the publisher node since it only has to send to one multicast address.

Flexibility

TCG needed middleware that would enhance their IPC flexibility. They needed to handle a multitude of data types and messages. They also needed to support numerous customer configurations, scaling from single to multiple computing nodes with the same TCM code.

TCM has over 100 application specific data types. Converting all these data types to unique RTI data types would have been tedious, time consuming and error-prone. RTI provides for many data types, but critical to TCM was the variable length data type. It allowed TCG to represent all 100+ existing data types as one variable sized data type. This saved TCG valuable development and validation effort.

Different TCM customers have different computing environments. TCM needs to scale across many different customer configurations. RTI's publish-subscribe

communications is anonymous; subscribers and publishers can be on the same node or across the network. The connection is based on the "topic" of the data. Subscribers to a "topic" automatically get publications of the "topic". The application doesn't need to know ahead of time. A communications model like client-server, on the other hand, requires setting up explicit network connections. Scaling across innumerable configurations is much simpler with publish-subscribe.

Reliability

TCG needed reliable IPC, but not at the expense of performance. RTI provides many reliability and other QoS parameters that TCG uses to tune their system. TCM has strict message throughput requirements and demands 100% reliability. TCG tuned parameters such as the maximum default message size, sending and receiving queue sizes, publisher high water mark and low water mark. In this way, TCG was able to meet its throughput and reliability requirements.

In real-time communications, there is a fundamental tradeoff between reliability and performance. TCP/IP is reliable, but quite often fails to provide the performance real-time systems require. With RTI, distributed real-time system developers can tune their applications data stream by data stream. RTI provides a reliable publish-subscribe protocol over UDP and multicast with many tuning parameters. A subscriber can be tuned to receive data from best-effort all the way through 100% reliability. Flexible reliability is very important in distributed real-time systems.

Conclusion

TCG's Tactical Communications Manager (TCM) is a distributed real-time application. RTI, with its real-time publish-subscribe communications model, enabled TCG to meet their performance, flexibility, and reliability requirements for the TCM's inter-process communications. Having been designed specifically for distributed real-time and embedded systems, RTI provided them high-performance data distribution, offered flexible and scalable publish-subscribe communications, and allowed TCG to tune their communications for the reliability and performance they needed. In the words of Bill Brock, General Manager for TCG, "We needed publish-subscribe middleware that would fit seamlessly into our inter-process communications. We were very pleased with how well RTI did the job."

About RTI

RTI supplies middleware and distributed data management solutions for real-time systems. With innovative technology and deep expertise in distributed applications, RTI provides an unequalled competitive advantage to customers developing systems that benefit from high-performance access to time-critical data. RTI solutions have been deployed in a broad range of applications including command and control, intelligence, surveillance, data fusion, simulation, industrial control, air traffic control, railway management, roadway traffic monitoring and multimedia communications. Founded in 1991, RTI is privately held and headquartered in Santa Clara, California.