

# RTI in Robotics

Enabling Distributed Real-Time Control



The future of robotics is distributed. Any complex robot is a diverse set of autonomous, semi-autonomous and human-controlled modules, all working closely together as a single cohesive system of interoperating parts. Human operators often need to control robots across very large distances and over unreliable network transports. RTI Connex<sup>®</sup> DDS is an ideal foundation technology and connectivity mechanism for highly resilient and responsive robotic systems that can operate in the most unpredictable, harsh conditions.

## Proven Readiness for High-Performance and High-Precision Robotics

Innovative data-centric connectivity model that integrates the wide range of demanding robotic system requirements

Low latency with real-time Quality of Service (QoS)

Proven integration of a fast local control loop with secure connectivity over long distances and with cloud infrastructure

Ability to enable reliable systems operation over low-bandwidth communication links with long transmission delays

Extremely scalable: suitable for increasingly large-scale and complex systems

Highly resilient: systems are self-forming and self-healing with no single point of failure

Security with full support for confidentiality, integrity and access control

*"RTI's Connex DDS and its predecessors have been integral to Schilling Robotics' ROV control systems for decades. The publish/subscribe model and its implementation have provided powerful interprocess communication and coordination functions in a networked, multi-OS software architecture that spans UI to real-time control. Along the way, RTI has provided technical support and consulting services that have helped us achieve our product goals. We are glad that we made the choice to build our control system software with DDS as a core component."*

**Steve Cohan, Vice President of Controls Technology, FMC Technologies Schilling Robotics**

*"Getting four complex robots with very different designs to use a common data system was challenging. The Data Distribution Service for Real-Time Systems (DDS) standard supports very flexible service parameters. We found that we could adapt the middleware to the unique needs of each robotic system."*

**Terry Fong, Director of Intelligent Robotics Group, NASA Ames**

*"My team was tasked with building the first telerobotic control systems for use in space. The SPAN telerobotics development platform allows us to assess the technology we've developed. We selected RTI for this advanced platform because their product seamlessly manages real-time closed-loop control over a highly challenged communication link. Just as importantly, it delivered a framework on which to build an extremely flexible development environment ideally suited to mechatronic development teams."*

**Dr. André Schiele, Head of Telerobotics & Haptics Laboratory, DSA**

## How RTI Customers Use Connex DDS

### Enabling Human-to-Robot Communication Between Land and Space

NASA's Human Exploration Telerobotics (HET) project takes routine, highly repetitive, dangerous or long-duration tasks out of human hands and improves the way humans live and work in space. NASA relies on Connex DDS because of its inherent tolerance of time delay and loss of signal that occur with signals sent across the vast distances separating the space station, satellites and land-based devices. NASA uses Connex DDS to test how astronauts on the space station could remotely operate planetary rovers.



### Operating in the World's Most Difficult Environments

FMC Technologies Schilling Robotics manufactures work-class remotely operated vehicles and manipulator arms. The systems operate in harsh environments, from the crushing pressure of the ocean floor to the high radiation of nuclear reactors. Any fault in these systems can result in a very expensive equipment loss. Schilling relies on Connex DDS for tying together distributed computing architectures via a common connectivity API across a wide variety of processors and operating systems. It eliminates low-level network programming and enables the addition of new components without modifying existing ones.



### Transforming Robotic Surgery

Operating on a beating heart requires a surgeon to perceive an almost static view of the heart in order to have better control over precise cuts and stitches. It also requires a haptic feedback loop that connects the surgeon's touch – the most important of surgeons' skills – to remote surgical instruments. MIRO Lab uses Connex DDS in an innovative minimally invasive robotic surgery (MIRS) system to connect three robots, an endoscope, a surgeon's robot controllers and user interfaces for the surgeon and technician. The deterministic solution functions at rates between 1KHz and 3KHz, thus enabling the development of the distributed haptic closed control loop. It gives a surgeon hand-eye capabilities and the "feel" needed to operate remotely.



#### About RTI

RTI provides the connectivity platform for the Industrial Internet of Things.

Our RTI Connex® messaging software forms the core nervous system for smart, distributed applications. RTI Connex allows devices to intelligently share information and work together as one integrated system. RTI was named "The Most influential Industrial Internet of Things Company" in 2014 by Appinions and published in Forbes.

Our customers span the breadth of the Internet of Things, including medical, energy, mining, air traffic control, trading, automotive, unmanned systems, industrial SCADA, naval systems, air and missile defense, ground stations, and science.

RTI is committed to open standards, open community source and open architecture. RTI provides the leading implementation of the Object Management Group (OMG) Data Distribution Service (DDS) standard.

RTI is the world's largest embedded middleware provider, privately held and headquartered in Sunnyvale, California.



Your systems. Working as one.

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