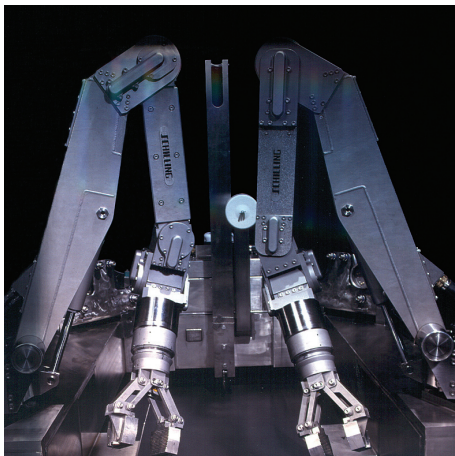


ALSTOM Schilling Robotics

Development tools selected for complex robotic systems

“We got the dual Conans up and running in a matter of days. It would have been months if we had not been able to reuse the Constellation components developed for the Titan project.”



Dual Titan Arms

ALSTOM Schilling Robotics is the world leader in telerobotic technology. Their systems operate in the world's most difficult environments, from the crushing pressure of the ocean floor, to the high radiation of nuclear reactors, and the toxic atmosphere within waste facilities. Schilling needs a reliable software framework: a critical fault in the software running these systems could result in the loss of very expensive equipment. At the same time, the software must be flexible and able to support rapid development across Schillings many product lines.

That's why they chose the Real-Time Innovations® (RTI) Constellation™ software platform with the RTI Data Distribution Service (formerly NDDS) distributed networking layer.

Constellation Enables Fast and Reliable Control System Development

Schilling used the Constellation software platform to develop and integrate the controls and communications for the robotic modules in the Titan 3 and Conan remote manipulator systems and the Quest Remotely Operated Vehicle (ROV). Using Constellation, the software engineers:

- Develop incrementally: Constellation scales well with project complexity. Schilling engineers break down complex systems into a hierarchy of interacting components. Each component is individually designed, developed and tested on a host system (well before the hardware is available). The components are then integrated into higher level components which in turn are tested and combined into even higher level components.
- Share designs and re-use code: Constellation's graphical “drawing board” provides a repository of re-usable modules and visual diagram editor. Engineers build components using graphic data flow and state chart representations and then store these in the repository. Any



Conan Remote Manipulator System

other engineer can pick up the diagrams, easily figure out what it does, and re-use it or modify it to suit their purposes.

Over 60 percent of the code first developed for a sub-sea operations project controlling a dual Titan 3 arm system was reused in a nuclear waste cleanup project controlling boom-mounted dual Conan arms.

- Tailor to each customer's needs: Every customer has special requirements; modifications and re-designs are a fact of life. The engineers make changes at the diagram level. The Constellation framework generates the code and configures the run-time scheduling accordingly, reducing the labor costs from 30%–50%.
- Constellation helped Schilling in other measurable and immeasurable ways:
- Concurrent development: Teams could work on different subsystems in parallel. Constellation manages the relationships between components in each subsystem, reducing the integration phase labor costs by 30%.
 - Controls systems focus: Application development was easier, and more intuitive, using a framework designed specifically for sensing and control applications.

- Documentation: Constellation automatically generates HTML documentation for all components.
- Debugging: The close integration between the Constellation framework and its debugging tools reduced the labor during test and debug by 50%.

Schilling's latest product is the Quest ROV. An underwater unmanned vehicle used for servicing, installation, exploration, salvage, and recovery operations. It runs from an all-electric propulsion system with an advanced network design to reduce the complexity of the cabling between the ROV and its support ship. Schilling used the Constellation framework to develop its control software. Schilling added the Constellation real-time, publish-subscribe communications middleware, RTI Data Distribution Service, to simplify ROV-to-ship communications in this project.

Schilling continues to use Constellation for upcoming projects. The engineers re-use the components developed for Titan, Conan and Quest, modify existing components to incorporate algorithm and hardware improvements, and add new components, all within Constellation's graphical diagram editor. The Constellation framework integrates new and old components, reducing rework and testing.

Publish-Subscribe Provides a Flexible Networking Backbone

The RTI real-time publish-subscribe networking middleware ties together Schilling's distributed computing architectures using industry-standard Internet Protocols. The middleware provides a common,



The Quest

"The entire Quest control system is based on the publish-subscribe paradigm. We made that choice based on its flexibility and efficiency. We use RTI throughout, and it has proven to be very reliable. This allowed me to focus my resources on the other aspects of the control system."

—Richard Gross, Schilling Chief Software Engineer

communications API across a wide variety of processor architectures and operating systems and eliminates the network programming. This gives Schilling's engineers the flexibility to use different processors and operating systems and add new publishers and subscribers without modifying existing components.

RTI Consulting Services Provide Valuable Expertise Early in Project Cycle

The RTI Consulting Organization worked with Schilling Robotics during critical phases of design, implementation, and new product testing. The consulting experts

provided product training and design analysis to make sure engineers were using the tools efficiently. They also provided programming talent. On several occasions, when Schilling needed additional support to meet their stringent delivery deadlines, the consulting organization assisted Schilling in designing and implementing the software control subsystems.

"RTI consultants produce high quality designs and code that works 'right out of the box'. I like to bring them in very early in a project and take advantage of their expertise."

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 Sunnyvale, California.