The Software Platform for Control Systems

Is Your Control Software Project:

- On a fast-track schedule?
- Requiring a lot of system integration?
- Creating long-lasting, reusable software?
- Coordinating engineers, programmers, and managers?

Control systems are a huge engineering effort. Software and controls integration are the greatest challenges. It has to be right.

Constellation is the commercial, off-the-shelf platform specifically designed to meet the challenges of developing software for control systems.

The Software Platform for Control Systems

What is a software platform? A software platform is a combination of a framework architecture and a set of development tools that work together in an integrated process. A software platform provides a complete package for a particular class of applications.

Software Platform = Framework + Tools

RTI’s Constellation for Control Systems is the software platform that contains everything you need to build and integrate a smart machine.

What Does Constellation Do?

- Gives engineers the right tools for all the jobs
- Improves team communications and project management
- Reduces risk with a field-proven framework architecture
- Speeds development from concept to production
- Jump-starts your project with hundreds of prewritten software components
- Backs you with professional support, training, and consulting
Field-Proven Software Framework

• Will our legacy software require significant work for each new project?
• How will we incorporate higher levels of autonomy into the system?
• Can we connect with a network?
• Should we design a multi-level control system?
• How do we change modes of operation?
• Will we get performance and true real-time execution?

If these questions sound familiar, then you know that control systems pose a tough software-architecture challenge. Every complex system needs an architectural framework. You can build your own framework, but designing a distributed, reusable software architecture with top performance is difficult and risky. Instead of building and maintaining your own framework, wouldn’t you rather focus on your application, your function, and your mission?

The Constellation software framework is the result of many years of engineering effort; it is field-proven in over a hundred autonomous systems, mobile robotics and other intelligent control applications.

The Constellation framework supports the needs of control systems. It provides a powerful, hierarchical structure that meets the hard, real-time needs of the system software. Underneath all of this functionality is an open, object-oriented, C++ implementation system that meets the demands of real production systems. Constellation provides the best framework for teams building control systems.

With Constellation’s powerful framework, you start with your software halfway done.

The Power of Components

Would it help your project if you could build from reused, tested code? Would you make faster progress? Would you reduce debugging?

Component-based development is truly powerful. With component-based design, you start with a top-down module design, precisely defining shared interfaces. Then, you build from the bottom up using pre-built, tested, software components. Separating interface from implementation ensures a good design and reusable modules.

Constellation provides the first, object-oriented, component-based architecture for complex control systems. It organizes your entire system into clean, well-defined components. It comes with pre-built components for control, device drivers, sensor processing, trajectories, mathematics, networking, robotics, and many more. You can use these and build your own components from structure diagrams, Simulink®, legacy code, or hand-written code.
System Integration

How much time do you spend in system integration? Would it help your schedule if system integration was easier? Would you like to incrementally build, simulate and test?

The Constellation framework brings all the pieces together into a complete application seamlessly. It includes full support for compilation and build, and is cleanly integrated with industry-standard environments, including VxWorks, Unix, Linux, and Windows.

"Mix-and-match" simulation and deployment is built into the Constellation framework. Since you can quickly direct any module to run on any processor, you can simulate today and test live tomorrow. Better, you can simulate any part of the system while testing the rest on live hardware. Your application can grow from pure simulation on a desktop workstation, to hardware in the loop tests, to the final embedded production hardware without changing. You also have the flexibility to target multiple hardware architectures and operating systems.

Constellation makes integration easy.

RTI, Your Best Resource for Control Systems

RTI was founded by researchers building control systems at Stanford University’s Aerospace Robotics Lab. Since then, RTI has grown into the leading expert in software and tools for complex embedded control systems. Thousands of developers world-wide trust RTI products for their embedded software.

RTI has built strong relationships with the leaders in the real-time and controls markets, including Wind River and The Mathworks, an ongoing research partnership with Stanford, and leadership positions in standards organizations such as the Object Management Group (OMG).

In addition to Constellation, RTI markets the most popular real-time visualization toolset in the world, ScopeTools™, and the WaveWorks® real-time middleware. The ScopeTools suite includes five tools for memory analysis, performance tuning, execution tracing, code coverage, and data monitoring. WaveWorks implements DCPS, the emerging data delivery standard for data centric real-time applications from OMG.

Need Help to Get Going?
RTI’s Professional Services Organization (PSO) can help you get your control system software off the ground in record time. We have the experts you need in application integration, RTOS selection and integration, control, robotics & electro-mechanical systems, networking, and graphical tools. We provide consulting, design reviews, custom tool integrations, software design, and help with legacy code conversions. PSO can deliver anything and everything you need: a quick checkup, training, in-depth design help, or a complete turn-key solution.
The right tools often mean the difference between success and frustration. Control system development requires many tasks: requirements analysis, software design, controls design, project management, networking, revision control, system integration, simulation, testing, and debugging.

How do you get the right tools for all these jobs? By seamlessly integrating the best tools, and all the important standards, into a single development environment.

Constellation users take advantage of an unprecedented end-to-end tool chain, stretching from conceptual modeling to the nuts-and-bolts of implementation and debugging. Constellation integrates:

**Simulink**

Simulink from The Mathworks is the industry-leading tool for advanced control algorithm design. Simulink models drop right into Constellation. Constellation automatically synchronizes the graphical models, incorporates the generated code, and executes Simulink models as part of the final system. Control engineers can create new algorithms in Simulink and combine them into a complete application without ever having to look at a line of code or a build system parameter.

**UML**

The Unified Modeling Language (UML) is the industry-standard notation for modeling complex software design. UML excels at capturing system requirements, preliminary design analysis, and overall system modeling. Constellation integrates the most popular industry-standard UML modeling diagrams, including use-case diagrams, class diagrams, state chart diagrams and message-sequence charts.

By providing a complete, end-to-end tool chain in an integrated development environment, Constellation gives engineers the tools needed to perform the many tasks of software development for control systems.
Networking: CORBA and DCPS
Control systems are inherently distributed. To simplify the design and programming of the communications between on-board computers, payload computers and ground station systems, Constellation integrates CORBA, the industry-leading middleware standard for distributed objects, and DCPS, the emerging data delivery standard for data centric real-time applications. Developers can define shared data and interfaces, insert them into applications and make their distributed system communicate without ever looking at a line of code.

Test Tools
Nothing is more important to a reliable system than efficient, powerful test and debug tools. Constellation works with an extensive array of test tools, including commercial products developed for state-machine tracking, memory checking, performance tuning, interface tracing, code coverage, and data monitoring. Source code debugging is also available through integration with code-based IDEs such as Visual Studio™.

Repository and Revision Management
Team development requires a way to organize and share the design and software between people. Constellation has a built-in, work-unit based, repository manager. Teams can organize the repository to suit their needs and make components available for other teams to use. Constellation comes integrated with the CVS revision control system and can be configured to work with other revision control systems.

Documentation
With Constellation, documentation is straightforward. The graphical design environment is automatically self-documenting. HTML web pages can be generated from the diagrams and component source code to facilitate easy sharing with those not working in the Constellation Developer environment.

VxWorks, Windows, and Linux
Finally, Constellation is seamlessly integrated with the industry’s most popular IDEs and operating systems, including Wind River’s Tornado/VxWorks®, Microsoft’s Windows®, Linux™, and more.

Constellation lets the developer use the right tools for all the jobs of software development: software design, control algorithm design, simulation, distributed communications, testing, debugging and monitoring. The right tools can mean the difference between failure and success.

The Constellation Tool-Chain Provides:
- Component-based development for defining and creating software modules.
- Graphical programming of data flow and state chart behavior for easier control software development.
- UML modeling for software documentation, design, and analysis.
- Simulink integration for the reuse of algorithms and simulation models.
- Data monitoring and calibration with RTI StethoScope® for system visualization and debugging.
- Integrated source-level debugging.
- Simplified networking communications.
- Straightforward, push-button documentation.
- Flexible integration of process tools such as the CVS revision control system.
The Industry’s Best Support

RTI is dedicated to providing the industry’s best support in addition to the best software. We staff support with experienced engineers, so we can solve your toughest problems quickly. RTI believes in extraordinary service, and it shows:

"Thank you for your excellent and timely support! It’s the best I’ve had in years!"

"The guys have been extremely enthusiastic about the level of support that they have been receiving from RTI and are gung-ho on your products."

"You kick @**! Thank you so much for the quick response."

"My boss said "You won’t have any problems getting answers from them, their support is excellent.""

"Your support is great! RTI’s support has always been very quick in responding."

"That was excellent support. It answered my question AND educated me. I was really impressed."

"You are amazing! I thought I was the only one crazy enough to be working here this late!"

"Thanks for all your help. It is really amazing to get tech support questions answered in one day. I usually wait a week or two to get anything from other companies."

These are just a few examples of the many unsolicited comments that RTI receives about our support.