Real-Time Distributed Object Computing: Ready for Mission-Critical Embedded System Applications

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Abstract
Distributed Real-time embedded (DRE) systems are relied on in a wide range of mission and safety critical applications such as avionics, flight control, industrial automation, automotive electronics, process control, and medical devices. As the complexity of these systems increases, high profile system development program difficulties gain recognition, and competitive and business pressures force increased development productivity, the use of emerging RT distributed object computing (DOC) middlewares becomes essential for next generation systems. This talk will characterize the key challenges confronting DOC middleware researchers and developers and then describe a case study of its successful deployment for mission critical large-scale military applications.

As an early example of the viability of RT middleware for mission critical applications, the Boeing Bold Stroke initiative has leveraged the capabilities of RT CORBA as a core component to provide the DOC foundation necessary for highly configurable and reusable avionics applications. The Boeing Bold Stroke architecture has been deployed on an expanding number of flight-tested embedded systems, and has demonstrated the programmatic benefits possible through product line reusable applications supported by RT DOC middlewares.

The establishment and population of a baseline RT CORBA-based application architecture has facilitated focused research in a number of new areas. As a member of a vibrant research community extending these benefits to new classes of systems, Boeing is engaged in a number of programs supported by DARPA, the US Air Force Research Laboratory, and the Open Systems Joint Task Force. The static scheduling approaches used in initial implementations are being extended to support dynamic and adaptive scheduling. Interoperating systems with highly constrained wireless links and multiple ORBs are being demonstrated. The applicability of RT DOC middlewares is being extended through development of application services for additional application domains. New commercial component models such as the CORBA Component Model are being leveraged towards definition of a standards-based RT Embedded System Component Model. In parallel, emerging implementations of the Real Time Specification for Java (RTSJ) are being benchmarked and Distributed RTSJ standard development is being supported.

In all of these efforts, a fundamental goal is to facilitate and transition the benefits of RT DOC capabilities to existing and emerging embedded systems. These programs provide a compelling case for the use of RT DOC in a wide range of embedded systems. As both the associated
research and development communities expand, our expectation is that mainstream usage of RT DOC middlewares will become a key enabler for future real-time embedded systems.

David Sharp is a Technical Fellow at Boeing Phantom Works in St. Louis, MO, USA. As Lead Architect and Core Architecture Team Leader for Boeing's Bold Stroke product line avionics software initiative, David spearheaded the development, documentation, and presentation of the Bold Stroke Software Architecture, a reusable product-line software architecture used as the basis for avionics program work on a range of Boeing production and experimental aircraft programs, and as the foundation for several highly influential US government-sponsored R&D programs. David serves as Principal Investigator (PI) for the DARPA Model-Based Integration of Embedded Systems (MoBIES) program. He also is PI for the Air Force Research Laboratory (AFRL) Real-Time Java for Embedded Systems (RTJES) program. He serves as Co-PI on the DARPA Networked Embedded Systems Technology (NEST) program. He received his BS at the University of Missouri, Rolla and his MS at Stanford University.