
Real-Time CORBA Experiences in an Avionics Domain

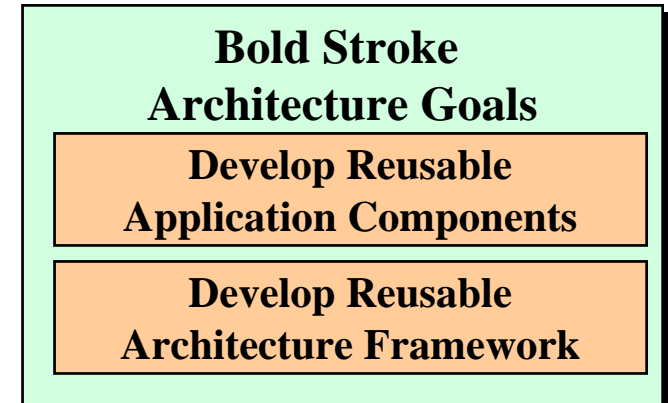
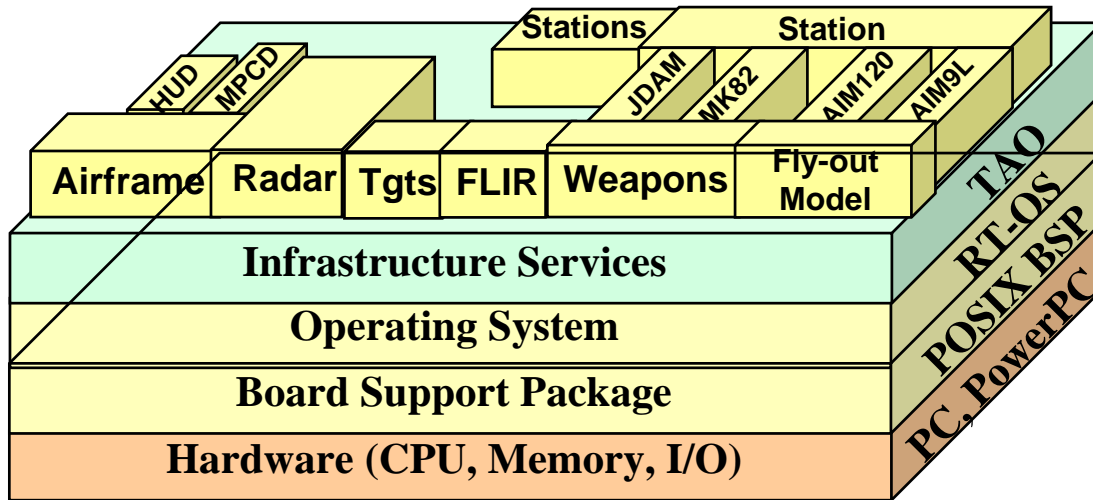
Jeanna Gossett, David Corman and David Sharp
The Boeing Company

OMG Real-Time Embedded and
Distributed Object Computing Workshop

June 7, 2001



Bold Stroke Architecture

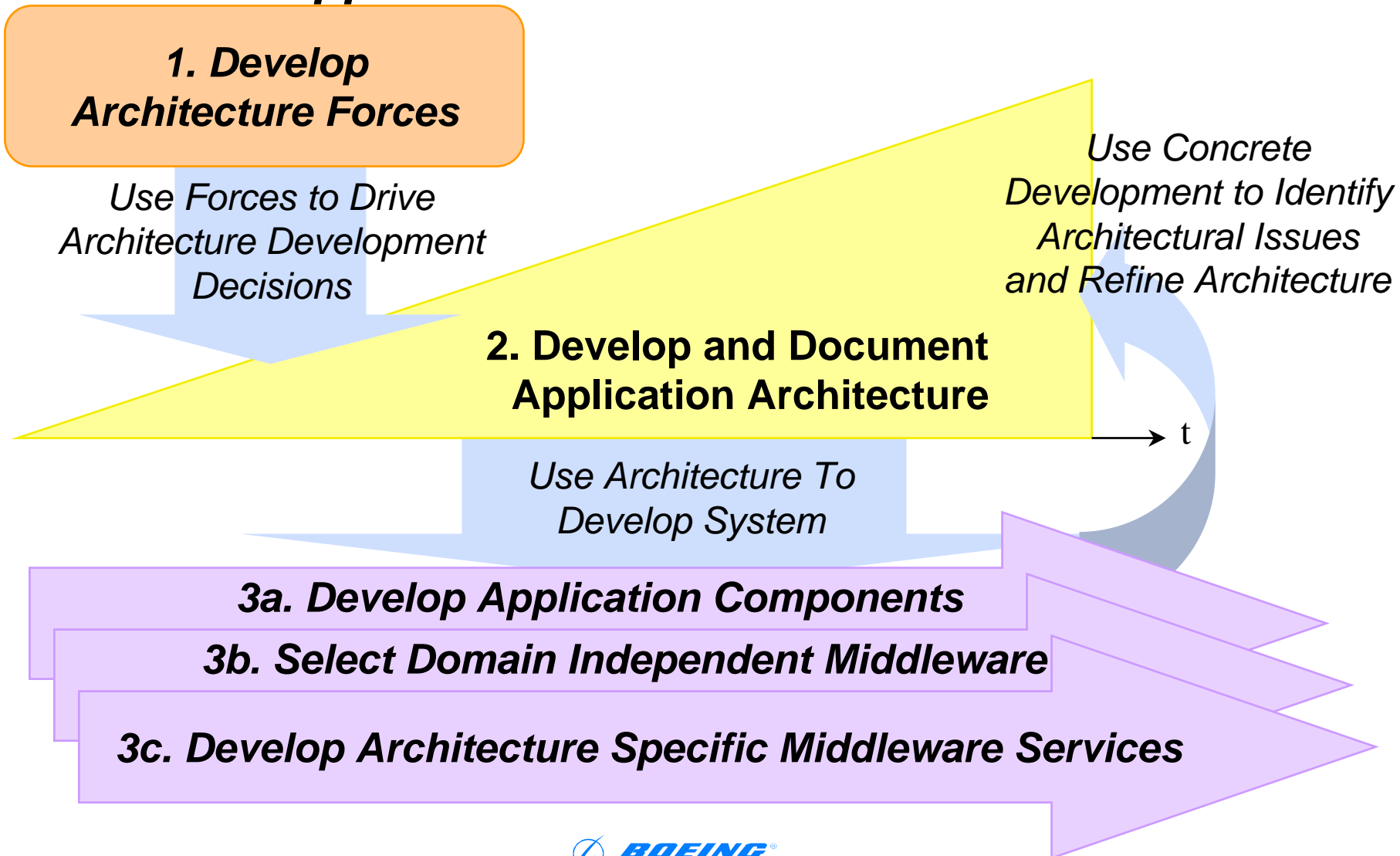


Achieve Affordable Flight Software for Product Line

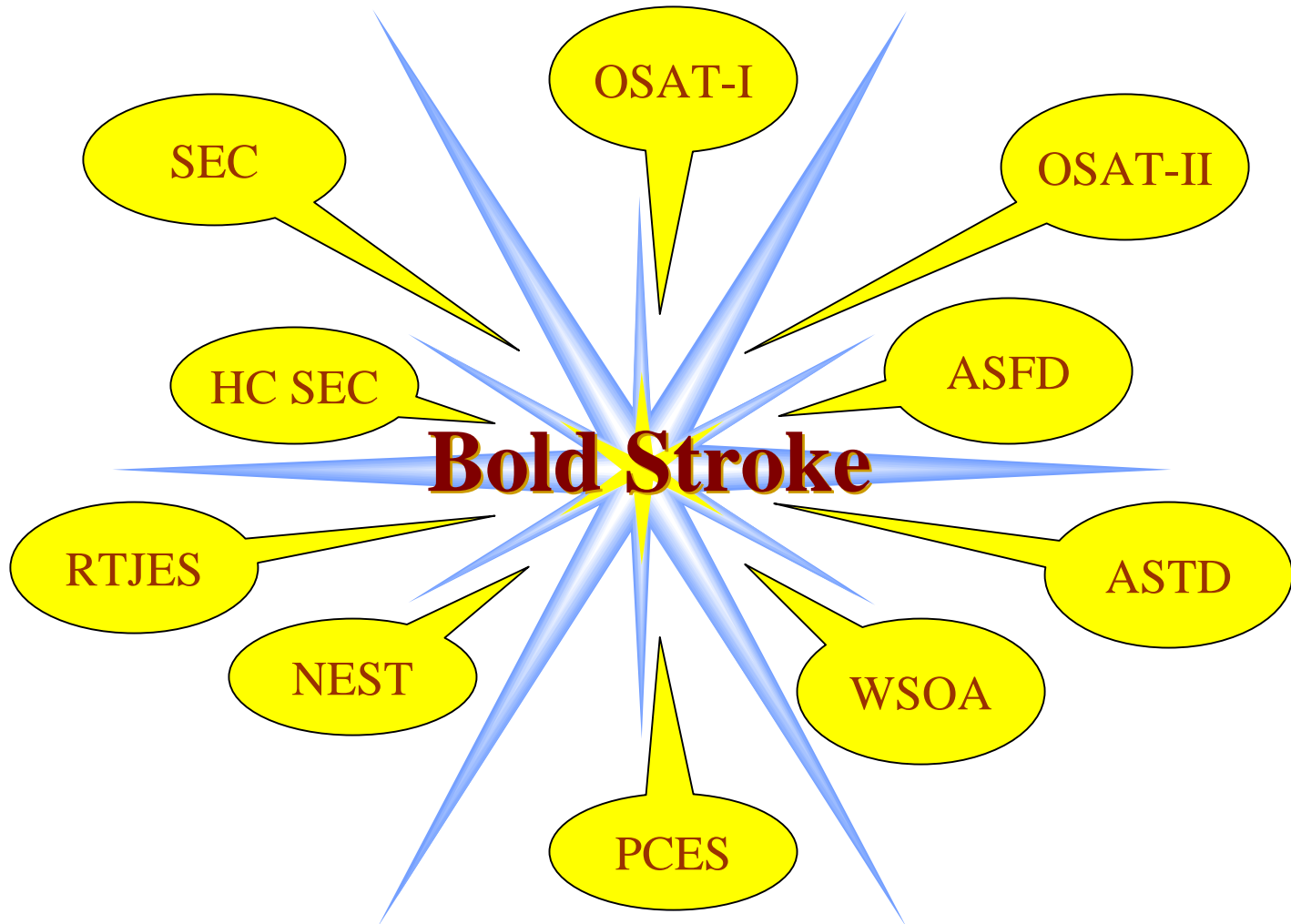
- **Hierarchical Component Based Architecture**
 - Real-Time CORBA (TAO)
- **Enhanced Platform Support**
 - Added support for X86 boards
- **Real-time Operating Systems**
 - Redhat Linux
 - Linux RT (soon)
 - SunOS
 - VxWorks (Tornado native)
 - Windows 2000
- **Transitioned to FA-18, F-15, T-45, AV-8B, UCAV Programs**
- **Scheduling Framework**
 - Dynamic Strategies
 - Hybrid (RMS/Dynamic)
- **Resource Management**
 - Rate adaptation
- **Reconfiguration Support**
 - Transition Support
- **Framework for Application Development**
- **Tool Integration**
 - MATLAB Integration
 - Integration with other tool suites

Lessons Learned from Bold Stroke

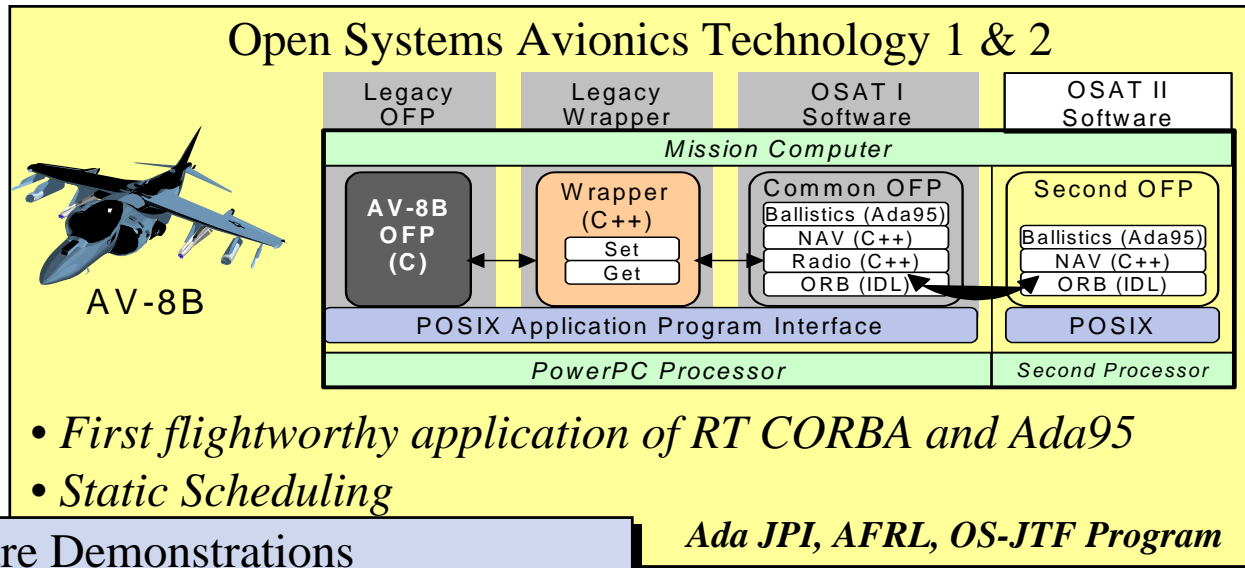
Application First Architecture Process



Research Programs Built on Bold Stroke

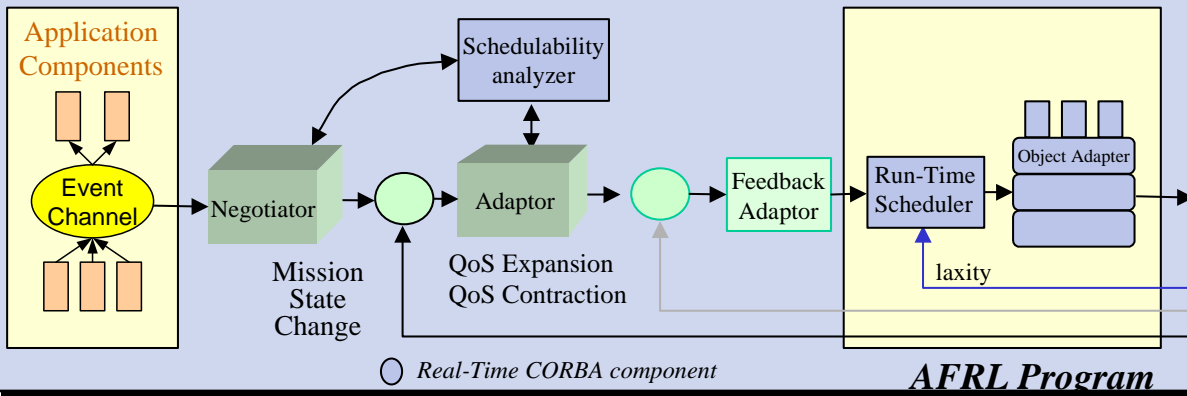


Run-Time Platform Programs

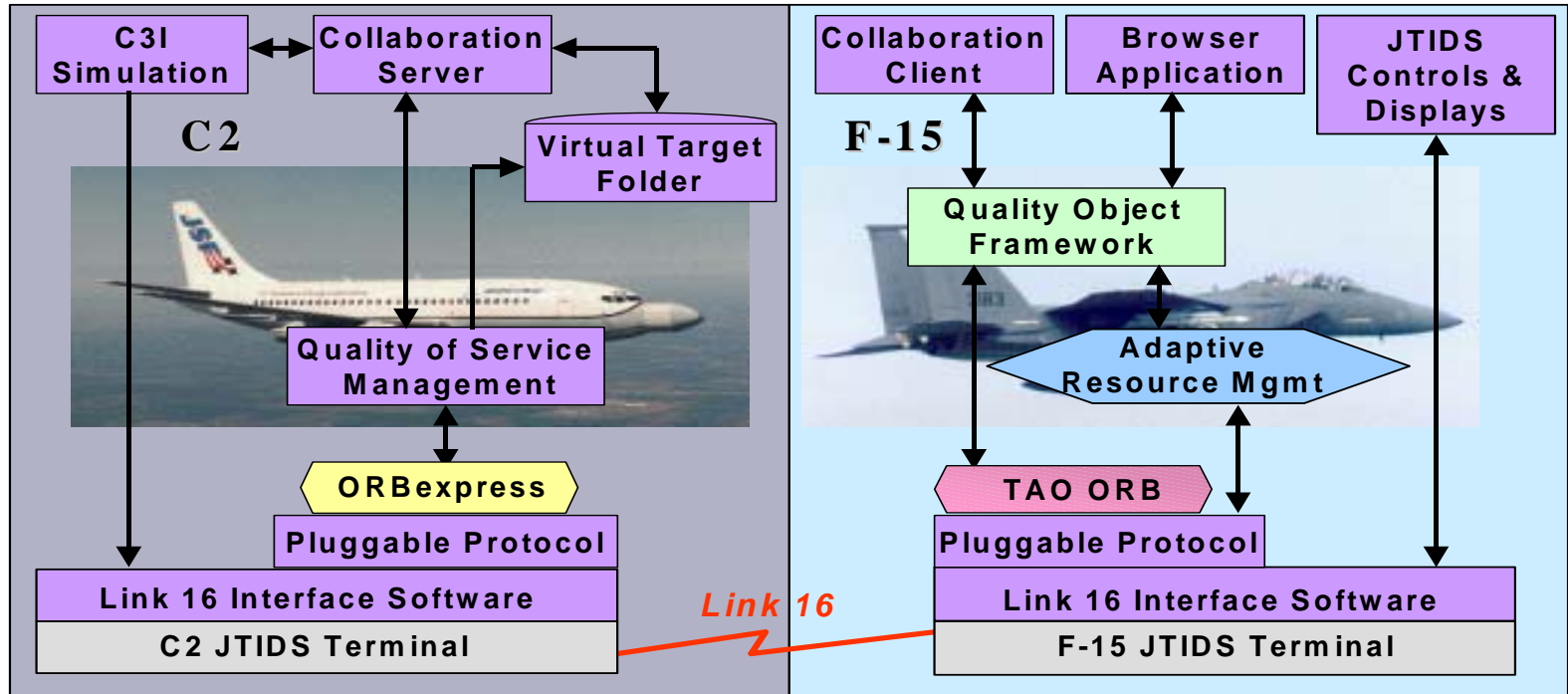


Adaptive Software Demonstrations

- *Dynamic Scheduling*
- *Performance feedback and adaptive resource mgt*



Weapons System Open Architecture

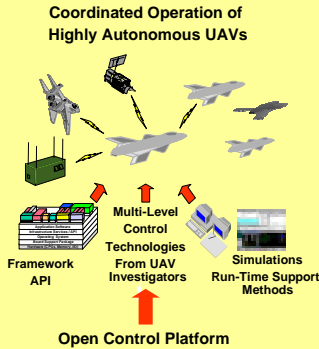
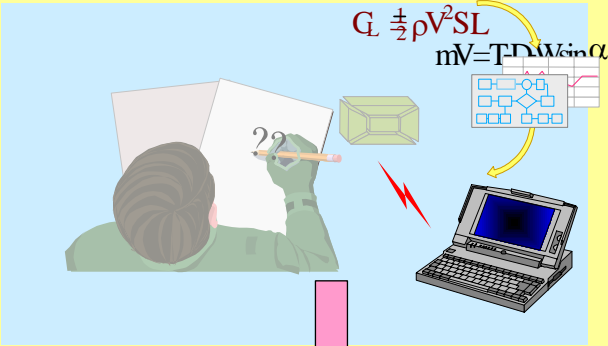


- **ORB Interoperability (ORBexpress and TAO)**
- **Legacy System Interoperability**
- **Transition of Quality of Service Management Technology**
- **Adaptive scheduling and resource management**
- **Pluggable protocols over tactical data network**

Software Enabled Control

Open Control Platform

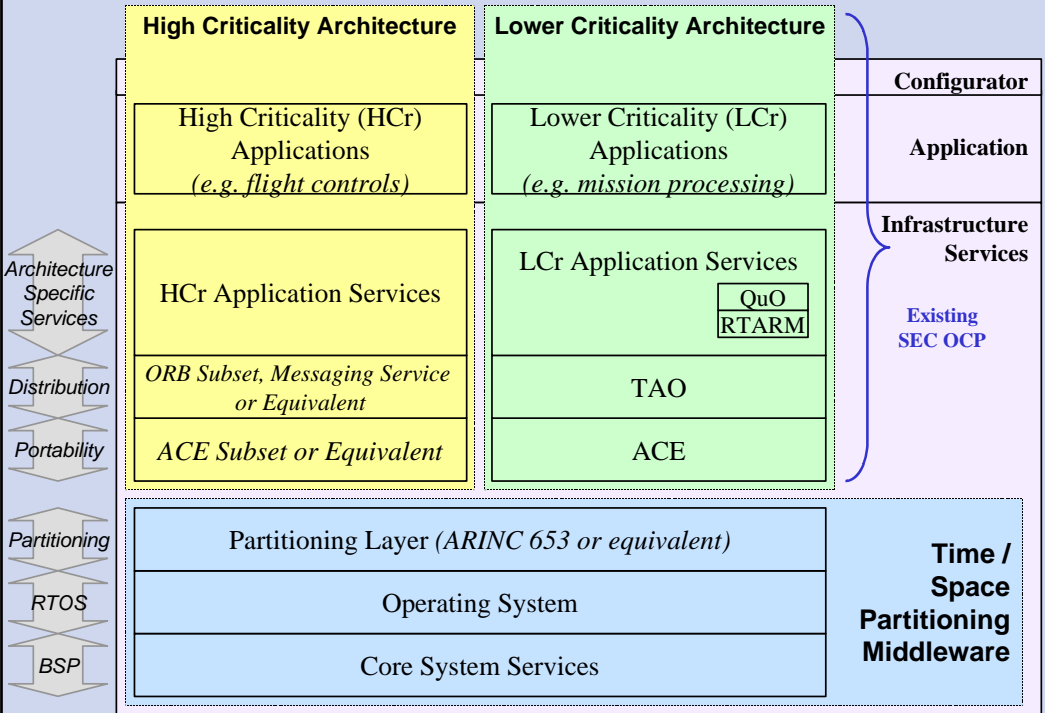
- Adds support for dynamic system reconfiguration



Live Flight Demonstration of SEC Control Technologies

High Confidence Open Control Platform

- Time/Space Partitioning
- On-line System Verification



Future Programs

Program Composition of Embedded Systems

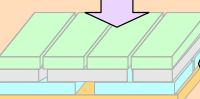
Aspect Oriented Programming

Advancing Aspect Oriented Programming
Research for Embedded Systems

- Develop tool for building single component from aspects



- Develop multi-component analysis tool



- Extend framework with real-time database from University of Virginia

Experimenting to Demonstrate
Component Development Benefits



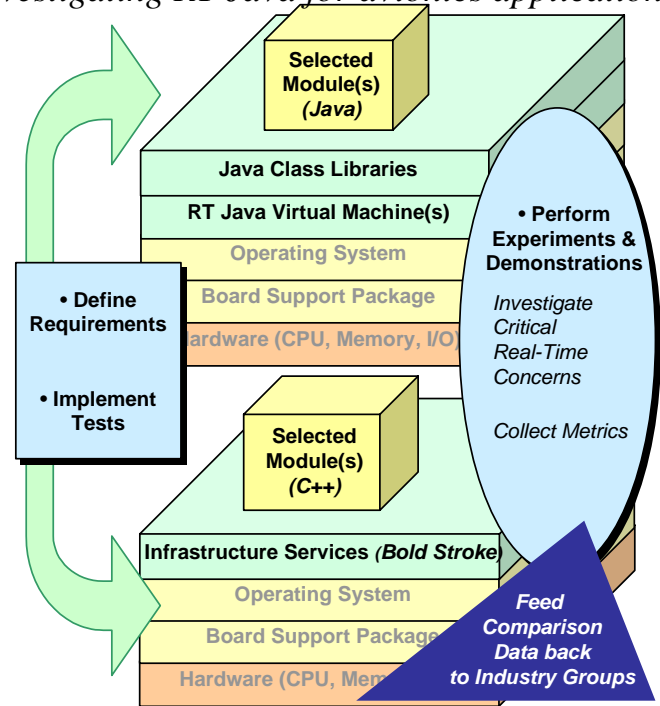
- Reusability
- Reconfigurability
- Schedulability
- Maintainability

- Leverage run-time platform for testing and integration

DARPA ITO Program

Real-Time Java for Embedded Systems

Investigating RT Java for avionics applications

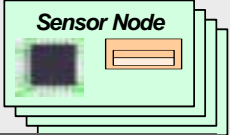


AFRL Program

Networked Embedded Software Technology

Very large number of small processing nodes (>100,000)

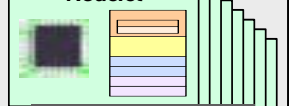
Traditional Approach



Data acquisition and raw signal processing only in sensor node

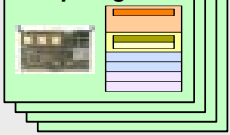
NEST Approach

Nodelet

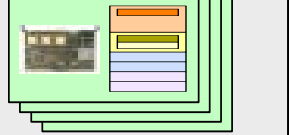


Addition of middleware capabilities and coordination services

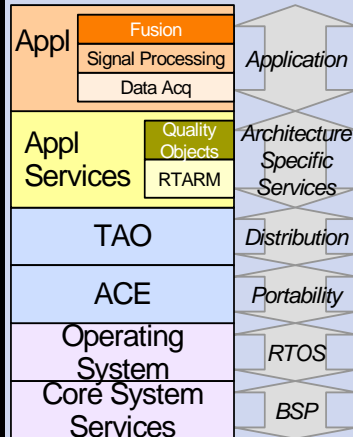
Computing Node



Node



Software Layer Legend



DARPA ITO Program

Extending Real-Time
Middleware Platforms

Lessons Learned from Research Programs

- **Middleware for non-computer scientists is evolving to shrink wrap capabilities**
- **Existing avionics applications are not fully utilizing all the latest middleware capabilities**
- **ORB interoperability exceeded expectations**
- **Test community verification processes need to be refined to deal with dynamic middleware**
- **Pluggable protocols is an enabler of new system capabilities in a tactical environment**