Telelogic

PRISMTECH
Productivity Tools & Middleware

LYNUXWORKS™

Optimizing Development and Delivery of SCA-Compliant SDR Applications Using An Integrated Tool Chain

Agenda

- Welcome & Company Introductions
- Challenges in Implementing SCA-Compliant SDR's
- A Model-Driven Development Approach for SCA-Compliant SDR's
- Demonstration
- Q&A

Welcome & Introductions

PrismTech

- Gary Putlock, Director, SDR Sales
  Gary.Putlock@PrismTech.com
  201-708-2906
- Karen Perry, Director, SDR Business Development
  Karen.Perry@PrismTech.com
  410-489-5974
- Jerry Bickle, Chief Scientist, SDR Products
  Jerry.Bickle@PrismTech.com

Telelogic

- Marty Bakal, Business Development Application Engineer
  Martin.Bakal@Telelogic.com
  978-645-3030

LynuxWorks

- Steve Blackman, Dir Bus Development Mil/Aero
  Sblackman@lnxw.com
  781-559-8141
- Gary Gilliland, Manager Systems Engineers
  Ggilliland@lnxw.com
  972-672-0516

About PrismTech

- Founded in 1992
- Privately held company
- Offices in USA and Europe
- Productivity Tools & Middleware
  - Software Defined Radio
  - Distributed, Real-Time, Embedded Systems
  - Security Solutions & Assurance

SPECTRA TOOLS

OpenFusion®

OpenSplice™

Xtradyne

- International Fortune 500 customers in aerospace & defense, telecommunications, and data communications sectors
- Original S/W architects and authors of SCA
- Leaders in commercial standardization
  - Founders of OMG's SBC Domain Task Force, SDR Forum members

PrismTech Spectra

Complete, vertically-integrated solution for developing, testing and deploying SCA-compliant SDR's

- Domain-specific modeling environment for developing SCA-compliant SDR's
  - Graphical, domain-specific modeling language (DSML)
    - Increases productivity of waveform and platform developers
  - Reverse engineering of existing SCA-based systems
    - Facilitates maintenance and SCA-compliance testing of existing systems
  - Automatic generation of SCA artifacts
    - Source code, XML descriptors, build artifacts, documentation
- Unit Test Framework for SCA-compliance testing of SDR's
  - Automatic generation of SCA infrastructure test code
  - Facilitates validation of waveform and platform for SCA infrastructure compliance
- Turnkey Operating Environment (OE) for deploying SCA-compliant SDR's
  - Lightweight, high-performance Core Framework, CORBA services, ORB
  - Supports deployment across GPP, DSP and FPGA devices

About Telelogic

- Established in 1987; focusing on complex system design and validation - Statemate ®
  - Dr. David Harel – Behavior Modeling/ Israeli Prime Minister's Award
  - Dr. Amir Pnuelli – Formal Verification/Turing Award
- 1998 – New generation Unified Modeling Language™ (UML™) compliant platform for seamless systems design and software development - Rhapsody®
  - Eran Gery – UML methodologist/technologist
  - Dr. Peter Hoffmann – Systems methodologist
  - Dr. Bruce Douglass – Software methodologist/author
- DOORS®, SYSTEM ARCHITECT®, Rhapsody, SYNERGY®

Telelogic SDR Solution

- **Telelogic DOORS (Requirements Management and Traceability)**
- **Telelogic Synergy (Change and Configuration Management)**
- **Telelogic Rhapsody (Model-driven Development)**
  - **Modeling (UML 2.0 PLUS)**
    - Benefit: Designing systems at a higher level of abstraction in order to easily deal with complexity
  - **Code Generation**
    - Benefit: Get to the final product quicker. Enables designers to work at a higher level of abstraction to deal with system complexity
  - **Model/Code Associativity**
    - Benefit: Freedom to work at the model level or source code level, and ensure views of the system are always synchronized.
  - **Real Time Framework**
    - Benefit: Allows you to create a deployable application, with the generated code, onto a real time operating system
  - **Reverse Engineering**
    - Benefit: Allows you to reuse your IP, as well as coexist with ongoing hand coding activities
  - **Design for Testability**
    - Benefit: Automate the testing process through using the *design requirements* to validate and to completely cover all system scenarios

The Leader in Open Architecture Based Embedded Systems

- Open Architecture and Standards based solutions
  - POSIX, **SCA**, LSB, Navy OA, JTA, ARINC
- Leading embedded Linux provider
- Leading embedded POSIX provider
- Hard real time performance
- Extensive experience in embedded market
- Founded in 1988

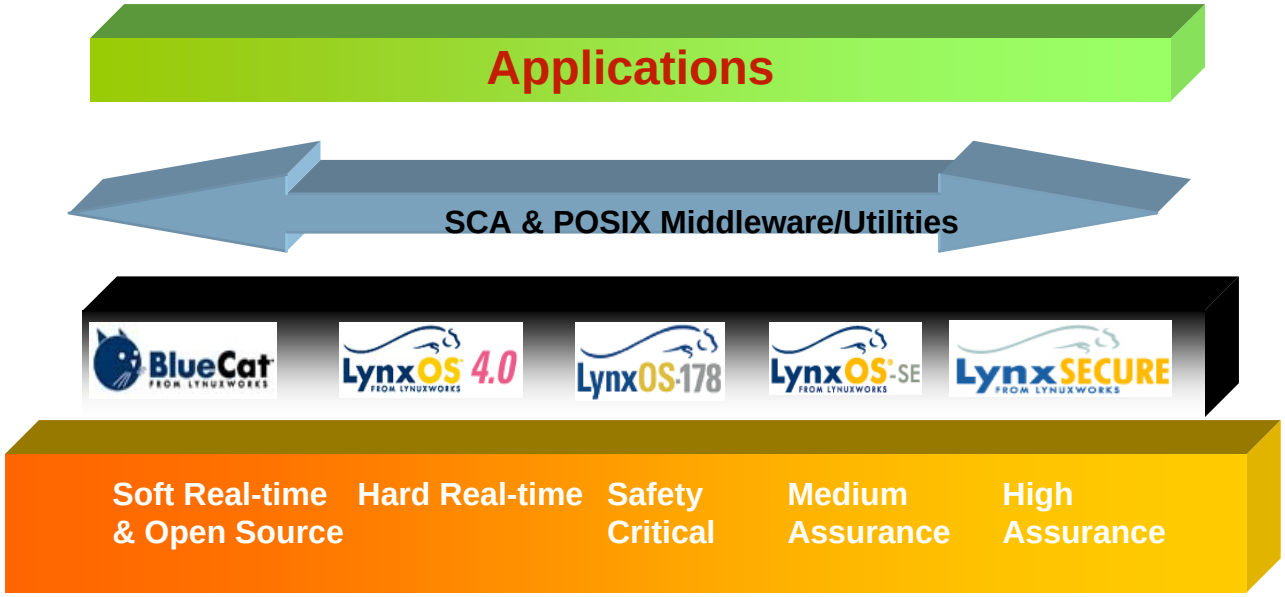
LynuxWorks SDR Solution

- **SCA conformance across family of Operating Systems including flight safety critical (DO178B) and high assurance (EAL7)**

B.3.1.4 Signals Function Behavior.

Table B-6. POSIX_SIGNALS Functions

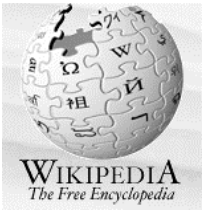
Function	Reference in POSIX.1	SCA AEP	LOS 4.0	LOS178
alarm()*	3.4.1	NRQ	YES	YES
kill()	3.3.2	MAN	YES	YES
pause()	3.4.2	MAN	YES	YES
sigaction()	3.3.4	MAN	YES	YES



What is a Software-Defined Radio (SDR)?

- A **software-defined radio** (SDR) system is a radio communication system which uses software for the modulation and demodulation of radio signals.
- An **SDR** performs significant amounts of signal processing in a general purpose computer, or a reconfigurable piece of digital electronics.
- The goal of this design is to produce a radio that can receive and transmit a new form of radio protocol just by running new software.

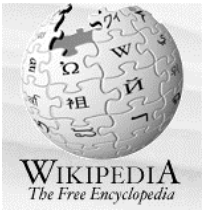
Shift from hardware to software…



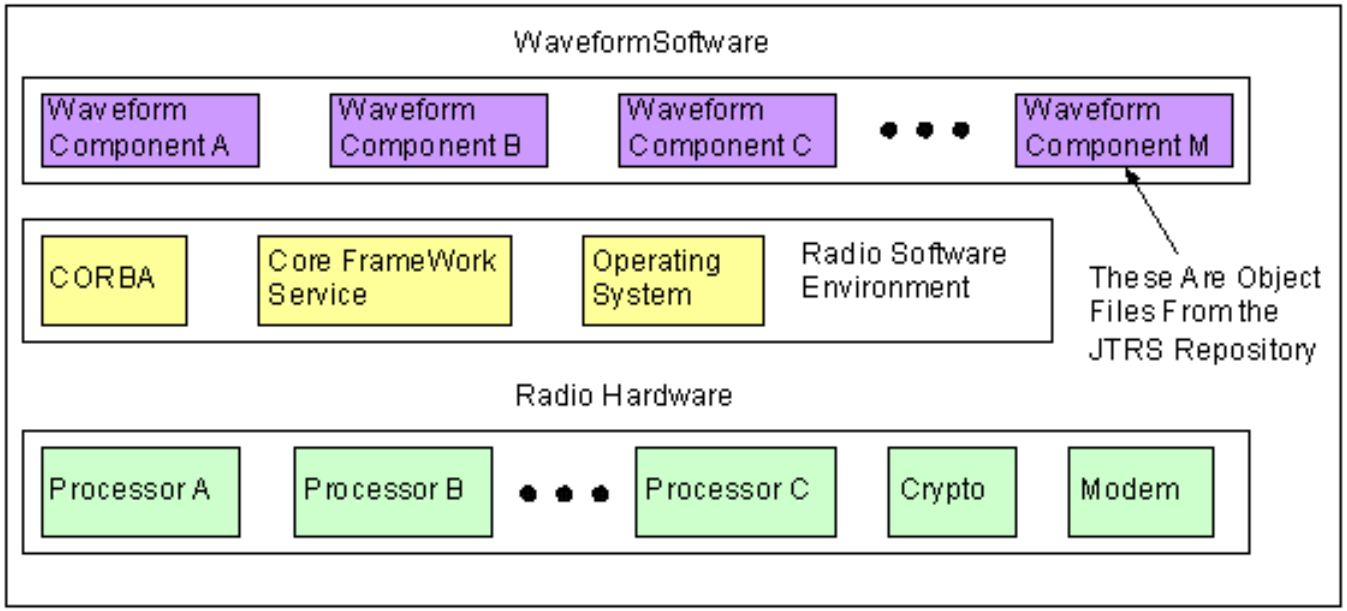
What is the SCA?

- The **Software Communications Architecture** (SCA) is an open architecture framework that tells designers how elements of hardware and software are to operate in harmony within a software defined radio.
- SCA is a key element in the U.S. military's Joint Tactical Radio System (JTRS). It governs the structure and operation of the JTRS, enabling programmable radios to load waveforms, run applications, and be networked into an integrated system.
- A Core Framework, providing a standard operating environment, must be implemented on every hardware set.
- Interoperability among radio sets is enhanced because the same waveform software can be easily ported to all radio sets.

…and lots of complex software!



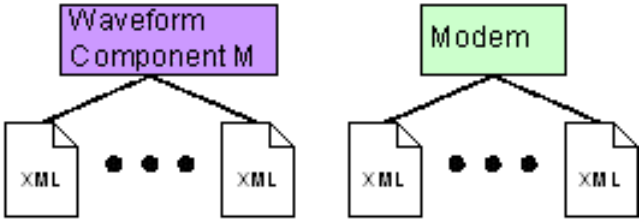
What is an SCA-Compliant SDR?



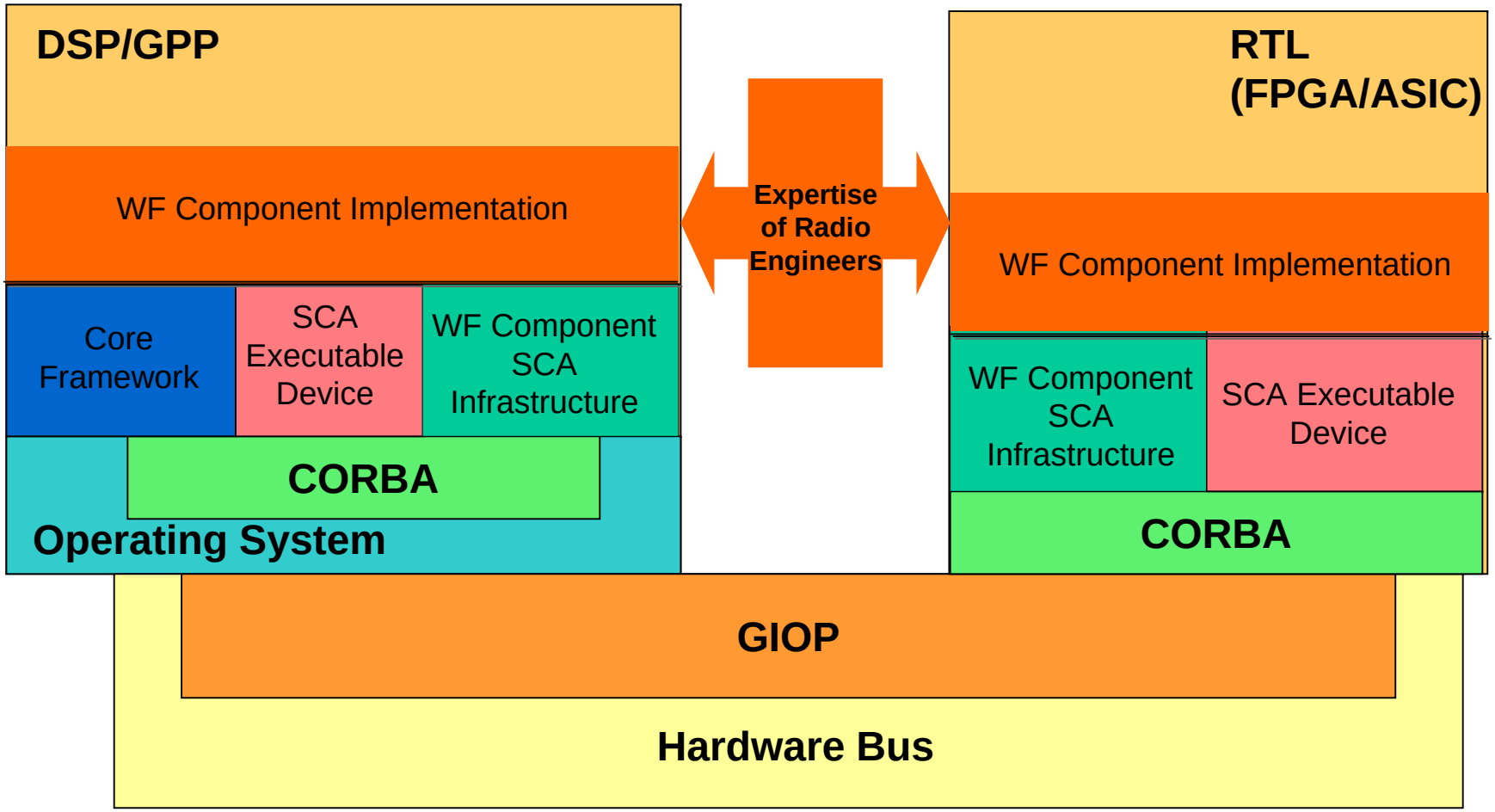
Waveform Component M

This Component Expects Other Components and Hardware Devices, but Doesn't Know Their Location or Capacity

Instead of Having Custom Builds for Individual Radios, We Have XML Files Associated With the Waveform Components and Hardware Devices that Allows the Waveform Startup to Find and Allocate Components Dynamically



Software Architecture of an SCA-Compliant SDR



Challenges in Implementing SCA-Compliant SDR's

- SDR developers are communications systems (radio) experts, not software architects/engineers
- Complex mix of software engineering skills required to achieve SCA compliance
  - SCA x.x.x specification (evolving)
  - C++ programming language
  - C++ template libraries (STLs)
  - CORBA (ORB, COS)
  - XML
  - Core Framework
  - RTOS
- Typically implemented across GPP, DSP and FPGA devices

So how do we address these challenges?

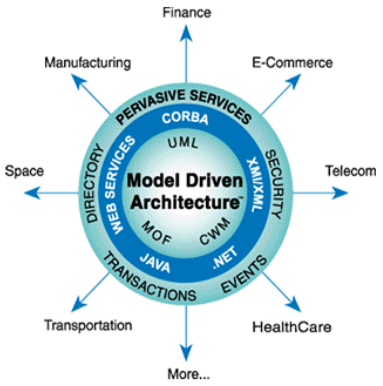
- Provide a means for SDR developers to express their design intent without exposing them to the underlying software complexities
- Automate the translation of that design into the required SCA artifacts, thereby allowing SDR developers to leverage the skills of SCA experts
- Deliver a Commercial-Off-The-Shelf (COTS) SDR software platform deployable on GPP, DSP and FPGA devices

Model-Driven Development Approach

What is Model-Driven Development?

- Model-Driven Development (MDD) is a software design approach that applies the systematic use of **models** as primary engineering artifacts throughout the engineering lifecycle of software systems.
- Using the MDD approach, system functionality is defined as a platform-independent model (PIM) through an appropriate **Domain Specific Language**.
- The PIM may then be **translated** to one or more platform-specific models (PSMs) for the actual implementation, typically using automated tools.

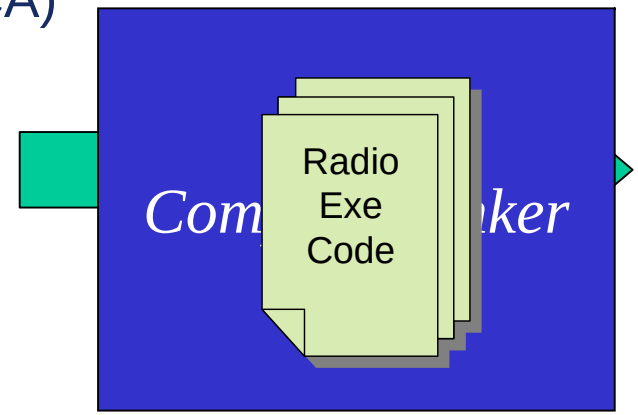
OBJECT MANAGEMENT GROUP



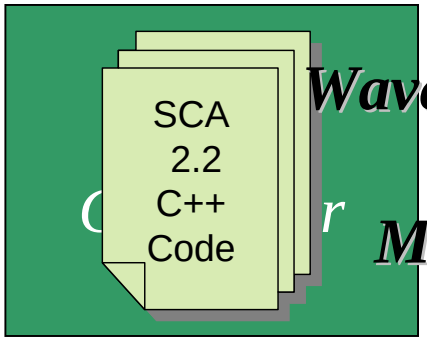
Model-Driven Development Approach for SCA-Compliant SDR's

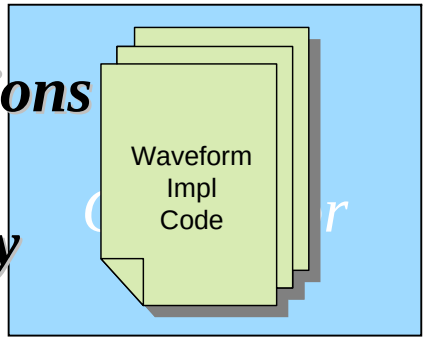
DSML (SCA)

UML



Proper separation allows SCA and Waveform Implementations to Mature Independently

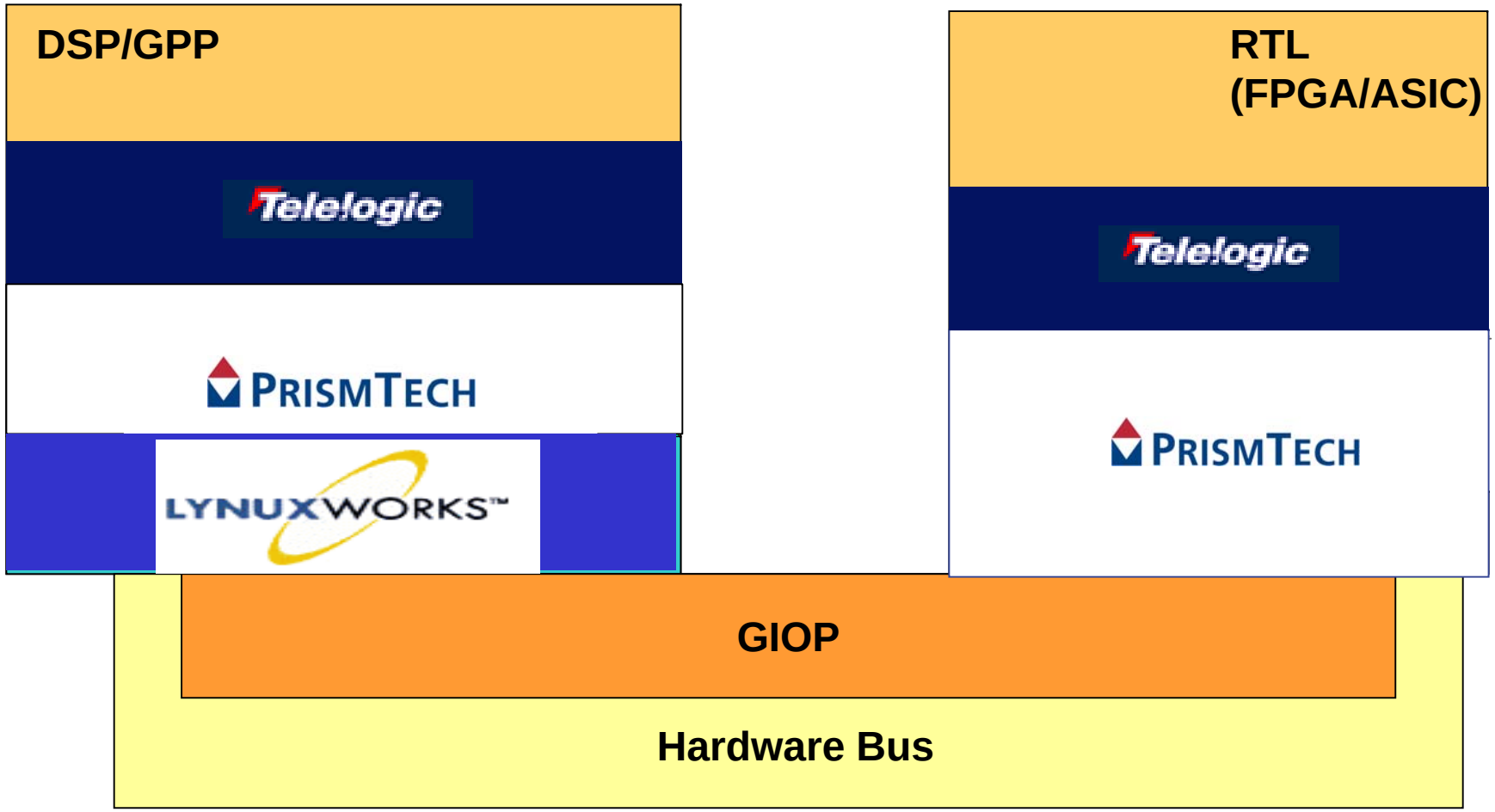




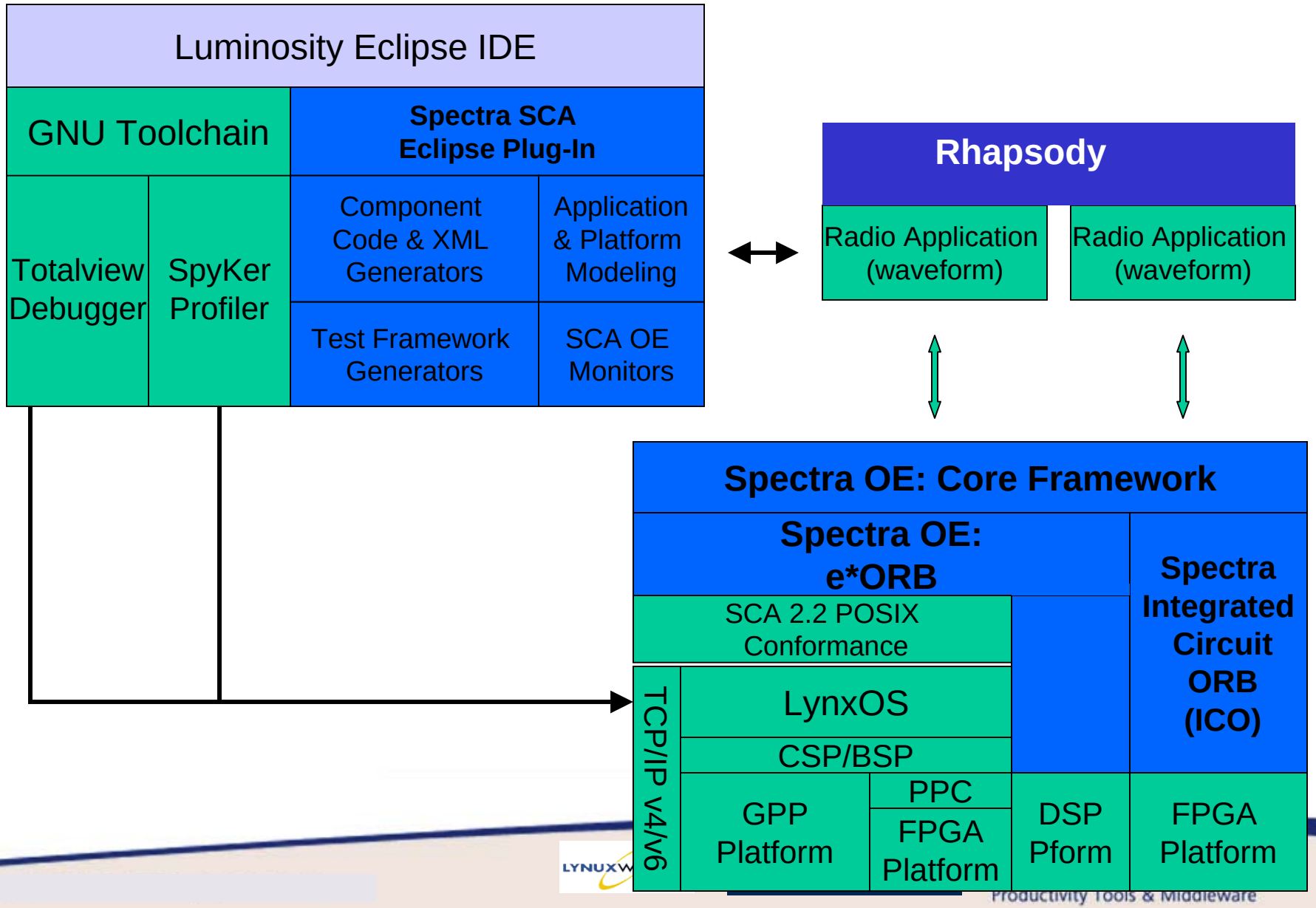
Benefits of Model-Driven Development (MDD) Supported by Spectra and Rhapsody

- **Modeling Language**
  - Enables designers to work at a higher level of abstraction to deal with system complexity
- **Graphical Editor**
  - Enables system design to be captured, visualized and understood from multiple perspectives
- **Code Generation**
  - Allows designers to work in application domain rather than in the underlying computing environment
- **Synchronization of Design, Development and Test Artifacts**
  - Eliminates costly errors due to out-of-sync lifecycle artifacts
- **Real-Time Framework**
  - Allows you to create a deployable application, with the generated code, onto a real time operating system (RTOS)
- **Reverse Engineering**
  - Allows you to reuse your IP, as well as coexist with ongoing hand coding activities
- **Design for Testability**
  - Automates the testing process by using the *design requirements* to validate and to completely cover all system scenarios

An Integrated MDD-Based SDR Development Environment



SDR Operating Environment

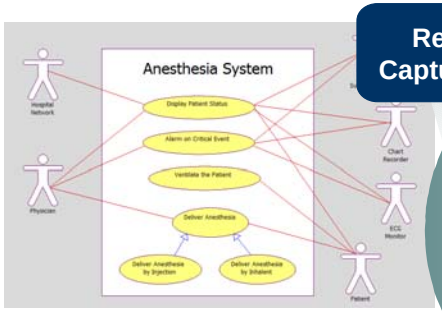


Iterative, Model-Driven Development

System Engineering

Software Engineering

Test Engineering



Requirements Capture & Analysis

Systems Analysis & Design

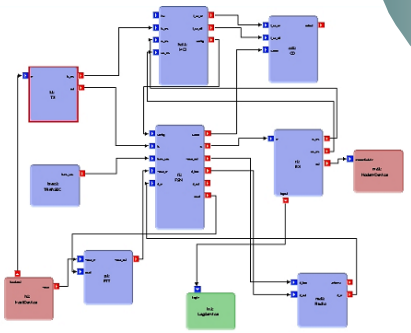
SW Design

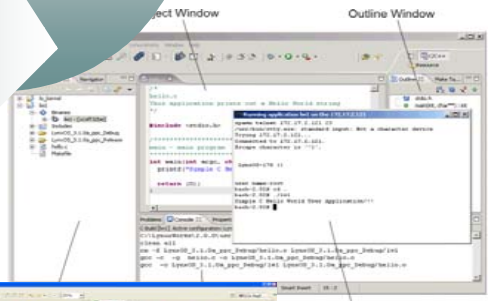
SW Implementation & Unit Test

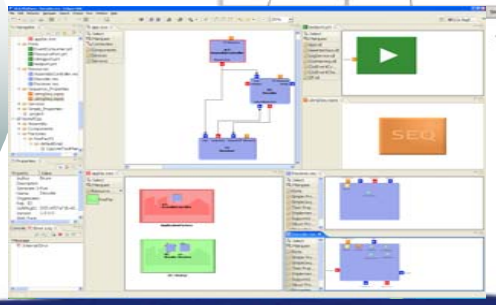
Module Integration & Test

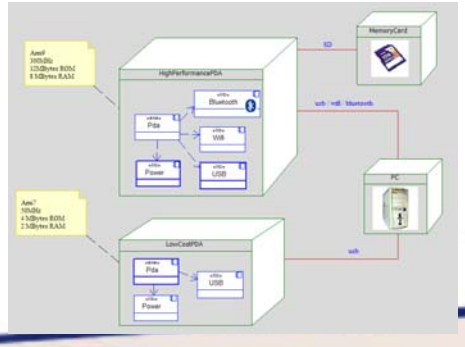
(Sub-)System Integration & Test

System Acceptance









LYNUXWORKS™

Telelogic

PRISMTECH
Productivity Tools & Middleware

Telelogic

PRISMTECH
Productivity Tools & Middleware

LYNUXWORKS™

Demonstration

Summary

- PrismTech, Telelogic and LynuxWorks provide:
  - An integrated, model-driven development capability for designing, developing and testing SCA-compliant SDRs
  - An optimized, vertically-integrated, COTS SCA-compliant SDR operating environment for deploying SDRs
    - including Core Framework, ORB, CORBA Services, and RTOS
- Benefits
  - Faster time-to-market
  - Significantly reduced development costs
  - Increased quality
  - Reduced porting risk and cost

For more information

- PrismTech
  - **Gary Putlock**
  - **Director, Sales**
  - **201-708-2906**
  - **gary.putlock@prismtech.com**
- Telelogic
  - **Jim McElroy**
  - **Director, Business Development**
  - **978-645-3026**
  - **Jim.mcelroy@telelogic.com**
- LynuxWorks
  - **Steve Blackman**
  - **Director, Business Development**
  - **781-559-8141**
  - **Sblackman@lnxw.com**

Thank You!