The Real-time and Embedded Systems Forum

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Famous Understatements

"I think there is a world market for maybe five computers."
(Thomas Watson, IBM 1943)

"Computers in the future may weigh no more than 1.5 tons." **(Popular Mechanics, 1949)**

"There is no reason anyone would want a computer in their home." **(Ken Olson, DEC, 1977)**

"640K ought to be enough for anybody."
(Bill Gates, Microsoft,. 1981)

Post-PC Computing

- By 2003, more than 50% of the people using the Internet will do so with handheld and/or portable (Post-PC) devices (IDC).
- By 2002, more than 55 million Post-PC devices will ship, and by 2005 shipments will exceed shipments of PCs (IDC).

Market Drivers

- Hardware performance continues to increase
  - Moore's Law continues
- Bandwidth is increasing rapidly
- Computing and communications proliferate beyond the desktop
  - Smart devices are becoming prevalent

What Are Smart Devices?

- Anything with a microprocessor that's not called a "computer"
- Traditional "embedded" products
  - *industrial,*
  - *aerospace,*
  - *medical*
  - *automotive control,*
  - *test, etc*
- The Internet
  - Servers, infrastructure and clients

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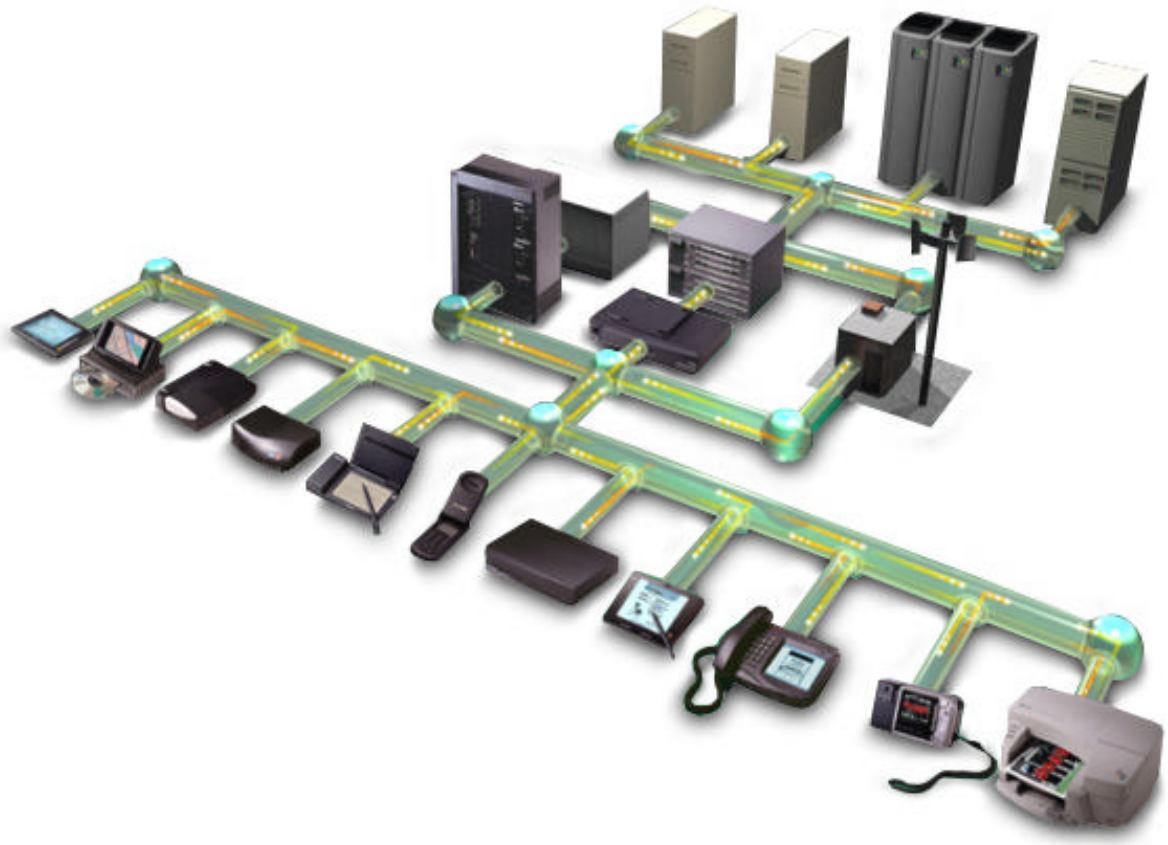
The Internet: The World's Largest Embedded System



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The Resulting Problem: Complexity

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Mission

Improve the time and cost, to market adoption, of real-time and embedded solutions by providing a forum where we can share knowledge and integrate open initiatives, and certify approved products and processes

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Members

- IBM Corporation
- FDS Embedded Systems Co. Ltd
- Lineo Inc
- The Mitre Corporation
- MontaVista Inc
- NASA SEWP Goddard Space Flight Center
- Rockwell Collins Inc
- REDSonic, Inc
- Silicon Graphics Inc
- Sun Microsystems Inc
- The US Department of Defense Defense Informations Systems Agency
- TimeSys Corporation
- VenturCom, Inc

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Products vs Standards: The Big Debate

- Standards have not proven to be 'sufficient' for either portability or interoperability
  - Portability has not been 'absolute'
  - Common products provide much better interoperability
- Product-based approach strongly limits the choices for the system developer/integrator

The Opportunity

- Implementors of this technology face the same challenges:
  - the need for fast, predictable response to events such as interrupts and messages
  - the ability to manage system resources to meet processing time constraints
- Existing standards are necessary yet insufficient
- We need to identify and remove blockages to adoption
- A need for test tools and certification

Scope of the Forum

- Operating system APIs (Application Programming Interfaces)
- Operating system profile standards
- Performance APIs
- Security policy and APIs for Real-time and Embedded Systems
- Real-time Java®
- Real-time CORBA ®

Collaborative Activities Are Key

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Liaisons

- IEEE PASC
- NCITS R1
- The Object Management Group
- The US Department of Defense, Open Systems Joint Task Force
- Society of Automotive Engineers
- J Consortium
- Java Community Process
- UDI Consortium

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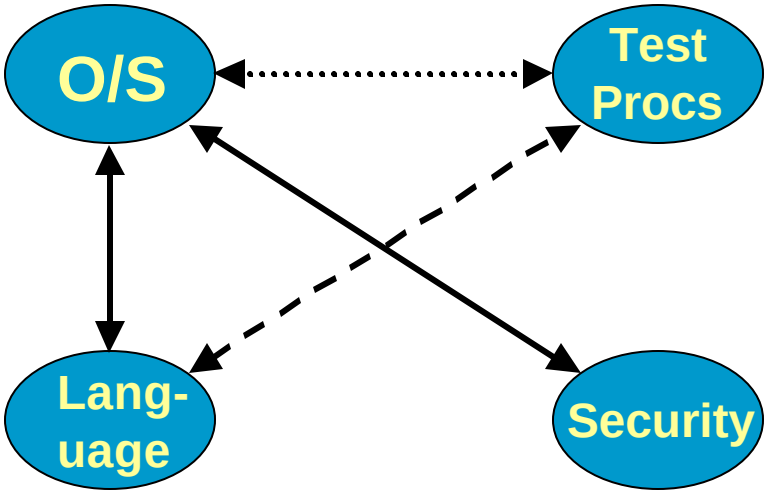
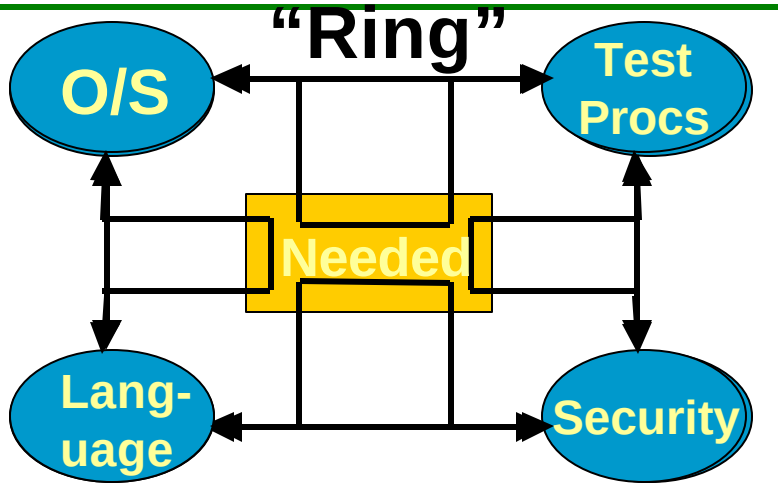
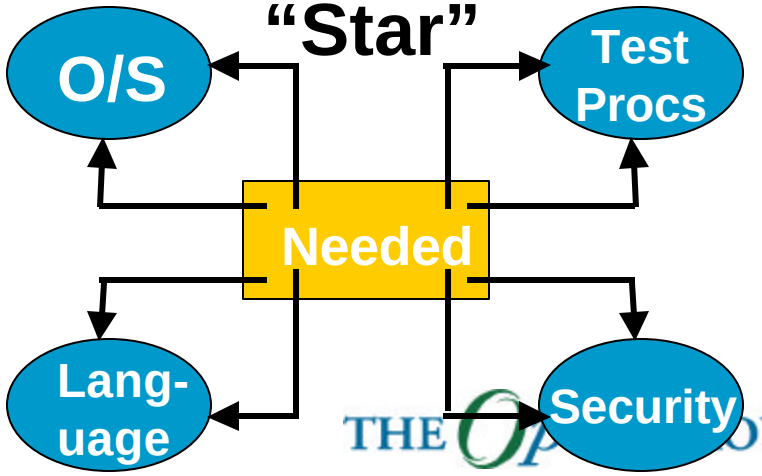
Cooperation







Forum Activities

- Regular meetings at the Open Group quarterly conferences
  - open plenary session
  - closed working group sessions
- Three Initial Working Areas:
  - Testing and Certification Working Group
  - Profiles Working Group
  - Real-time Security working group

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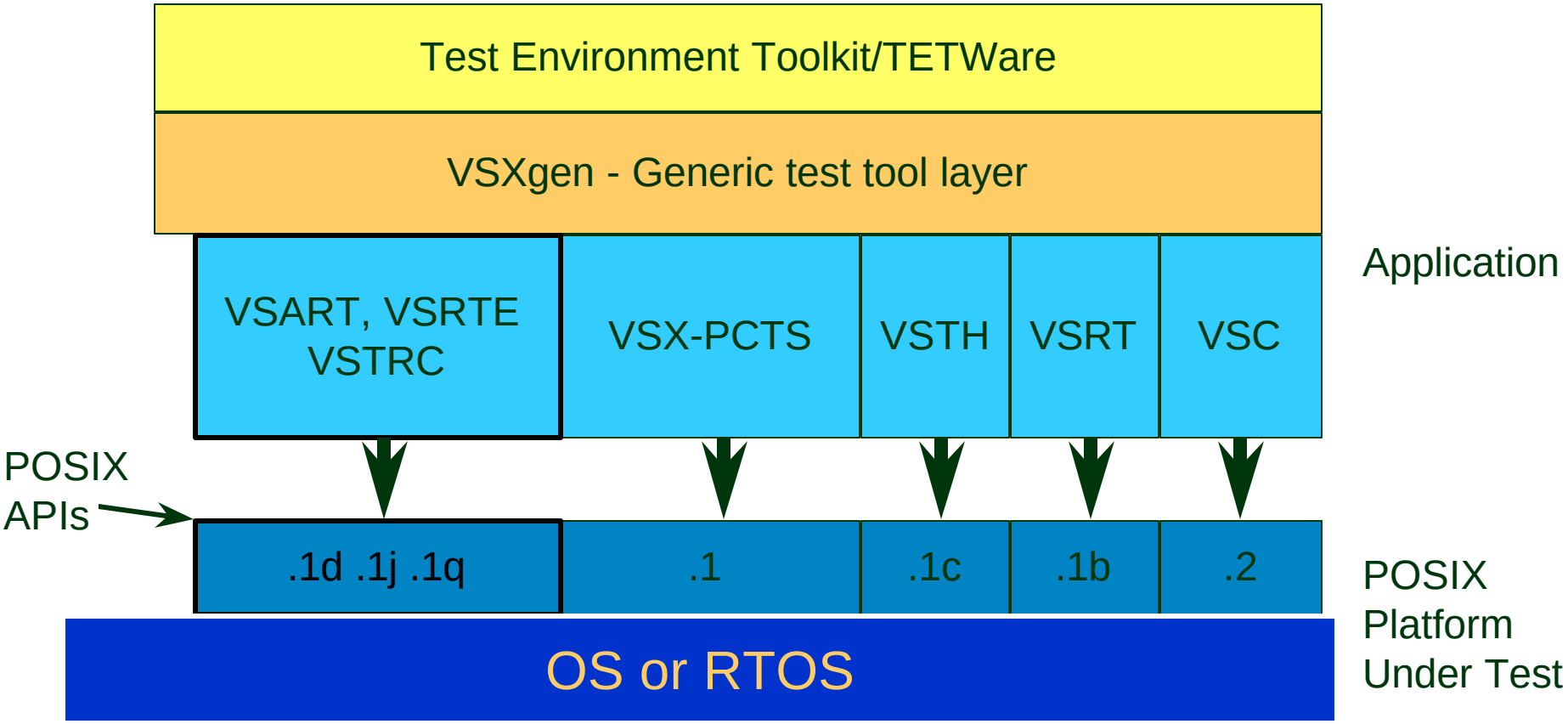
Activities

Sub- Group	Activity
Testing and Certification	❑ Test tools for suppliers to establish confidence their products conform ❑ An independent certification program for suppliers' products that delivers guaranteed conformance to the buyer.
Profiles	❑ Build upon existing work, adding extensions to address market requirements.

Operating System Test Tool Architecture

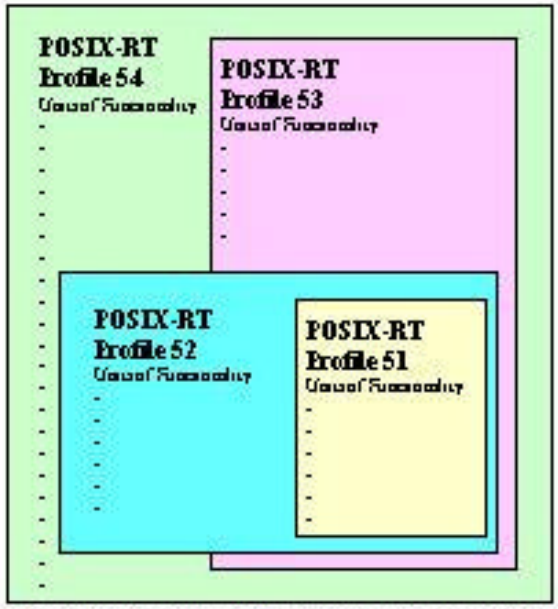


Note: All POSIX options are tested by test tools

POSIX Profiles

POSIX Approach to RT Kernel Configuration

POSIX RT Profiles: Relationships



Profile 54: All POSIX.1,
Multi-process, Threads, File System

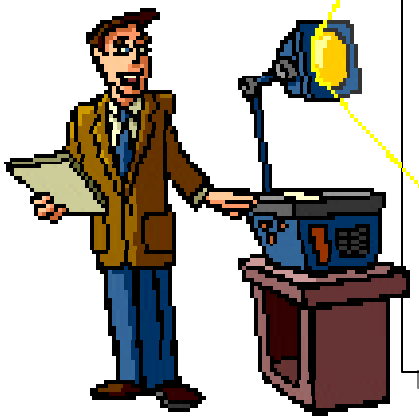
Profile 53:
Multi-process, Threads; No File System

Profile 52:
Single Process, Threads, File System

Profile 51:
Single Process, Threads; No File System

Portable Operating System Interface (POSIX)
IEEE Industry Standard
ISO 9001 Industry Standard

Allows Portability of Applications



Activities (Cont'd)

Security	❑ File System and Network Security Guidelines have been established for full function, non-real-time Oss. However, requirements for Kernels implemented on Real-time OSs (such as LynxOS, VxWorks) are still to be established
New opportunities	Quality of Service of Real-time and Embeded Systems Real-time Behavioral Specification

Security Overview

- Many real-time and embedded systems control critical systems
  - Human lives depend on these systems functioning as designed
- The unique nature of the operating environment and the protection of such systems present a unique challenge

Real Time Security

- System Integrity requires memory protection.

- Subject-object access control mechanism, (non-intrusive).
  - Non-intrusive access control mechanism means that the enforcement of access control does not intrude into the critical time of a Real-time system.

Security for Real-time and Embedded Systems

- These systems, by themselves frequently cannot contain all the necessary security functionality to adequately protect them
- Software security solutions must work in conjunction with other security safeguards (e.g., physical security) to achieve an acceptable level of risk
- Software security cannot be considered in a total vacuum
- Bottom line there are no specific RT/Embedded security standards

Quality of Service

- "Real-Time" flavors of commonly used network/distributed computing services, providing bounded time options and Quality of Service support
  - TCP
  - Sockets
  - Directory Services
  - Guards, Firewalls, etc
- Reliable and Unreliable network broadcast protocols
- Real-Time Data Management/Database Services
  - "I need the answer to this query in .03 seconds, or we'll be dead…"

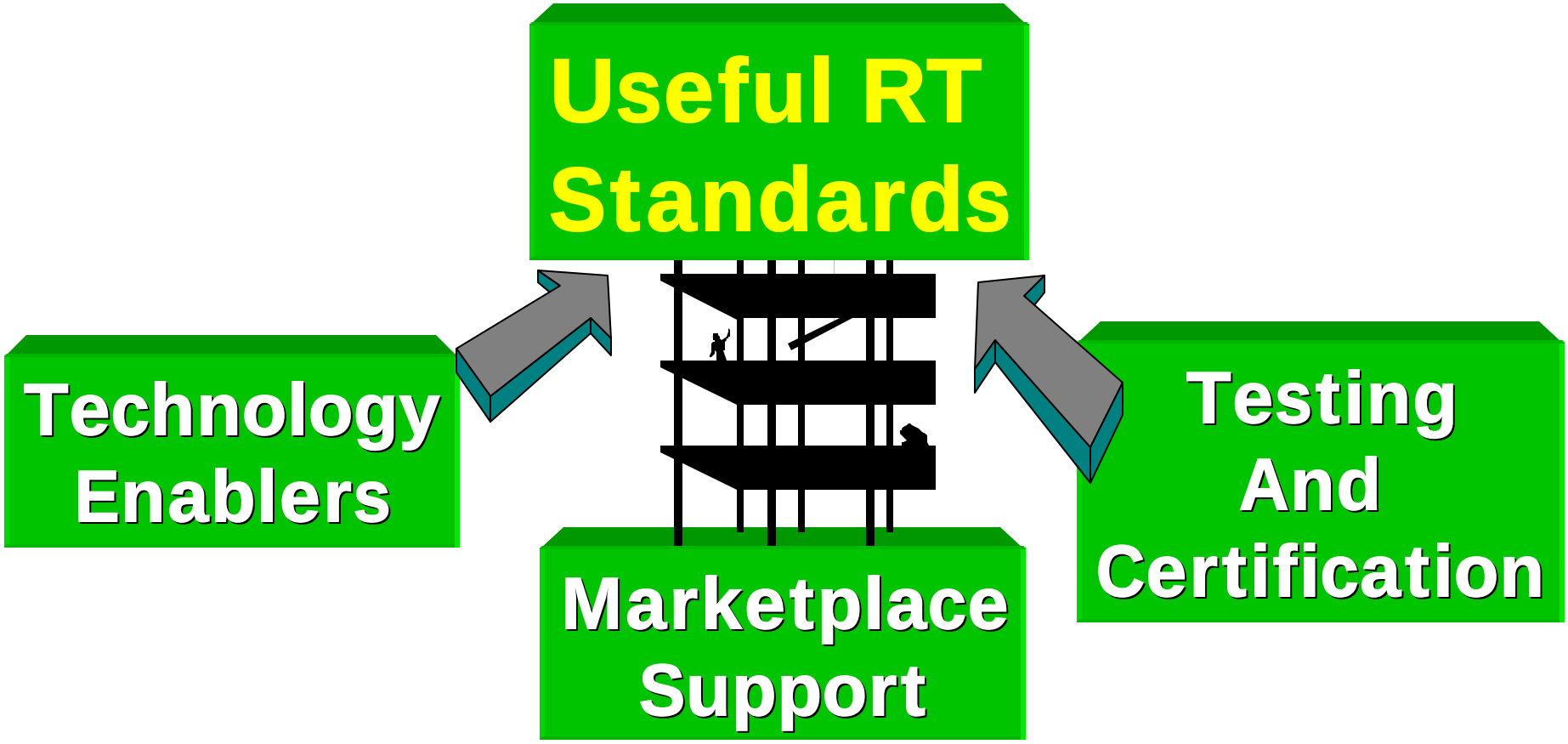
Specifying Real-Time Behavior

- Few examples exist on how to specify Real-Time behavior of software components and standards
- How should Real-Time behaviors be tested/validated?
- How to move QoS into standards, allowing QoS properties across products and systems?
- What are the effects of 'composing' Real-Time systems from software written by different developers/manufacturers?

Challenges for the Real-Time Open Systems Community

- Improvements in 'specification technology'
  - Standards that are more complete, less ambiguous, more interoperable
- Improvements in test and verification approaches
  - More test tools
  - Open Source test suites?

The Goal



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More Information

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