



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).

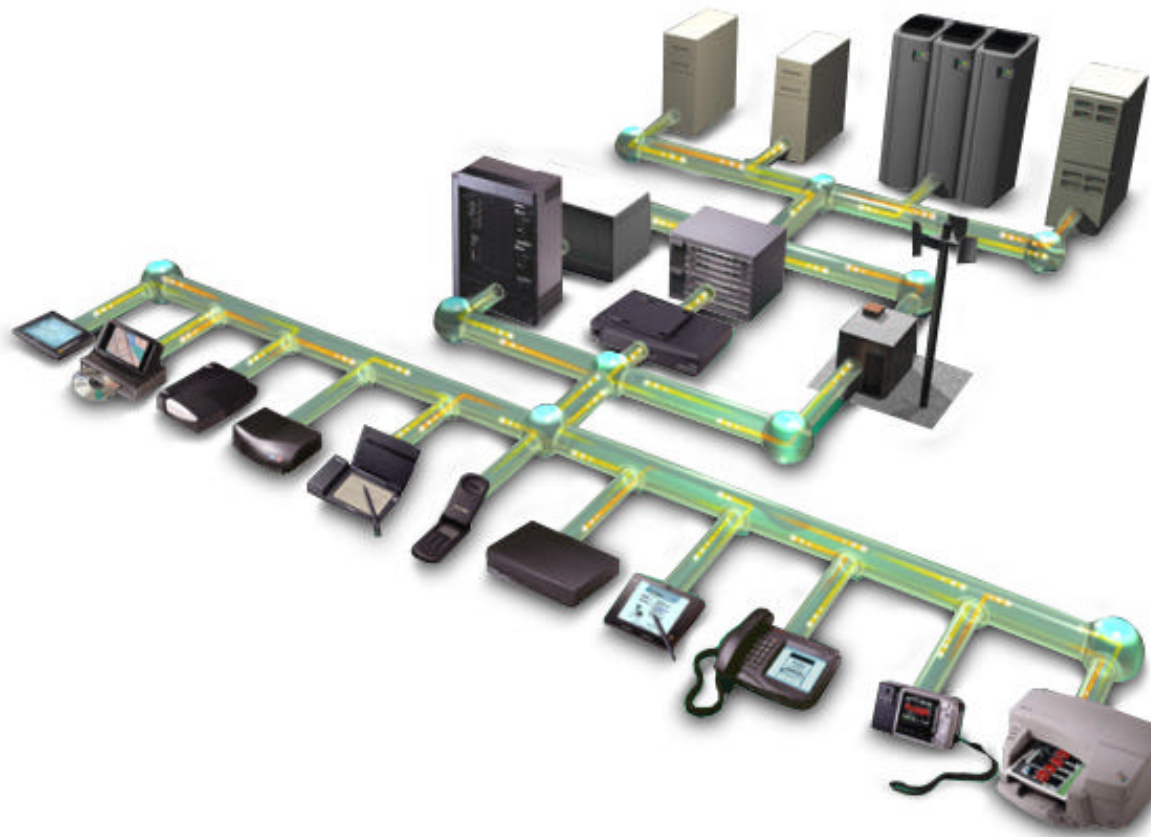
Market Drivers

- ❑ 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

The Internet: The World's Largest Embedded System



The Resulting Problem: Complexity



Time-to-Market

Real
Hardware Functions
Network
Systems
Management
Speed
Connectivity
Density
Internet
DRIVERS
Functionality
Multimedia

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

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

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
- ❑ Security policy and APIs for Real-time and Embedded Systems
- ❑ Real-time Java®
- ❑ Real-time CORBA ®
- ❑ Safety Critical/High Reliability Software

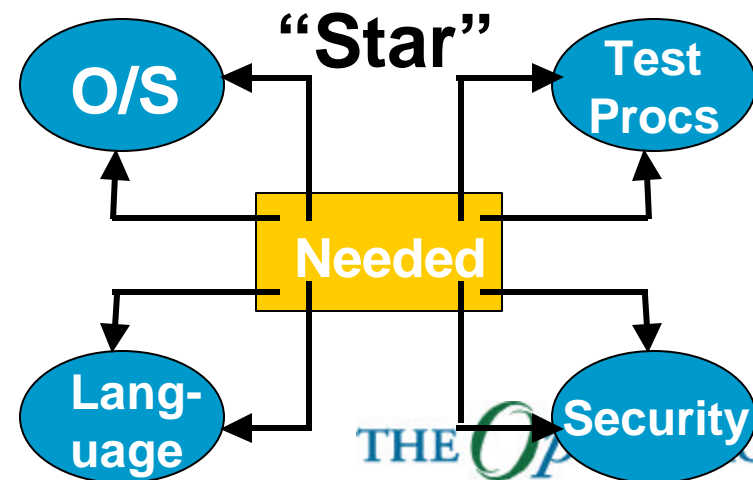
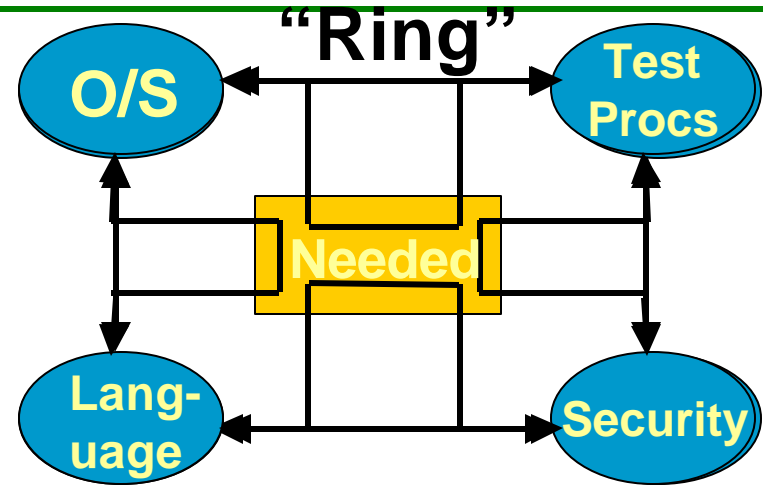
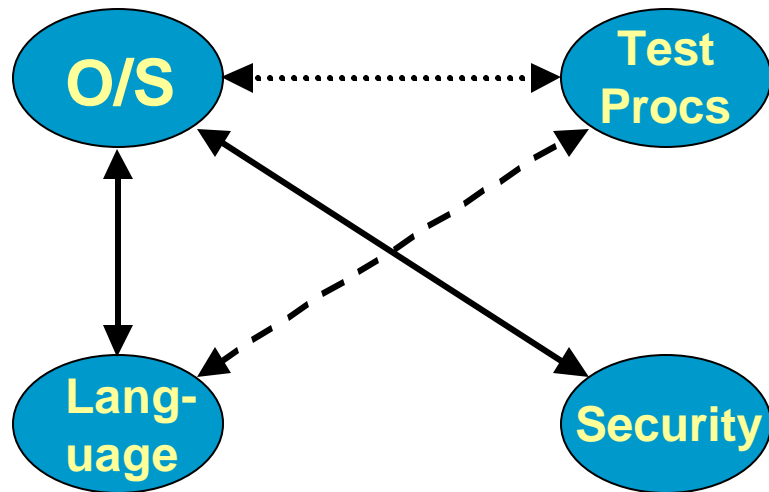


Collaborative Activities Are Key

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

Cooperation



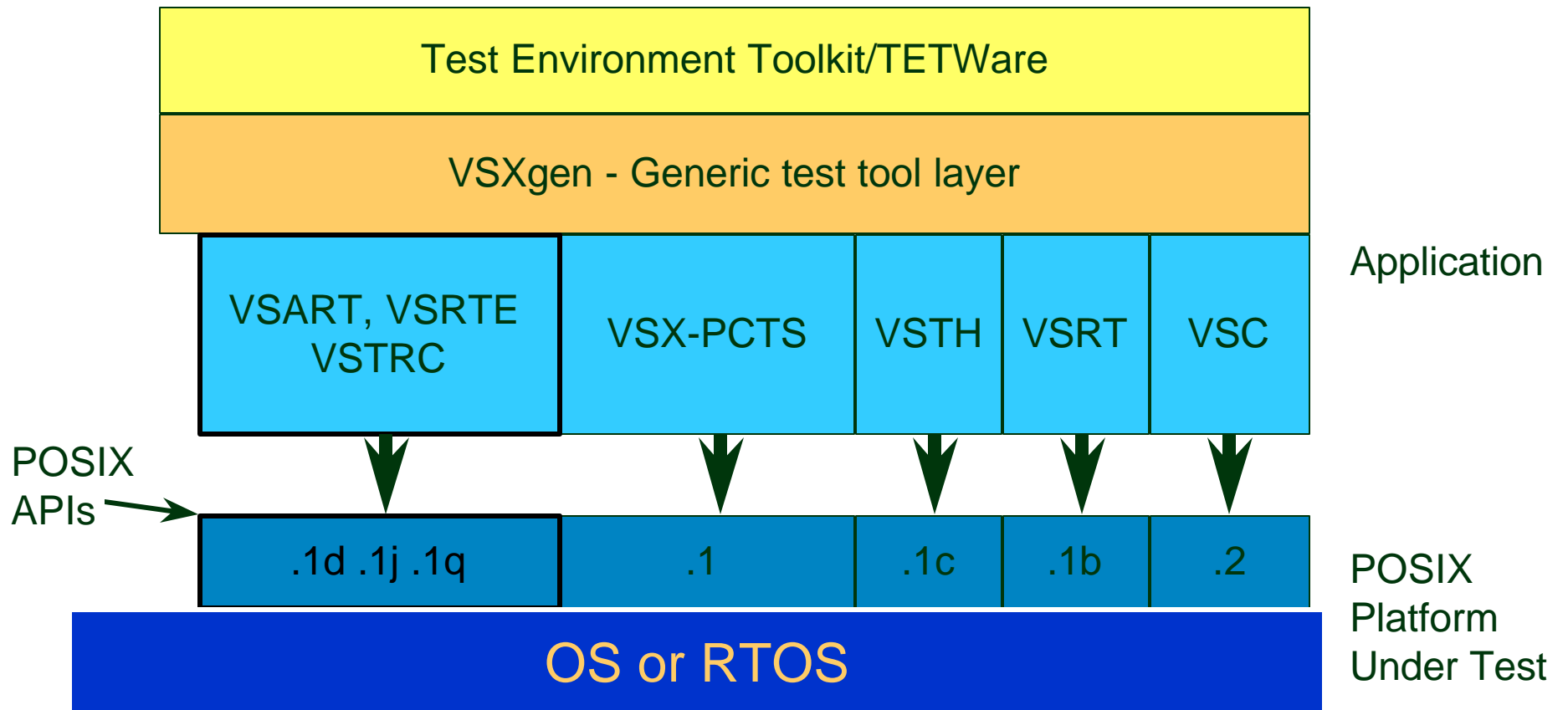
Forum Activities

- ❑ Regular meetings at the Open Group quarterly conferences
 - open plenary session
 - closed working group sessions
- ❑ Initial Activities:
 - Testing and Certification
 - Profiles
 - Real-time Security
 - Quality of Service

Activities

<u>Sub- Group</u>	<u>Activity</u>
Testing and Certification	<ul style="list-style-type: none">❑ 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	<ul style="list-style-type: none">❑ Build upon existing work, adding extensions to address market requirements.

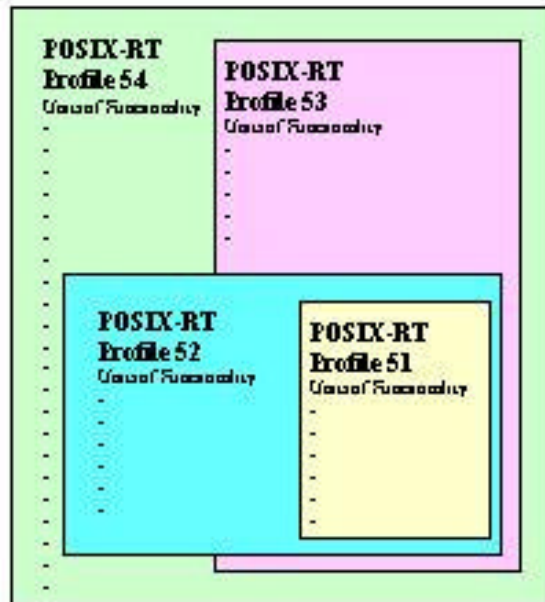
Operating System Test Tool Architecture



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

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AOB Briefing ZZ



Activities (Cont'd)

Security	<ul style="list-style-type: none">□ 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 Embedded Systems Real-time Behavioral Specification Safety Critical/High Reliability Software

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..."

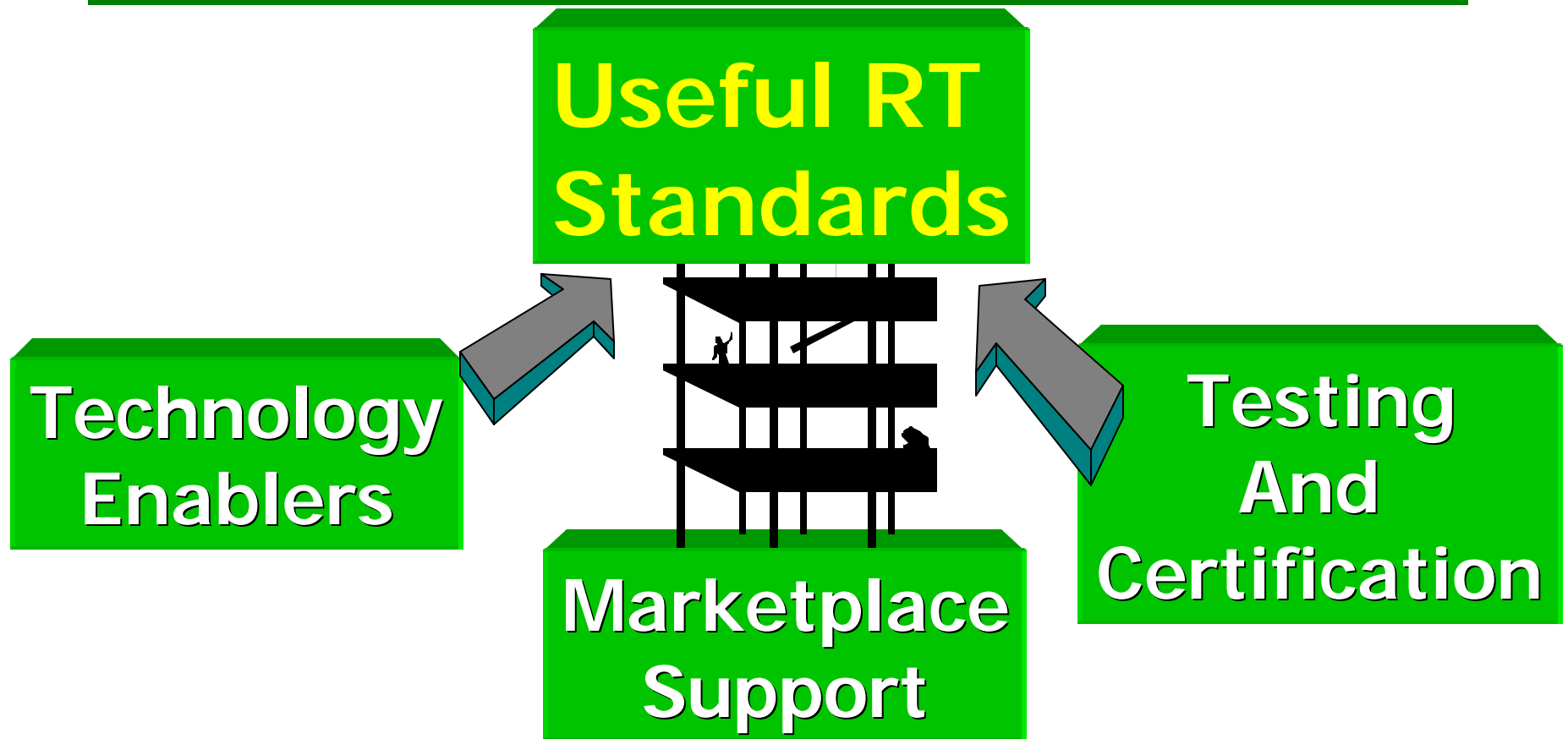
Specifying Real-Time Behavior

- ❑ 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



More Information

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