Certification of the open-source SCA Reference Implementation (SCARI)

Hugues Latour

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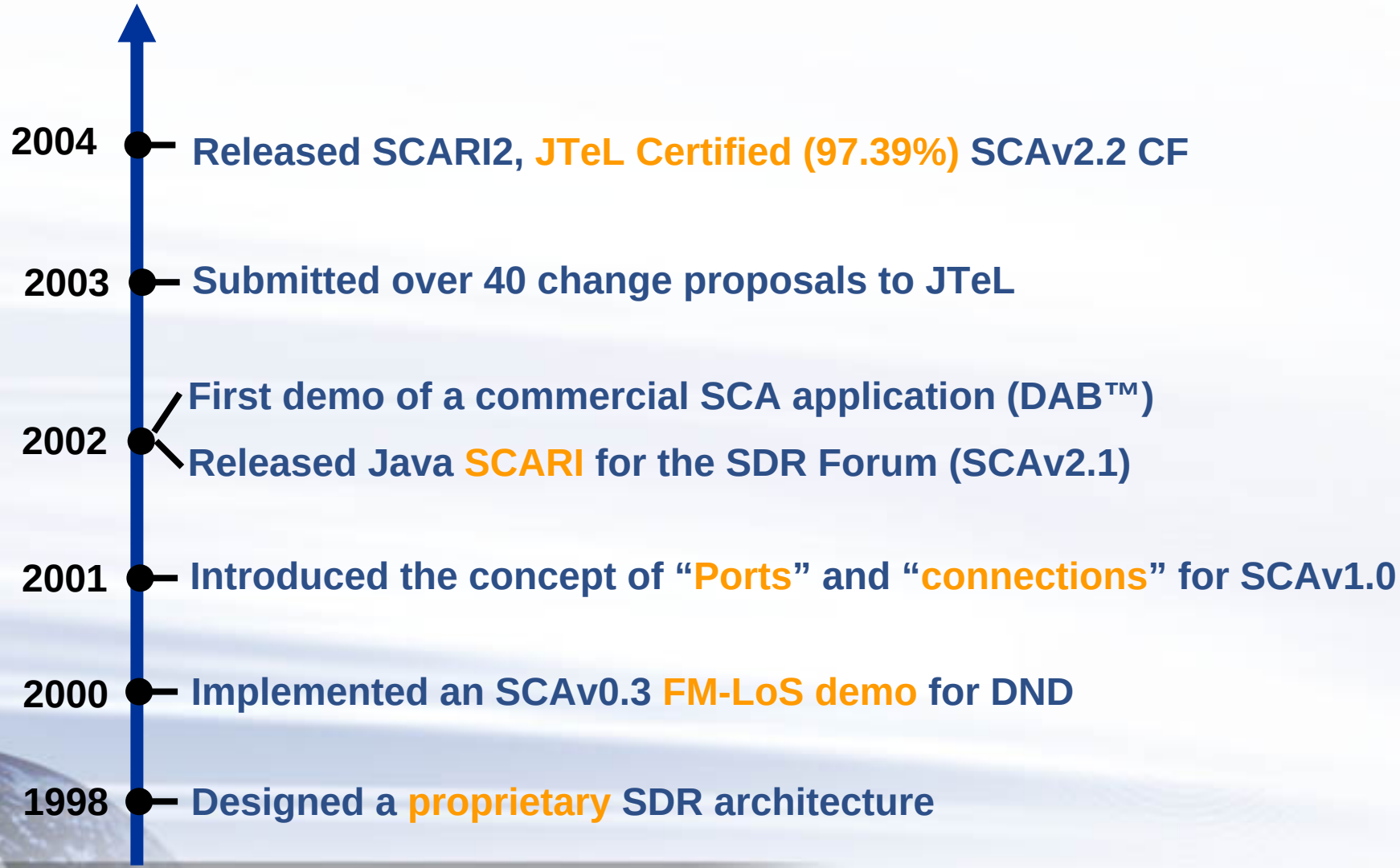
Advanced Radio Systems

Outline

- Overview of CRC
- SCARI Projects
- Introduction to Certification Process
- SCARI 2 OE Certification
- Conclusion

CRC's SCA Debut



SCARI Projects

- **2001 - SDR Forum sponsored CRC to develop an open source reference implementation of the SCAv2.1**
  - Development done in collaboration with Defense R&D Canada (DRDC-Ottawa)
  - Implementation was completed in December 2002
  - Included SCA CF source code, documentation and an example application (audio effects)
  - Over 10,000 downloads worldwide of the various deliverables

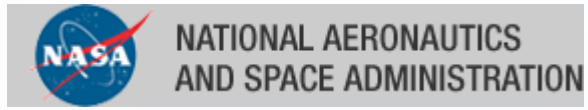
SCARI Projects

- **2002 - First demonstration of a commercial SCA compliant waveform**
  - SDR Forum technical conference (San Diego)
  - Digital Audio Broadcast (DAB) developed at CRC

- **2004 - SDR Forum sponsored CRC to update SCARI Open project to SCAv2.2 and obtain JTRS certification**

SCARI Projects

- **CRC assembled an international team of Forum members to participate in SCARI Open project**
  - ISR Technologies
  - Joint Tactical Radio System Joint Project Office
  - NASA Glenn Research Centre
  - Rohde and Schwarz
  - Mercury Computer System



SCARI v2.2 Deliverables

- **Source code**
  - Java Source code of SCAv2.2 Core Framework
  - Java/C Source code of simple demonstration application
  - 60,000 LOC
- **Documentation**
  - Code convention for Java
  - SCA CF design documentation
  - SW / HW platform requirements and installation procedures
  - 300 pages of documentation
  - JTRS / JTel certification report
- **Demonstration to SDR Forum community**

Java / C++ and the RI

- **A Java implementation of the SCA does not preclude C++ for applications**
- **However, C++ will usually require**
  - An additional compiler and ORB compatible with C++
  - A set of makefiles
- **JNI can be used to avoid the use of C++ ORB**
  - The CRC RI uses JNI to “wrap” signal processing intensive modules

SCARI Projects

- **Still used world wide by academia and industry**
  - Used in Mercury FM3TR waveform project for SDR Forum
  - Inspired Virginia Tech C++ SCA CF : Ossie
  - Used as a base for derived Robotic SCA standard
  - Book
    - Software Defined Radio: The Software Communications Architecture John Bard, Vincent J. Kovarik,
  - Used in graduate and post graduate projects
  - Used in many research activities

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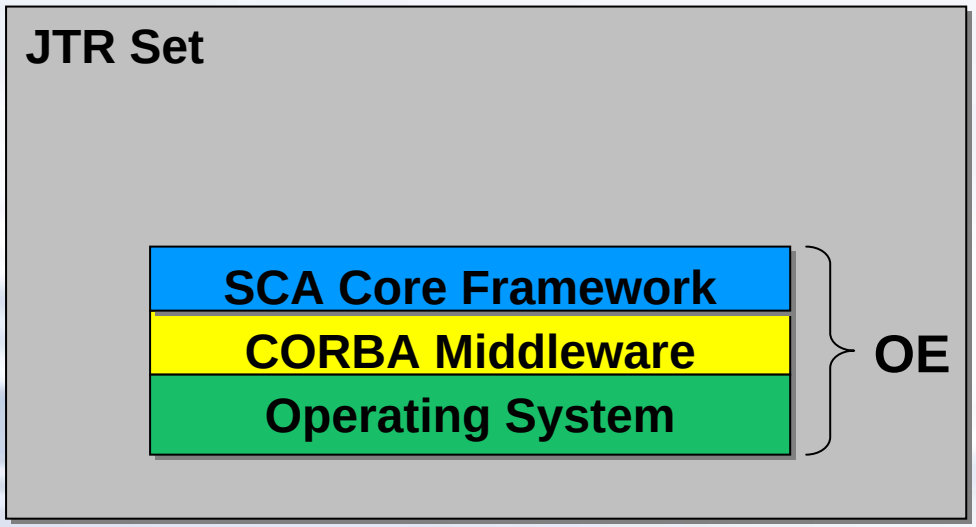
JTeL Certification Terminology

- **Joint Tactical Radio (JTR) Set Software is composed of:**
  - **Operating Environment**
  - SCA Devices
  - Radio System Applications
  - Cryptographic Subsystem

Operating Environment (OE)

- SCA Core Framework (CF)
- CORBA Middleware (ORB)
- Operating System (OS)



Test Model OE-1

1. **JTAP software delivered to JTR set manufacturer**
2. **Port JTAP components to JTR set**
3. **Conduct SCA OE tests:**
   - By the JTR Manufacturer
   - Witnessed by JTeL rep
4. **JTeL test report review**
5. **JTeL submission of recommendation for SCA compliance to JPO**
6. **JPO issue certificate for JTR set compliance**

Automated Testing: JTAP

- **JTAP = JTRS Test Application**
- **Automated SCA requirements testing**
  - Core framework interfaces (SCA IDL)
  - CORBA Services (Naming Service, Event Service)
  - Application and Device deployment
  - Required Operating Environment support for external components
    - FileSystem, FileManager, File

Automated Testing: JTAP

- **Test components provided**
  - Code: written in C++
  - OS: been tested on Window or VxWorks
  - ORB: been tested for TAO and ORBexpress
- **Test components needs to be ported to programming language, ORB and OS.**
- **Test components software package descriptor (SPD) needs to be adapted to target environment.**

Automated Testing: JTAP

- **Node Test Components**
  - PseudoDeviceManager (optional)
  - PseudoDevice
  - PseudoCompositeDevice
  - PseudoService
- **Application Test Components**
  - PseudoAssemblyController
  - PseudoResourceFactory
  - PseudoResource

Automated Testing: JTAP

- **Operated from a Windows PC**
- **Utilizes the ACE TAO CORBA ORB**
- **JTAP tool requires a IIOP/TCP connection to the Operating Environment**
  - Requires TCP/IP access to the Radio
- **JTAP v2.3.2 certifies SCA CF v2.0 and v2.2**
- **JTAP v3.5 now certifies SCA CF v2.2.2**

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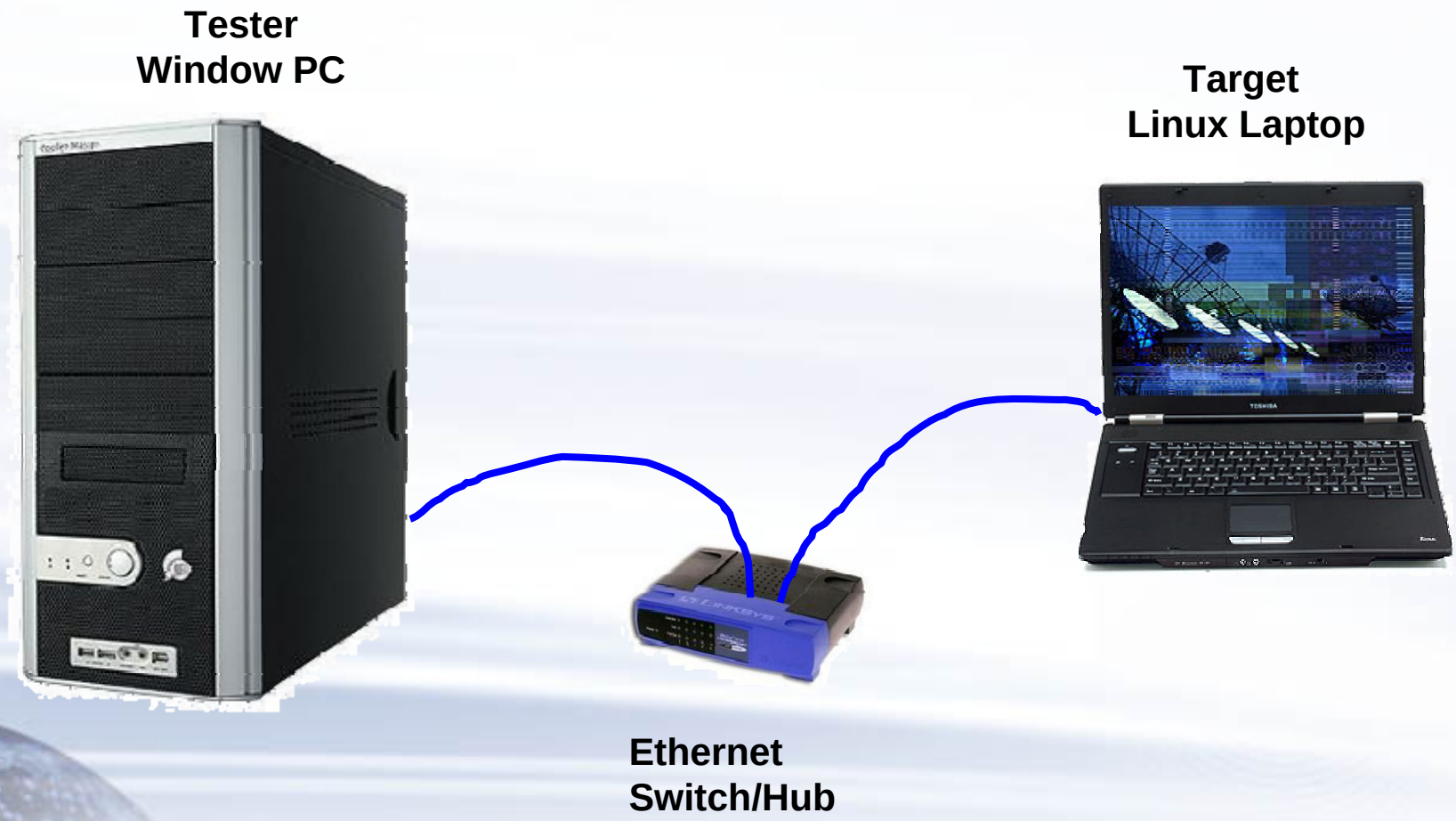
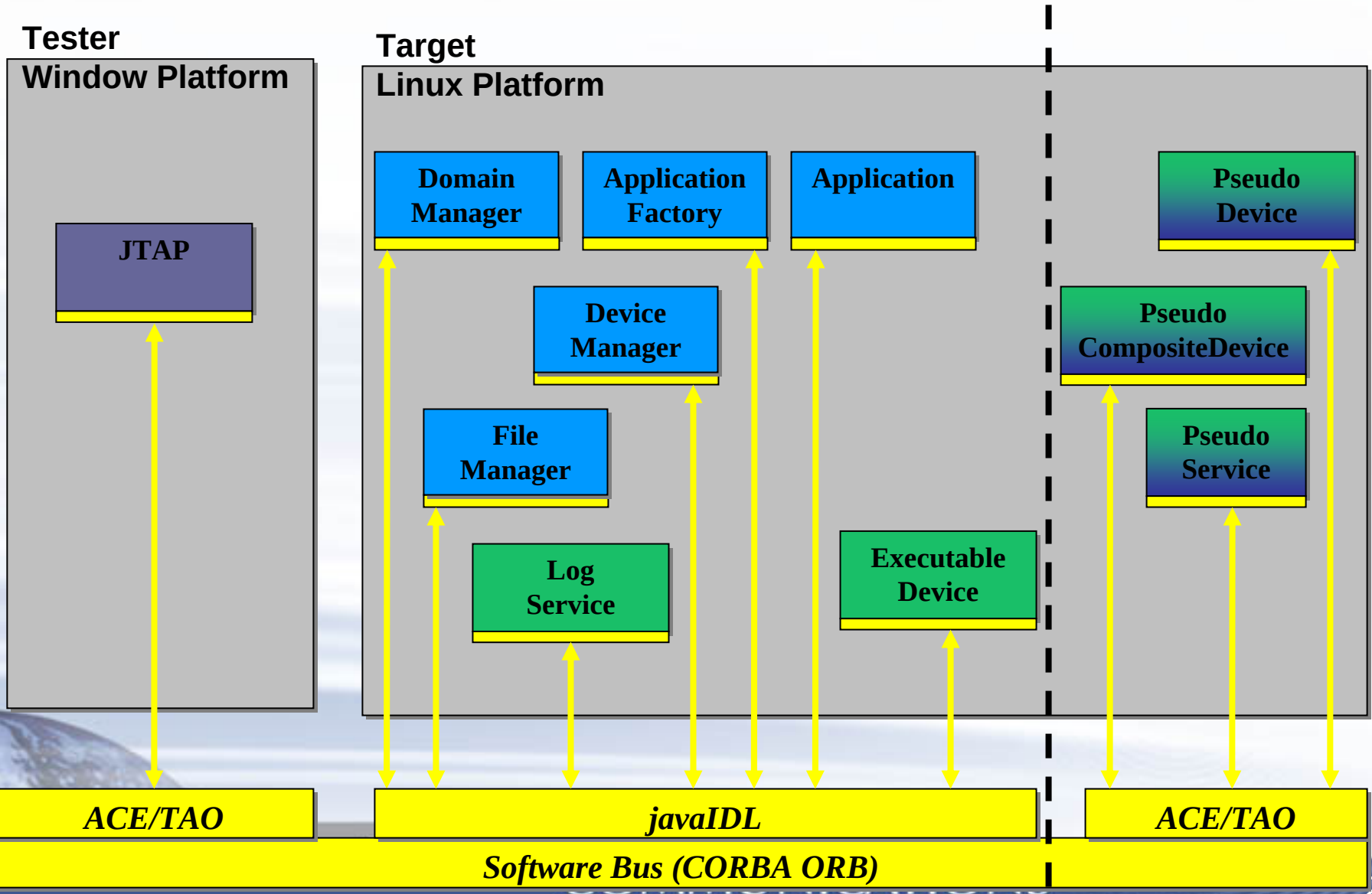
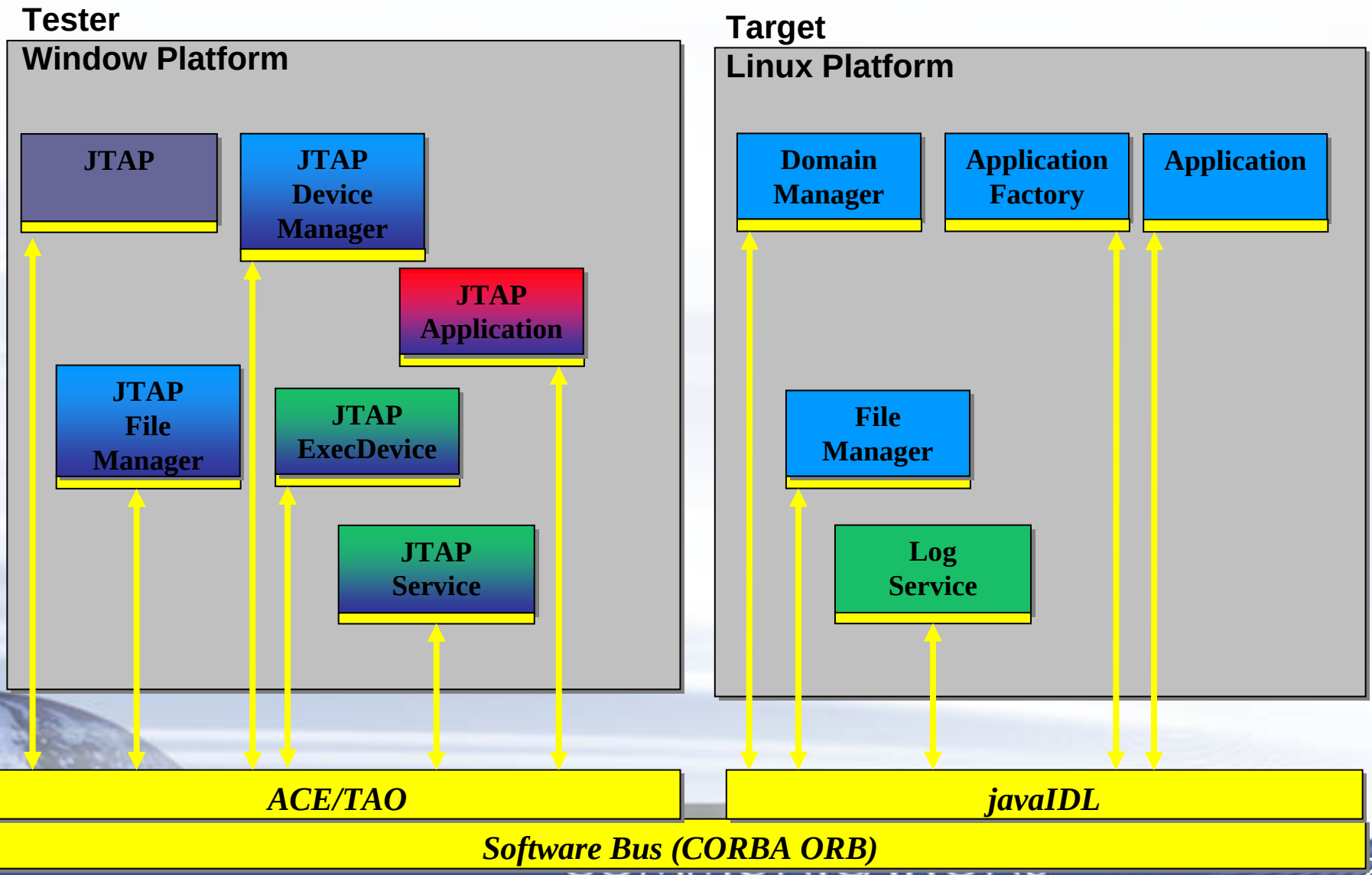
SCARI Open Testing Suite



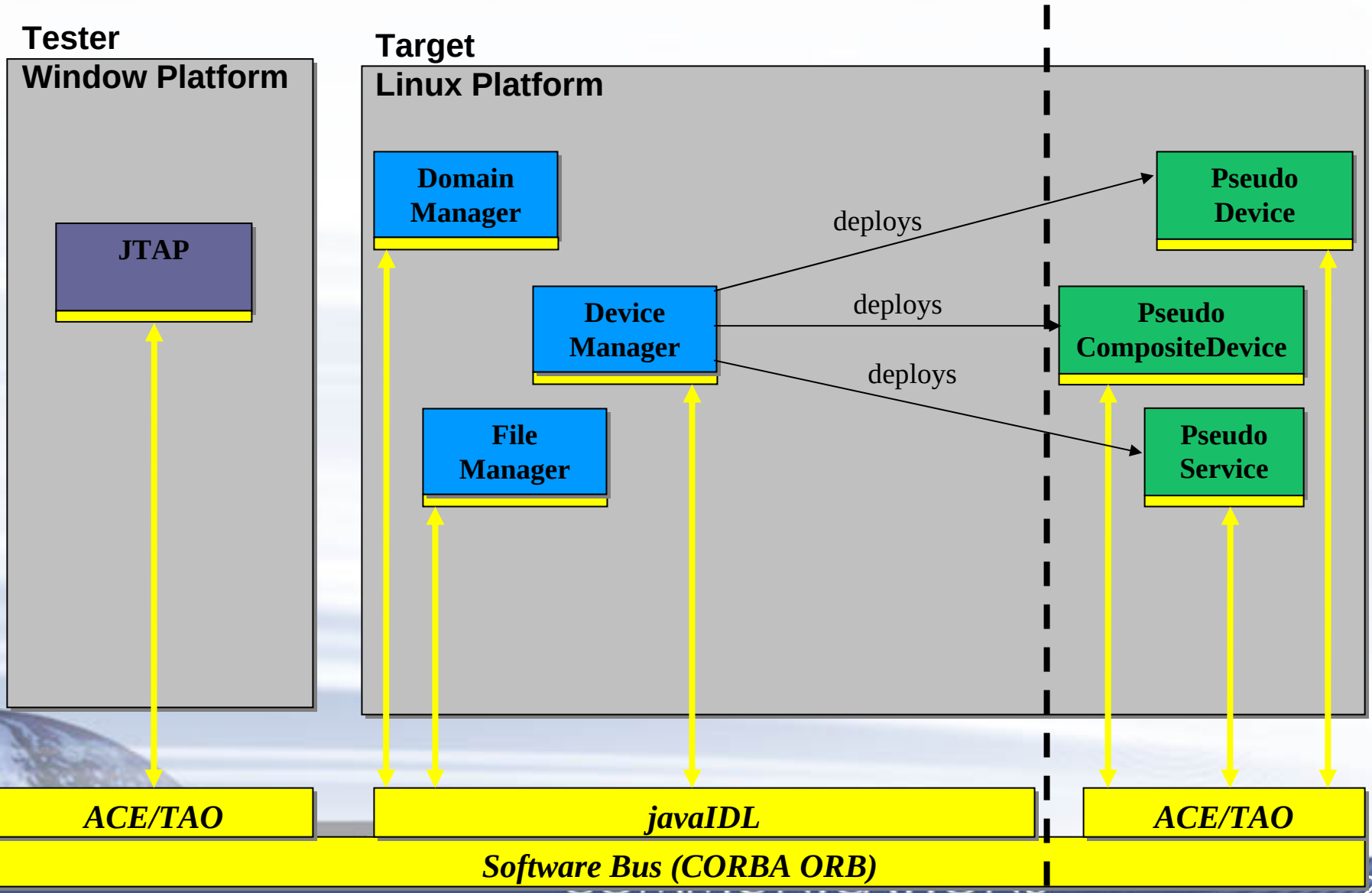
SCARI Open Test Suite



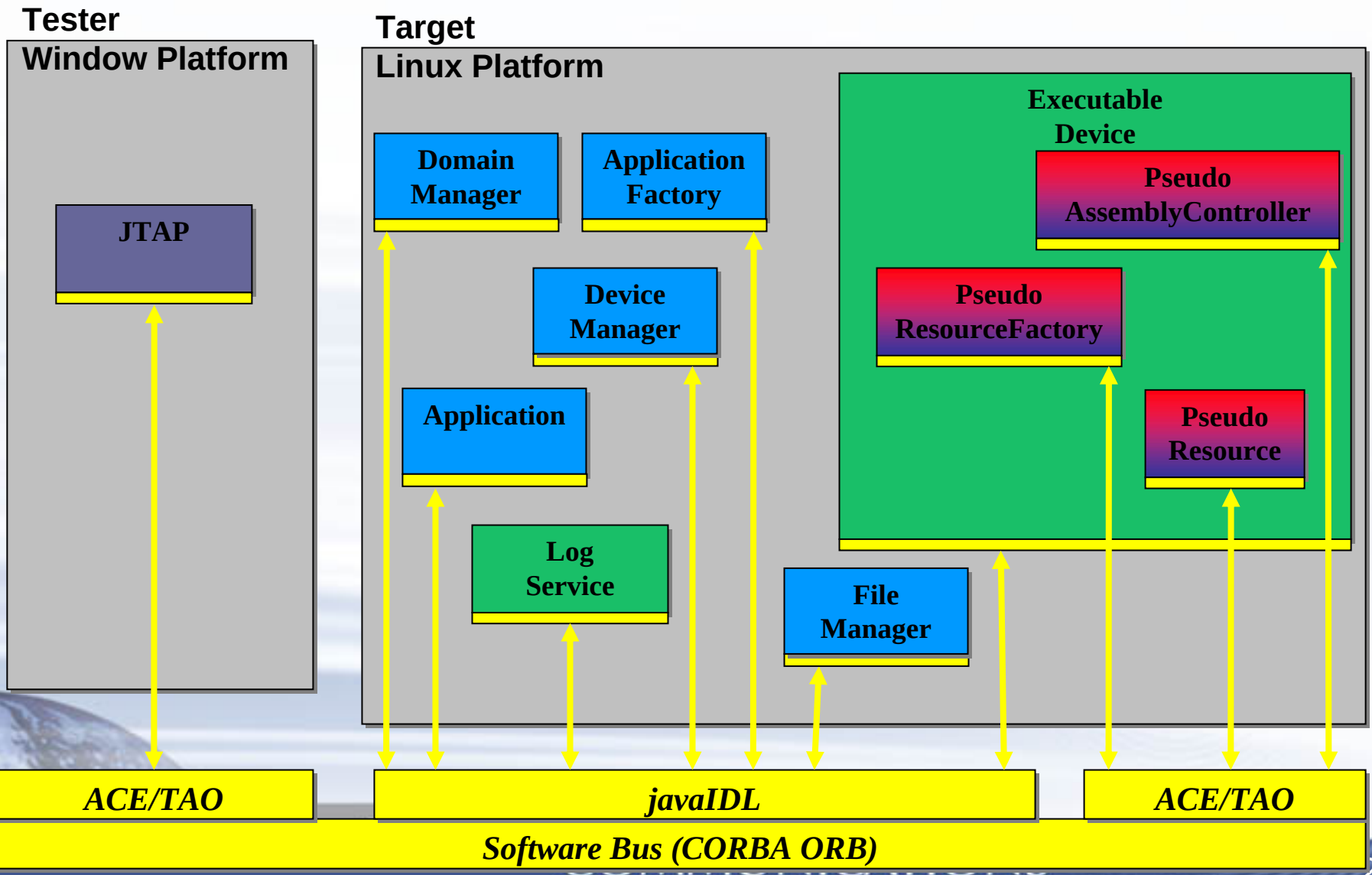
DomainManager Testing



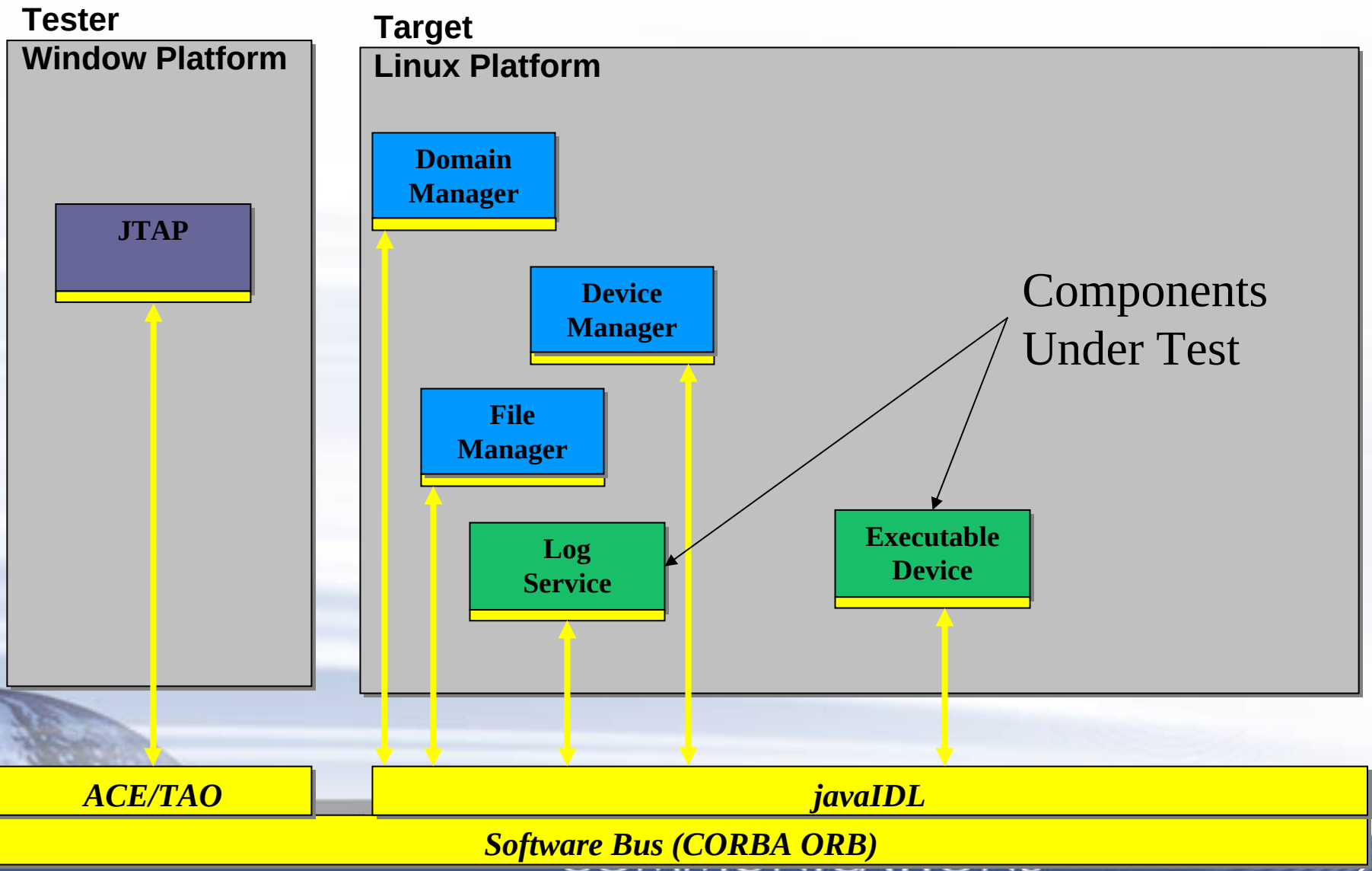
DeviceManager Testing



Application Factory Testing



Optional Testing



Test Report

JTRS Technology Laboratory

Operating Environment (OE) Test Report

for the

SCARI-Open

February 28, 2005

Prepared for:

Joint Tactical Radio System Joint Program Office

1700 N. Moore Street, Suite 1000, Arlington, VA 22209

Prepared by:

JTRS Technology Laboratory

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P.O. Box 190022, North Charleston, SC 29419-9022

Requirements Results

- **SCA Issues** are usually specification contradictions
- **Failed** are non implemented SCA features.
- **JTAP interpretations** are debatable interpretations of the specification

Categories	# of Req	% of Req
Passed	635	97.39%
SCA Issues	5	0.77%
Failed	6	0.92%
JTAP Interpretations	6	0.92 %

Requirements Results

- **Failed**
  - priority and stacksize is not supported by all OS even less the Java JVM
  - OS process is abstracted from Java
  - UsesDevice not supported
- **SPEC Issues**
  - Native exception never provide return code
  - PRODUCER_LOG_ID: numerical pre 2.2 then became string
- **JTAP Interpretation**
  - Application delayed connection to services
  - exclusive exception: InvalidFileName or InvalidProfile
  - JTAP tries to remove the application twice
  - FileSystem copy file: performed recursive copy

Testing Method

- **Automatic**
  - Using the JTAP tool
- **Manual Inspection**
  - Code inspection
  - Using SCARIOpen GUI tools
- **Semi-Automatic**
  - Using the JTAP tool
  - Using SCARIOpen GUI tools
- **Mixed**
  - Any combination of the above

Testing Method

TestMethod	# of Tests
Auto	498
Inspection	99
Semi-Automated	17
Mixed	21
Total	635

Positive Outcome

- **First CF provider to exercise 100% of the tests**
  - AggregateDevice Test Procedure
- **At the time, Fastest Certification**
  - Completed in 5.5 days over 9 Calendar days
  - Used the ScariOpen GUI tools to support and accelerate manual testing

Questions ?

For more details, visit: www.crc.ca/scari

Or send an email to: info_scari@crc.ca