

# An Integrated Test Environment for Systems Engineering

Ryan Brooks  
Roberto Escobar

Boeing  
Mesa, AZ

# What is OSEE's OTE Framework?

- The **Open System Engineering Test Environment (OTE)** is a framework for requirements-based testing in the context of an overall systems engineering approach
- OTE has been used commercially to qualify mission software for Boeing's next generation Apache Attack Helicopter
- Being contributed as a component of the Open System Engineering Environment (OSEE) Eclipse project
- Facilitates seamless flow between test development, debugging, execution, and result analysis

# Integrated Requirements-Based Testing

- Bidirectional traceability between software requirements, application code, and tests is provided through OSEE Application Framework
- Coverage holes detection via traceability
- Action Tracking System identifies test impacts driven by requirement changes
- Test development status tracking
- Detailed, integrated test status and coverage reporting

Dynamic Service  
Discovery

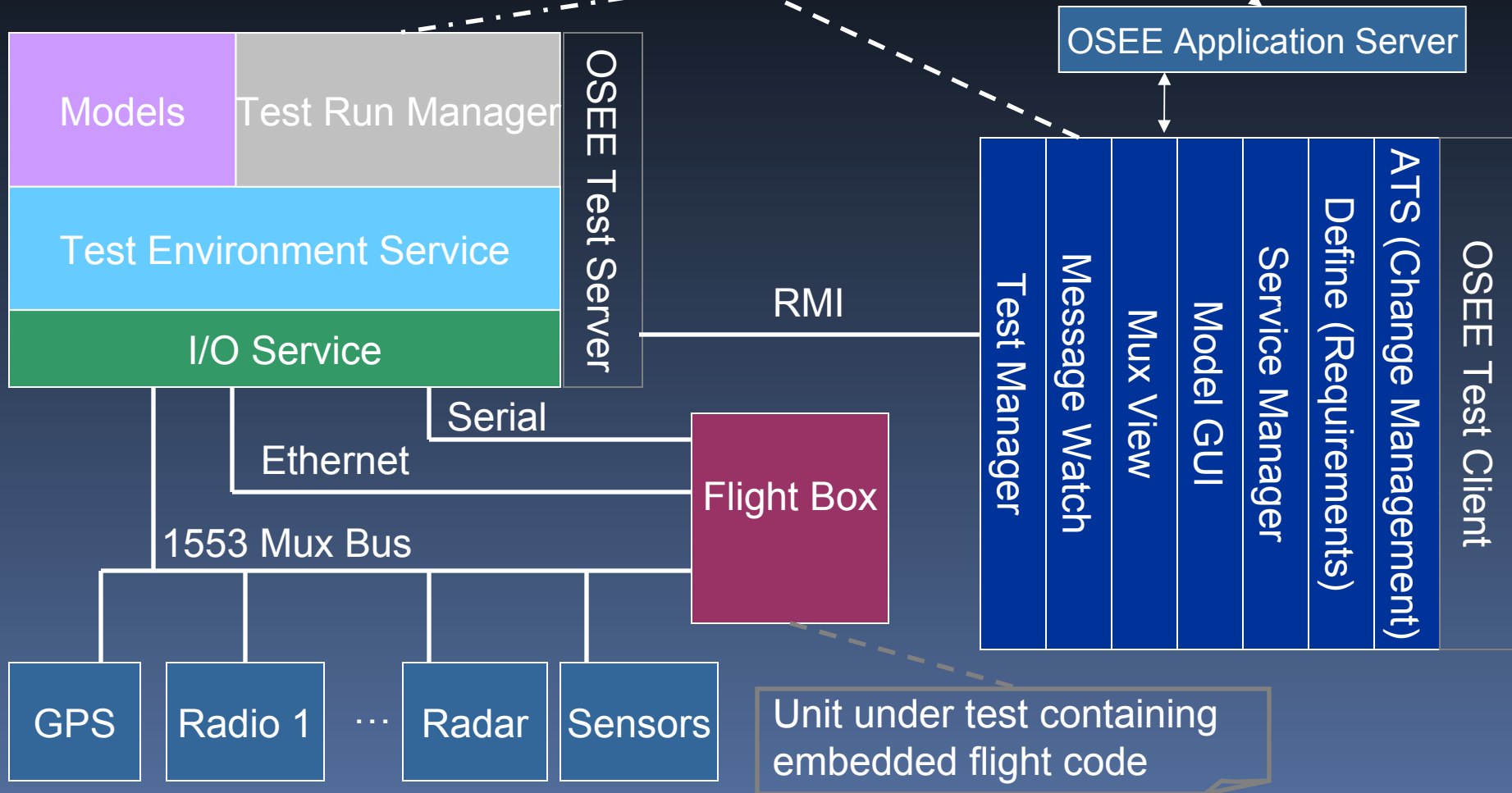
JINI Lookup

Relational  
Database

Remote File  
System

OSEE Datastore

# Architecture



# Test Environment Service

- Provides dynamic lookup of resources
- Provides both soft real-time and simulated capabilities
- Schedules periodic execution of models (simulation components)
  - API for easy creation of simulated components
- Supports a user configurable number of simultaneous client connections
- Manages I/O and testing resources

# Extensible Real-time Messaging System

- Supports communication with real hardware via
  - MIL-STD-1553 MUX
  - Serial
  - Wire
  - Analog and Digital discretes
  - Publish/Subscribe Data Distribution Service (DDS) through Ethernet

# Real-time & Simulated Functional Testing

- Simulated Environment (eases demand on limited test station hardware resources)
- Tests (without modification of any kind) can be run in both soft real-time and simulated environments (simultaneously, if desired)
- Simulated components can be used with both environments
- Streaming automated test point tally and rollup of pass/fail determination
- Interactive Testing (automated tests with user input)


# Test Manager

- Provides a common interface for functional tests in real-time and simulated environments across all levels of testing fidelity
- Test results streamed in real-time from test service to test manager
- Create, save, and load run lists
- Integrated with JDT/CDT debugger
- Lists available test services that can be used to run test files
- Real-time display of test service usage information
- Supports the execution of multiple simultaneous batches within a single workspace



# Test Manager

TM TestManager



	Test	Result	Status	Output File	Test Location
<input type="checkbox"/>	CND_COM_power.java	PASS (74)	READY	✓	/lba.test.script.qual.cnd.com...
<input type="checkbox"/>	CND_COM_recv_time.java	✗ FAIL (2/33)	READY	✓	/lba.test.script.qual.cnd.com...
<input type="checkbox"/>	CND_COM_gps_time.java	PASS (38)	READY	✓	/lba.test.script.qual.cnd.com...
<input type="checkbox"/>	CND_COM_send_time.java	PASS (35)	READY	✓	/lba.test.script.qual.cnd.com...
<input type="checkbox"/>	CND_COM_current_time_status.java	PASS (20)	READY	✓	/lba.test.script.qual.cnd.com...
<input type="checkbox"/>	CND_COM_wod.java		READY	✓	/lba.test.script.qual.cnd.com...
<input type="checkbox"/>	CND_COM_mwod_status.java		READY		/lba.test.script.qual.cnd.com...
<input type="checkbox"/>	CND_COM_fmt_trng_net.java	✗ FAIL (6/81)	COMPLETE	✓	/lba.test.script.qual.cnd.com...
<input type="checkbox"/>	CND_COM_fmt.java	✗ FAIL (4/65)	COMPLETE	✓	/lba.test.script.qual.cnd.com...
<input checked="" type="checkbox"/>	CND_COM_cnv.java	(0/0)	RUNNING	✓	/lba.test.script.qual.cnd.com...
<input checked="" type="checkbox"/>	CND_COM_mode.java		IN_QUEUE	✓	/lba.test.script.qual.cnd.com...
<input checked="" type="checkbox"/>	CND_COM_zeroize.java		IN_QUEUE	✓	/lba.test.script.qual.cnd.com...

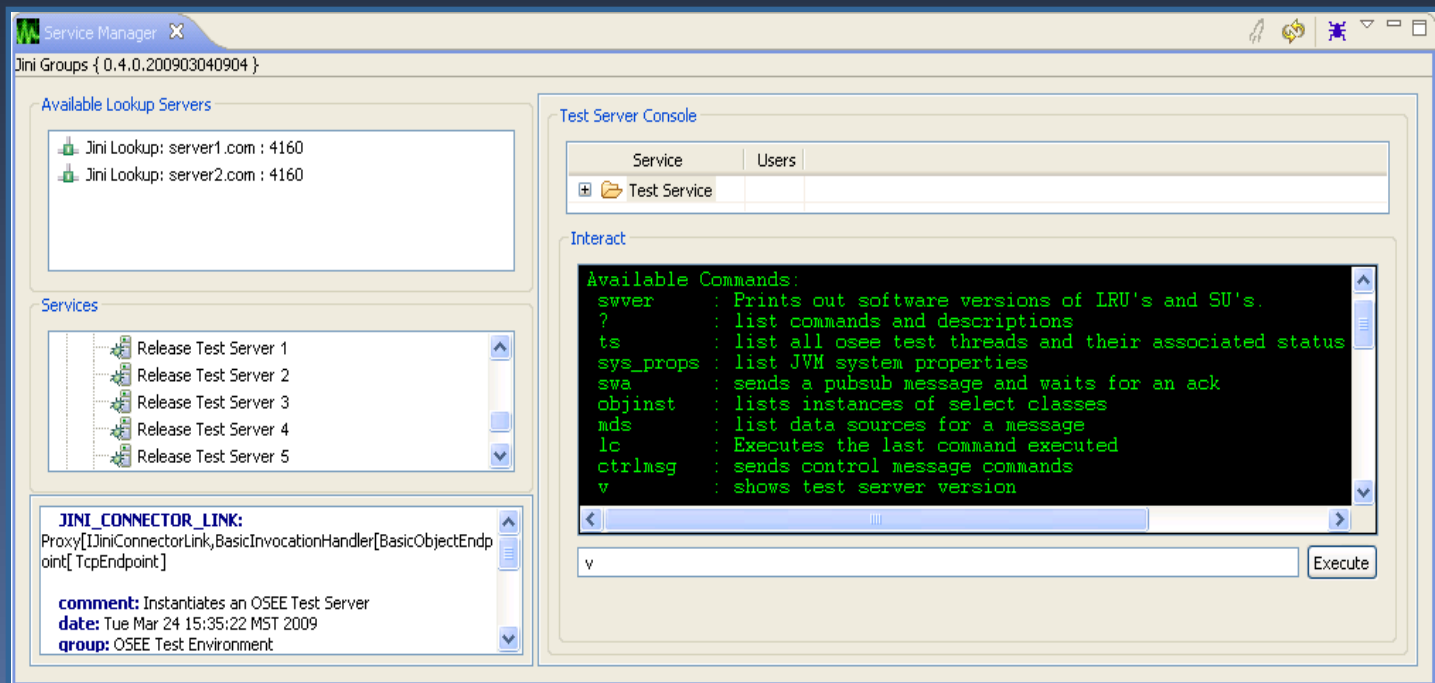
Filter:  Search:  RE 12 Loaded - 12 Shown - 1 Selected -

**Selected Host:** sun447.com  
**Config File Path:** C:\Documents\TestManagerEditor.scriptConfig.xml  
**OFFP:**

Overview Hosts **Scripts** Advanced Source

# Service Manager

- Integrated test server resource management
- Remote viewing and manipulation of test service



# Test Output

- Test output file format is XML
- Interactive out files (user can navigate the out file)
- User selectable views of out files
- Automatic correlation of a run-time test point to the test source line that generated it (integrated into JDT using problem view and markers)
- Full test output can be stored in the OSEE object-oriented persistence layer for later analysis and results summary and reporting

# Test Output Editor

✓ lba.test.script.qual.acs.asm.ACS\_ASM\_air\_data\_display.d699ceaa947201efbbbdfdf89df03b1.tmo ✕

## OTE Test Output

▶ Test Overview

▼ Results Summary - FAILED - Pass[5] Fail[13]

Title	Expected	Actual	Elapsed Time
● [124] - TP 1 { ASM_ACSYS_MODES.FAT_OUT_OF_TOL }	IN_TOLERANCE [0]	IN_TOLERANCE [0]	0
● [125] - TP 2 { ASM_ACSYS_MODES.FAT }	10(0xA)	128(0x80)	0
● [126] - TP 3 { ASM_ACSYS_MODES.FAT_SIGN }	MINUS [0]	PLUS [1]	0
● [133] - TP 4 { ASM_ACSYS_MODES.FAT_OUT_OF_TOL }	OUT_OF_TOLERANCE [1]	IN_TOLERANCE [0]	1002
● [135] - TP 5 { ASM_ACSYS_MODES.FAT }	10(0xA)	128(0x80)	1000
● [136] - TP 6 { ASM_ACSYS_MODES.FAT_SIGN }	PLUS [1]	PLUS [1]	0
● [145] - TP 7 { ASM_ACSYS_MODES.PA_OUT_OF_TOL }	IN_TOLERANCE [0]	IN_TOLERANCE [0]	0
● [146] - TP 8 { ASM_ACSYS_MODES.PA_10000_S }	ZERO [0]	ZERO [0]	0
● [147] - TP 9 { ASM_ACSYS_MODES.PA_1000_S }	2(0x2)	0(0x0)	1001
● [148] - TP 10 { ASM_ACSYS_MODES.PA_100_S }	6(0x6)	0(0x0)	1001
● [149] - TP 11 { ASM_ACSYS_MODES.PA_10_S }	7(0x7)	0(0x0)	1000
● [150] - TP 12 { ASM_ACSYS_MODES.PA_SIGN }	MINUS [0]	MINUS [0]	0
● [159] - TP 13 { ASM_ACSYS_MODES.PA_OUT_OF_TOL }	OUT_OF_TOLERANCE [1]	IN_TOLERANCE [0]	1001
● [161] - TP 14 { ASM_ACSYS_MODES.PA_10000_S }	TWO [2]	ZERO [0]	1001
● [162] - TP 15 { ASM_ACSYS_MODES.PA_1000_S }	6(0x6)	0(0x0)	1001
● [163] - TP 16 { ASM_ACSYS_MODES.PA_100_S }	5(0x5)	0(0x0)	1001
● [164] - TP 17 { ASM_ACSYS_MODES.PA_10_S }	4(0x4)	0(0x0)	1001
● [165] - TP 18 { ASM_ACSYS_MODES.PA_SIGN }	PLUS [1]	MINUS [0]	1001

Filter:  Search:  RE | 18 Loaded - 18 Shown - 0 Selected -

▶ Ofp Log

▶ Ofp Version

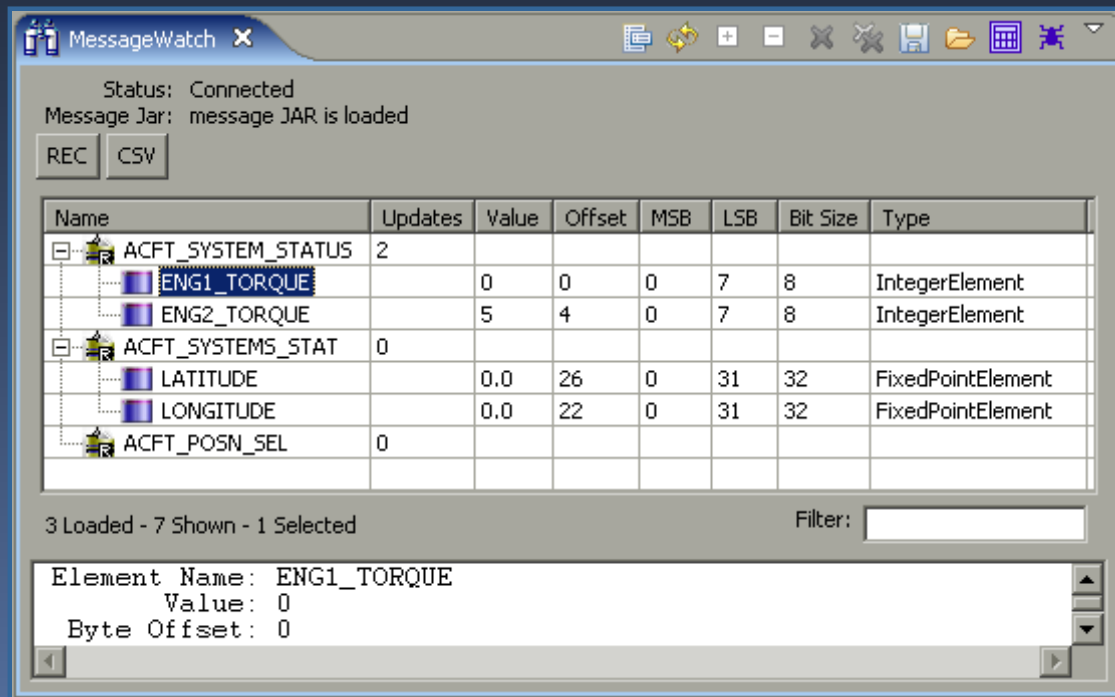
▶ Ote Log

Overview Details

Test points  
linked to test  
code that  
generated

# Messaging and Playback GUIs

- Monitor, manipulate and record real-time messaging data
- Advanced regular-expression searching for messages
- Import/Export view lists
- Playback environment
  - Supports advanced debugging of the test environment using repeatable conditions
  - Investigate real flight recordings



# Questions?