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

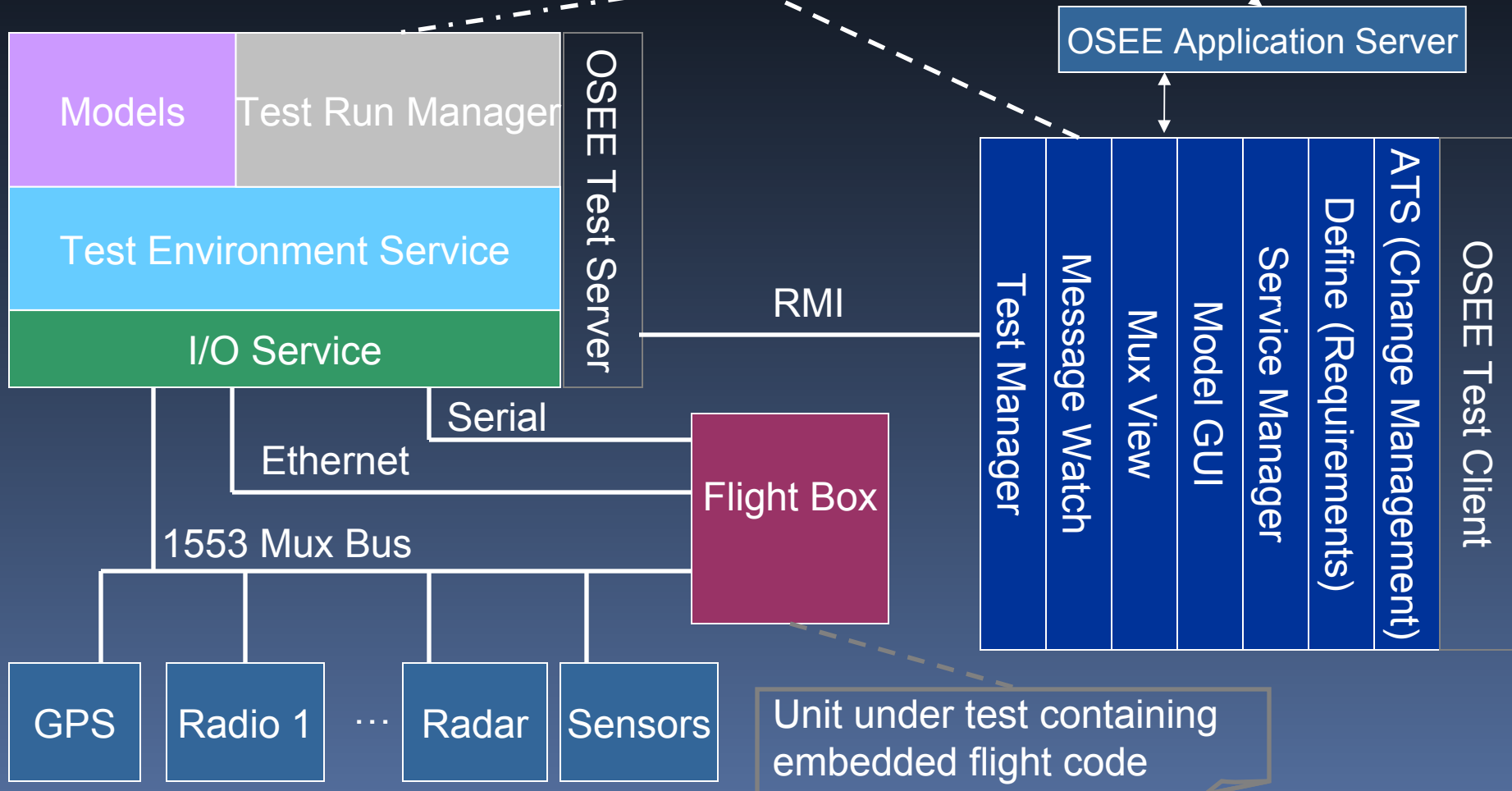- Detailed, integrated test status and coverage reporting

Architecture

Dynamic Service Discovery

JINI Lookup

OSEE Datastore
- Relational Database
- Remote File System

OSEE Application Server

OSEE Test Server
- Models
- Test Run Manager
- Test Environment Service
- I/O Service

RMI

Serial

Ethernet

1553 Mux Bus

Flight Box

GPS | Radio 1 | ⋯ | Radar | Sensors

OSEE Test Client
- Test Manager
- Message Watch
- Mux View
- Model GUI
- Service Manager
- Define (Requirements)
- ATS (Change Management)

Unit under test containing embedded flight code

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

Service Manager

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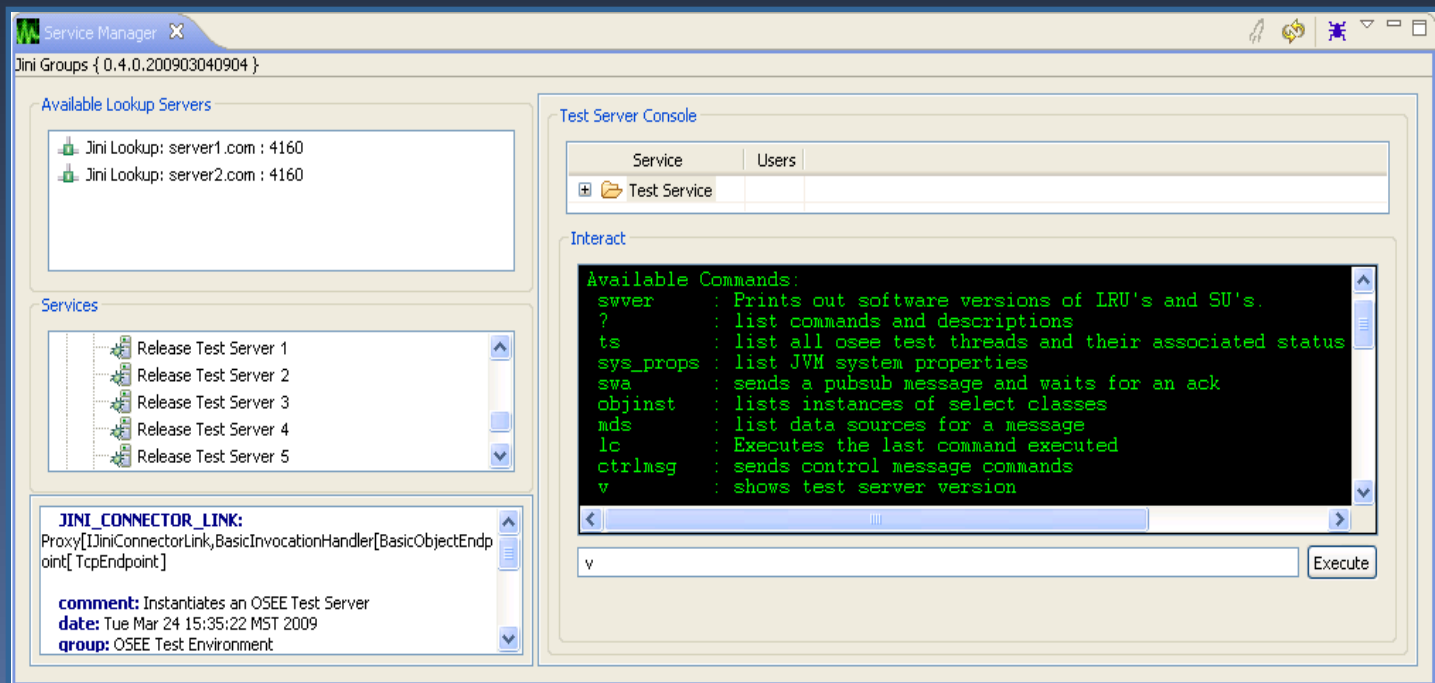
Test Output

- 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
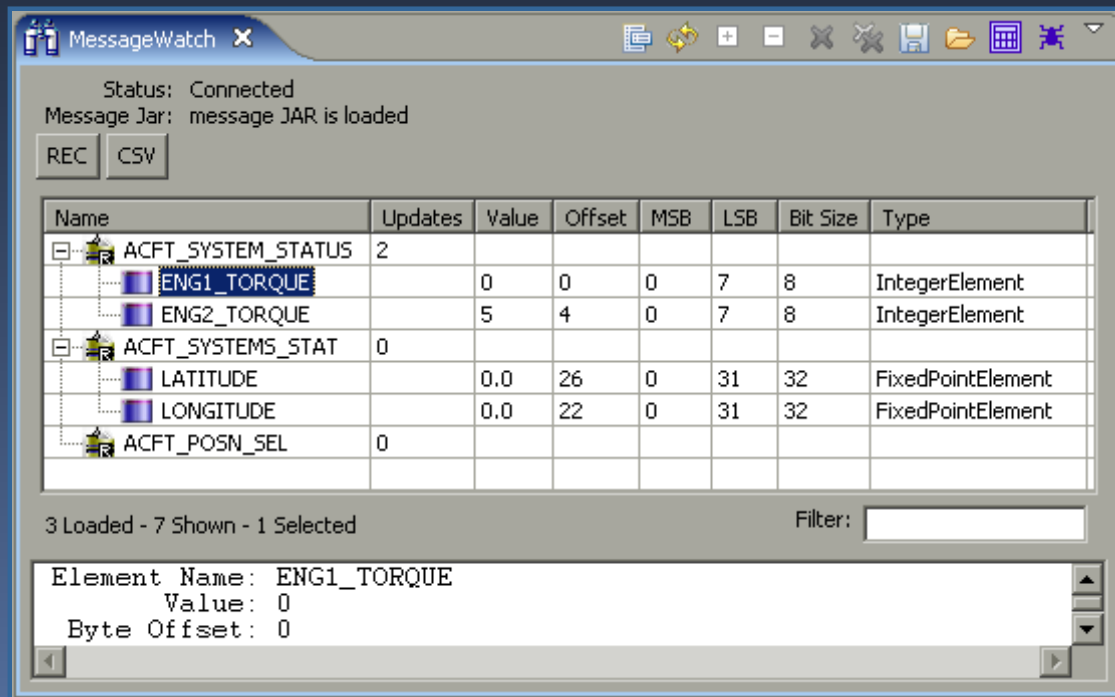

Test points linked to test code that generated

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

MessageWatch

Status: Connected
Message Jar: message JAR is loaded

REC CSV

Name	Updates	Value	Offset	MSB	LSB	Bit Size	Type
ACFT_SYSTEM_STATUS	2						
ENG1_TORQUE		0	0	0	7	8	IntegerElement
ENG2_TORQUE		5	4	0	7	8	IntegerElement
ACFT_SYSTEMS_STAT	0						
LATITUDE		0.0	26	0	31	32	FixedPointElement
LONGITUDE		0.0	22	0	31	32	FixedPointElement
ACFT_POSN_SEL	0						

3 Loaded - 7 Shown - 1 Selected   Filter:

```
Element Name: ENG1_TORQUE
        Value: 0
  Byte Offset: 0
```

Questions?

Test Run Results View