Automated Interoperability Testing with TTCN-3

How to increase efficiency

TTCN-3 User Conference
June 4th 2009
Sophia-Antipolis, FR

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Outline

- Motivation
  - Interoperability testing – Who and Why
- How to increase the efficiency of interoperability testing
  - Where is the money spend
  - How can we spend the money more efficiently
- Conclusion
Different Types of Testing

- Development Tests (Unit, Module, Component, ...)
- (Standardized) Functional Tests (Single IUT)
- Interoperability Tests (2+ IUTs)
- Performance Tests (High, long-lasting load)
Different Types of Testing

Development Tests
(Unit, Module, Component, …)

(Standardized) Functional Tests
(Single IUT)

Interoperability Tests
(2+ IUTs)

Performance Tests
(High, long-lasting load)
Rise of Interoperability Testing

- Classical conformance testing is becoming too costly
  - New approach which checks conformance as part of interoperability testing is showing promising results
  - Does not guarantee interoperability of tested products

- Bi-lateral testing and interoperability events are increasingly accepted as a solution to improve interoperability
  - ETSI - interoperability test specifications & Plugtests™ for a wide range of technologies including IMS, HDMI, IP, VoIP, RFID, grid, etc
  - OMA - interoperability test specifications & Testfests for enablers
  - WiMax – network infrastructure interoperability testbed
  - Over 700.000 hits with Google, more than 1,3 million hits with Yahoo
Interoperability Testing Today

- Interoperability testing means different things to different people
  - Attend an event
  - Test whatever with whoever whenever you want (ad-hoc)
  - Scheduled test sessions (attempting to cover all possible pairings of different participating products)
  - Execution of agreed test list in each test session
  - Validation of execution traces against standards
  - As well as various combinations of the above

- Majority of interoperability testing and validation is performed manually
  - Labor intensive
  - Does not scale
  - Error prone
  - Frequently inconsistent
Break-Down of Test Effort today

Test Design: < 50%
Test Specification: < 50%
Test Validation: > 50%
Test Implementation: > 50%
Test Effort spent at ETSI 1st IMS Plugtest 2007

- **Background information**
  - Event assessing IMS core network interoperability at network-to-network (NNI) interface
  - Agreed test list with 23 different interoperability tests
  - 6 IMS core networks tested all against each other
  - 30 recorded test sessions (A -> B as well as B -> A)
  - 482 test execution traces to be evaluated (SIP message flows)
  - 4 days time for test execution, recording, and evaluation

- **The testing effort**
  - 180 h of interoperability testing (46%)
  - 204 h of manual validation of execution traces (54%)
  - Sums up to total effort of 384 h (100%) related to testing
    - 48 pd
Break-Down of Test Effort today

- Test Implementation: > 50%
- Test Validation: > 50%
- Test Specification: < 50%
- Test Design: < 50%
Desired Break-down of Test Effort

HOW TO ACHIEVE THIS?

Concentrate on what should be tested not how.
Reuse: key for increasing efficiency

- Reuse of test code across different types of testing
- Reuse of information between
  - System architects
  - Developers
  - Testers
  - Managers
- Reuse of test system artifacts
- Reuse of know-how

- Use TTCN-3 as a common test language during different phases!
How to Profit from TTCN-3

Development Tests
- Test Cases

Standardized Functional Tests
- Test Cases

Interoperability Tests
- Test Cases

Performance Tests
- Test Cases

TTCN-3 Environment

SW-Based Access
- Module Under Tests

PC-Based Access
- Device Under Test

Trace-Based Access
- System Under Test

Load Test Devices Access
- Network Under Test

Global Players
- ETSI, WiMAX, OMA, and Others

Plugtests & Testfest support

Native Test Devices Support
Recommendations to increase testing efficiency

- Automate the interoperability trace checking with TTCN-3
  - Reduces cost+time & increases consistency of results!
- Reuse constructs from existing test frameworks
  - Profit from investments already made
- Use industrial grade test automation tools
  - Benefit from well accepted processes, workflows and tools

*A TTCN-3 allows to minimize validation effort for interoperability testing!*
One example implementation – TT trace player

- Uses files to configure IP information of equipment monitored in test session
- Import of PCAP trace and validation integrated in TTCN-3 tool
- Implements test system for standardized IMS interoperability trace checking tests
- Successfully used for trace analysis in 2nd ETSI IMS Plugtests 2008
Example trace checking test execution log
What did we gain?

Manual Validation
- Total time for execution: 180
- Total time for validation: 204
What did we gain?

- Manual Validation: 200 units
- Automated Validation: 64% of 200 units, which is 128 units

Total time for validation:

- Manual Validation: 200 units
- Automated Validation: 64% of 200 units, which is 128 units

64% decrease in total time for validation.
What did we gain?

- Manual Validation: Total time for preparation
- Automated Validation: Total time for validation

20% decrease in total time for validation
STF 370 – Automating interoperability testing

- ETSI STF investigating use of TTCN-3 for automating interoperability testing of distributed systems
  - Case study selected to be IMS core network testing
  - Funded in part by European Commission
  - Builds on results from TTCN-3 tool development for 2nd IMS Plugtest
  - Started in 2009 and expected to finish in 2010

- Output includes
  - ETSI guide on a methodology for automated IOT
  - ETSI technical specification on application of it to IMS domain
  - TTCN-3 tests implementing standardized ETSI IMS interoperability test descriptions
  - TTCN-3 codec and adapter implementations for a test system
  - Validation and report for using TTCN-3 tool in upcoming IMS Plugtest
  - White paper on STF experiences & lessons learned
Conclusions

- Interoperability testing is an accepted way to reduce interoperability problems
- Manual interoperability testing is time consuming and error prone and therefore expensive
- Automation of interoperability trace checking can reduce the costs up to 50% as compared to manual validation
  - Standardized test framework
  - Off-the-shelf TTCN compilers
- Standards, tools and the people are available today
Road ahead

- Reduce cost even more by further optimizing the TTCN-3 test design for interoperability trace checking
  - Based on feedback from first use at 2nd IMS Plugtest
  - Note that previous test system was build in only 10 days!
- Align existing test framework with new ETSI automated methodology
- Next application of this is at 3rd ETSI IMS Plugtest in Lannion FR
  - [www.etsi.org/plugtests/IMS_IPTV](http://www.etsi.org/plugtests/IMS_IPTV)
- Apply these concepts also in other domains
  - Grid
  - WiMax
  - HL7 (eHealth)
THANK YOU!

Questions?