TOWARDS THE USAGE OF MBT AT ETSI

A Status Report of the ETSI Specialist Task Force 442

for 8-th MBT Workshop 2013 – Rome, Italy
Agenda

Introduction
- Motivation
- STF 442

Case Studies
- Overview
- GeoNetworking Case Study
  - Modeling
  - Test Generation
- Evaluation

Methodology
- Outline
- MBT Process for Test Standardization

Conclusions
Motivation

MBT has matured into an industrial technology
• Successfully used in a wide range of application areas

Enable MBT technology at ETSI
• ETSI Standard on model-based testing
• ETSI MBT User Conference
• Next Step: applying MBT in standardized test development

Goals
• Assess feasibility
• Feedback on current MBT standard
• Create a methodology and process
• Determine next steps in MBT standardization
Specialist Task Force initiated by ETSI MTS

Manpower
- 4 persons with 30 days each (120 working days total)

Duration
- February 2012 – December 2012

Expected Results
- Case Study Report
  - Experiments with state of the art MBT tools
  - Evaluation: MBT and ETSI test development
- ETSI MBT Methodology Guidelines
  - Tool independent
  - Outlining the usage of MBT at ETSI
Overview of the Case Studies

Tools
• Fraunhofer MDTester (academic)
• Conformiq Designer
• Microsoft SpecExplorer
• Sepp.med MBTsuite

Case Studies
• Academic Example
  • Automated Teller Machine (ATM)
• GeoNetworking Protocol (ETSI TS 102 636)
  • Intelligent Transportation Systems (ITS)
  • Location service functionality of the GeoNetworking protocol
  • Packet routing in ad-hoc networks, packet distribution in a geographical area
• Diameter Protocol (ETSI TS 129 214)
  • UMTS, LTE, Rx interface
  • Conveys session information and policy/charging rules between the Application Function (AF) and the Policy/Charging Rules Function (PCRF)
Vehicles exchange information with
- other vehicles,
- road infrastructure and
- Internet peers.

Example usages
- Locating free parking lots
- Instant notifications
  - Braking actions
  - Road hazards
  - Traffic conditions
What is modeling?

- A sometimes simplified “mathematical description of a system or process, used to assist calculations and predictions”. – Oxford Dictionary
GeoNetworking Model Example (Conformiq Designer)

Model consists of:
- Graphical part
  - FSM
- Code part
  - Message handling
  - Internal data
  - Generating response data
  - Guard conditions

Forwarding
Configuration
Location service requests and data transmission
Buffering
Retransmission
Modeling (3/3)

Challenges
- Expertise in protocol, tool and testing
- Choosing the right level of abstraction
- Dealing with complexity

Models for GeoNetworking Case Study
- SpecExplorer
  - C# code is mapped to an extended state machine
  - Lower abstraction level than the Test Purposes
  - Complete modeling, slicing
- Conformiq, MBTsuite, MD Tester
  - Extended State Machines (Conformiq)
  - Annotated UML State and Activity Diagrams (MBTsuite, MD Tester)
  - Abstraction level of the Test Purposes
  - Simplified modeling using Test Configurations
Influencing Test Generation

- Different modeling approaches lead to different test suites
- Each tool has different means to control test generation

Generating Tests for GeoNetworking Case Study

- SpecExplorer
  - Coverage goals were selected requirements extracted from standard
- Conformiq Designer, MBTsuite, MDTester
  - Coverage goals were based on standardized test purposes
Example for generated tests in SpecExplorer
Evaluation of Generated Tests

- Test Purposes (TP) were used for comparison.
- The manually created TPs could be covered in all case studies.
- Tools have also means to go beyond the TPs.
- The generated test cases were at least on the same level of abstraction as the TPs.

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Adaptation to Test Environment

Support of Test Execution
• Possible to generate executable test cases with all tools
• 3 out of 4 tools have TTCN-3 support

Test Harness
• Adaptation to the target test system
• Adding of data not specified in the model, because it does not influence the test generation
• Parallelization

Improving Maintainability
• Parameterization
• Renaming of test cases, messages, variables etc.
• Re-structuring of test behaviour (e.g. preamble, test body, postamble)
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Methodology Outline

Modeling
- Identification of requirements
- Identification of modeling strategy
- Annotating models with references for requirements
- Modeling guidelines
- Model quality

Automatic test generation
- Defining test coverage
- Generating test cases
- Quality of generated test cases

Transformation and adaptation of generated test cases
- Transformation and adaptation steps
- Quality of adapted test suite
MBT Process for Test Standardization

Outline

- Base Standard Specification
- Cataloguing of Requirements
- Creation of Implementation Check List
- Identification of Test Group Structure
- Specification of Test Purposes
- Specification of Test Descriptions
- Specification of Test Cases
- Validation

Standard

- Requirements
- ICS/IFS
- TSS
- TPs
- TDs
- TCs
MBT Process for Test Standardization

**Outline**

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**Standard**

- Requirements
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**Modeling for Testing**

- Model
- Test Generation
- Abstract Testcases
- Adaptation/Transformation

**Validation**
Conclusions

- Case studies were successful with all tools
  - All case studies have been modeled
  - Abstract test cases were successfully generated
  - Test coverage comparable with the manually designed test suite

- MBT can be applied in standardized test development
  - Additional validation of base standards and requirements
  - MBT allows better control of test coverage

- Challenges
  - Gather expertise in base standard, testing and modeling
  - Abstraction gap between generated and manually written test cases
  - Maintenance of test suite vs. maintenance of test model
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About ETSI:

• ETSI produces globally-applicable standards for Information and Communications Technologies (ICT), including fixed, mobile, radio, converged, broadcast and internet technologies and is officially recognized by the European Commission as a European Standards Organization. ETSI is a not-for-profit organization whose 700 ETSI member organizations benefit from direct participation and are drawn from 60 countries worldwide. For more information, please visit: www.etsi.org

About ETSI Specialist Task Forces (STF):

• STFs are teams of highly-skilled experts working together over a pre-defined period to draft an ETSI standard under the technical guidance of an ETSI Technical Body and with the support of the ETSI Secretariat. The task of the STFs is to accelerate the standardization process in areas of strategic importance and in response to urgent market needs. For more information, please visit: http://portal.etsi.org/stfs/process/home.asp