Microsoft Research

Faculty Summit 2010

Making a Open Ecosystem

Fred Wurden
Partner Product Unit Manager
Microsoft Corporation
fred.wurden@microsoft.com
“BlueLine” Technical Document Testing Program of Windows (as of 03/09)

- 222 protocols/technical documents tested
- 22,847 pages studied and converted into requirements
- 36,875 testable requirements identified and converted into test assertions
  - 69% tested using model-based testing with Spec Explorer
  - 31% tested using traditional test automation
- 66,962 person days (250+ years)
  - Hyderabad: 250 test engineers
  - Beijing: 100 test engineers
Comparison MBT vs Traditional

- In % of total effort per requirement, normalizing individual vendor performance
- Vendor 2 modeled 85% of all test suites, performing relatively much better than Vendor 1
Spec Explorer Features

- Visual Studio add-in
- Multiple modeling styles and languages
  - Programs, patterns, diagrams
- Asynchronous & non-deterministic systems
- State machine extraction from model program
- Test code generation from state machine
- Model composition
Model Exploration
Give it a try…

- Microsoft offers Spec Explorer 2010 as preview technology free of charge via MSDN DevLabs: http://msdn.microsoft.com/devlabs
- Licensing allows for commercial use
- Academic institutions can join MSDN Academic Alliance for access to Visual Studio 2010
Moving Forward: The Challenges

- **Multiple masters**
  - Specs, Code, Parsers, Models, Test Suites, Inventory
  - Efficiency and accuracy of creation / maintenance hard

- **Verification**
  - Need to improve efficiency
  - Need to reduce subjectivity

- **Difficulty capturing messages**
  - High bandwidth
  - Compression, encryption, and fragmentation
  - Virtualization, network stack offloading
Present

Code -> Technical Document

Protocol "Design" -> Technical Document

Inventory Record -> Technical Document

Network Parser -> Technical Document

Test Adapter -> Technical Document

Test Model -> Technical Document

PEF
Future – Open Protocol Notation (OPN)
Language Concepts

- **OPN**
  - Algebraic/Axiomatic Specification
  - Model-Oriented Specification
  - Declarative Programming
  - Process-Oriented Specification
  - Standards

- **Standards**
  - ACT-ONE, OBJ3, CASL, Temporal Logic, ADL, ...
  - CIP-L. VDM, Z-Notation, B-Method, ASM, TLA, ADLs, ...
  - CSP, CCS, PI-Calculus, ...
  - Functional (ML, Haskell, …), Logical (Prolog, Curry, …)
  - LOTOS, SDL, UML, TTCN-3, ASN.1, …
The Protocol Object Model (POM)

- ProtoXML Input Adapter
- IDL Input Adapter
- WSDL/WCF Input Adapter
- Type Checking Processing Adapter
- OPN Input Adapter
- oDOC Output Adapter
- IDL Output Adapter
- C# Output Adapter
- WSDL/WCF Output Adapter

Bootstrapping
Down the road

- Extended Consistency Checking
  - Matching analysis
  - Architecture checking
- Model-Checking and Simulation
  - Symbolic state space exploration (as in Spec Explorer)
- Test generation
  - Traversals on the result of state space exploration
- Architecture exploration
  - Enumeration of valid configurations
- Code-Stub generation and contract injection
  - Get assertions from the model into the code