Plugtests Event - Principles and Comparison with Conformance Testing

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What is a Test Methodology?

A well documented, structured approach to the development of test specifications

• Well documented
  • ISO/IEC 9646 for conformance test specifications
  • ETSI EG 202 237 for interoperability test specifications

• Structured
  • Test Suite Structure (TSS)
  • Test Purposes (TP)
  • Test Descriptions (TD)
  • TTCN-3 Test Cases (TC)
Why use a Test Method?

- The basis for achieving consistent test specifications of highest quality – especially when working with teams of test developers
- A way of ensuring that the same concepts and principles are used regardless of technology
- A common understanding between test developers, reviewers and users
Why Produce Test Specifications?

- A proven way to secure interoperability
- Their development provides a first validation of the base standard(s)
- Leads to significant improvements of base specifications
- Provide a basis for certification of products or a test plan for an interoperability event
Types of Testing

- **Conformance testing**
  - Testing a single part of a product for its compliance to a base standard
  - See Conformance Demo

- **Interoperability testing**
  - Checking end-to-end functionality between a collection of equipment or devices

- **Interoperability testing with conformance checking**
  - Testing interoperability while monitoring conformance parameters
  - This is applied for 1. ITS CMS Plugtest
ETSI Conformance Test Specs

- ETSI develops conformance test specifications for many of its mainstream standards
- For use by members in their proprietary development processes
- Certification schemes, for example
  - Developing standardised conformance test specifications for GSM and 3G (UMTS/LTE) for over 15 years
  - Follow strict methodology (based on TTCN-3)
  - Average budget 1M€ per year
  - 3GPP RAN#5 delivers these tests to GCF (Global Certification Forum)
  - All tests validated (executed) on up to 5 platforms against real equipment before approval and publication
There are Standards Validation Tools

- Peer review
- Simulation
- Model-based testing
- Prototyping
- Testbeds
- ETSI Plugtests™ Interoperability Events

ETSI Interop Test Specs used for ETSI Plugtests™ Interoperability Events
Black-Box Testing

Test System

Requirements

System Under Test

Stimulus
Response

Stimulus
Response
What Conformance Testing Does

Determines the level to which a product (or part of a product) meets the requirements specified in a base standard (specification)

- Assumes other parts are tested and working
- Assesses the implementation of mandatory and optional requirements
- Gives a high degree of confidence that this part of a product is working as specified
- A single test usually focuses on a single requirement
Limits of Conformance Testing

- Does not specifically prove end-to-end functionality (interoperability) between communicating systems
  - This is often a specification problem rather than a testing problem!
    Need for minimum requirements coverage or profiles
  - Usually tests specific paths through a protocol

- Focuses on one specific part rather than the complete product
  - A system is greater than the sum of its parts!
  - the user’s ‘perception’ of the system is not tested
End-To-End Testing
What Interoperability Testing Does

- Exercises all parts of a product which realize a specific end to end functionality – regardless of whether all parts are standardized
- Exercises all interfaces between products required to realize a specific end to end functionality – regardless of whether all interface are standardized
- Can be performed in different settings, e.g., interoperability events or permanent testbeds
Limits of Interoperability Testing

- Does not prove that any part of a product is conformant
  - Devices may interoperate even though they do not conform to a standard

- Cannot explicitly test error behaviour

- Does not prove interoperability with other implementations with which no testing has been performed
  - ‘A’ interoperates with ‘B’; ‘B’ inter-operates with ‘C’. But ‘A’ may not interoperate with ‘C’
The Combined Approach

Interoperability Testing

Protocol Conformance Monitoring
What is the Combined Approach?

- Interoperability testing of early prototypes
  - No designated “Qualified Equipment”
- Protocol monitoring at one or more external interface
  - Vendors have not yet run Conformance Tests
- Interoperability test failures evaluated with protocol monitor traces to determine cause
Limits of the Combined Approach

- Does not eliminate the need for pure conformance testing and it can show a concrete need for it!
- Assessment of conformance is limited to requirements that can be exposed at standardized interfaces with common end to end services
Interoperable products may still not conform!

Performance addressed to some degree – depends on the complexity of the test scenarios

Cannot explicitly cause error conditions so robustness addressed to a limited degree and in a less controlled manner

Scope of Interoperability Testing

Interoperability

Conformance to Requirements

Robustness

Performance
Scope of Conformance Testing

Conformant products may still not interoperate!

Performance not usually addressed – requirements not standardised and testing is done under ideal conditions.

Can simulate error conditions – but only standardised robustness requirements addressed.
Conclusion

Although interoperability and conformance are complementary, there is no direct relationship between them

- Equipment can interoperate without being conformant to the standards
- Equipment can conform to the standards but not interoperate

Do conformance and interoperability testing before deploying equipment in the field
THANK YOU!