TTCN-3 General Concepts and Applications
Agenda

• Introduction
• Language concepts, standards and tools
• Application domains
• Summary and outlook
Introduction
Why Using TTCN-3

- Speed to Market
- High Integration
- High Reliability
- Optimal Cost
- Law Changes
- Complexity
- MPLS
- WLAN
- LTE/5G
- IP

MISMATCH

Test Methods

Requirements
Why Using TTCN-3

- Speed to Market
- High Integration
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Java

TCL

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Why Using TTCN-3

- Speed to Market
- High Integration
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- MATCH
- Requirements
- Test Methods
- WLAN
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High Quality
Did you know that **YOUR PHONE**... 

...has been **tested** using **ETSI** specifications written in **TTCN-3**?
Challenge Test Automation

- TTCN-3 is the **Testing and Test Control Notation**
- **Internationally standardized** testing language for formally defining test scenarios.
- Designed **purely for testing**
Testing of communication scenarios

```java
 testcase Hello_Bob () {
    p.send("How do you do?");
    alt {
        []p.receive("Fine!") {
            setverdict( pass );
        }
        [else] {
            setverdict( inconc )} //Bob asleep!
    }
}
```
Testing and Test Control Notation (TTCN-3)

• Distributed testing
• Automatic execution (TTCN-3 -> Java/C++) and logging
• Import and use of external data types (ASN.1, IDL, XML, JSON)

```java
testcase Hello_Bob () {
  p.send("How do you do?");
  alt {
    [] p.receive("Fine!");
    [else]
      [setverdict( pass )];
      [setverdict( inconc )] // Bob asleep!
  }
}
```
Design Principles of TTCN-3

• One test technology for different tests
  ✓ Distributed, platform-independent testing
  ✓ Integrated graphical test development, documentation and analysis
  ✓ Adaptable, open test environment

• Areas of Testing
  ✓ Conformance and functional testing
  ✓ Interoperability and integration testing
  ✓ Real-time, performance, load and stress testing
  ✓ Security testing
  ✓ Regression testing

• Used for system and product qualification and certification
TTCN-3 History

TTCN (1992)
- published as ISO standard
- Tree and Tabular Combined Notation
- used for protocol tests: GSM, N-ISDN, B-ISDN

TTCN-2/2++ (1997)
- enhancements by ETSI MTS
- module concept, concurrency
- used for conformance tests
TTCN-3 History (Cont.)

TTCN-3 (2000)
- Further development by ETSI MTS
- **Testing and Test Control Notation**
- Standardized test specifications:
  - SIP, SCTP, M3UA, IPv6
  - HiperLan, HiperAccess, WiMAX
  - 3GPP UMTS, LTE, NB-IoT, 5G
  - OMA
  - TETRA
  - MOST, AUTOSAR, ITS
  - EUROCONTROL
  - oneM2M
TTCN-3 is designed for Dynamic Testing

TTCN-3 Test Case

Port.send(Stimulus)  Port.receive(Response)

• Assignment of a Test Verdict

System Under Test
### Major language elements of TTCN-3 notation

<table>
<thead>
<tr>
<th>module definitions</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imports</td>
<td>Importing definitions from other modules defined in TTCN-3 or other languages</td>
</tr>
<tr>
<td><strong>Data Types</strong></td>
<td>User defined data types (messages, PDUs, information elements, …)</td>
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<td><strong>Test Data</strong></td>
<td>Test data transmitted/expected during test execution (templates, values)</td>
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<td><strong>Test Configuration</strong></td>
<td>Definition of the test components and communication ports</td>
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**Test data** transmitted/expected during test execution
- single values (constants or variables)
- templates (including wildcards like: ?, * )
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**Specification of the dynamic test behavior**
- **message**: send/receive
- **procedure**: call/getcall, reply/getreply, raise/catch
- if-then-else, alternatives, functions
- loops: for, while, do-while
- control: component/port/timer
# TTCN-3 Standards Overview

## Language mappings
- **ASN.1**
- **IDL**
- **XSD**
- **JSON**

## Extensions
- **Documentation t3doc**
- **Advanced parameterization**
- **Behaviour types**
- **Static configuration**
- **Object-oriented features**
- **Real-time support**
- **Continuous signal support**
- **Advanced TRI**
- **Advanced Matching**

## Core language
- **TTCN-3 Structuring**: Imports, Groups, Attributes
- **TTCN-3 Behaviour**
- **TTCN-3 Data**

## TRI/TCI mapping
- **Java**
- **C**
- **C++**
- **XML**
- **C#**
A TTCN-3 Test System

ETSI ES 201 873-1
TTCN-3 Core Language

ETSI ES 201 873-5
TTCN-3 Runtime Interface (TRI)

ETSI ES 201 873-6
TTCN-3 Control Interfaces (TCI)
Implementation

Test Specification

Test System

TTCN-3 Executable

TCI Adaptors

TRI Adaptors

Communication / Invocation

Systems Under Test

Automated Test Execution and Reporting
TTCN-3 tools (source: www.ttcn-3.org)

**TTCN-3 Compilers and Interpreters**

- TTworkbench
- elVior
- TITAN
- broadbit
- PragmaDev Tester
- TTCN-3 Toolbox

**TTCN-3 Generators and Support**

- CONFORMIQ
- t3tools
Application Domains
TTCN-3 for multiple purposes

- Test technology addresses various protocols and interfaces
- Control of **real** and/or **virtual devices** (special hardware-interfaces, simulators)

Earlier days

Today
TTCN-3 in industry

- Develop an efficient test platform fulfilling industrial testing requirements
- Execute high-level test models, e.g. TDL and UTP
TTCN-3 domain: Medicine

- SiemensMED (image processing)
- HL7 eHealth protocols (interoperability)

Upcoming E-Health infrastructure for Germany

- High security requirements (e.g. certificates, cryptography)
- Multiple heterogenous interfaces:
  - Card Terminals & simulations,
  - Webservices, OCSP server etc.
TTCN-3 domain: Internet of Things (IoT)

**IoT-Testware:**
- MQTT
- CoAP
Summary and outlook
Good Reasons for standardized test languages

- They significantly increase your system quality.
- You can focus on what to test, not on how.
- They reduce costs and efforts in test system maintenance.
- They are independent of access technology, operating system and implementation domain.
- They support communication between system development and test department.
- You can count on available and certified experts.
TTCN-3 Sources

Online Information
→ www.ttcn-3.org

TTCN-3 Conference/Webinar
→ ETSI, UCAAT, STV, ...

TTCN-3 Standards, Papers, Book
→ https://www.ttcn.de/en/

Quick Reference
→ http://www.blukaktus.com/

Exercises and Tooling
→ Research licenses
Q&A

For further information please visit www.ttcn-3.org and/or contact ETSI TC MTS via www.etsi.org/MTS

Next:

TTCN-3 Language Extensions Object-Oriented Features

9th October 2020, 10 AM