

Using TTCN-3 in a telecommunication operator: experiences and improvement proposals

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01 Testing Telecommunication Services

Definitions (I)

■ Definitions of Telecommunication Service:

- “The offering of telecommunications for a fee directly to the public, or to such classes of users as to be effectively available directly to the public, regardless of the facilities used.”;

where “Telecommunications”, in turn, is defined as “the transmission, between or among points specified by the user, of information of the user's choosing, without change in the form or content of the information as sent and received.”

(Telecommunications Act of 1996)

- Mechanism to enable access to a specified set of user-information transfer capabilities, provided to a group of users by a telecommunication system or infrastructure.

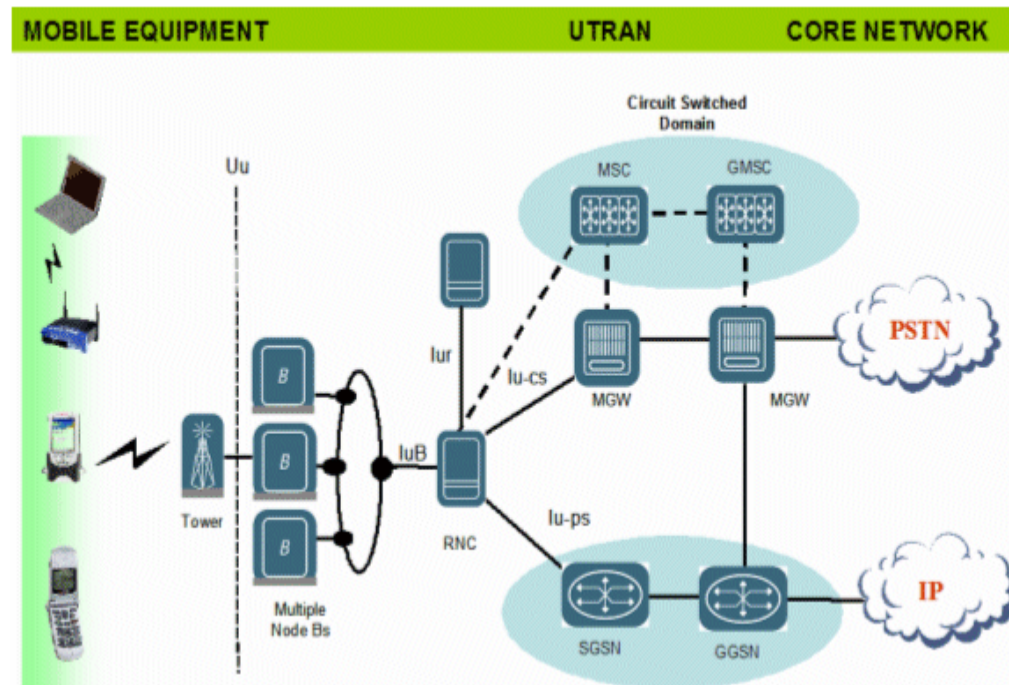
01 Testing Telecommunication Services

Definitions (II)

- Telecommunication services usually involves a number of hardware (nodes, controllers, switches, user equipments, etc) and software elements.

— Example:

UMTS telephone /
data service



01 Testing Telecommunication Services

Characteristics

- Main characteristics of telecommunication services testing:
 - Main operation situations of telecommunication services must be reproduced:
 - **Model** and simulate **user behaviour**
 - **Check** the behaviour and performance of **service elements and components** (in interfaces, reference points, etc.)
 - It could be necessary to check several **heterogeneous** service elements **simultaneously**
 - Tests are **complex** to define and configure:
 - Many cases to be tested → **Huge test campaigns**
 - Test parameterization is very complex
 - Great **flexibility is needed** for test definition, configuration and execution

02 Specific issues of testing telecommunication services with TTCN-3

Problems of TTCN-3 (I)

- Limitations of TTCN-3 for telecom service testing:
 - Lack of a formal model for ***test campaign***
 - Difficult to plan huge test campaigns:
 - Lack of concept of ***test databases***
 - Difficult test results management:
 - A more powerful management system for test results is needed due to a **high number of test executions**

02 Specific issues of testing telecommunication services with TTCN-3

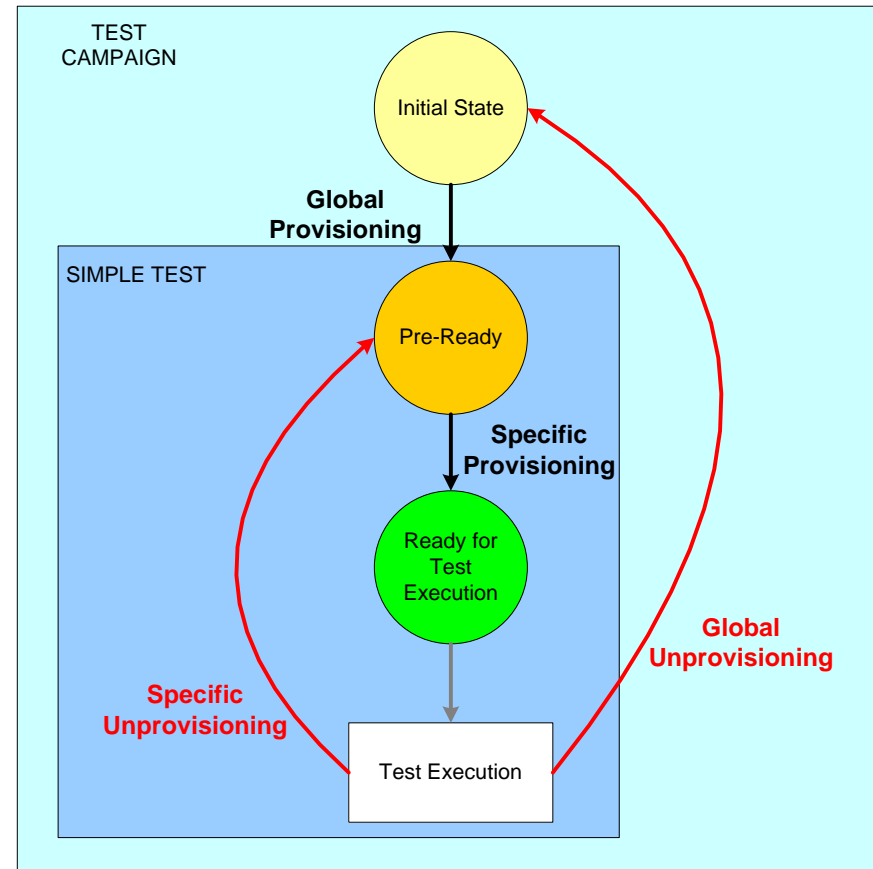
Problems of TTCN-3 (II)

- TTCN-3 does not offer a **high level language to specify tests**. It makes quite difficult to complete telecommunication service tests. Abstraction level of TTCN-3 language is not enough to model complex behaviours
- **Code reutilization** problems: several different elements must be tested simultaneously for the same service, so its necessary to combine existent ATs and their associated adaptation libraries. However, there is not a standard way to achieve this goal

02 Specific issues of testing telecommunication services with TTCN-3

Problems of TTCN-3 (III)

- Telecommunication service test execution requires **provisioning complex configuration information** to achieve a successful service simulation. This must be done before and after test execution
- It is difficult to **integrate** complex service provision operations into the execution of TTCN-3 tests



03 Adopted solutions

Huge Test Campaigns

■ Huge Test Campaigns

- Make use of fully parameterized testcases:
 - Two types of parameters are distinguished:
 - Module level parameters:
 - Common for the whole test campaign
 - Defined as TTCN-3 *modulepar* { ... }
 - Testcase level parameters (PIXITs):
 - Defining specific characteristics of individual tests
 - Defined as formal parameters of TCN-3 *testcases*
- Therefore, a test campaign is formed by:
 - Set of common parameters (module level parameters)
 - A database of PIXITs (one set of PIXITs for each individual test to be executed)

03 Adopted solutions

Test complexity management (I)

■ Test complexity management

- The high complexity of telecommunication services makes them difficult to be modelled by TTCN-3 test code
 - It is necessary to reduce the complexity of TTCN-3 code in order to achieve flexibility and code reusability
- The right parameterization of test cases can reduce TTCN-3 code complexity, maintaining almost equivalent functionality
- However:
 - The number of parameters needed to define a telecommunication service test may be very high (for example, in medium-complexity voice services, about ~100 parameters must be checked)
 - In practice it is not possible to specify manually every single test parameter
- In addition, test parameterizations could change throughout service life cycle

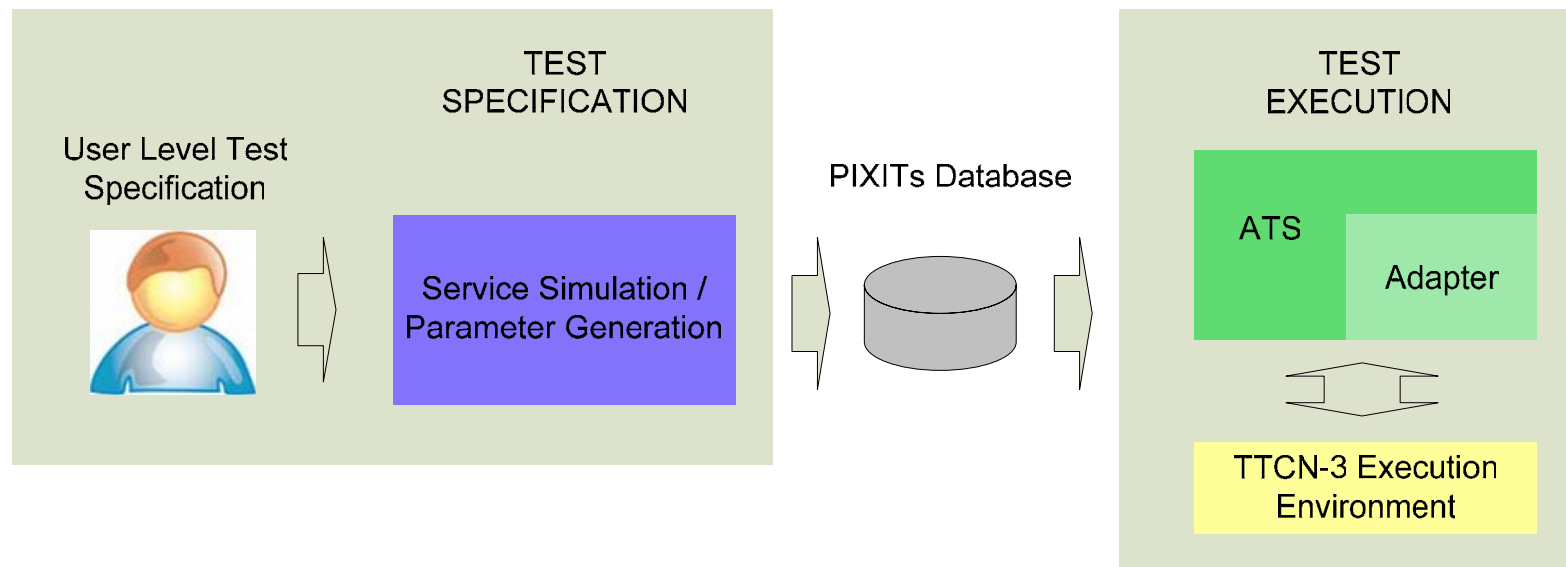
03 Adopted solutions

Test complexity management (II)

- Test parameterization complexity management
 - Suggested solution:
 - **Separate** test parameter **specification** from test **execution**
 - Simplify whole test specification through external auxiliary tools:
 - Using **high-level descriptions** of tests
 - Automate test **parameters generation**, avoiding human error sensitive manual specification of parameter values
 - **Simulating** telecommunication services behaviour using appropriate tools (for example, complex behaviour simulation through high level rules definition)

03 Adopted solutions

Test complexity management (III)



03 Adopted solutions

Service Provisioning (I)

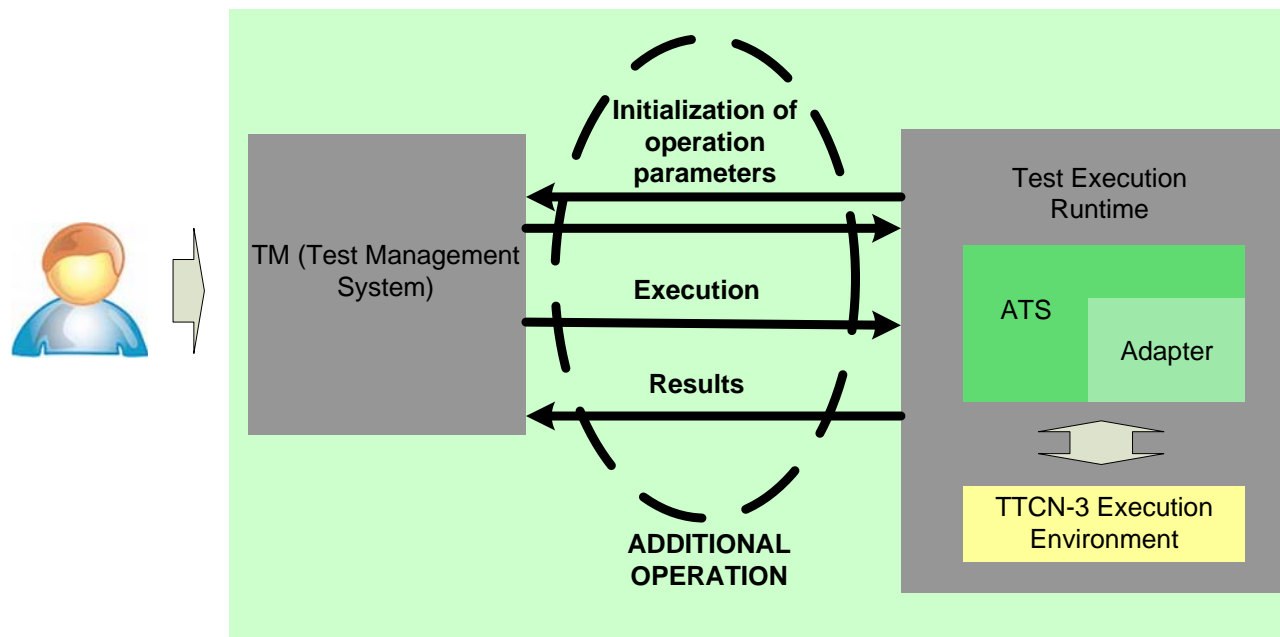
■ Service Provisioning

- One possible way to automate provision of services consists of using *external functions* from TTCN-3 code
- However, *external functions* are not enough when the service to be configured is complex. Semiautomatic provision of services is commonly needed:
 - In huge test campaigns the state of the TTCN-3 execution environment (TE) must be monitored. This state must be taken into account before deciding which provision information has to be configured
 - Usually some provision operations depends on the current execution state of the system under test and even on the execution state of the TE
- Therefore, a flexible information interchange between TE and TM (Test Management System) is required

03 Adopted solutions

Service Provisioning (II)

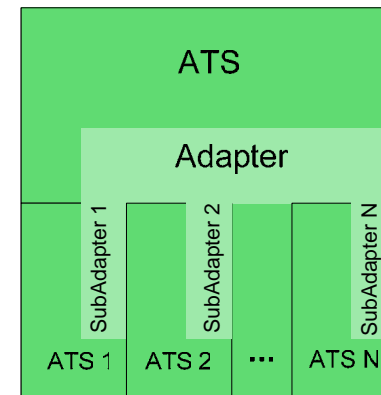
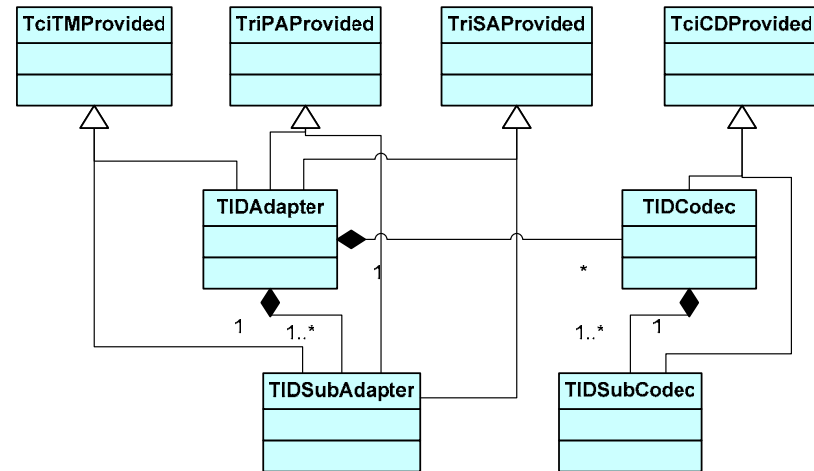
- One possible solution consists of modifying standard interfaces (TCI-TM and/or TRI-PA) to allow the execution of more complex operations, which can be even interactive



03 Adopted solutions

Code Reutilization

- Code Reutilization:
 - Basic design guidelines for ATSS:
 - ATSS must be as simple as possible
 - ATSS testcases must be as parameterized as possible
 - Architecture to simplify reutilization of adaptation libraries:
 - Adapter → Composed by several independent Subadapters
 - Codec → Composed by several independent Subcodecs





Thank you for your attention

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