Java-based test system development with open source components

Presented by Zhang LinLin

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About TMC

- TMC --Telecommunication Metrology Center of CATR *(China Academy of Telecommunication Research)* of MIIT *(Ministry of Industry and Information Technology of the People's Republic of China)*
  - Founded in 1980
  - With 4 departments
  - Over 200 staff
  - Standard Development Organization
  - Objective and independent 3rd-Party Test/Calibration Organization

About TMC (cont.)

- TMC is an objective and independent third-part research and test institute, it provides services on
  - Products inspection, verification and technical assessment
  - Testing instrument metrology and calibration
  - Telecommunication technology development
  - Telecommunication product standards and test methods research
  - Software verification

GO4IT China Project

- The project goal is to increase the capabilities of TMC to build tools to validate any technologies in support of China development strategies and policies
- The project would help TMC position themselves as leading organisation in China
- **Direct cooperation between**
- **Started March 2009**
- **ETSI introduced international partners from France and Russia**

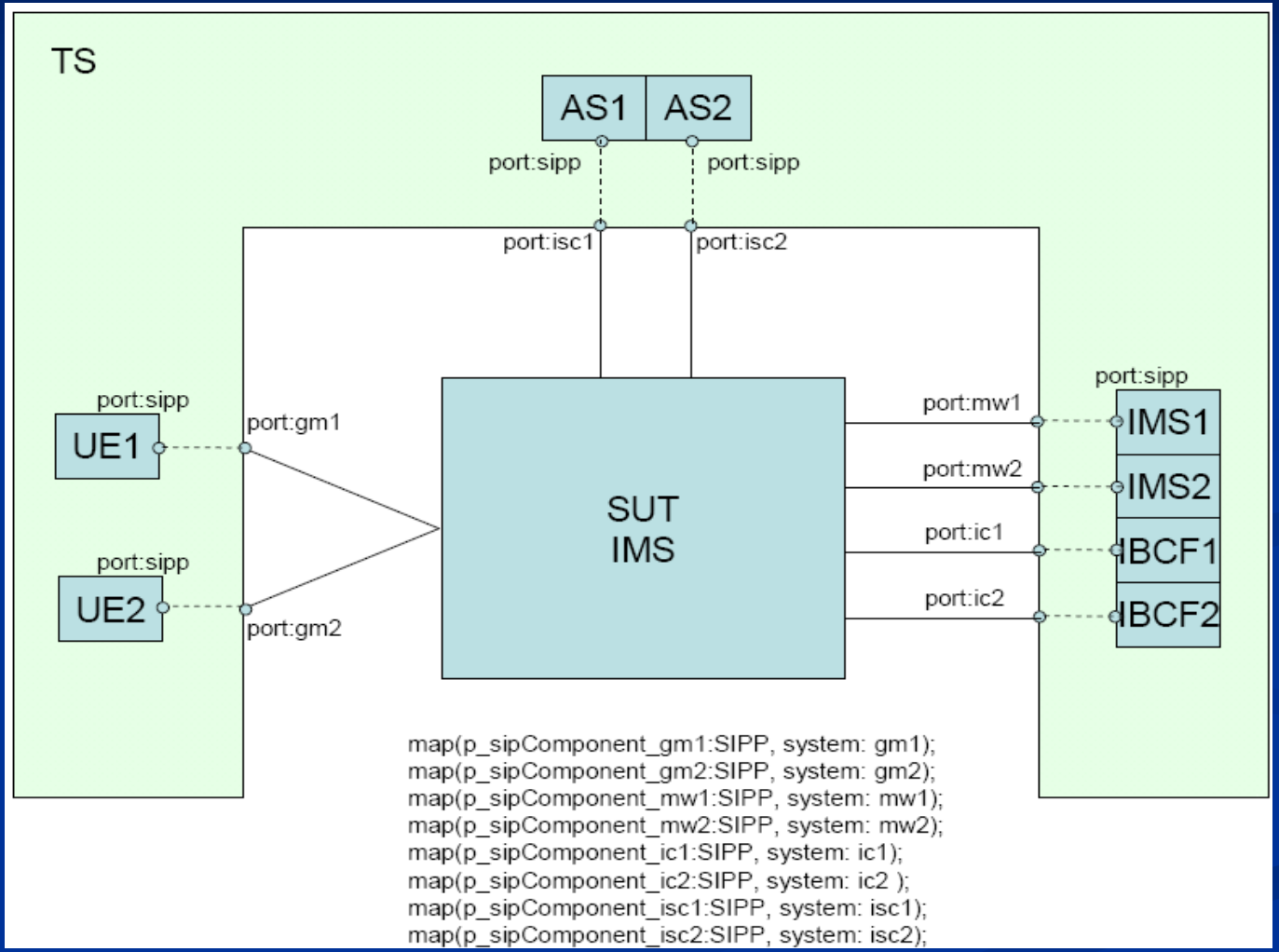
GO4IT China Objectives

- Give China and TMC the capability to develop test services in a timely and efficient manner to support deployment of interoperable products and services in China
- Associated specific objectives
  - Development of a conformance test tool based on the TTCN-3 open standard
  - Launch of operational services for new key areas (e.g IMS)
  - Provide test service for the products and accelerate the time to market of new products
  - To promote the adoption of long-term scientific methods based on open-standards for systems interoperability improvement
  - Use of the existing and scientifically reliable testing language TTCN-3

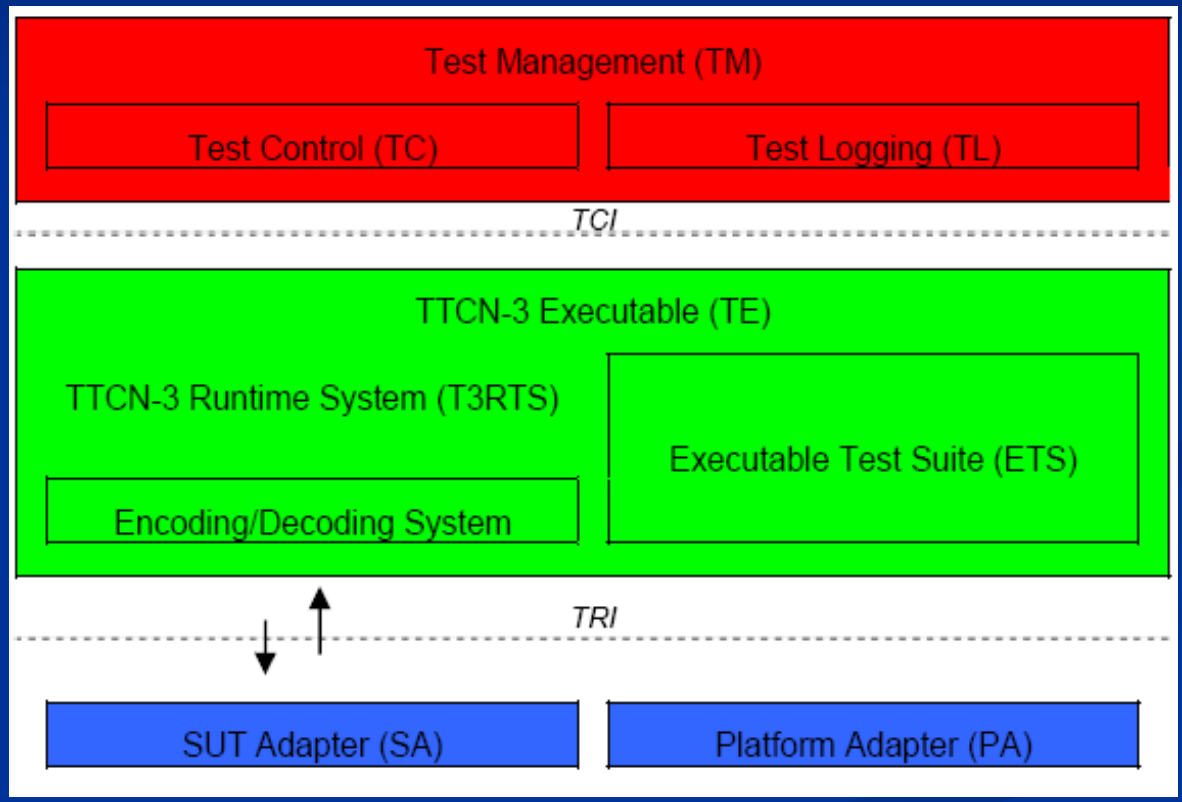
Specific development target

- Develop an IMS/SIP test tool
- Relevant test specification completed by ETSI Technical committee INT (Technical Committee for IMS Network Testing)
- TS 102 790 validated and published in March 2010
- Test system simulates using parallel components: User equipment, Application Servers, different Call Session Control Functions and other IMS systems
- The System under test is an IMS implementation
- The following slide shows how TS and SUT interact

Interconnection of TS and SUT



Test System Architecture



Design decisions

- Develop the project in Java
- Use TTworkbench

- Rely on TTworkbench for Platform Adapter implementation
- Develop the System adapter using open source framework

- Develop a generic codec for text based protocols (companion presentation at this conference)

Platform Adapter

- Platform adapter functions that need to be implemented in a test platform:
  - Timer related functions: Start, stop, read timer， Enquiry timer status，Generate timeout events
  - TTCN-3 external functions used in the test suite
- Since TTworkbench integrates all the timer operations, GO4ITC decided to use them

System Adapter

- Apache MINA was used to implement System adapter functions
- Apache MINA (see http://mina.apache.org/) is a network application framework
  - Helps users develop high performance and high scalability network applications easily.
  - It is an · event-driven · asynchronous API over various transports such as TCP/IP and UDP/IP via Java NIO.
- TRI function implementations
  - Use Apache MINA for handling UDP and TCP traffic
  - Messages received from MINA need to be unpacked or reassembled before delivery to TTCN-3 layer

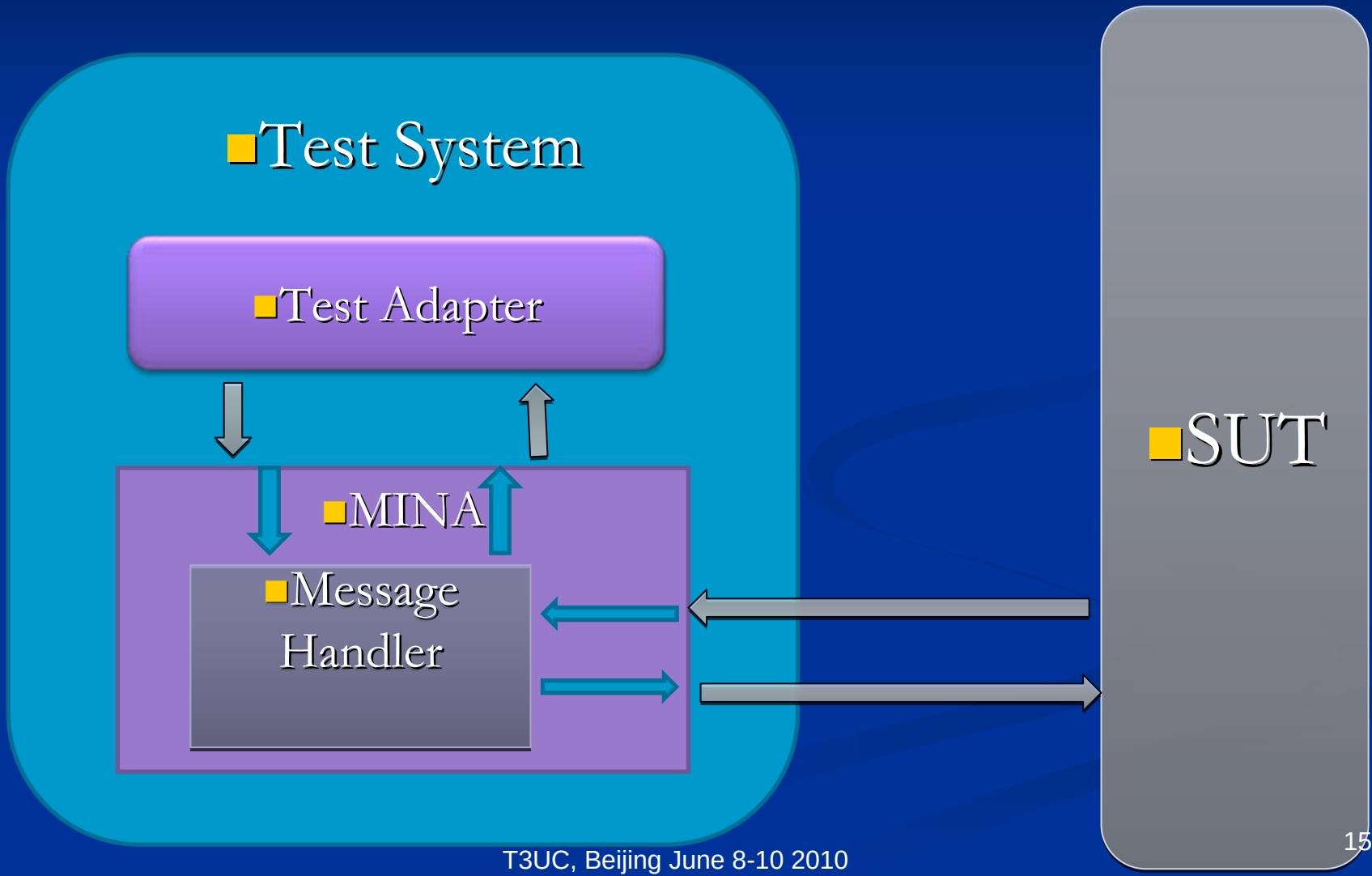
Testing the developed code

- Two approaches used
  - Java based testing
  - TTCN-3 based testing
- Java unit Testing
  - The objective is to mix the development of Java code with immediate testing
  - Small pieces of Java code – single class or even a separate method – are tested before integrating new code into larger components.
  - The project used JUnit framework for Java unit testing
  - The project used eclEmma code coverage tool to estimate testing quality.

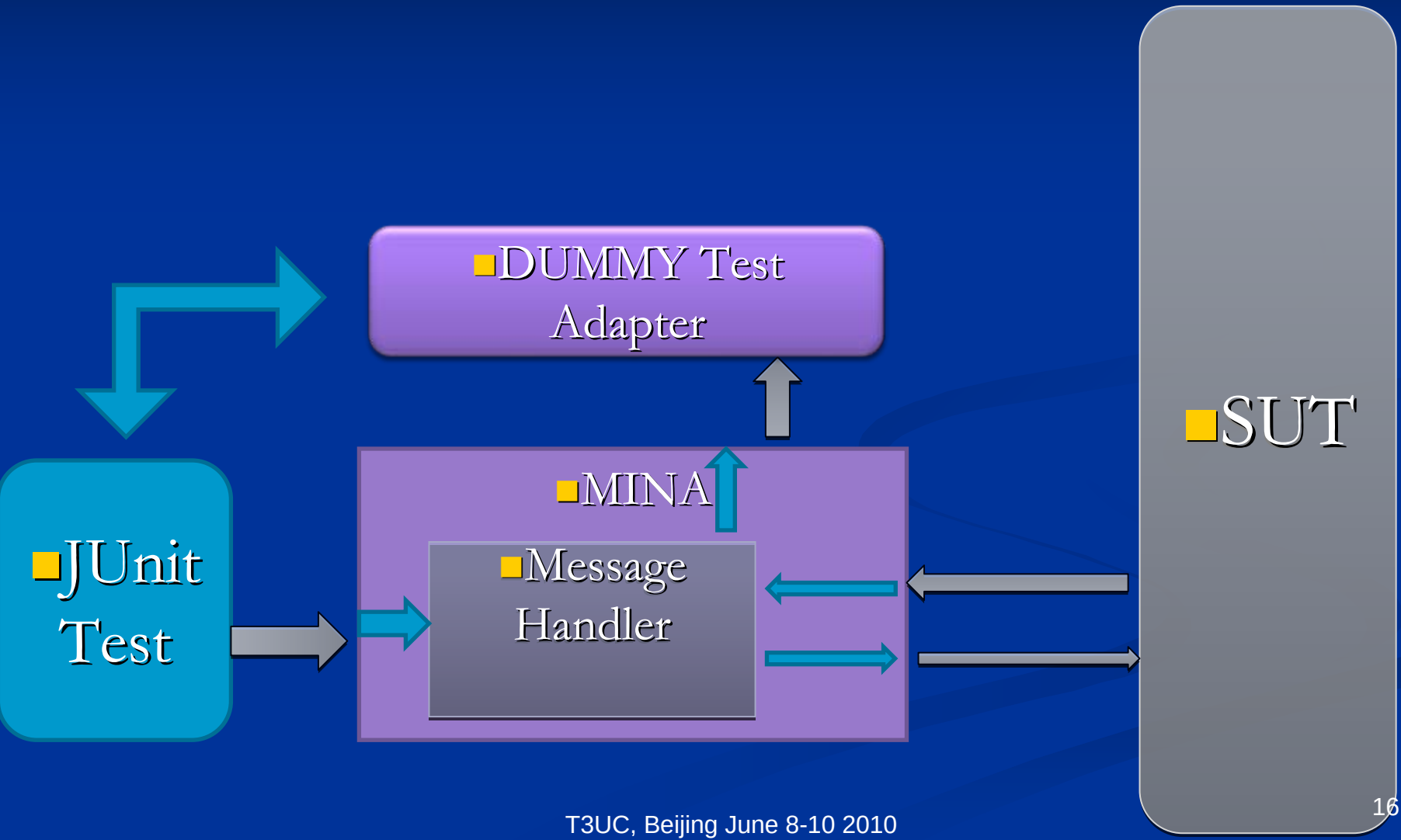
Java testing of external functions

- JUnit tests of a class are possibly provided when the class is independent of TTWB runtime
- The class that called by the tool when external function is invoked must be TTWB dependent, so we implement some classes which are TTWB independent for testing

When integrated in the test system, JUnit testing not possible



JUnit Test for Sending and Receiving Messages



TTCN-3 Testing of TRI function implementation

- TTCN-3 can be used to check that TRI functions are correctly implemented.
- The basic concept is to define additional external functions that will be used only for testing the TRI implementation.
- Such functions query internal state of test adapter and provide this information to a TTCN-3 Test Case.
- Some TRI operations cannot be tested in this way as they do not return the control to TTCN-3 code (stopping the test case and similar)

GO4IT China Project Results

- IMS/SIP test tool developed
  - System adapter
  - Platform adapter
  - IMS/SIP codec
- Robust testing of developed components
- Validation of the test tool
  - Efforts are in progress to secure a validation SUT
- TMC capabilities to develop own test platforms enhanced
- International team achieved good working spirit and answered to the challenges of the project

Technical conclusions

- Use of Apache MINA
  - Accelerated the System Adapter development
  - Removed the need of stand-alone testing of functions implemented by Apache MINA
  - Will facilitate maintenance – continued use of open source as it evolves
  - Using most appropriate Apache MINA facilities correctly did pose some problems initially
  - Apache MINA offers more than required in this project
- Java as the development language
  - Productive development environment
  - No insight into performance at the time of submitting the presentation

Technical conclusions (cont.)

- Testing the developed code
  - Initial testing with JUnit essential for robust development
  - Easy to use
  - Specific solutions required to isolate the code from dependencies of a particular run time environment
  - TTCN-3 testing of system adapter TRI function implementations used where possible and gave good insight into the functioning of the adapter code fully integrated with the specific run-time environment
- Validation of the test tool
  - Results to be reported at the conference if accomplished in time

Thanks for your attention!
Any Questions?

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