ERICSSON

TTCN-3 Test Environment in IPv6 Test

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Outline

- Who are we
- What is TTCN-3
- TTCN-3 compiler
- TTCN-3 example
- Test Configuration
- Test Suite Development Process
- Current Status

Our aims

- Competence center for conformance and interoperability testing
- Formal methods for protocol specification and testing (SDL, TTCN version 3, CATG)
- Functional and performance testing
- Test methodology of software testing
- Tester prototype development for different types of testing

Our activities

- Branch of Ericsson Research
- Tool (prototype) development for
  - TTCN-3 compiler
  - performance feature test
  - etc.
- Investigating test methodologies
  - TTCN-2 to TTCN-3 conversion
- Test Suite writing in TTCN for testing protocol implementations
  - for Ericsson needs (IPv6, IPv6/v4 transition, MIB conformance)
  - for standardization

TTCN-3

- Tree and Tabular Combined Notation 3 (ETSI standard)
- TTCN-3 supports new areas of testing
  - performance & integration testing
  - stability & stress test
- Powerful, flexible and protocol/platform independent
- Can be viewed in various presentation formats
  - text (easy to read and understand)
  - tabular format (like TTCN-2)
  - graphical format (Message Sequence Chart)
  - possible to add other standardized formats

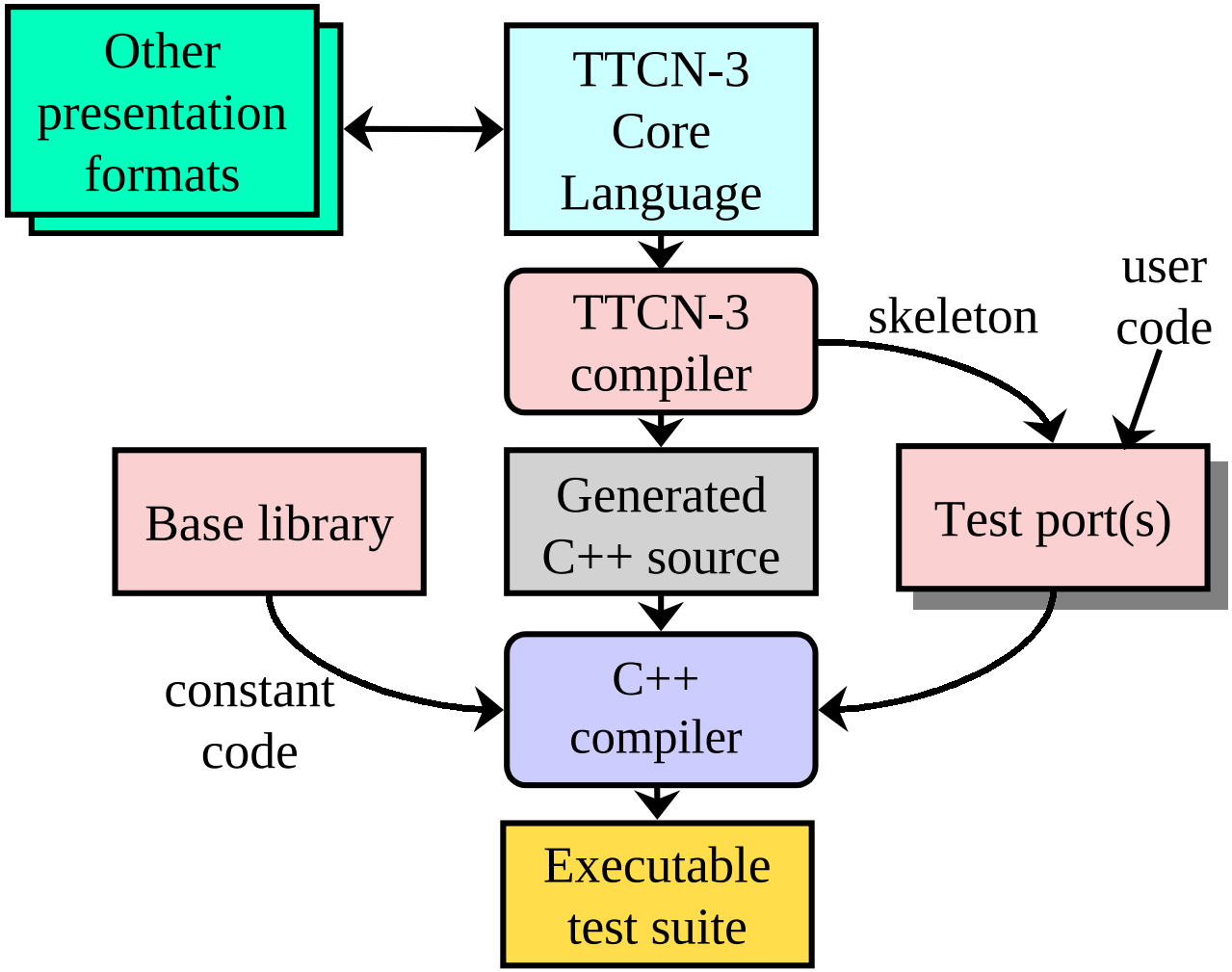
Main capabilities of TTCN-3

- **Designed specifically for testing**
  - **Dynamic concurrent testing configurations**
  - **Various communication mechanisms (synch and asynch)**
  - **Data and signature templates with powerful matching mechanisms**
  - **Specification of encoding information**
  - **Display user-defined attributes**
  - **Test suite parameterization**
  - **Test case control and selection mechanisms**
  - **Assignment and handling of test verdicts**
  - **Harmonized with ASN.1**
  - **Different presentation formats**
  - **Well-defined syntax, static semantics and operational semantics**

Development of a TTCN-3 compiler

- Creating a parser for TTCN-3 from the BNF
  - Using GNU flex and bison
  - Finding and correcting errors in BNF and reporting to ETSI
  - Resolving grammar conflicts
- System architecture design
  - Single step cross compilation to C++
  - No interpretation
  - Still without semantic analysis
- Implementation of the basic run-time environment
  - Basic data types & operations
- Adding code generation functions to the parser

Structure of the test executor



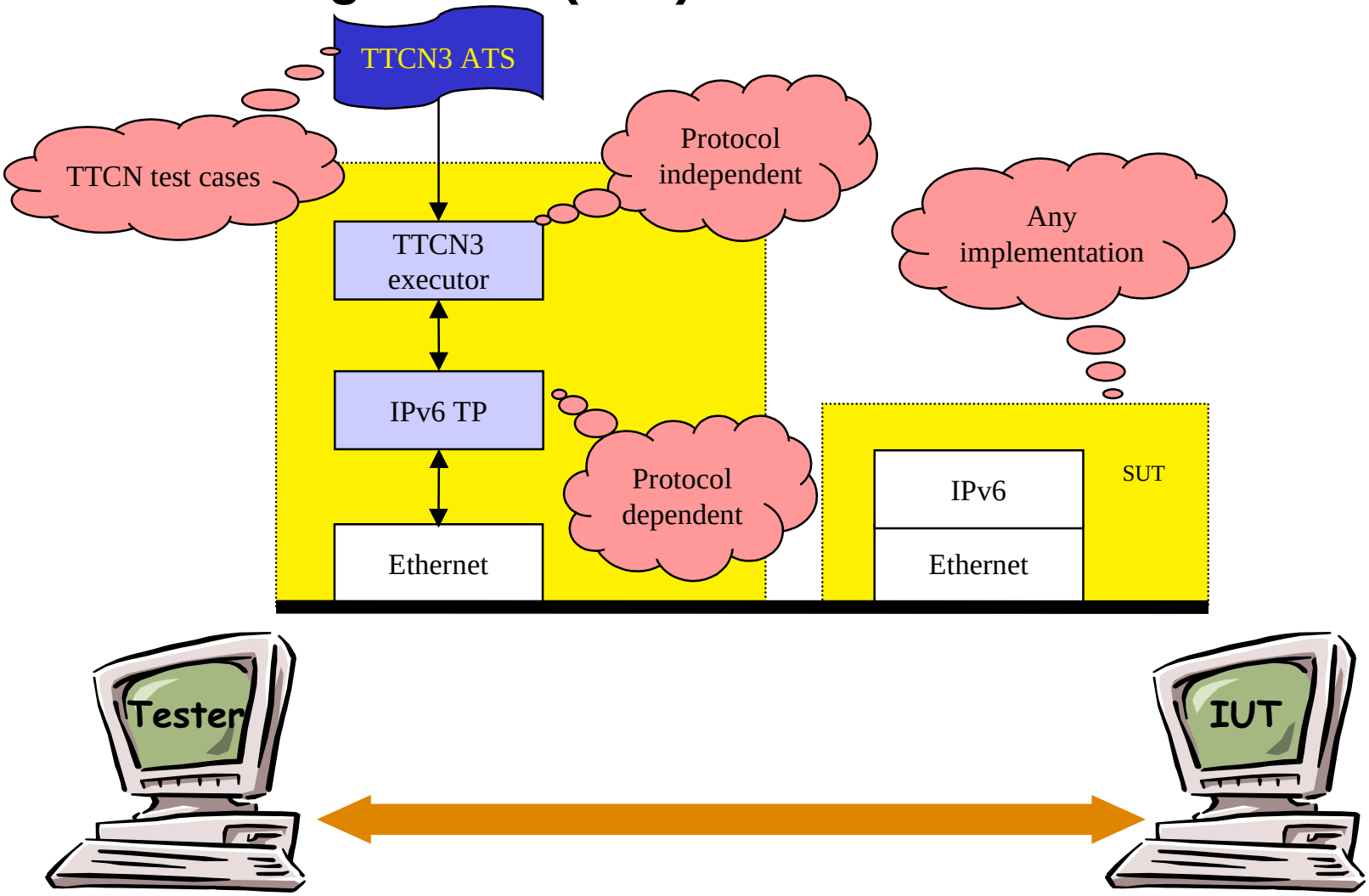
Test Suite in TTCN-3: Hello, world!

```
module MyExample
{
  type port   PCOType       message
   {
    inout      charstring
   }

  type component     MTCType
   {
    PCOType    MyPCO
   }
```

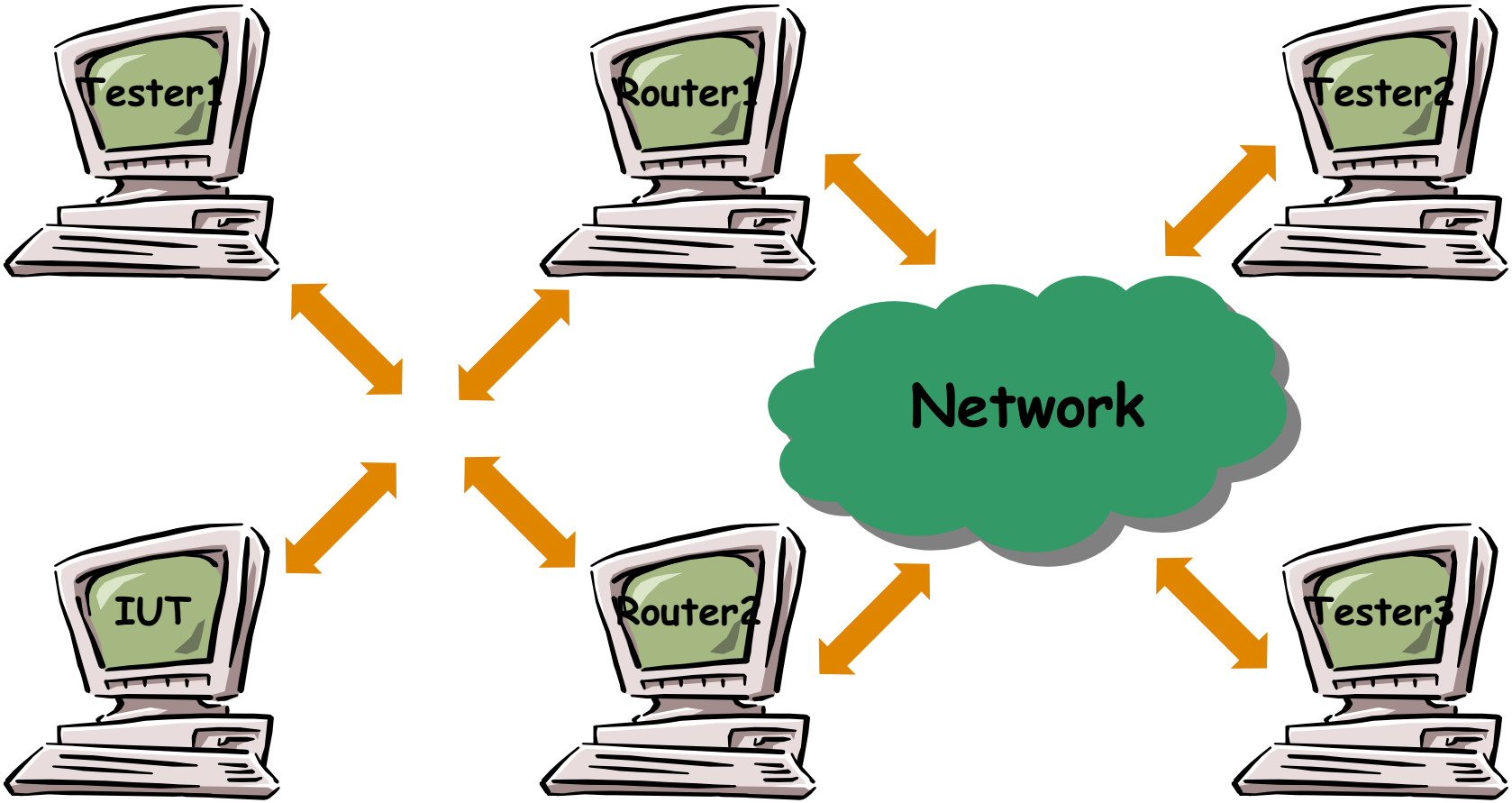
Test Suite in TTCN-3: Hello, world!

```
testcase     HelloW()     runs on MTCType
 {
  MyPCO.start;
  MyPCO.send ( "Hello, world!" );
  verdict.set ( pass );
  MyPCO.stop;
 }

 control
 {
  HelloW();
 }
}
```

Test configuration (real)



Test configuration (simulated)



Features of conformance testing

- ✓ Laboratory environment
- ✓ Black box method
- ✓ Repeatable and reliable tests
- ✓ Automatic execution
- ✓ Easy to trigger possible (or known) errors
- ✓ No need for trace analysis
- ! Not about certification
- ! Extension to interoperability test

Test Suite development

- Protocol Specification
  - RFC
  - Standard
  - etc.
- Requirement Specification
  - What to test
  - Based on protocol specification
- Test Purposes
  - How to test
  - Textual format
- Test Suite in TTCN-3

Mobile IPv6

- **Correspondent node (19)**
  - Valid and erroneous Binding Updates
  - Handling of Binding Cache
  - Usage of Routing Header
- **Home agent (31)**
  - Home Agent Address Discovery
  - Primary Care-of-address registration and deregistration
  - Handling of tunnelled packets
- **Mobile node (25)**
  - Home Agent Address Discovery
  - Primary Care-of-address registration and deregistration
  - Movement Detection
  - Processing of tunnelled packets, BAs and RAs

Current status

- Test environment:
  - TTCN-3 compiler
  - Test Ports
- Test Suites:
  - IPv6
  - Mobile IPv6
  - SIP
  - OSPFv2
  - IPv4/v6 transition
- Types of testing:
  - conformance
  - performance
  - interoperability

- Demonstration on IPv6 Summit, Birmingham, 05/2000 (organized by IPv6 Forum)
- Demonstration on 8th Internet Days, Stockholm, 06/2000
- Providing conformance testing services on IPv6 Bake-off in ETSI, Sophia Antipolis, 10/2000
- Tool demonstration on TTCN-3 Launch
- Connectathon 2001