

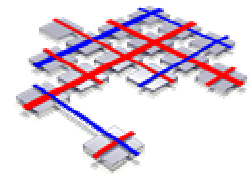
TTCN-3: Key Features for Protocol Tests

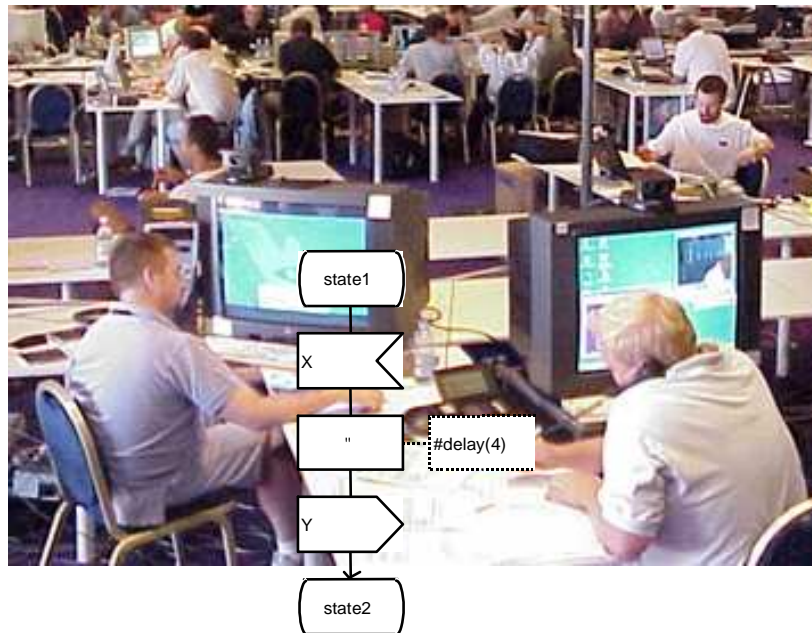
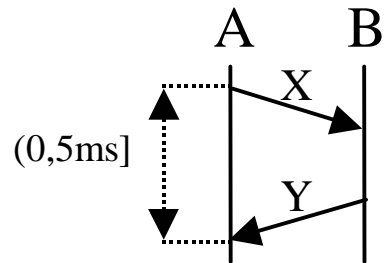
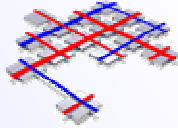
Dieter Hogrefe

Chairman ETSI TC Methods for Testing and Specification (MTS)



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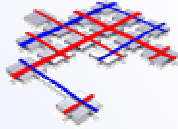


A.send(X); myT.start(5E-3);

alt { [] A.receive(Y); ...

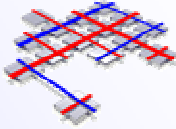
 [] myT.timeout; ... }

...



Peculiarities of Communication Software (Protocols) vs. other types Software

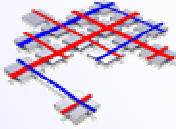
- 1) Establishment of states (connection, interface, process) -> state oriented modelling
- 2) Precisely defined and standardized message formats
- 3) The software has to interwork with a large amount of (unknown) implementations
- 4) Distribution



Consequences from the peculiarities

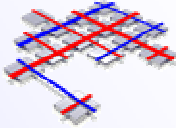
- 1) Existence of detailed specifications (Internet Draft, ETSI Standard, ITU-T Standard, Proprietary, ...) Base Standards and Test Specifications
- 2) Specialized (state oriented) specification languages and methods have been developed
- 3) Testing against reference implementations (protocol testers)
- 4) Testing by Interop events, e.g. IPv6 Event, Mandelieu, 23-27 Sep.





Specialized specification languages, methods and tools

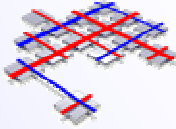
- 1) Languages:
SDL, MSC, TTCN, ASN.1
- 2) Methods:
 - State based modelling
 - State based verification (e.g. state space exploration)
 - Systematic test case development based on specialized methodology (ISO 9646, UIO, ...)
- 3) Tools:
Telelogic TAU, Solinet SAFIRE, DANET, DaVinci, TestingTech,
...



Testing Language **TTCN-3**

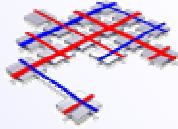
<http://www.etsi.org/ptcc/ptccttcn3.htm>

- Testing and Test Control Notation
- **Versions 1 and 2** developed by ISO SC21 WG3 (1984 - 1997) as part of the widely-used ISO/IEC 9646 conformance testing standard
 - **ISO/IEC 9646-3** (edition 2) and **ITU-T X.292**
- **Version 3** developed by ETSI TC MTS (1998 - 2000)
 - Specialist Task Forces **STF 133 & STF 156**



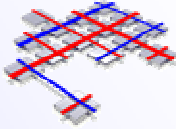
Testing Language **TTCN-3**

- One test notation for many testing applications
- Cheaper education and training costs
- Facilitates the application of a common methodology
- Easier maintenance of test suites
- Off-the-shelf tools
- Universally understood syntax and operational semantics
- Tests concentrate on the meaning of the test
- Constant maintenance of the language



Motivation for developing **TTCN-3**

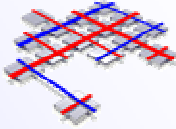
- Modernization
 - **technology has changed** since TTCN was first developed
- Wider scope of application
 - should be applicable to **many kinds of test applications** not just conformance (development, system, integration, iop ...)
- Harmonization
 - should be the **first choice** for test specifiers, implementors and users both for standardized test suites ...
 - ... and as a **generic solution** in industrial product development



Testing Language **TTCN-3**

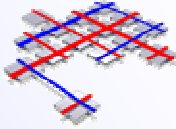
– Kinds of testing to which TTCN-3 could be applied

- - Conformance
- - Configuration
- - Performance
- - Robustness
- - Functional
- - Reliability
- - Scalability
- - Unit
- - Development
- - Interface
- Interoperability
- Compatibility
- Stress
- Integration
- Load
- Fault tolerance
- Degraded mode
- Product
- Design
- System



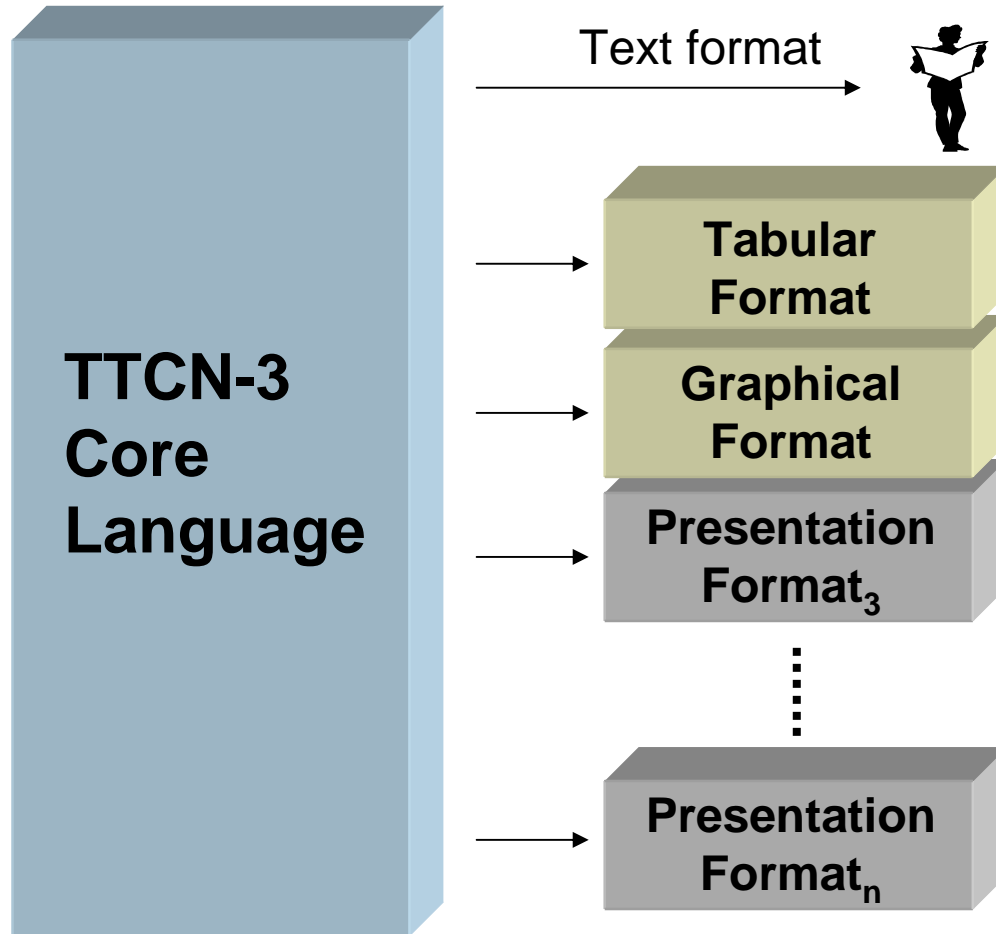
Main Capabilities of **TTCN-3**

- Dynamic **concurrent testing** configurations
- Various **communication mechanisms** (synch and asynch)
- Data and signature **templates** with powerful **matching mechanisms**
- Specification of **encoding information**
- Display and 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**

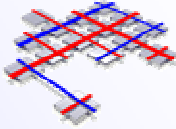


Core Language

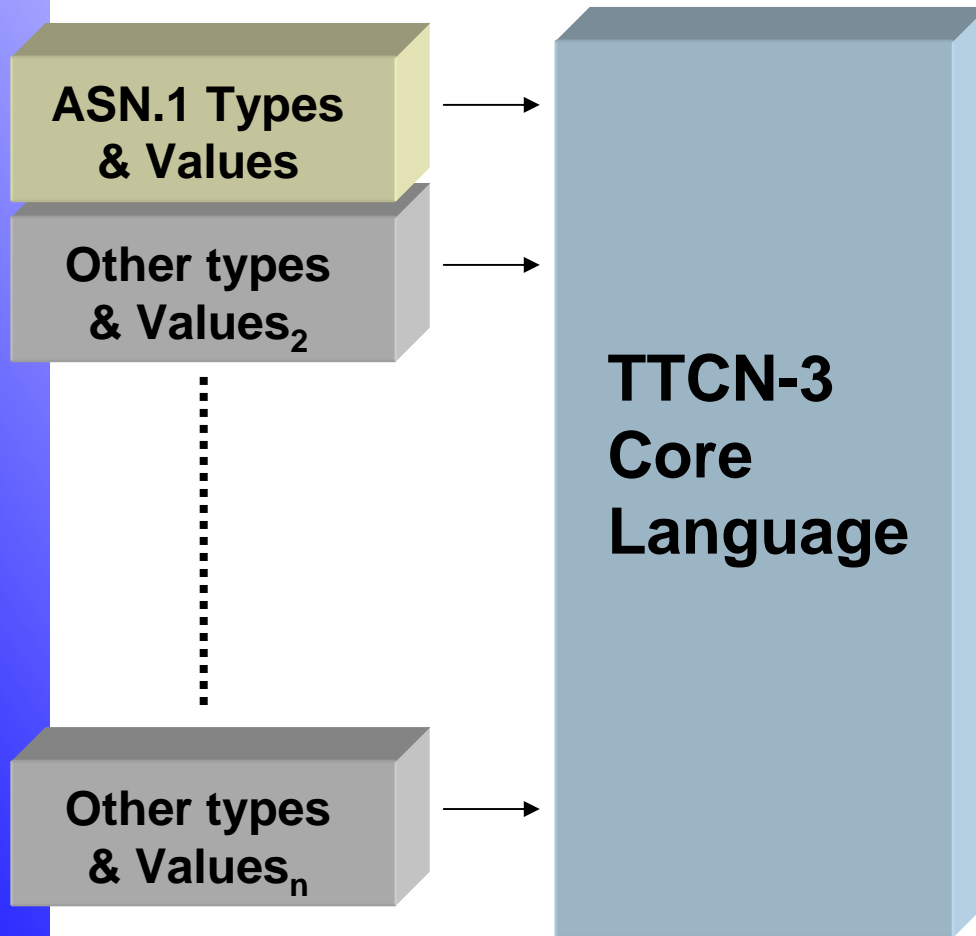
TTCN-3



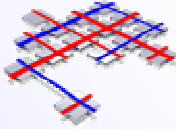
- Core format is a text based language
- Core can be viewed as text or in various presentation formats
- Tabular format for conformance testing
- Graphical format for visual overview
- Other standardized formats in the future
- Proprietary formats



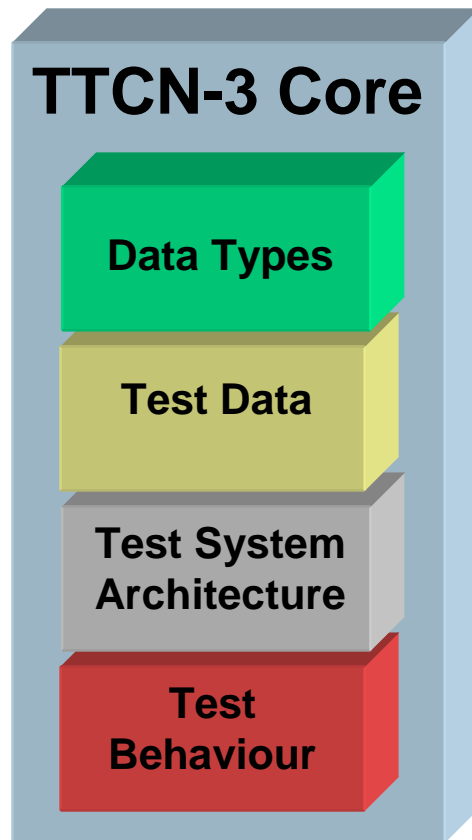
Use with other Languages **TTCN-3**



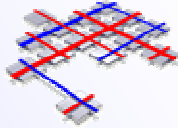
- TTCN can be integrated with other 'type and value' systems
- Fully harmonized with ASN.1 (1997)
- Harmonization possible with other type and value systems (possibly from proprietary languages)



Major Elements of **TTCN-3**

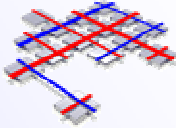


- Built-in and user-defined generic data types (e.g., to define messages, service primitives, information elements, PDUs)
- Actual test data transmitted/received during testing
- Definition of the components and communication ports that are used to build various testing configurations
- Specification of the dynamic test system behaviour



Example Core (Text) **TTCN-3**

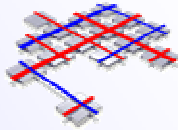
```
function PO49901(integer FL) runs on MyMTC
{
  L0.send(A_RL3(FL,CREF1,16));
  TAC.start;
  alt {
    [] L0.receive(A_RC1((FL+1) mod 2)) {
      TAC.cancel;
      verdict.set(pass)
    }
    [] TAC.timeout {
      verdict.set(inconc)
    }
    [] any.receive {
      verdict.set(fail)
    }
  }
  END_PTC1() // postamble as function call
}
```



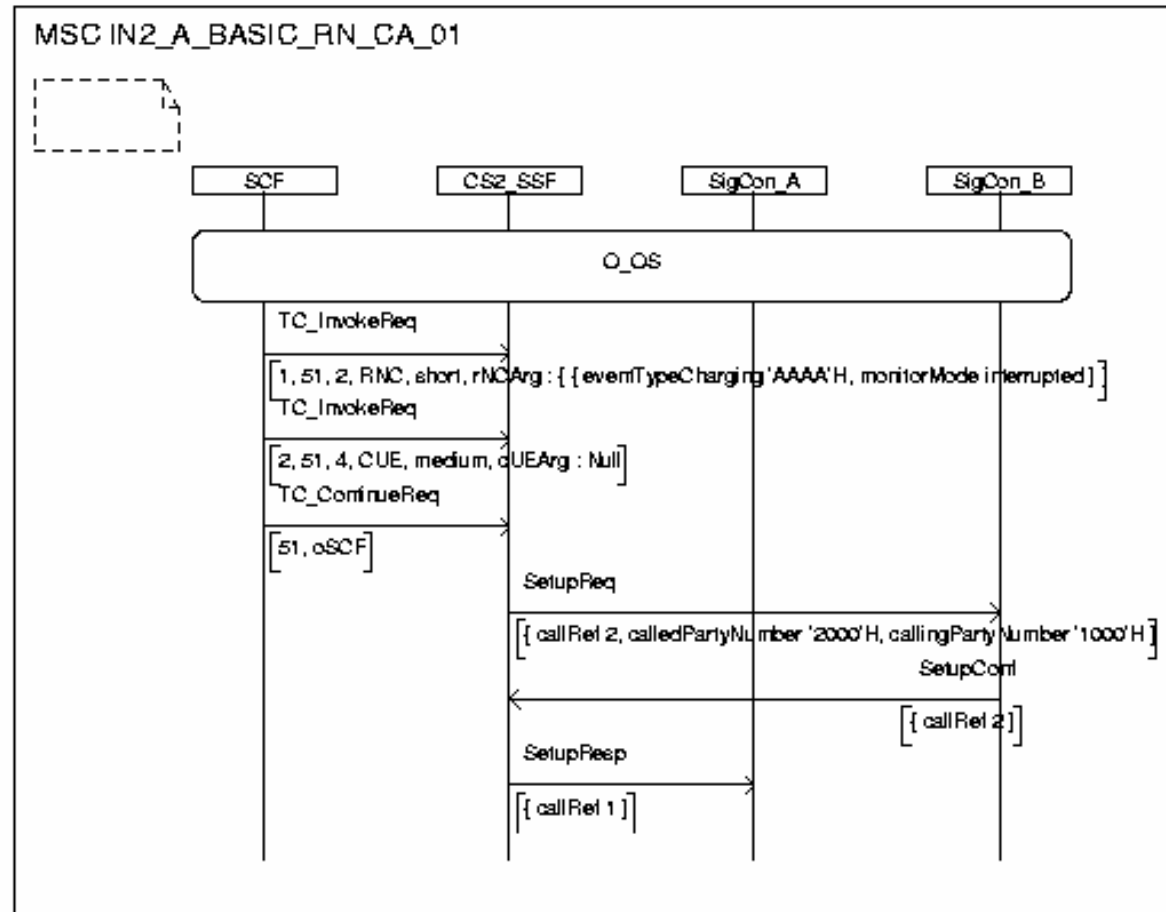
Example Tabular

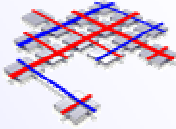


Test Case Definition			
Name	: MyTestcase		
Group	:		
Purpose	: Example Testcase		
System I/f	:		
MTC Type	: MyComponentType		
Comments	:		
Name	Type	Initial Value	Comments
MyVar	INTEGER	0	
Behaviour Definition			Comments
<pre>alt { [] MyPort.receive(Msg); [] : }</pre>			
DetailedComments:			



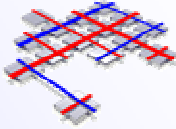
Example Graphical





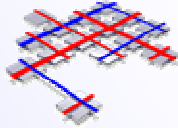
Use of **TTCN-3** for XML Tests

- Open Settlement Protocol (OSP)
 - EP TIPHON XML-based protocol
 - use TTCN-3 Core Language

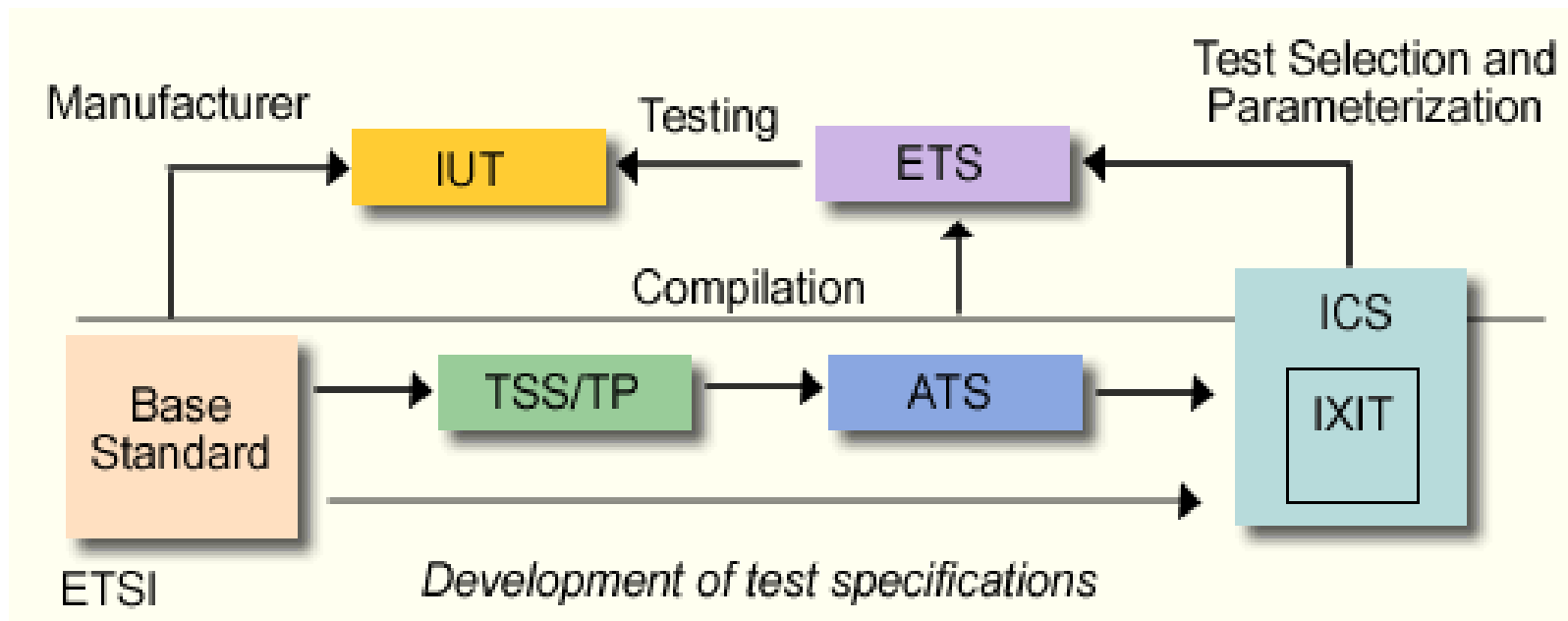


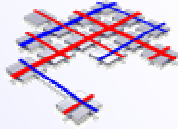
Use of **TTCN-3** for SIP Tests

- IETF Session Initiation Protocol (SIP)
 - EP TIPHON SIP Profile
 - mainly telephony aspects (SIP-T)
- Work was done by STF196 in EP TIPHON
 - Nokia, Ericsson, GMD Fokus (Testing Tech), ACACIA, FSCOM, GN Nettest
 - work finished in 2002
 - executable tests running
- TTCN-3 will be used by 3GPP for SIP tests in 2003

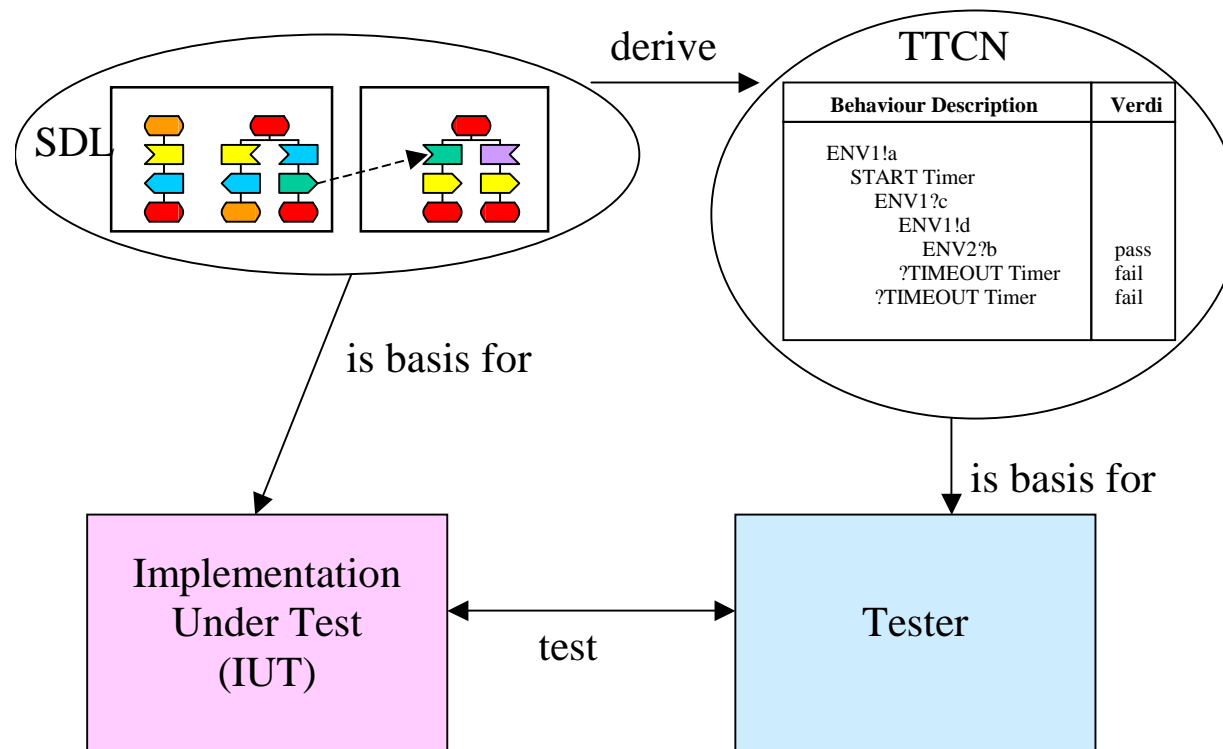


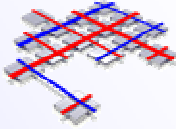
Methodology

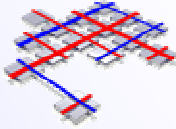




Methodology







Questions and Answers

