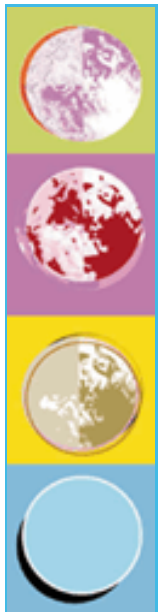


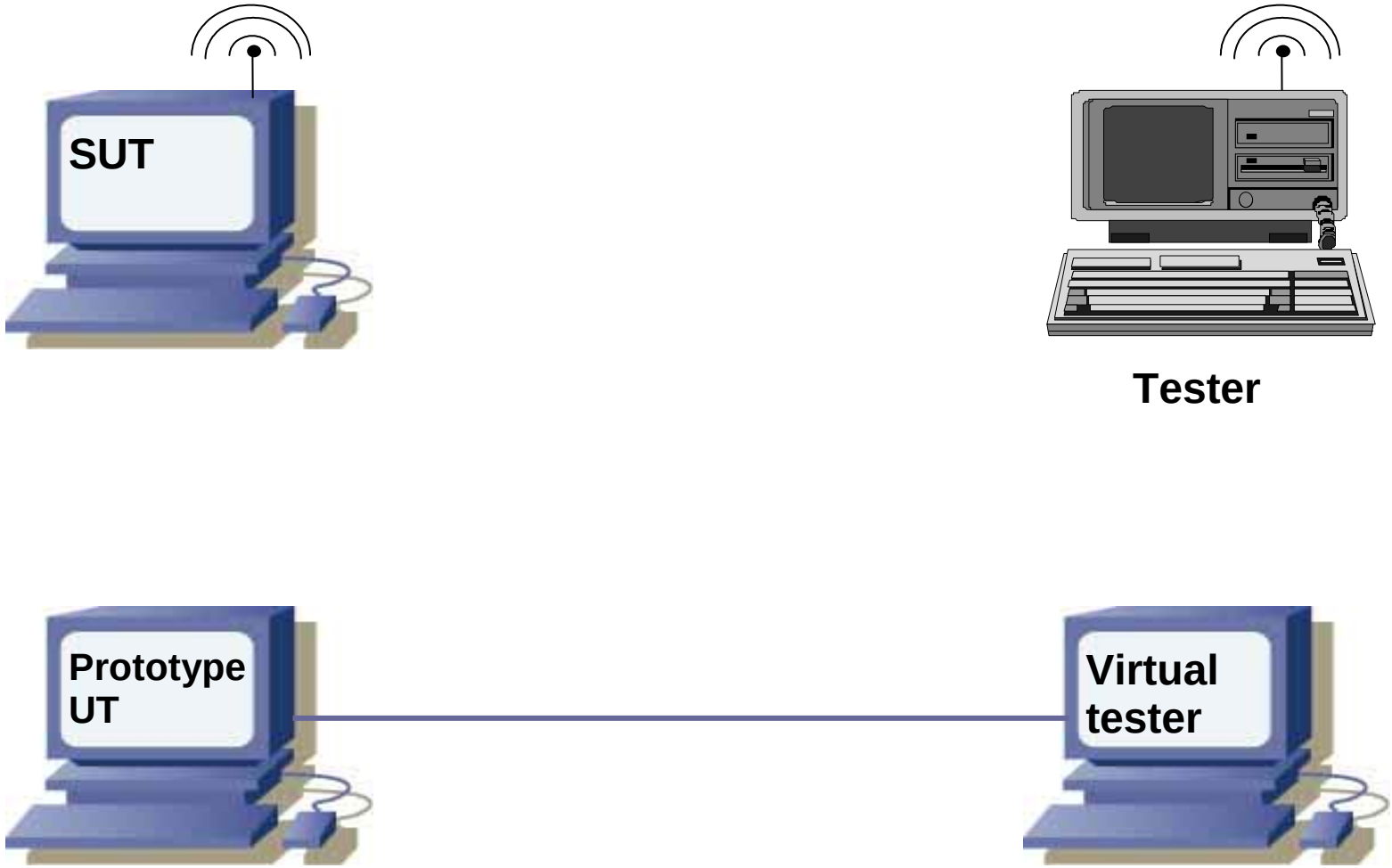
Standards for Business

Testing Wireless over Wire with TTCN-3

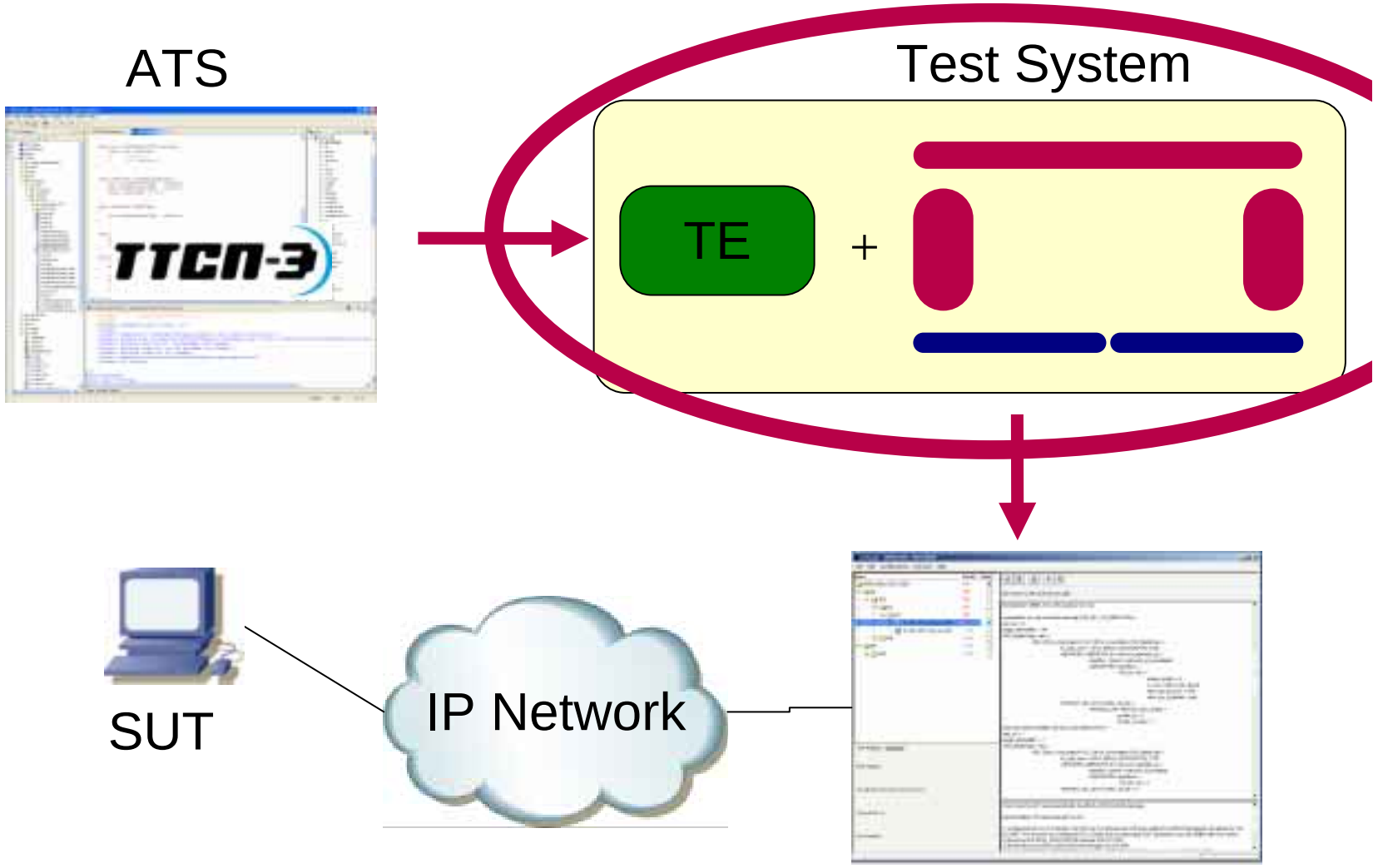
Milan Zoric, ETSI
Sebastian Müller, FSCOM
Scott Moseley, Farbum Scotus

1st TTCN-3 User Conference,
Sophia Antipolis, May 2004

Wireless over wire



Testing over the network

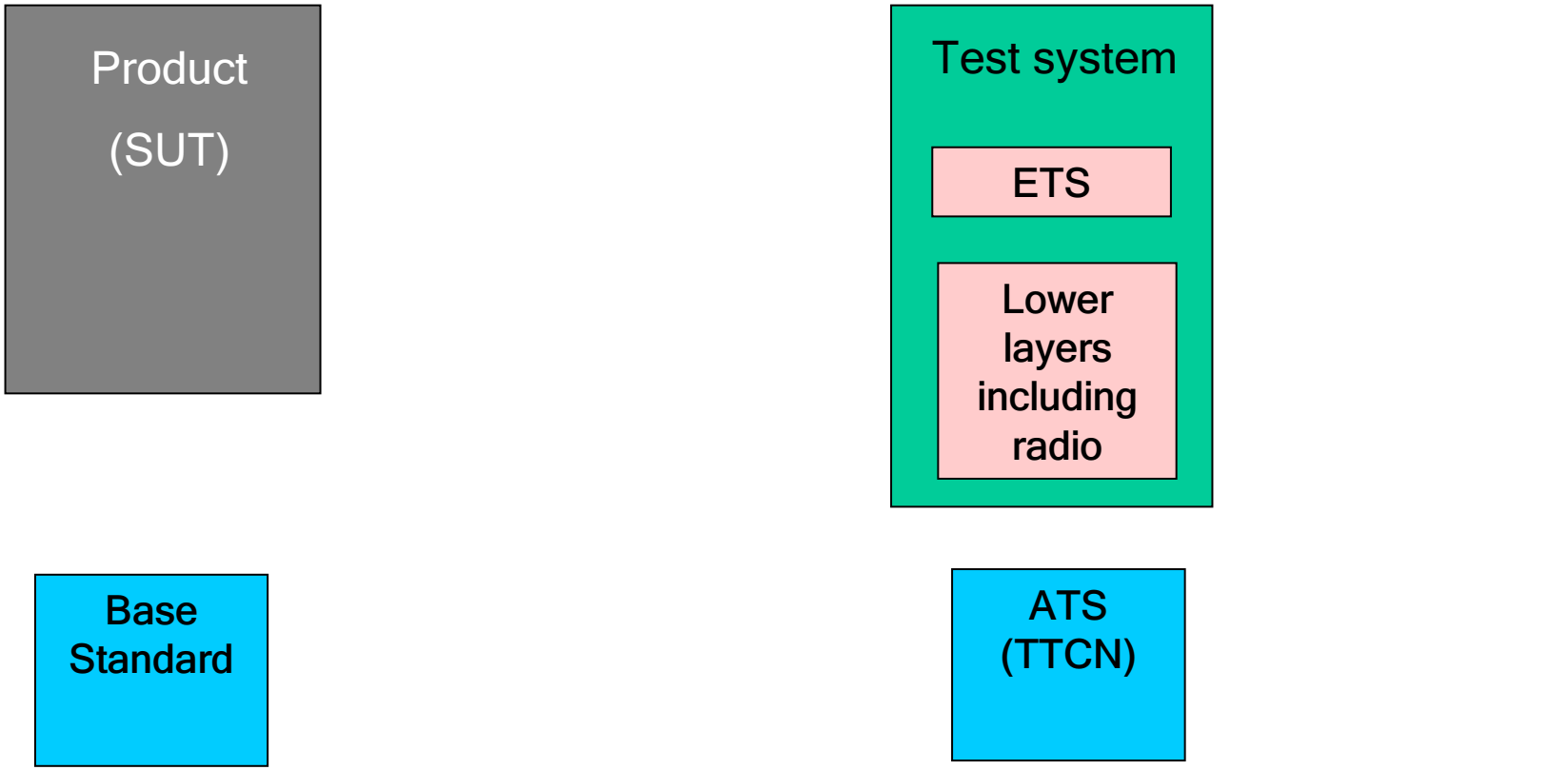


ETSI Has a Long History of Producing Test Specifications

- Conformance test specifications since early 90's
  - GSM, DECT, VB5, HiperLAN2, VoIP, ISDN, INAP, TETRA, IP Cablecom, 3GPP …
  - Moved from strict regulatory testing, with expensive and cumbersome 3rd party testing regimes to …
  - … lean test suites focusing on conformance for interoperability that are "extremely good value for money"
  - Strong demands for technologies that have earlier used other approaches (IP testing)
- Now also producing interoperability test specifications
  - SIP <-> H.323 interworking
- ETSI has unique resources related to testing
  - TC MTS, The PTCC, The Plugtests™ Service

Standards for Business

First challenge: start with multiple unstable components



More challenges

- The radio based test tool
  - May not be available at all
    - Commercial reasons
  - May become available late
    - Commercial and technical reasons
  - May be excessively expensive
    - Real costs combined with limited number of potential vendors

- Test suite validation
  - the process of assuring that the ATS not only passes through the compiler but also executes successfully
    - More expensive
      - done in the context of radio based test tool development
    - Possibly available later than desired
      - for in-house prototype debugging
      - for providing feedback and making corrections to a stadard

- Before testing against conformance test tools or other implementations, each company individually spends a lot on in-house testing/debugging schemes

The goals

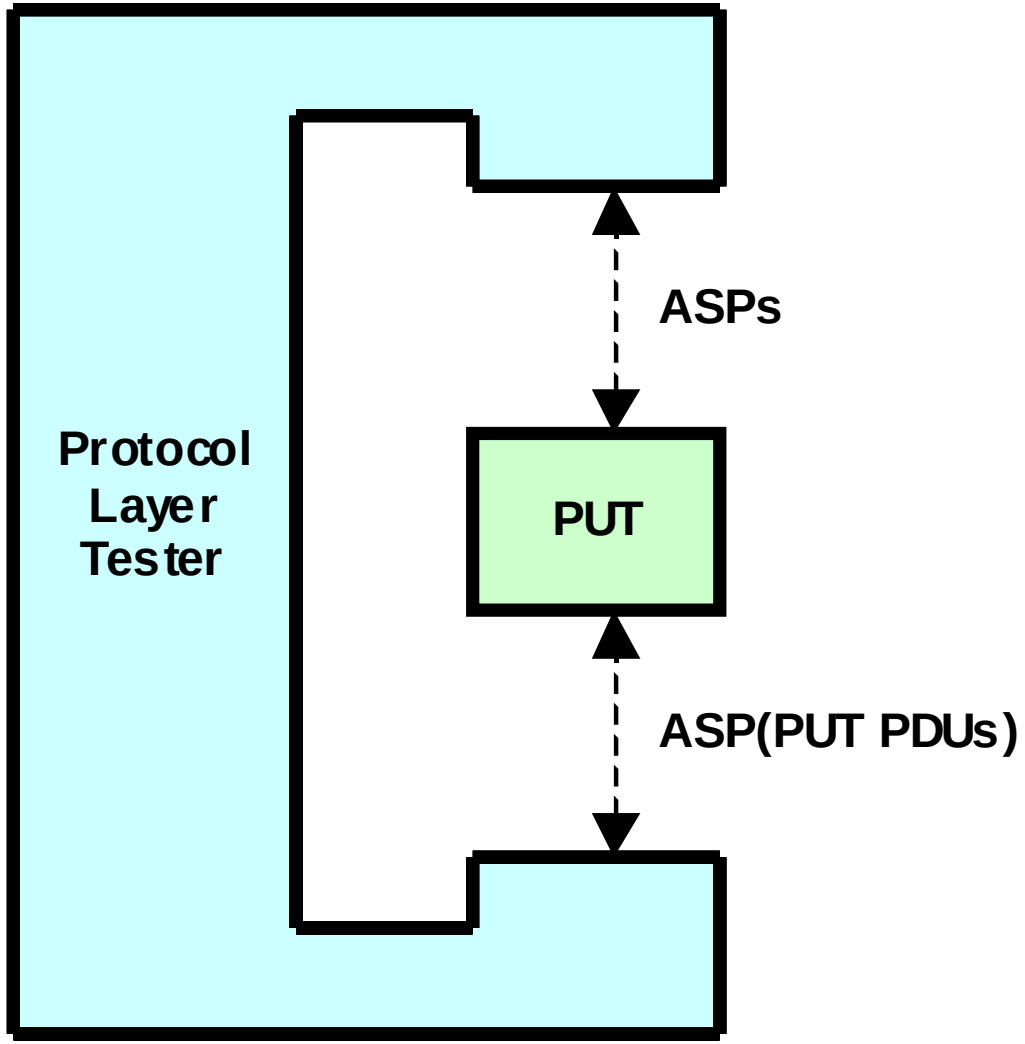
- Make test suite validation faster and cheaper
- Enable sharing of efforts (costs) in protocol conformance testing and company in-house testing/debugging
- Make product testing/certification available to all technologies with alternative solutions
  - Cheaper and faster development of radio based protocol test tools, or
  - Combination of some level of protocol conformance testing and interop events

Standards for Business

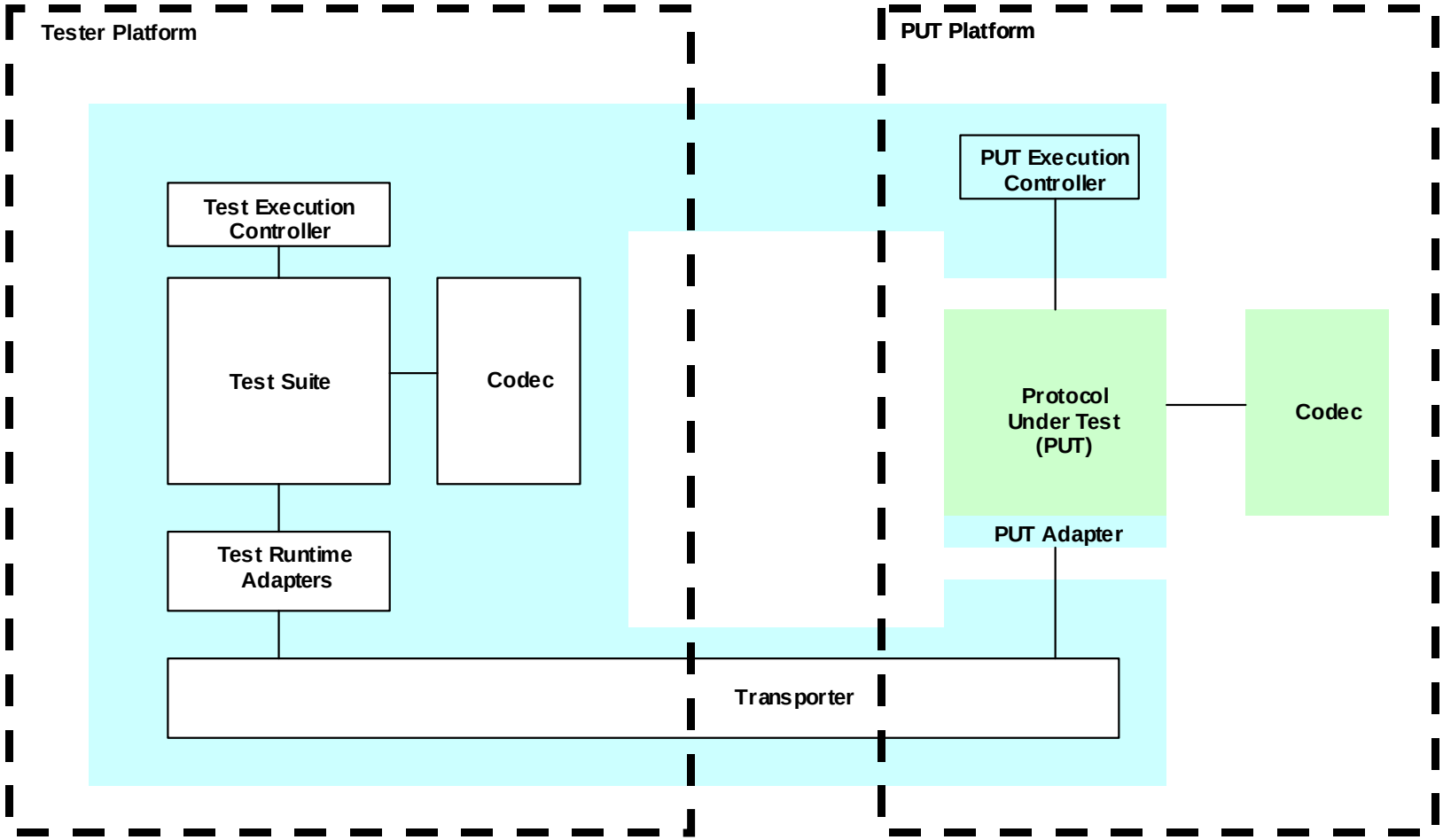
The implementation goals

- Definition of a test tool implementation framework
  - Abstract
    - Fits with ISO 9646 methodology and TTCN-3 language
  - Generic
    - Reusable for different protocols
    - Reusable for different transport mechanisms, including full radio based transport
  - Tool independent
    - Using standardized interfaces
  - Extensible
    - For modifications of the test suite and the implementation
- First virtual tester implementation
  - Modular
  - Easy to understand
  - Demonstrate feasibility of the approach
  - Maintainable

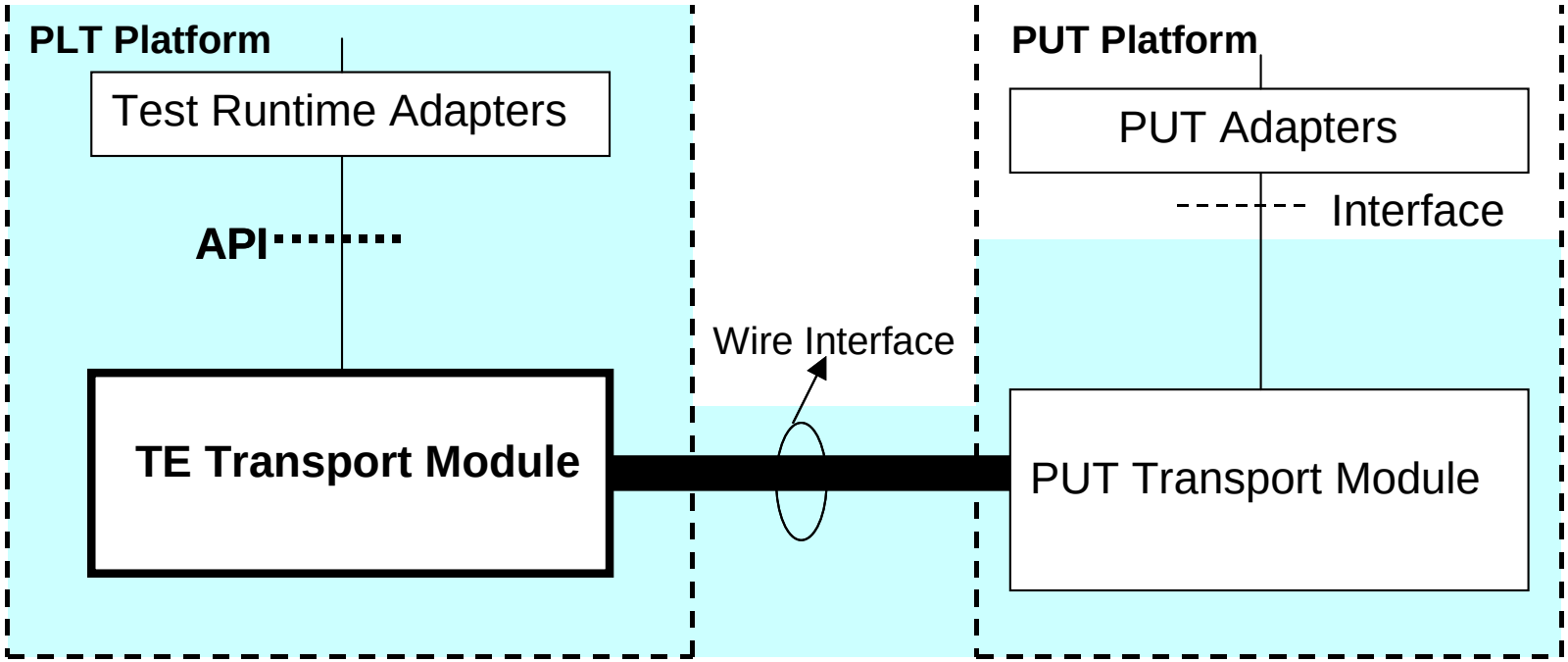
Protocol Layer Tester (PLT)



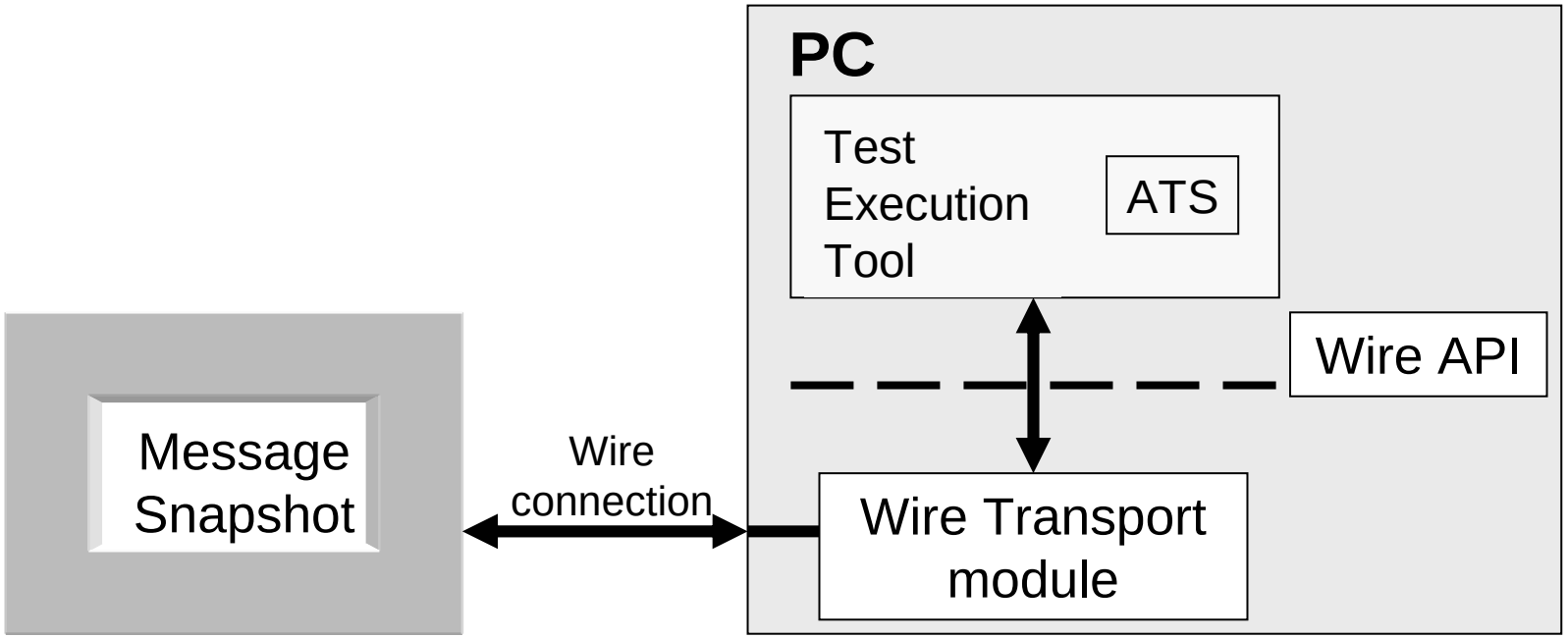
PLT and PUT Components



Transport mechanism

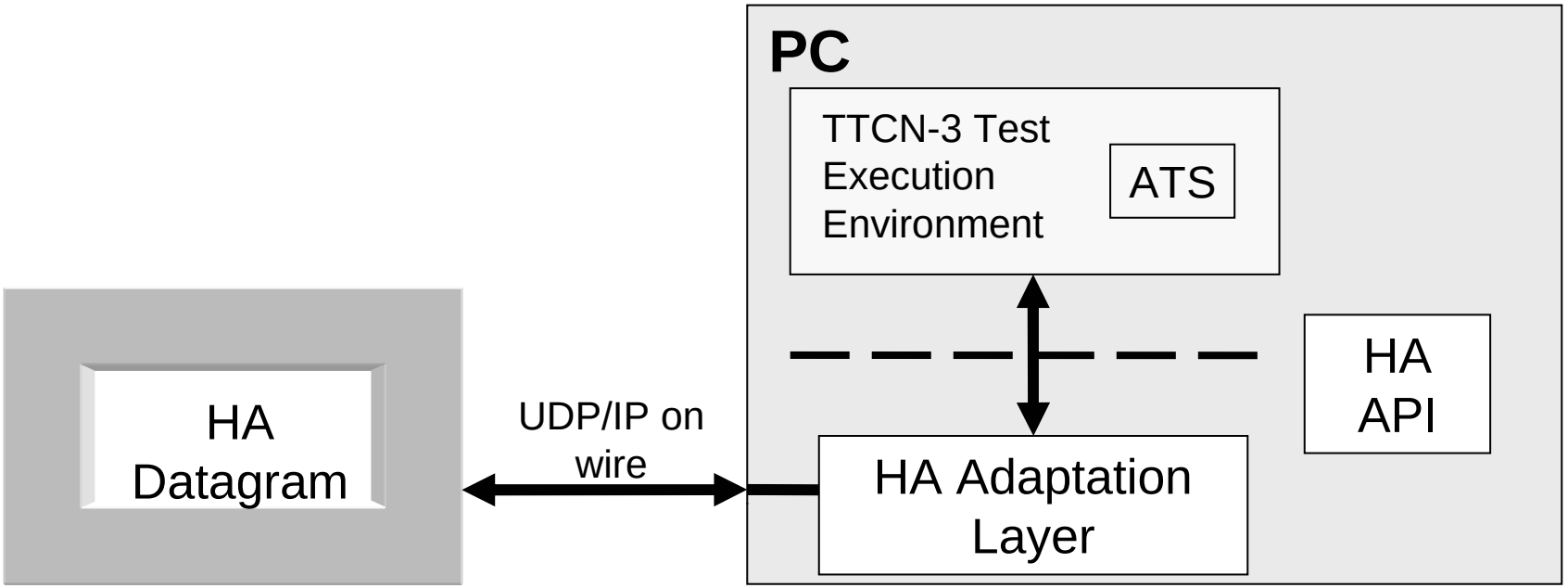


Generic wire based test tool



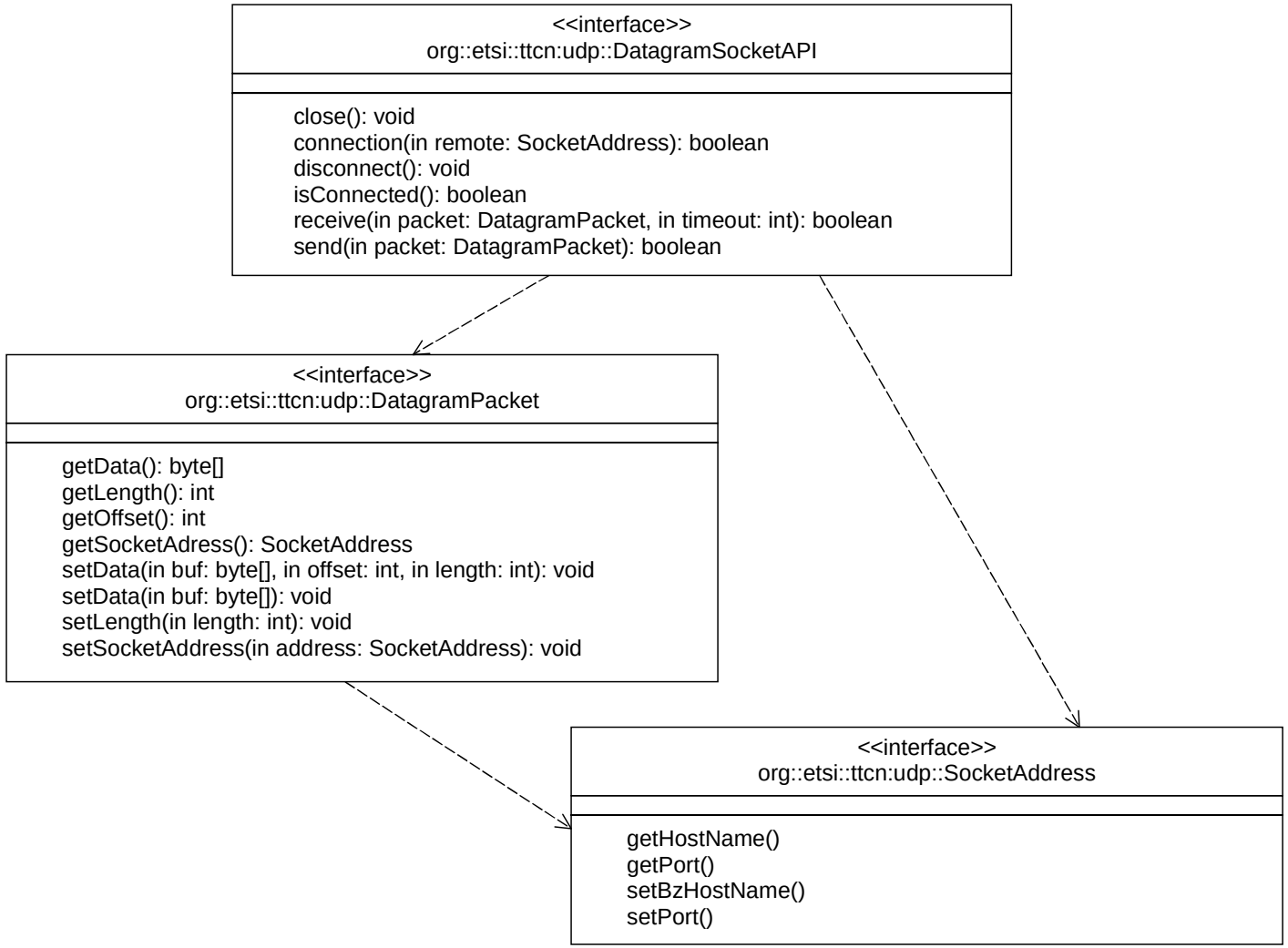
- Generic approach to message snapshot content
- Generic definition of the Application Programming Interface

Specific wire based test tool

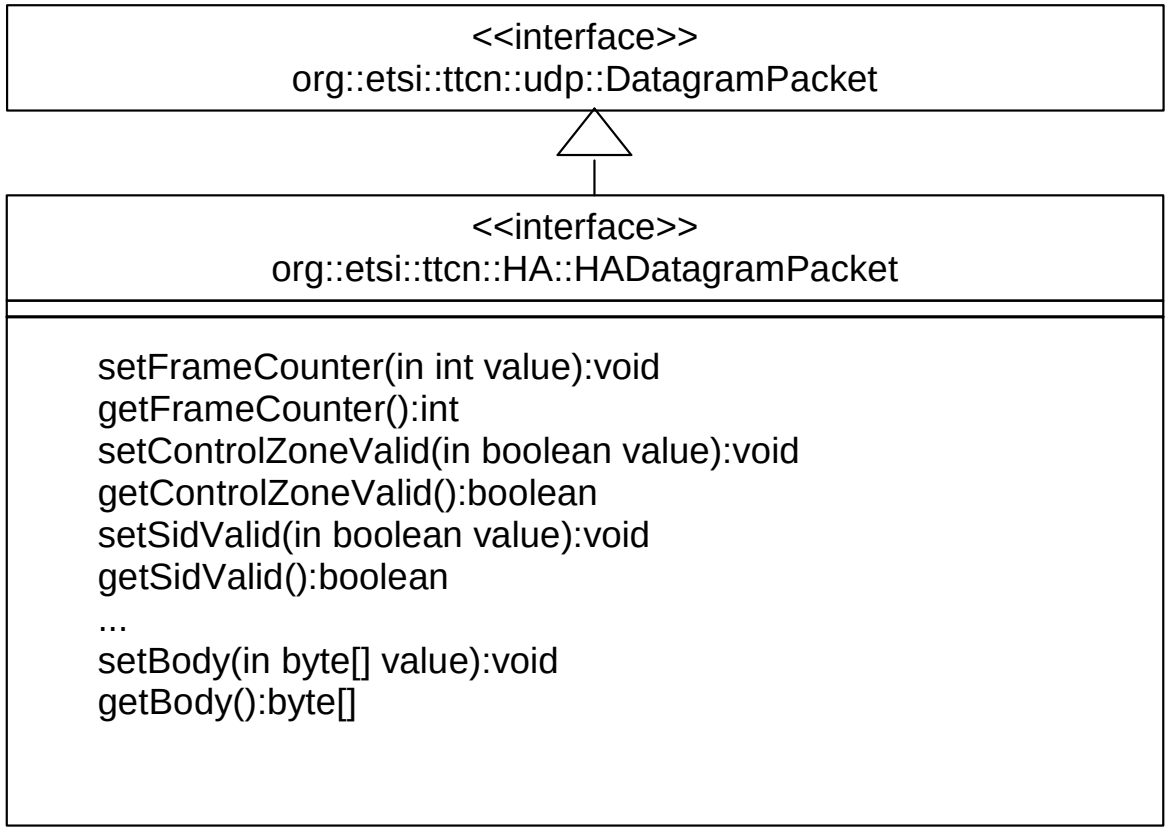


- HA specific message snapshot content
- HA specific Application Programming Interface

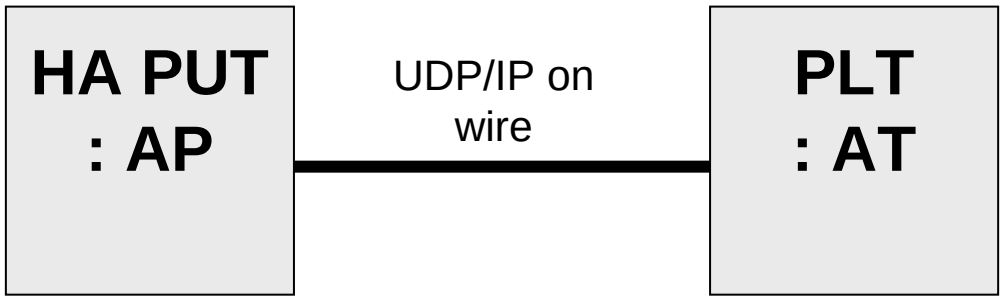
Generic API specification



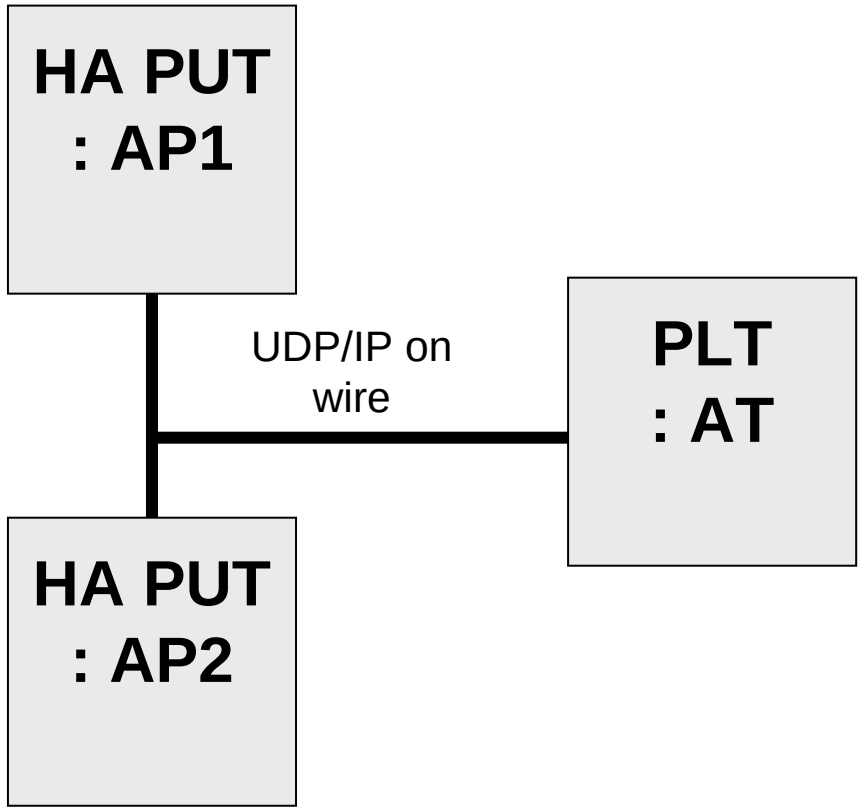
Specific API part



Testing one protocol entity



Testing multiple protocol entities

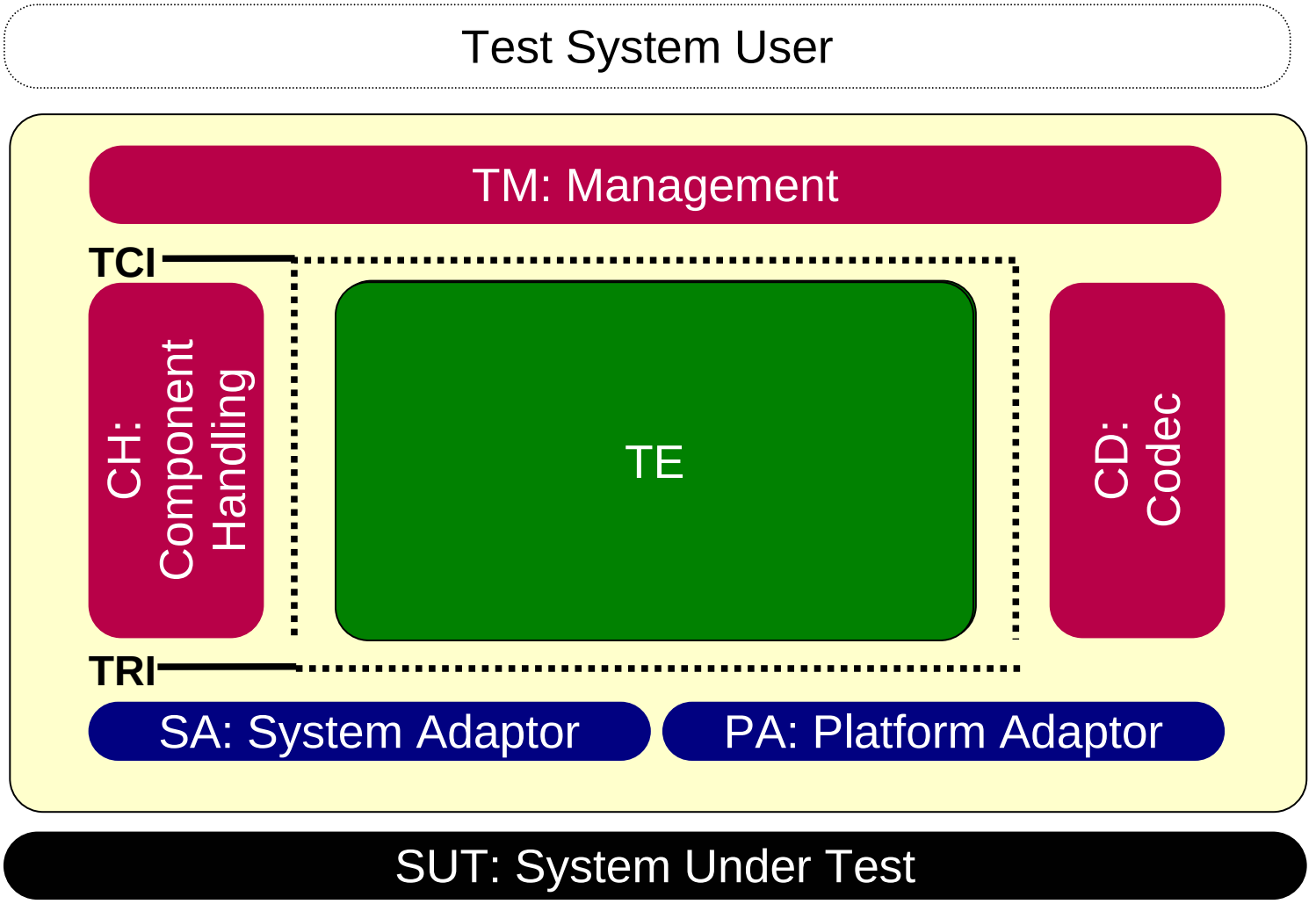


First use of the test system prototype

- Revealed
  - Errors in prototype implementation
  - Ambiguity in specification
  - Defects in Abstract Test Specification

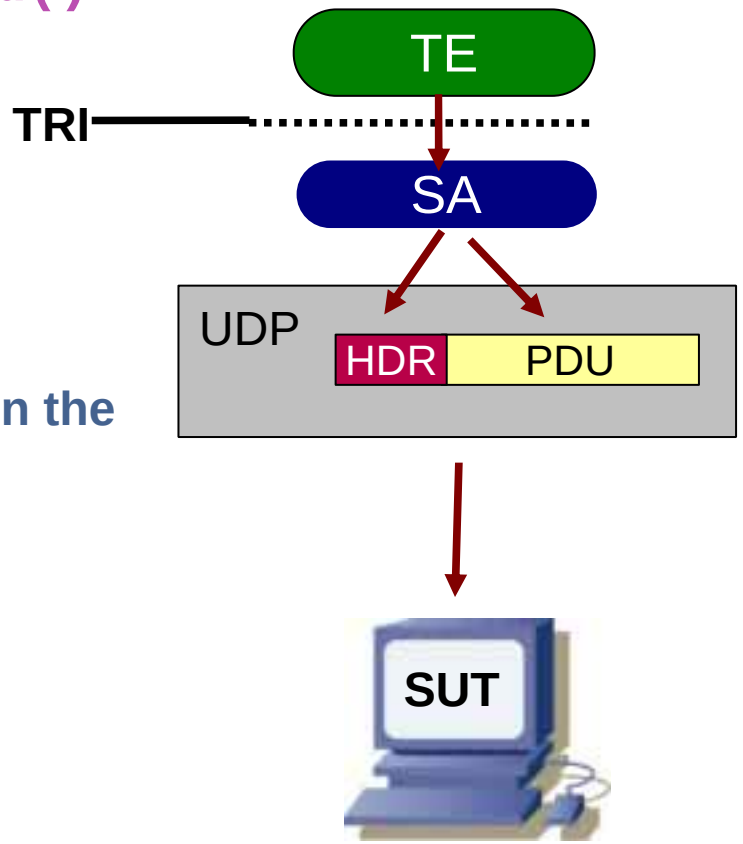
- The above are assumptions to be clarified and corrected between standard writers, implementers and test specification developers

TTCN-3 Execution Environment

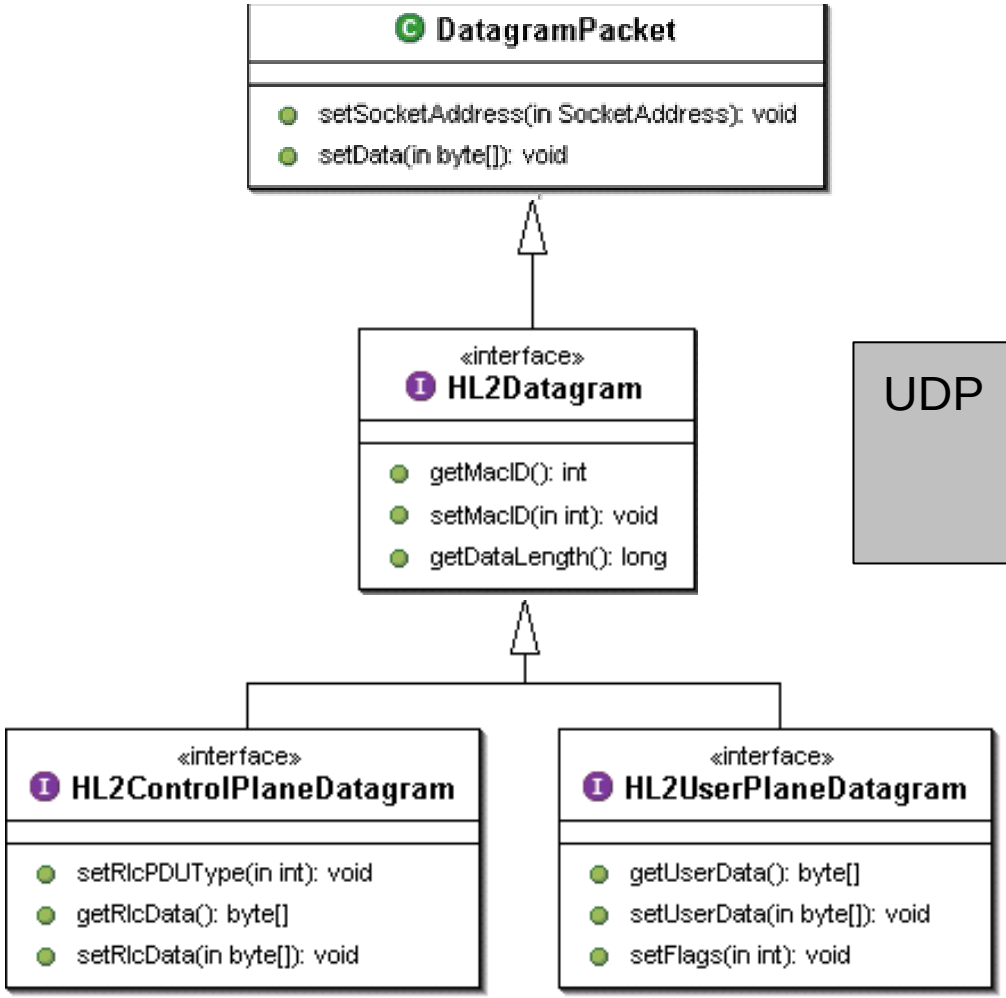


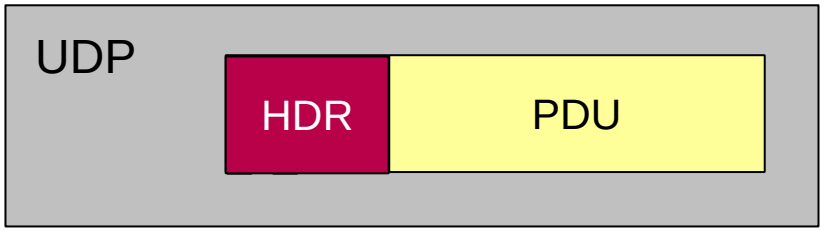
The Test Implementation Framework

- Implementation of TTCN-3 send()
  - TE calls `triSend()` in SA
  - Sending of encoded PDU
- Building of API Message
  - Depends on the type of PDU
  - Contains various information in the header
    - MAC ID
    - Long vs. Short Channel PDU
    - Up-/Downlink
- Sending to System Under Test



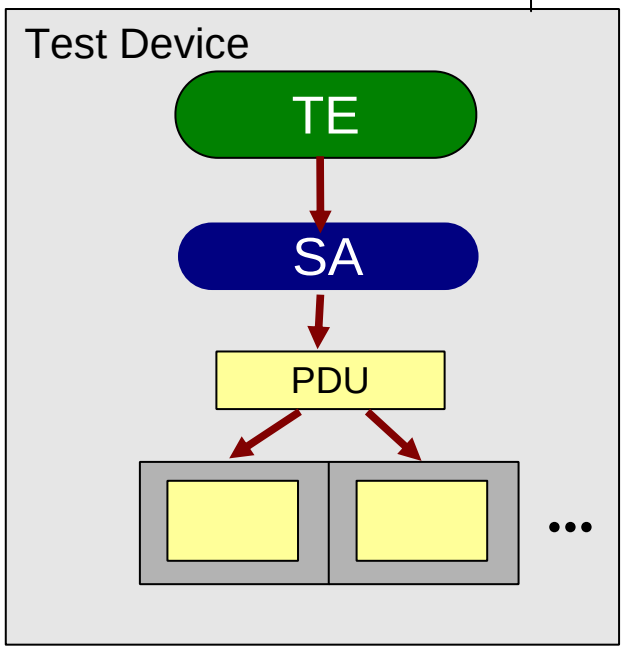
Construction of Datagrams

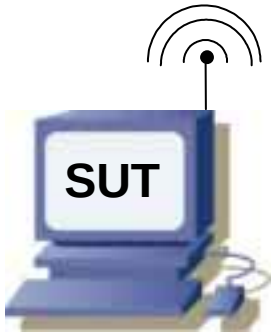




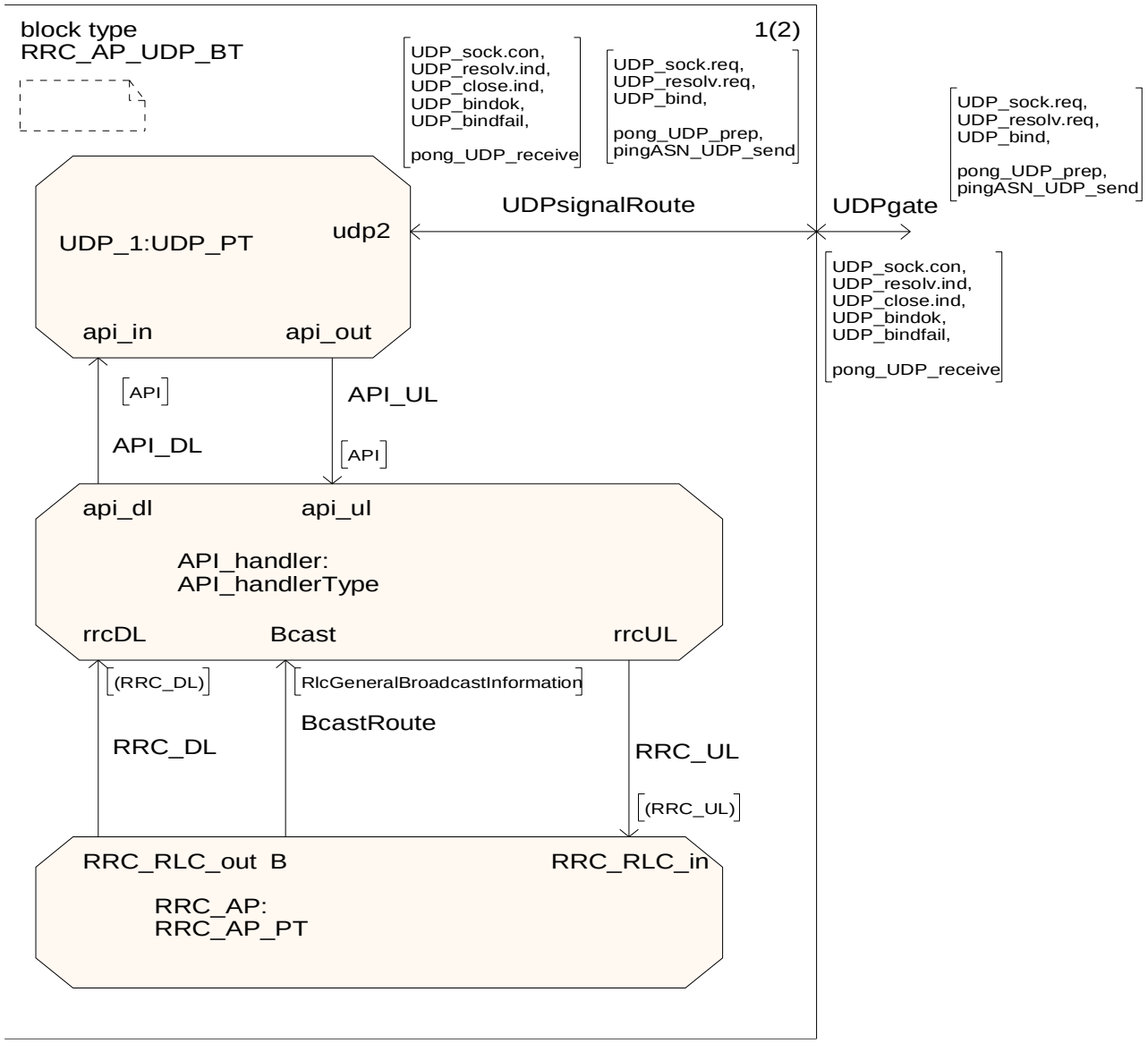
Using the radio link

- Implementation of TTCN-3 send()
  - TE calls `triSend()` in SA
  - Sending of encoded PDU
- Using the lower layer SAP
  - Introduces framing
  - Power level, frequency etc.
  - Sends it out using radio
- Sending to System Under Test





Test validation against the SDL model



Results

- Test system prototype
  - Using current version of the test suite
  - Using only standardized interfaces
  - Using the generic test implementation framework
- Easy adaptation to test devices, using other lower layers
- Implementation will be made available to the indust
  - Abstract Test Suite
  - Validated Executable Test Suite running in the Test System over UDP/IP
  - Test Management for execution
  - Documentation

New challenges

- Timing
  - Requirements on timing of all testing related activities may be different and rather challenging
- There may be implications on how test specifications are written
- Implementation issues that affect prototype testing/debugging
  - Software/hardware division in relation to API positioning

Acknowledgements

- EP BRAN (Broadband Radio Access Networks) for their support
- EC for funding part of the work
- Member companies that provided protocol stack executables to be tested
- Testing_tech for providing the TTCN-2/TTCN-3 converter, TTCN-3 compiler and run time environment
- Kaiserslautern University for providing apiGEN software and extensive support
  - Prof. Dr. Reinhard Gotzhein, Marco Brandt
- Theofanis Vassiliou-Gioles for his contribution to this work
- Protocol test specifications developed by
  - Gérard Daugan, Scott Moseley, Jean Claude Wattelet