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Application of TTCN-3 for 2.5 and 3G Testing

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Paradigm of SW development (cliche of present times)

- Complexity of SW systems rapidly increasing
  - Growing resources spent on SW design&coding
  - Number of potential errors in the code is increasing
  - Consequently: resources and time spent on testing has to be risen too
- Use of incremental SW development
  - massive regression testing
- The earlier SW non-quality discovered the lower the cost of its removal
  - Major increase of testing efforts should be concentrated to the early phases

Managers view (cliche 2 of present times)

- Increase product quality
  - decrease number of errors in SW products (increase testing)
- Decrease time to market
  - decrease time spent on test execution and result evaluation (both regression and new functionality)
- Decrease costs of testing
  - decrease human and equipment resources used for testing
  - uniform processes and solutions in different testing phases
    - basic testing
    - function testing (regression and new functionality)
    - integration verification
    - conformance testing
    - load and system performance testing
    - stability and stress testing
    - type acceptance testing

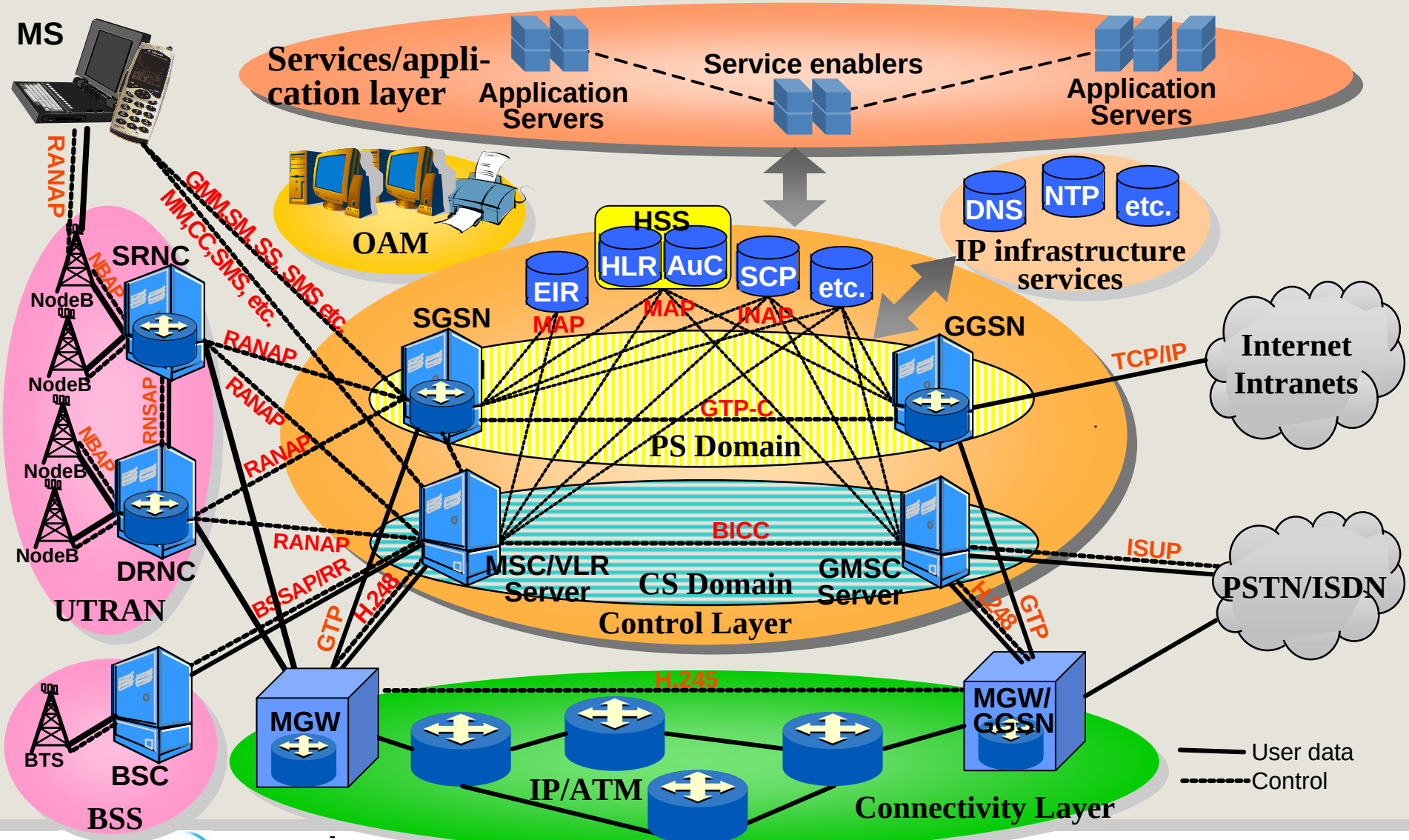
We all know

- the habitual answer to these requirements:

The Solution is: Test Automation

- But we also know, that the substance is in the details

The UMTS domain: network architecture



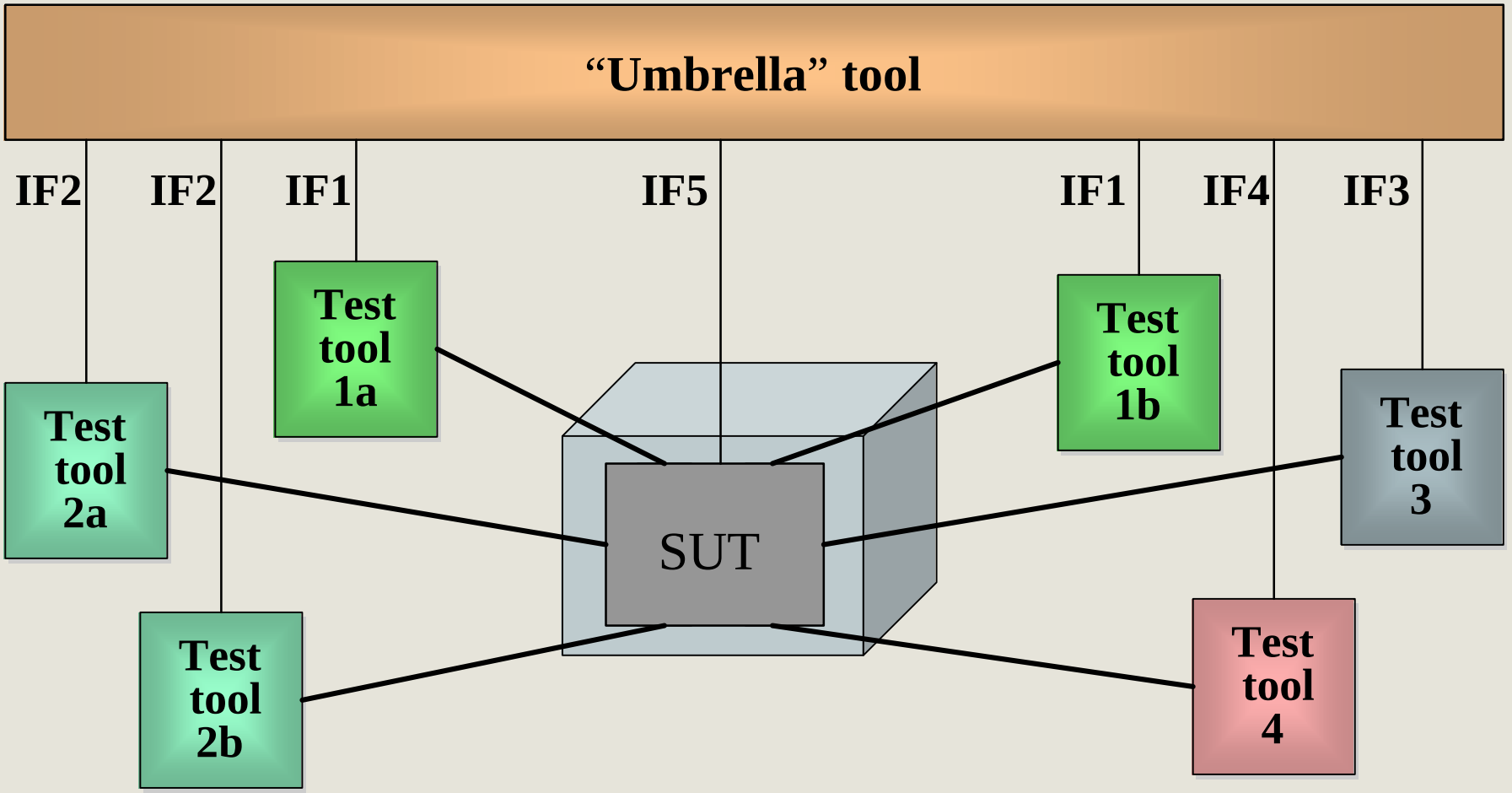
The UMTS domain: specifics

- Very complex networking scenario(s)
- Large number of different types of nodes
  - differ in functionality (more than 40 types of nodes/entities defined from switching nodes to databases)
  - differ in character (platform, capacity etc.)
- Huge variation of protocols
  - text-based (SIP, http etc.)
  - native bit-oriented (TCP, IP, SS7 protocols, L3 control etc.)
  - ASN.1-based (H.245, H.248, RANAP, NBAP, RNSAP etc.)
  - XML-based (SOAP-based etc.)
- Individual nodes are still complex with variety of interfaces

The UMTS domain: challenges in testing

- Normally several different test tools shall be used
  - expensive, difficult to purchase big quantities
  - support and certification (when needed) are also costly
  - each of them have different philosophy and/or scripting language
- Automatic testing is practically not viable
  - not all tools support a form of automatic testing
  - development and/or execution of test cases is costly (due to different philosophy and scripting)
  - difficult to synthesize a uniform test environment
  - automatic test co-ordination is practically not viable
  - IUT/SUT control is unsolved
  - automatic test result evaluation is unsolved

Use “umbrella” tools !?



Use “umbrella” tools !? (2)

- “Too many type of tools” problem is still unsolved
- Only tools supporting the idea can be integrated
- Usually different interfaces between the “umbrella” tool and separate kinds of test tools
  - practically impossible to uniform umbrella-TT interfaces
  - significant development cost
  - specification and development take a long time
  - difficult to solve test co-ordination and automatic result evaluation
- Difficult to synchronize introduction of new functionality
- The solution is SUT-specific

Let look for an another answer !

What we need:

- An effective solution for the test automation problem
- But we shall also consider other aspects
  - Usability/user friendliness
  - Quality, price and performance of available tools
  - Possible integration of already used test tools
  - Uniformity of the solution for different nodes/interfaces
  - Re-usability in different testing phases
  - Future proof-ness

What is TTCN-3 ?

- A program language?

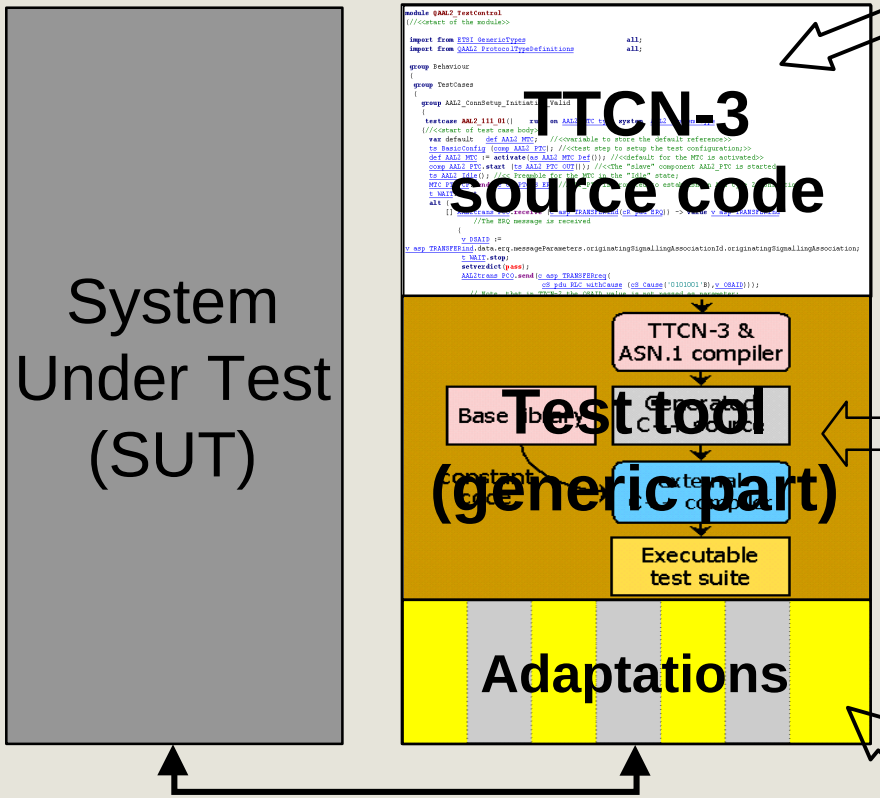
  YES (with testing-specific features)
- A test tool/test environment ?

  YES
- A test philosophy ?

  YES

All together: a test solution

The TTCN-3 solution

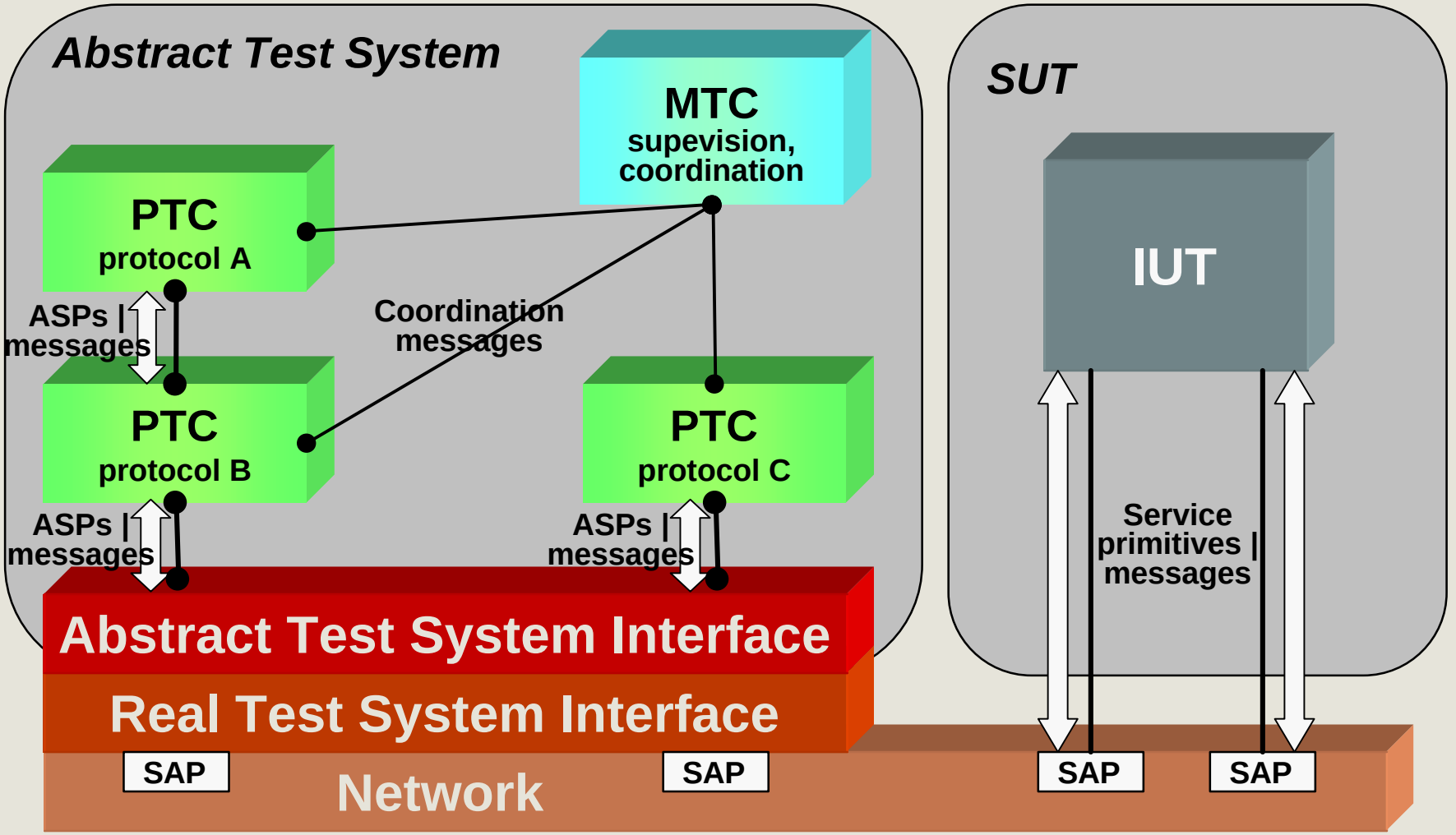


- Describes the test behaviour
- Abstract language: independent of the SUT and the test tool
- Easy-to-learn C like language
- Transportable and re-usable code
- ASN.1 source is directly usable

- SUT independent (reusable in all test environments)
- Ready-coded testing functionality
  - communication procedures: message sending, receiving etc.
  - timer & timeout handling
  - alternative events handling etc.
- Compiles TTCN-3 to an executable
- Test execution support
  - parameterization of test execution
  - test case selection & test control
  - logging & result evaluation

- Handling “physical” connections between the SUT and the test environment

TTCN-3 view of testing



TTCN-3 language considerations (1)

- Up-to-date technical features
  - supports testing of asynchronous and synchronous interfaces, enriched typing features, full ASN.1 support, usable for IP protocols, CORBA etc., test execution control, language support of automated test execution!, support for IDL (& XML) etc. etc.
- User friendliness (coding efficiency)
  - high-level program language with C-like syntax and testing specific features
- Living language: its evolution is ongoing
  -> based on your requirements and proposals !
  - Usability ✓/user friendliness ✓(but the tool need to be too)

TTCN-3 language considerations (2)

- Application areas

TTCN-2	TTCN-3
Function test	(Basic &) Function test
Conformance test	Conformance test
Type approval	Load &Performance test
	Integration verification
	Stability & Stress tests
	API tests
	Type approval

– Re-usability in different testing phases ✓

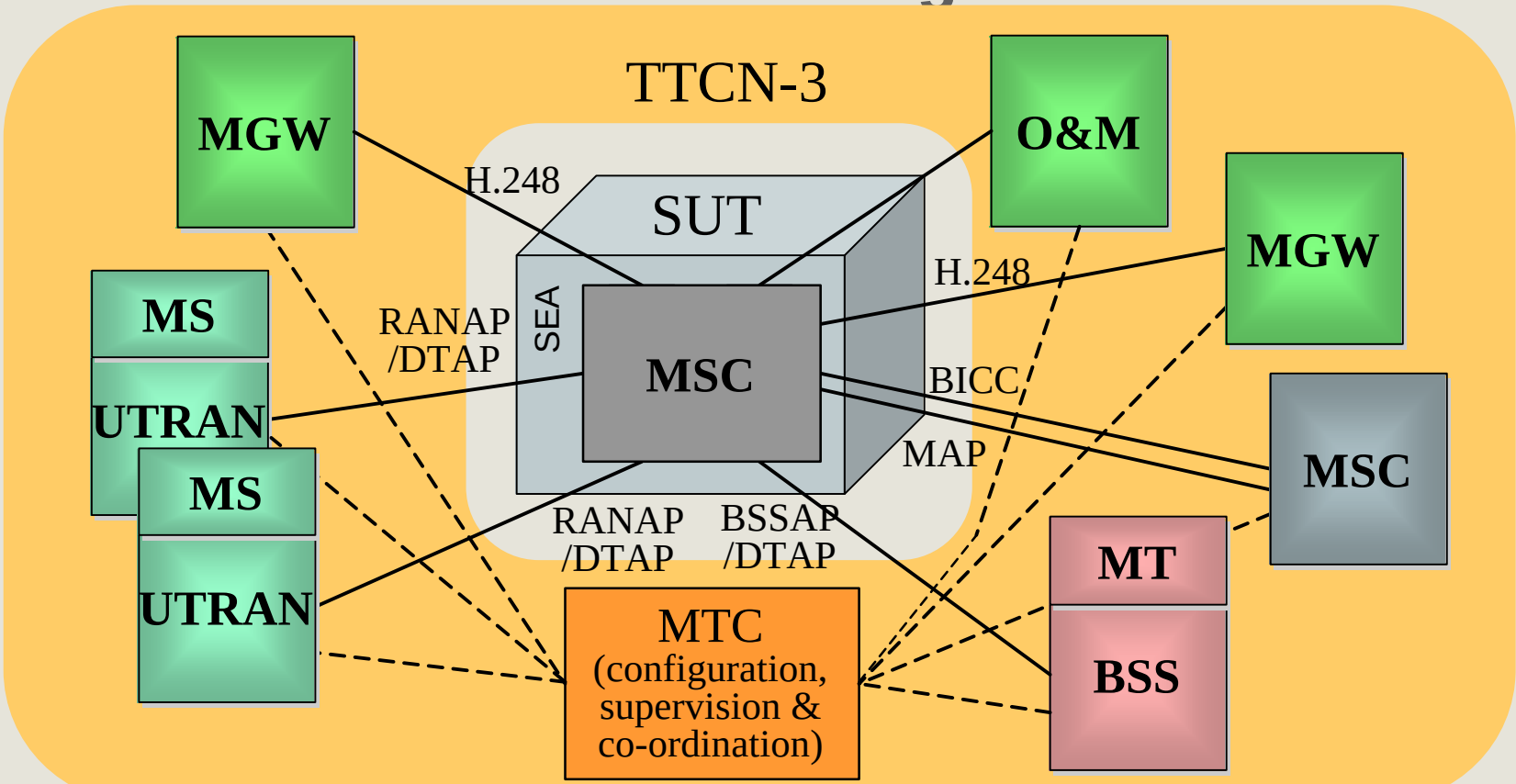
Tool considerations

- "New" tools and new tool vendors appeared on the market
- TTCN-3 tools are evolving quickly

Sorry, this cake you have to eat yourself !

- TRI provides a standard mean to integrate other tools
- Tools with known APIs can be integrated by developing appropriate adaptations
  - Quality, price and performance of available tools
  - Possible integration of already used test tools ~

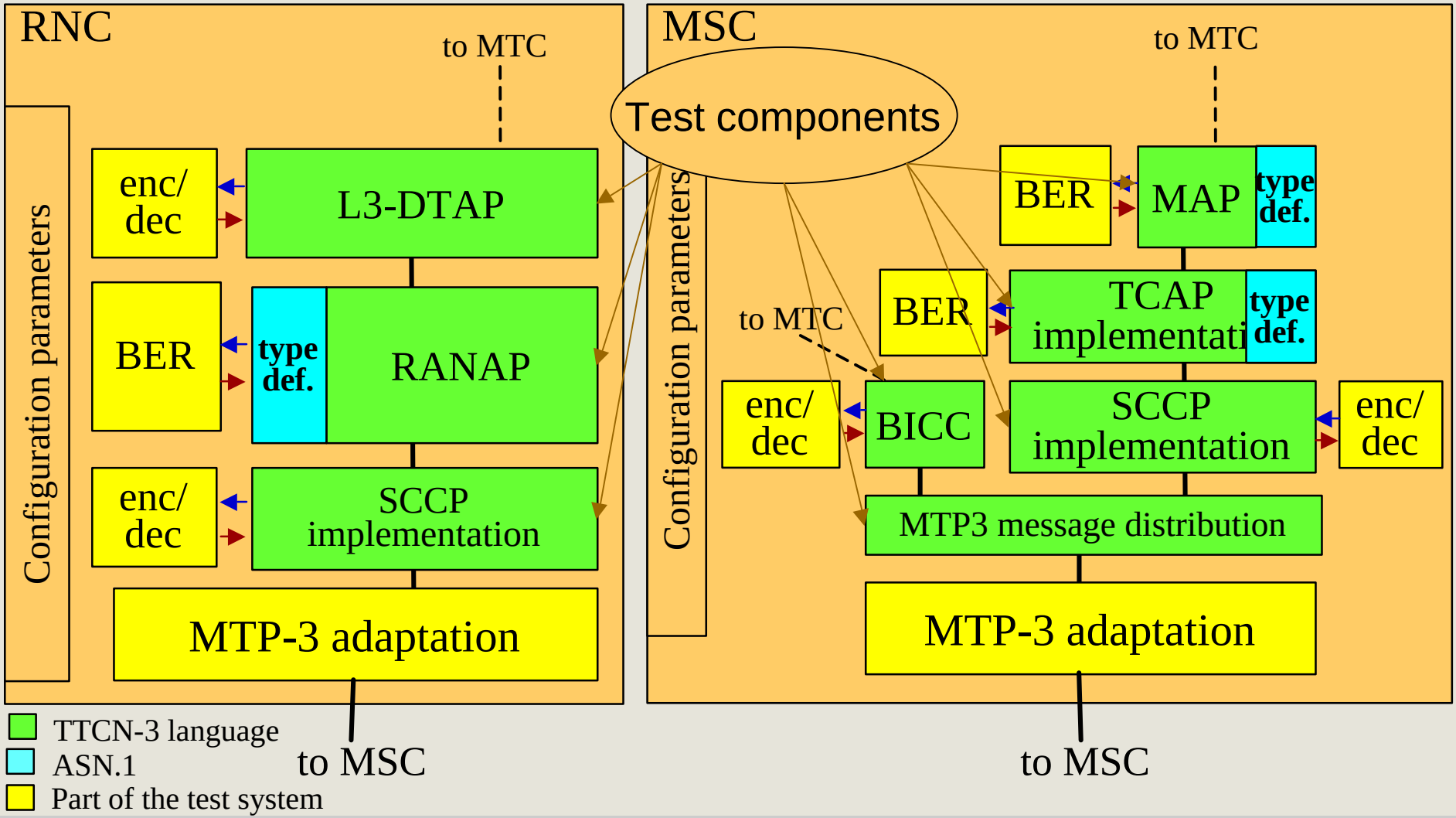
Use of TTCN-3 in MSC testing



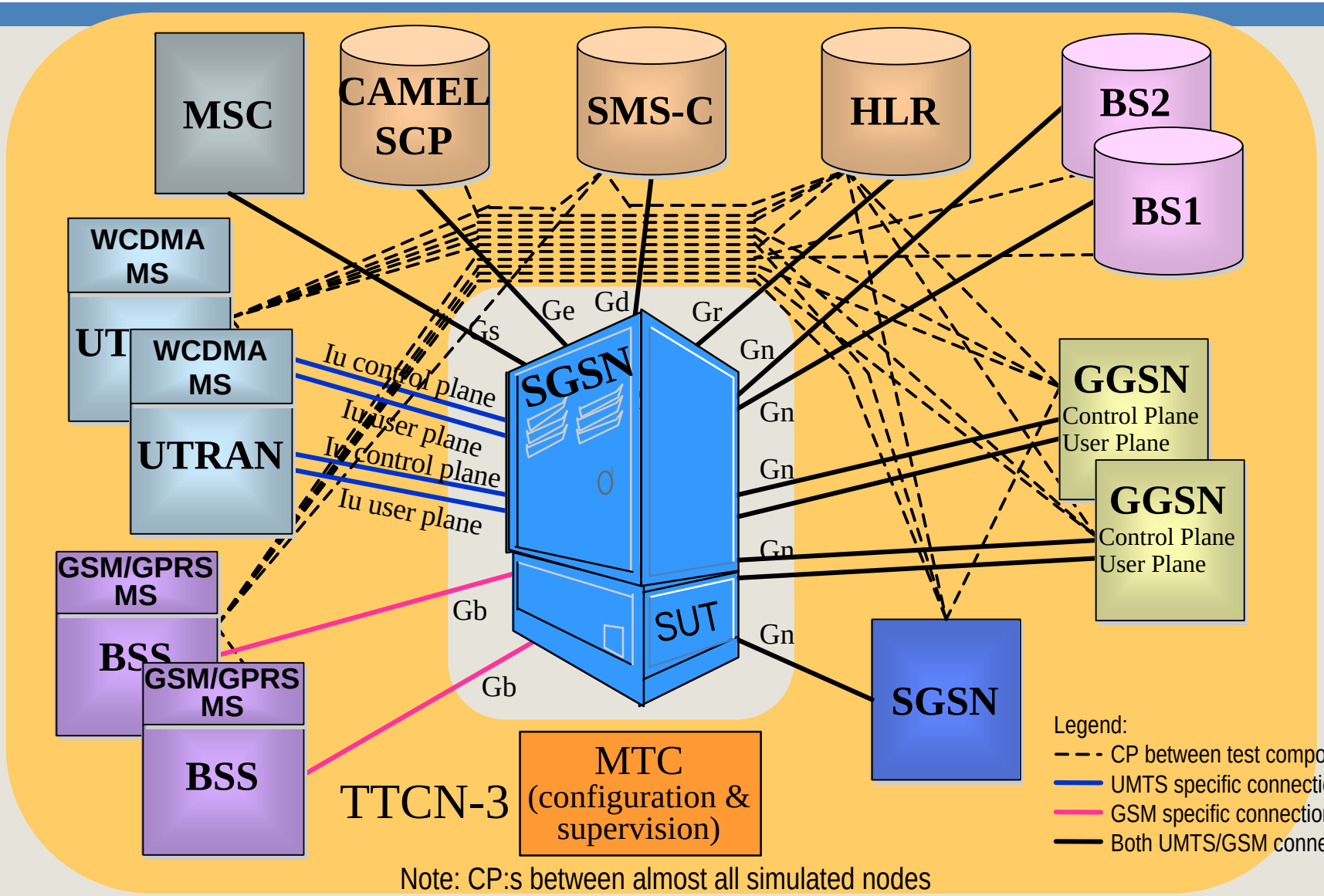
Legend:
BSC - (GSM) Base Station Controller
MSC - Mobile Switching Centre
MTC - Main test component
SEA - Simulated environment for AXE
MGW - Media Gateway
RNC - (UMTS) Radio Network Controller
SUT - System under test
—— Signalling connection
- - - Co-ordination point between test component

– Uniformity of the solution for different interfaces ✓

Emulation of UMTS nodes



Use of TTCN-3 in GSN testing



– Uniformity of the solution for different nodes/interfaces ✓

Is TTCN-3 a future-proof solution ?

- Yes.
- A new and evolving language with well-established basis
  - the best of TTCN-2 are preserved while its less attractive features are stripped
- Several application areas (much more than just UMTS)
- Standard abstract test suites available and more will come in future
- New upcoming concepts: e.g. UML testing profile

  - Future-proofness ✓

What we should also keep in mind ?

- Using TTCN-3 differs from most of the recent test solutions
- TTCN-3 based testing signifies:

  testing a SW by means of another SW

  - Users need proper training
  - To develop complex test suites similar processes shall be used as for developing the SUT itself
    - version control systems, naming conventions, design rules, source code documentation, etc.
  - Project planning & processes shall be adjusted:
    - start test preparations in an early phase of the SW design project, test result evaluation and documentation changing (eased in most cases), etc.

When TTCN-3 may not be the best choice

- Ad-hoc tests for checking one specific item
  - e.g. cheching a protocol IE value, a message etc. @ node support or troubleshooting
- Low layer tests, tests close to the physical layer
  - though there exist TTCN tests for the ISDN physical layer
- In cases when HW or HW-close load generation is a must (e.g. low level STM-x traffic)
  - but such load generators may be controlled from TTCN-3

Conclusions

- TTCN-3 is a mature test solution to be seriously considered for automated testing of complex SW systems
- You will hear during this conference about
  - several other application ideas and experiences as well
  - standardization status and
  - future extensions of the language

Hopefully you will get enough information to judge the applicability of TTCN-3 to your domain

Thank You
for your attention!