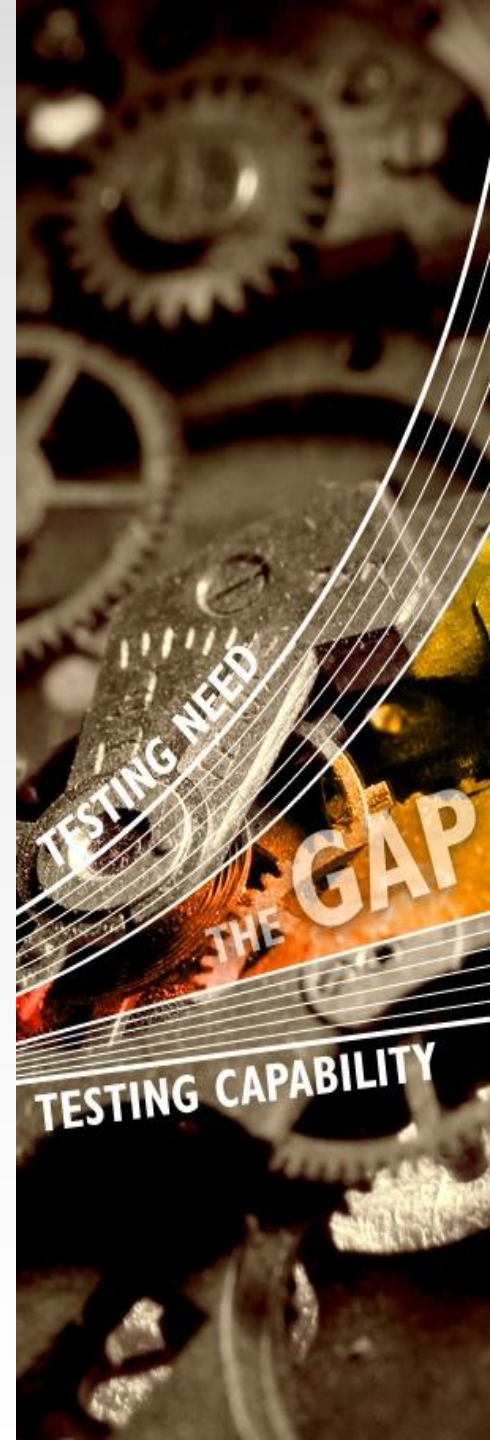


CONFORMIQ

MBT & TTCN-3 in practice: The Ericsson RCS project

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About the Ericsson RCS Project

- Goal: Investigate the feasibility of the model-based testing approach for end-to-end and conformance testing
 - Context: Interoperability testing of RCS clients and networks
- The project created and validated two models

Focus of this presentation

- A RCS **network model** created from system specifications, standards, and actual system behavior which was validated against a real SUT via TTCN-3 test execution
- A RCS **client model** created from system specifications simulating actual XCAP and SIP network behavior, which was validated by running it against the *network model*

Presented at SQS 2009

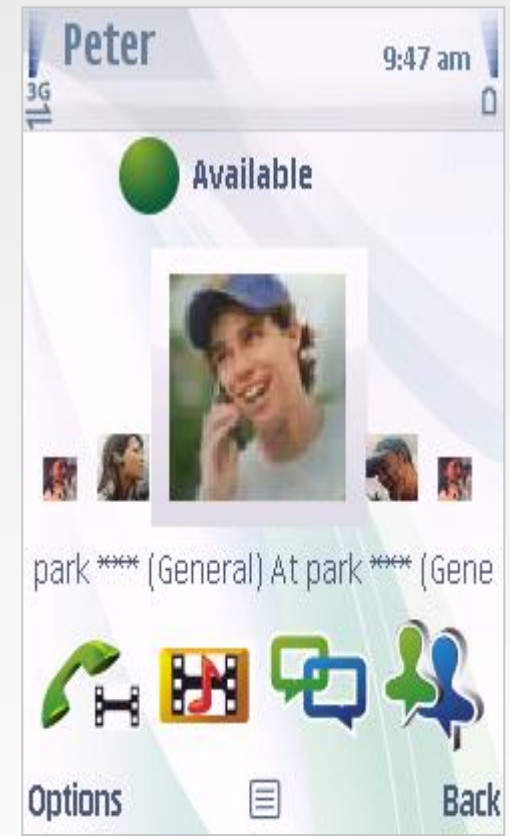
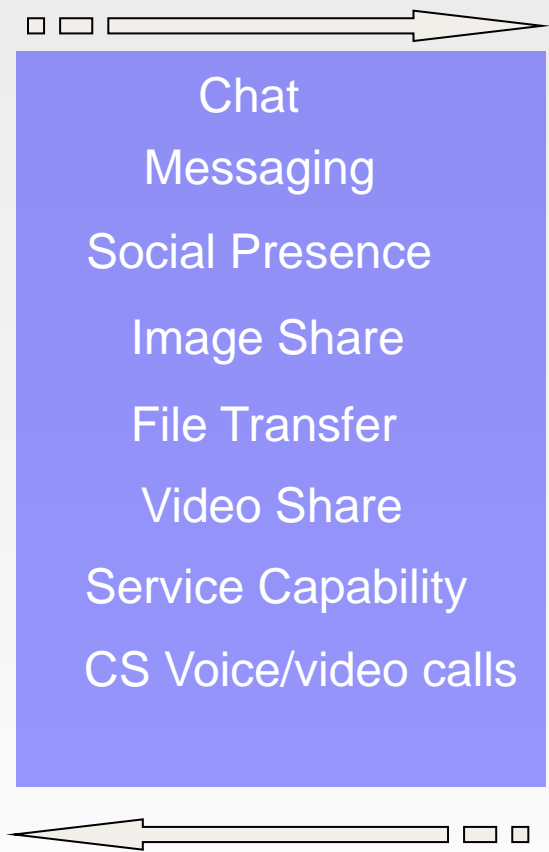
About Rich Communication Suite (RCS)



*The RCS Initiative is the joint effort of leading industry players to speed up and facilitate the adoption of applications and services that provide an **interoperable**, convergent, rich communication experience based on IMS.*



What RCS looks like in practice



Model-Based Testing with Conformiq

- **Model Based Testing (MBT)** is an umbrella of approaches where computers automatically generate tests from models based on some coverage criteria
- **Conformiq Automated Test Design** is an MBT approach which uses advanced technology to automatically derive and generate test scripts, documentation, and reports directly from models specified from a *system* perspective
- Such models specify the correct (expected) functionality and operation of the system to be tested

The Conformiq MBT Workflow

1 Projects with model files

2 Extracted requirements from model listed by group / hierarchy

3 Relationship between requirements and generated tests

4 High level test view for review

Testing Goals

Testing Goals	1	2	3	4	5	6	7	8
Send ERROR RESPONSE from server							X	X
Send OK RESPONSE from server	X	X	X	X	X	X	X	X
Process DELETE					X	X		
Process GET	X	X		X				
Process PUT			X					

Sequence Diagram:

```

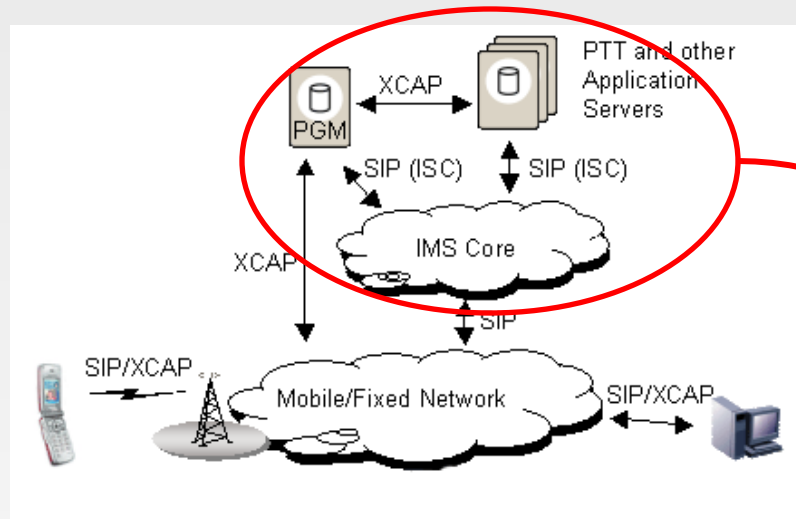
sequenceDiagram
    participant Tester
    participant IMScore
    participant SIPnet
    participant XCAPnet

    Tester->>IMScore: netConfigRequest
    activate IMScore
    IMScore->>SIPnet: SIPRequest
    activate SIPnet
    SIPnet->>SIPnet: SIP/Network/Register Client A
    SIPnet->>SIPnet: SIP/Network/Send OK RESPONSE from server
    deactivate SIPnet
    deactivate IMScore
    
```

Message / Field Details:

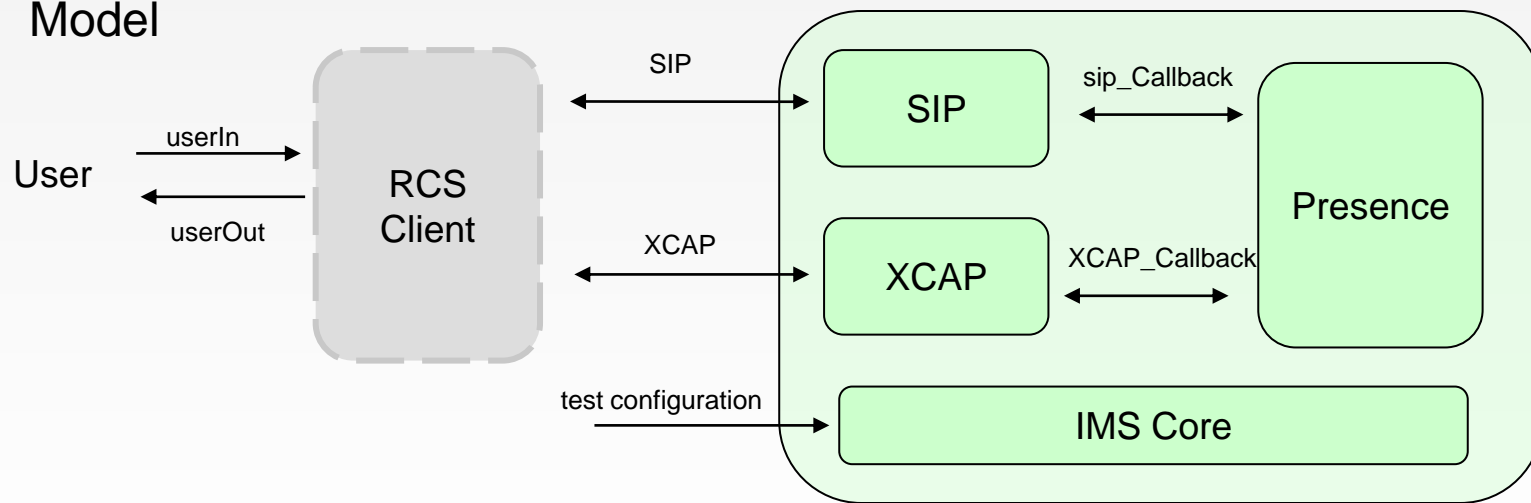
Message / Field	Port / Field value
SIPRequest	to GmIn
startLine	
method	"REGISTER"
via	
vias	
Via [0]	branch
branch	"z9hG4bKQtronic.1"
callID	
callID	"QtronicCallId.0@ipaddr1"
CSeq	
sequenceNumber	1
requestMethod	"REGISTER"
from	
addr	"sip:user_a@imt-001.ims.stp"
to	
addr	"sip:user_a@imt-001.ims.stp"
presenceDocument	omitted

Scope of Testing: RCS Presence



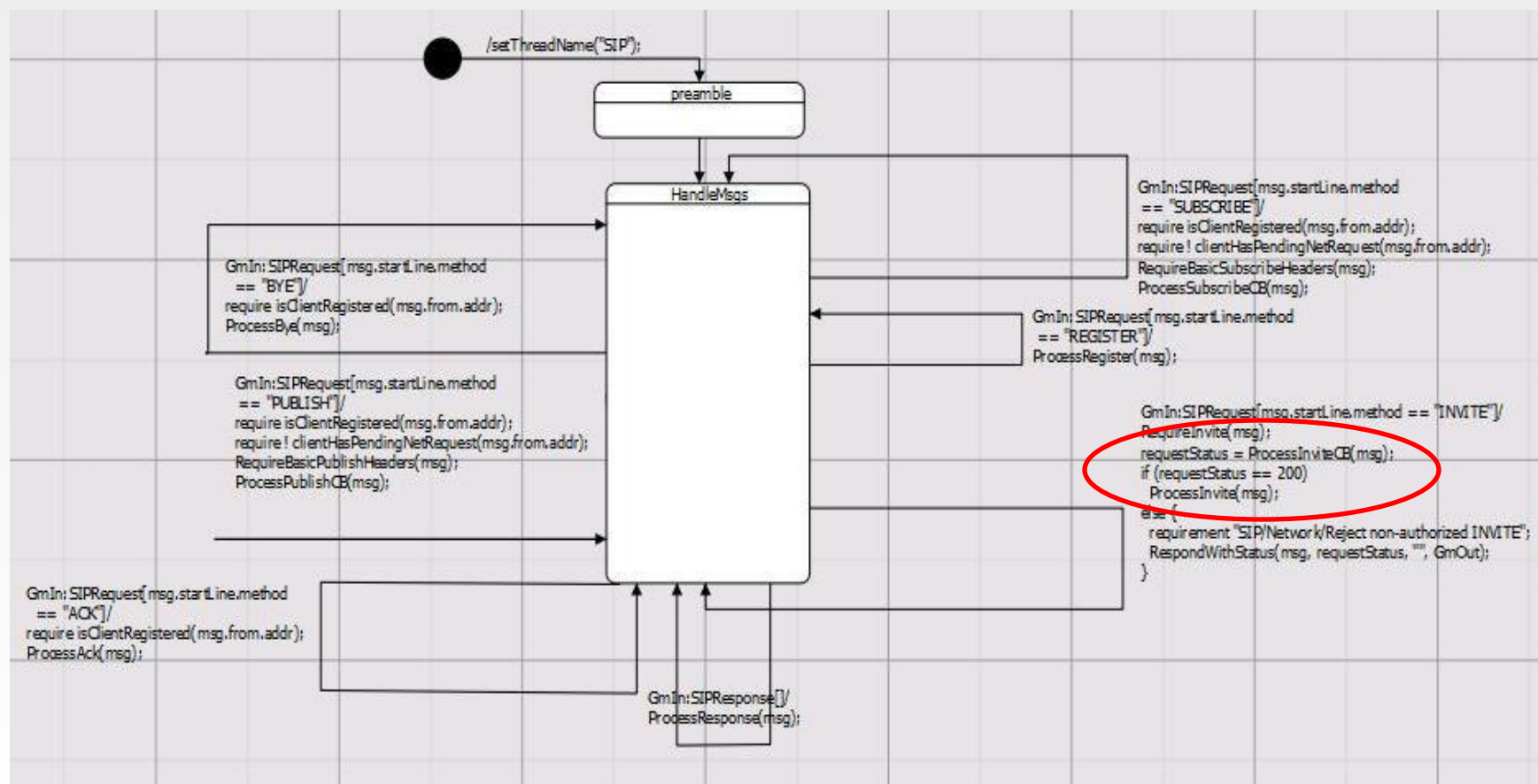
Real World

Model



The RCS network model

- Specified at a high level of abstraction using QML (UML with Java-like action language)

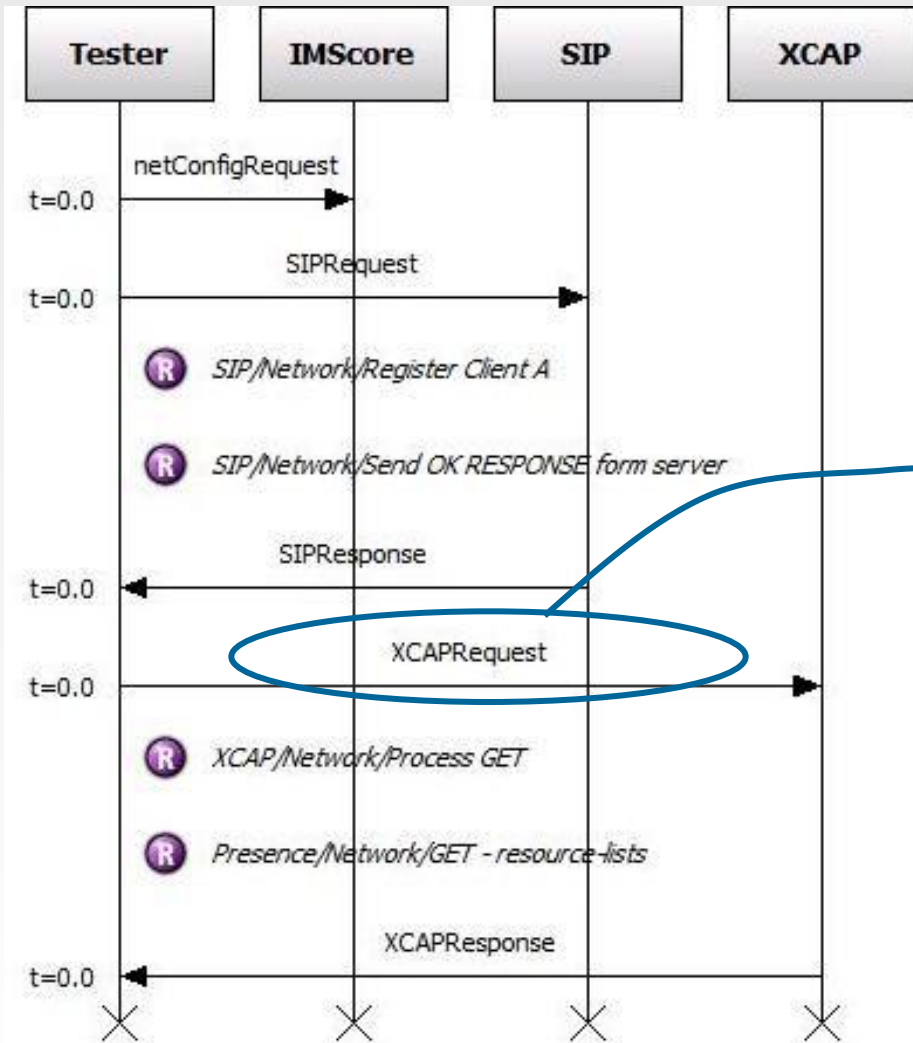


Example of Abstraction: processInvite()

- Model focuses on *what* to test – leaves out details
 - “Yes” examples : Return codes, URI, XML doc refs
 - “No” examples: call ID, sequence number, tags handling

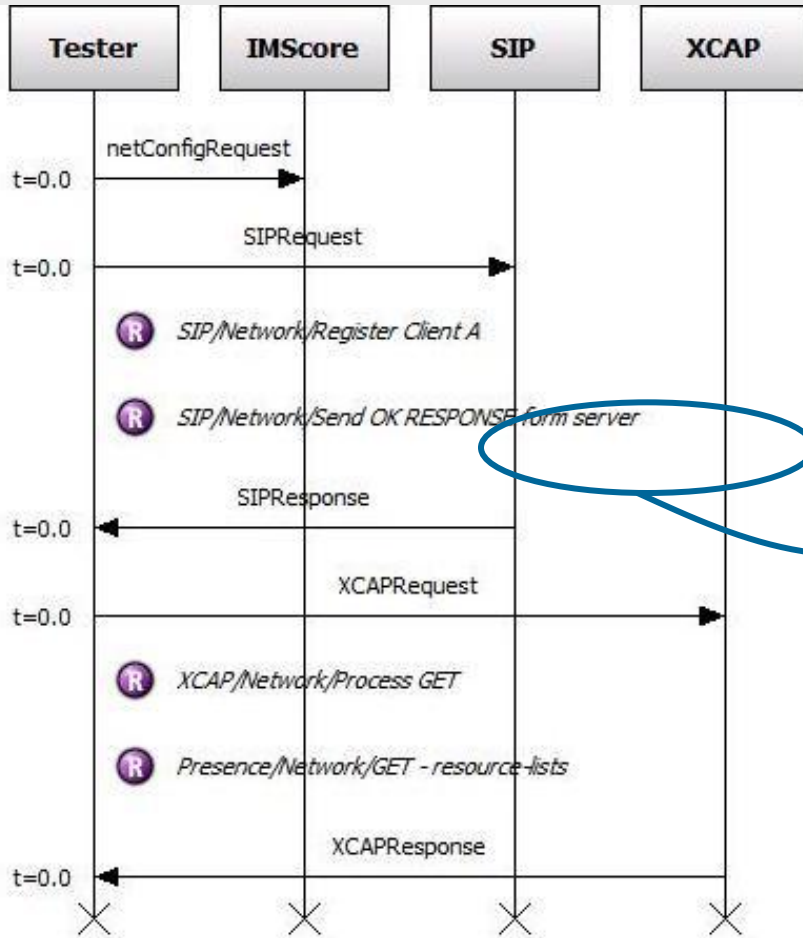
```
public int processInvite(SIPRequest request){
    String clientURIFromUser = request.from.addr;
    String clientURIToUser = request.to.addr;
    XDMSconfigRequest presenceDoc = getPresenceDocumentForClient(clientURIFromUser);
    if (enableAuthorization){
        if (xdms_isClientOnBuddyList(clientURIToUser, presenceDoc) ||
            xdms_isClientOnGrantedContactsList(clientURIToUser, presenceDoc))
            return 200; // OK
        else if(xdms_isClientBlocked(clientURIToUser, presenceDoc)) {
            requirement "Presence/Network/INVITE - deny if on blocked list";
            return 403; // Forbidden
        } else if(xdms_isClientOnPoliteBlockedContactsList(clientURIToUser, presenceDoc)) {
            requirement "Presence/Network/INVITE - deny if on politely blocked list";
            return 480; // Temporarily unavailable
        } else {
            requirement "Presence/Network/INVITE - deny if client not found";
            return 404; // Not found
        }
    }
    return 200; // OK
}
```

Abstract Generated Test Visualization



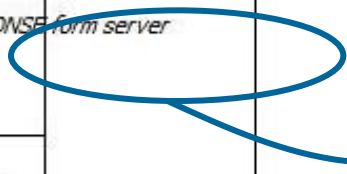
4 XCAPRequest to HTTPIn	
from	"sip:user_a@imt-001.ims.stp"
method	"GET"
requestURI	
rootURI	""
documentSelector	
path	""
user	""
document	"directory.xml"
nodeSelector	""
requestPayload	omitted
contentType	omitted

Generated TTCN-3 code

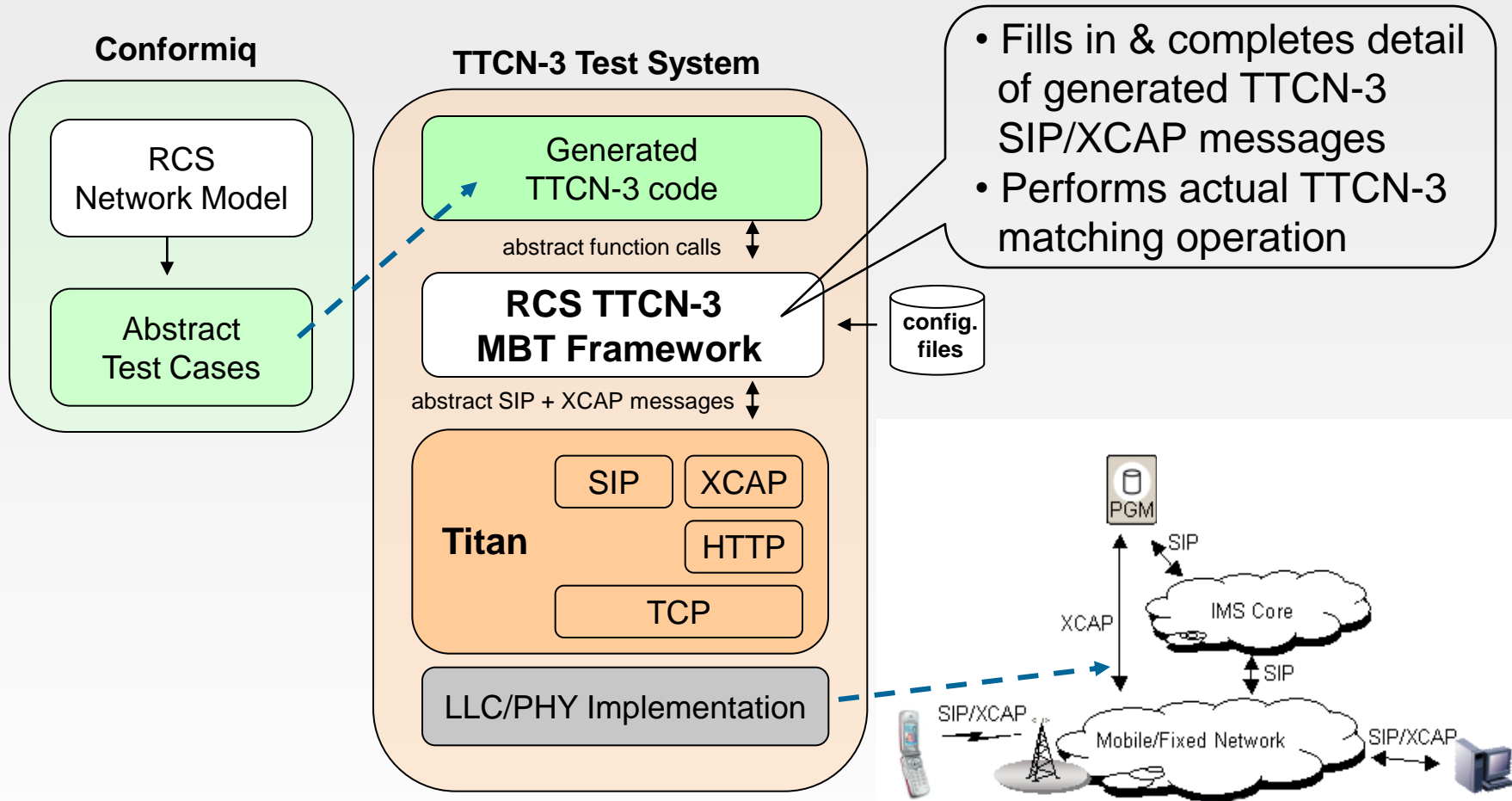


```

/* Generated test case #2 */
testcase test_case_2() runs on CQ_MTC system RCS_TSI
{
    var float v_last_timeout := 0.0;
    var default_v_cq_default_ref := activate(template CQ_SIPRequest SIPRequestTemplate7 :=
    {
        start_line := {method := "REGISTER"},
        v_cq_default_from := {addr := "sip:user_a@imt-001.ims.stp"},
        to := {addr := "sip:user_a@imt-001.ims.stp"},
        contact := {URI := "sip:user_a@imt-001.ims.stp"; parameters := "+g.3gpp.cs-voice;+g.oma.sip-im"},
        expires := omit,
        event := omit,
        subscriptionState := omit,
        sipifmatch := omit, // presence document
        watchedInfo := omit, // link to profile picture
        buddyList := omit // link to a list of buddies and status
    });
    f_cq_send_netConfigRequest_to_management(template netConfigRequestTemplate6);
    f_cq_send_SIPRequest_to_GmIn(SIPRequestTemplate7);
    f_cq_receive_SIPResponse_from_GmOut(SIPResponseTemplate8);
    f_cq_send_XCAPRequest_to_HTTPIn(XCAPRequestTemplate9);
    f_cq_receive_XCAPResponse_from_HTTPOut(XCAPResponseTemplate10);
    setverdict(pass);
    deactivate(v_cq_default_ref);
    f_cq_end_test_case();
}
    
```



Test Execution: The complete tool chain



Conclusions

- We have introduced and compared automated versus manual test design in the context of TTCN-3
 - Test engineers specify behavioral models using only directly relevant information
 - Automatic generation of abstract TTCN-3 test cases from models
 - Handling of details is suppressed into a MBT TTCN-3 framework
 - Industrial projects indicate significant gains in productivity
- MBT means a paradigm shift in test automation
 - A higher level of test specification requires new skill set
 - However classic testing skills are still needed and important
- Approach has been validated with complex real world case study, i.e., RCS network testing