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TTCN-3 based Implementation of ETSI TISPAN IMS Benchmark

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Contents

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Motivation

- Goal - performance benchmark for IMS components
  - Performance and scalability testing of all IMS and related components with simulated real-world traffic
  - Measurement and analysis of important QoS parameters
- Why
  - Creation of objective means to compare overall IMS of different systems by performance (and price)
  - Check ability of hardware/software to run the IMS
- How
  - Define standard scenarios and traffic models for the work load
  - Define the metrics to be measured
  - Standardize the test procedure, the test parameters and the Benchmark test report
- Where
  - Standardization of IMS benchmarking at ETSI TISPAN WG6
  - Version 1.0 of IMS benchmarking standard has been released.

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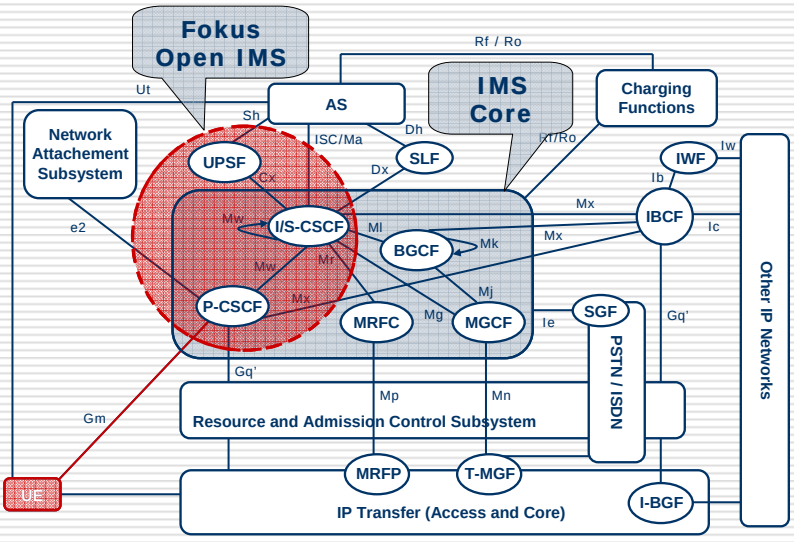
System under Test



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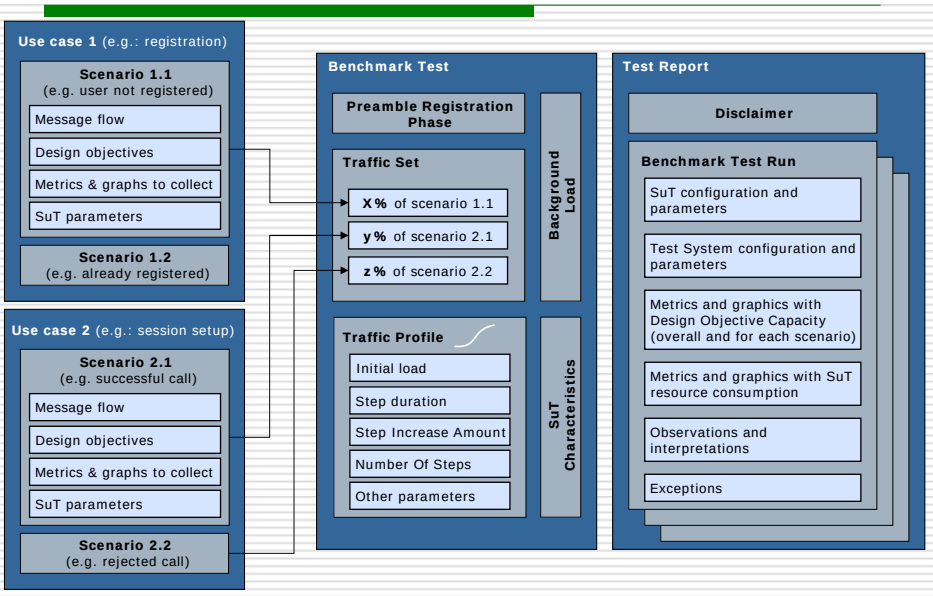
Benchmark Information Model



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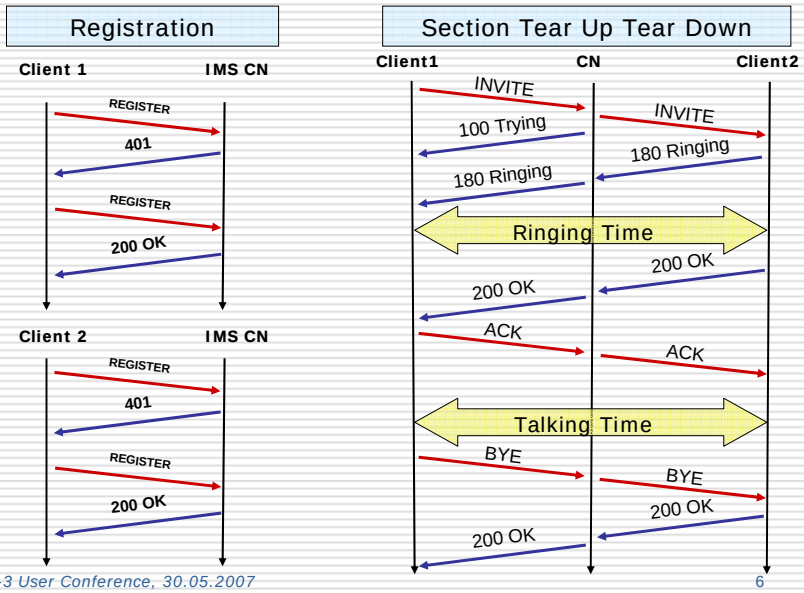
Scenario: Successful Call



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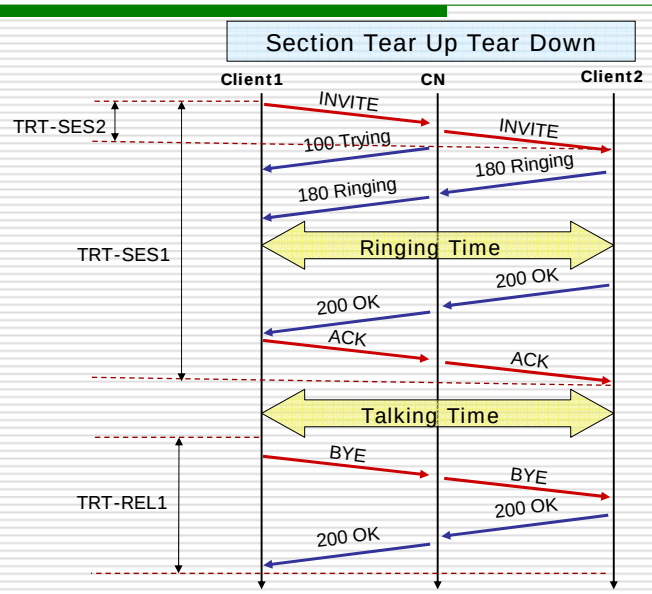
Scenario: Successful Call



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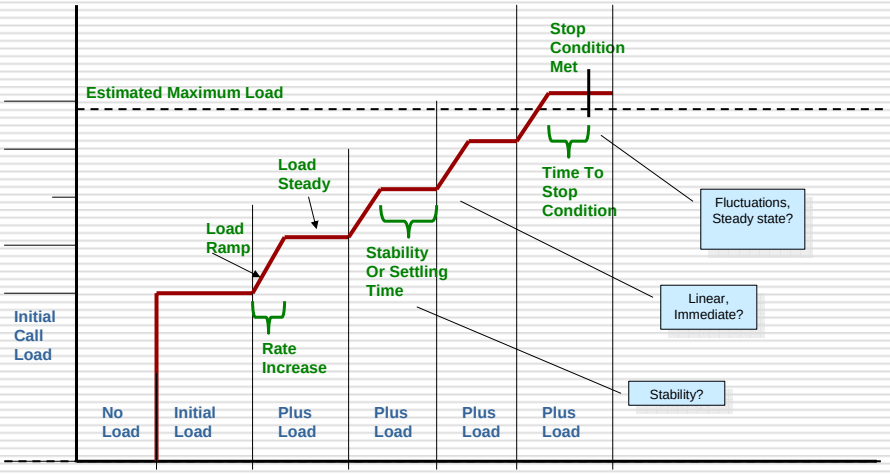
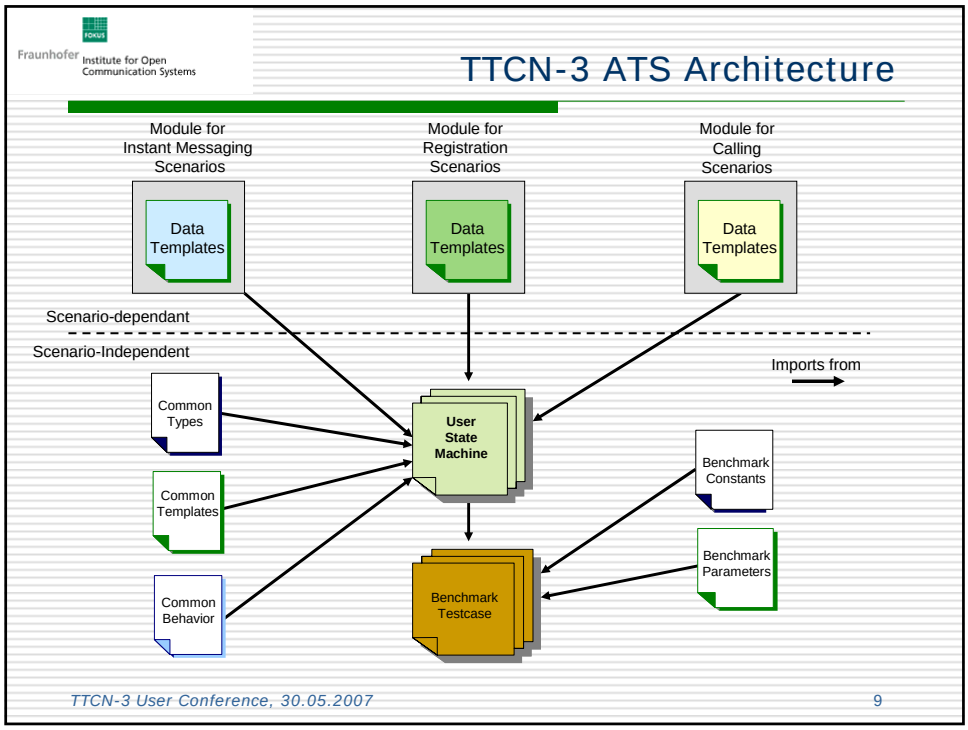
Benchmark Procedure

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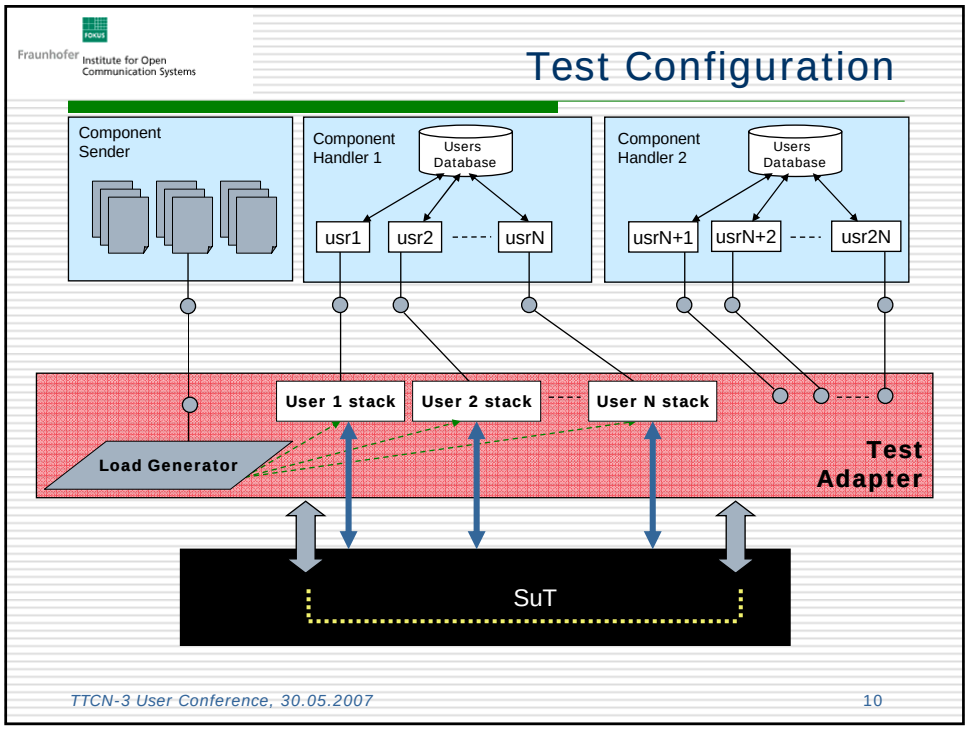
TTCN-3 ATS Architecture
Module for Instant Messaging Scenarios
Module for Registration Scenarios
Module for Calling Scenarios
Data Templates
Data Templates
Data Templates
Scenario-dependant
Scenario-Independent
Imports from
Common Types
Common Templates
Common Behavior
User State Machine
Benchmark Testcase
Benchmark Constants
Benchmark Parameters
TTCN-3 User Conference, 30.05.2007
9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Test Configuration
Component Sender
Component Handler 1
Users Database
usr1
usr2
usrN
Component Handler 2
Users Database
usrN+1
usrN+2
usr2N
User 1 stack
User 2 stack
User N stack
Load Generator
Test Adapter
SuT
TTCN-3 User Conference, 30.05.2007
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User Concept

1. A user is a state machine running a scenario
2. A user may be „callee“ or/and „caller“
3. A user may create > 1 calls
4. A user may be reused to create other calls
5. A user may call randomly any other user

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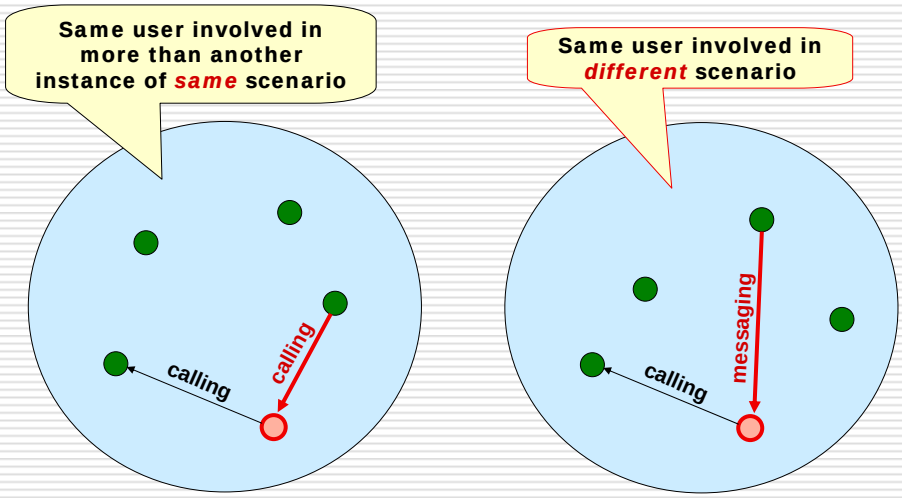
Simultaneous Scenarios



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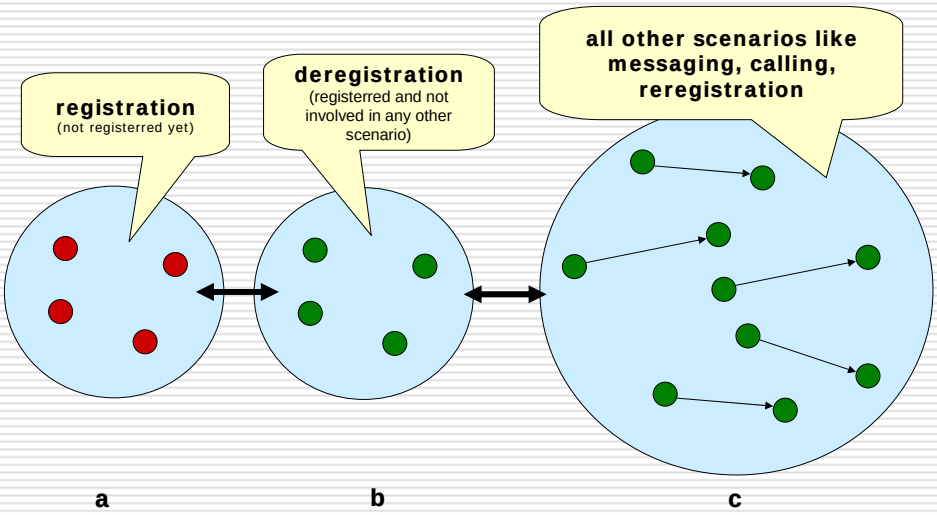
Population Clusters



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TTCN-3 Message Types

```
// general type
// can be exten
// other reques
type record Re
  integer trans
  RequestLine
  MessageHeac
  charstring m
}
```

```
type set MessageHeader {
  Authorization authorization optional,
  CallId callId optional,
  Contact contact optional,
  CSeq cSeq optional,
  Expires expires optional,
  From fromField optional,
  RecordRoute recordRoute optional,
  Route route optional,
  ServiceRoute servicerou
  To toField optional,
  Via via optional,
  MaxForwards maxForwa
  ContentLength contentL
  WwwAuthenticate wwwA
  Event event optional
}
```

```
// [20.7 RFC2617 3.2.2]
type record Authorization {
  FieldName fieldName(AUTHORIZATION_E),
  //Credentials body
  charstring body optional
}
```

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TTCN-3 State Handling

```
alt {
     // P-CSCF --------REQUEST--------> User
     [] p2SUT.receive (TRequest) -> value request {
            // P-CSCF --------INVITE--------> User
            if (match(request, Request_INVITE_r)) {
            }
            // P-CSCF --------MESSAGE-------> User
            else if (match(request, Request_MESSAGE_r)) {
            }
            // P-CSCF --------ACK--------> User
            else if (match(request, Request_ACK_r)) {
            }
            ..................
     }
     // P-CSCF --------RESPONSE--------> User
     [] p2SUT.receive (TResponse) -> value response {
            // P-CSCF -------- 200 OK --------> User
            if (match(response, Response_200_r)) {
                 if (response.msgHeader.cSeq.seqMethod == "INVITE") {}
                 else if (response.msgHeader.cSeq.seqMethod == "BYE") {}
                 ..................
                 else if (response.msgHeader.cSeq.seqMethod == "REGISTER") {}
            }
            // P-CSCF -------- 401 OK --------> User
            else if (match(response, Response_401_r)) {
            }
            ..................
     }
}
```


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Messages Creation

```
// P-CSCF --------RESPONSE--------> User
[] p2SUT.receive (TResponse) -> value response {
     // P-CSCF -------- 200 OK --------> User
     if (match(response, Response_200_r)) {
          if (response.msgHeader.cSeq.seqMethod == "INVITE") {

               ackReq := ACK_Request_s;
               ackReq.transactionId := getNewTransactionId();
               ackReq.requestLine.method := ACK_E;
                  . . . . . .

               ackReq.msgHeader.callId := response.msgHeader.callId;
               ackReq.msgHeader.cSeq := response.msgHeader.cSeq;
               ackReq.msgHeader.cSeq.seqMethod := "ACK";
                  . . . . . .

               ackReq.msgHeader.fromField := response.msgHeader.fromField;
               ackReq.msgHeader.toField := response.msgHeader.toField;
               ackReq.msgHeader.via := response.msgHeader.via;
               ackReq.msgHeader.route := getServiceRoute(response);

               userChannel := getChannel(response);
               p2SUT.send (ackReq) to userChannel;
               delTransactionId(response.transactionId);
```

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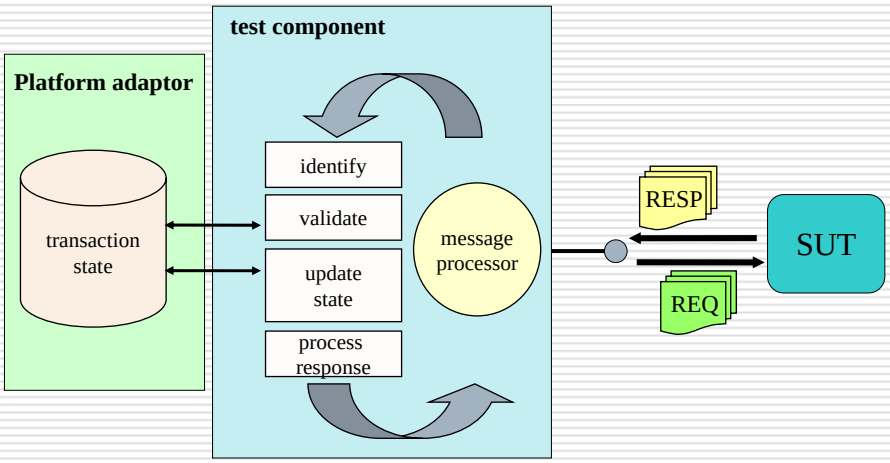
Processing of Messages



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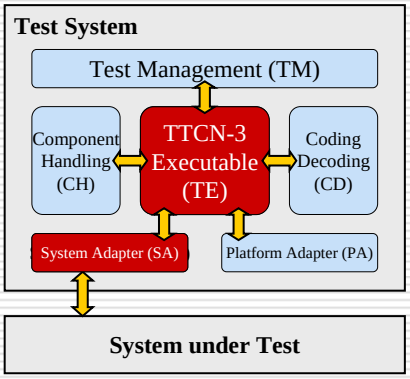
Adaptation Layer

Aim: Maximize TTCN-3 system performance !

- Handles multiple parallel connections with SUT
- Uses Pools of Threads and Listeners
- Smaller number of
  - threads and context switches
  - mutex-es and semaphores
  - contended message queues



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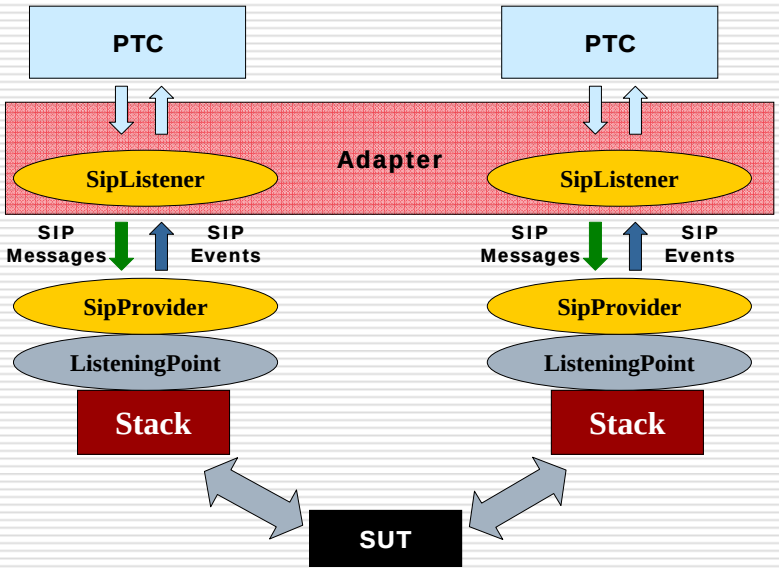
Transactions



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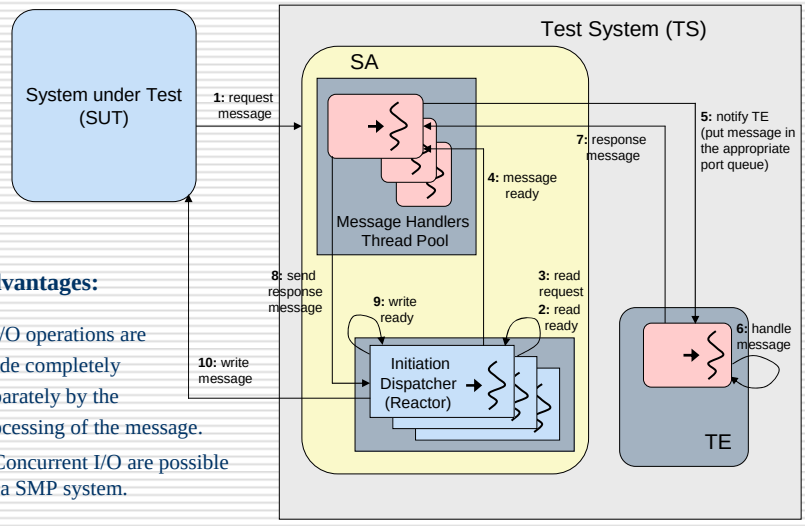
Test Adapter Design



Advantages:

- I/O operations are made completely separately by the processing of the message.
- Concurrent I/O are possible on a SMP system.

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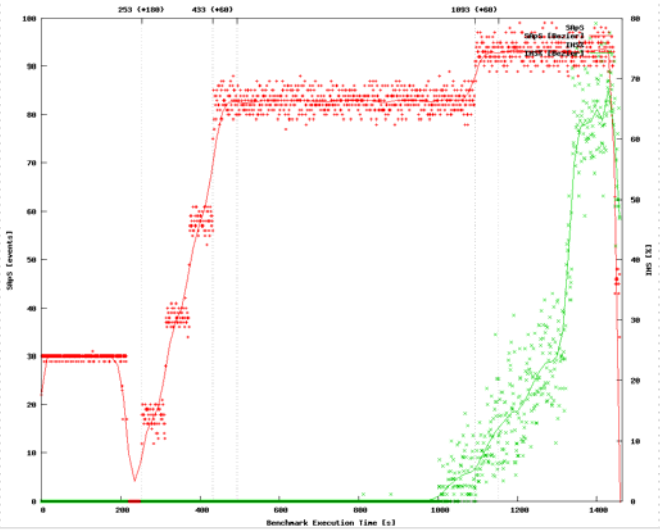
Overall Traffic



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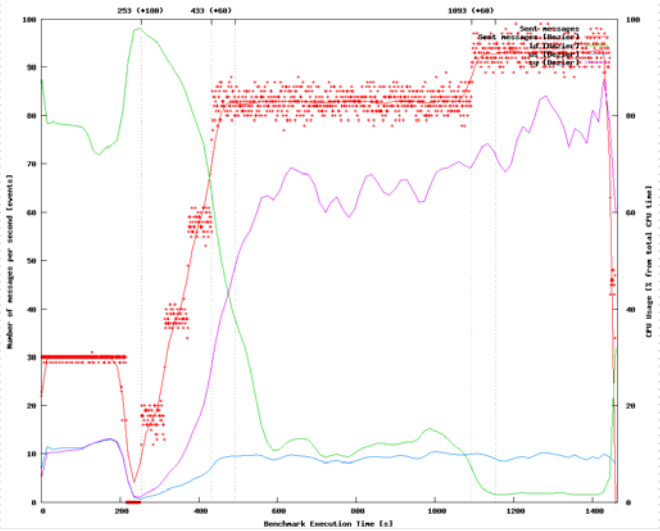
CPU Monitoring on SuT



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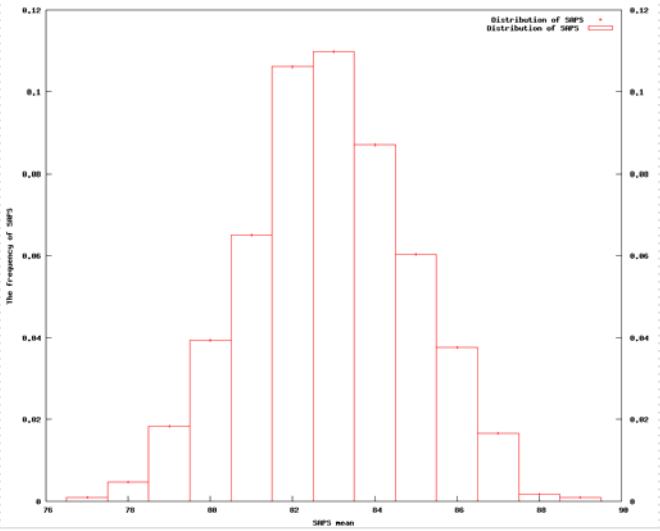
Distribution of SAPS



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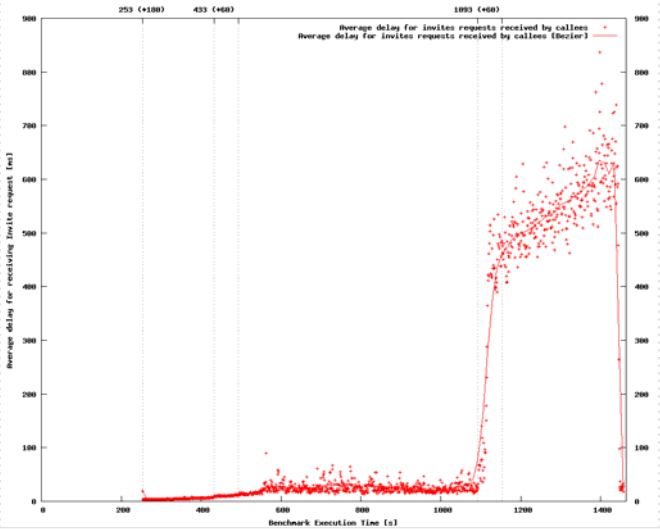
Average Delay for Invite Requests



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Conclusions

- TTCN-3 specification has a big impact on the performance of the hole test system
  - Using a component to simulate more than one user
  - Using a component sender
  - Using a tree like mechanism for matching the messages
- Efficient Adaptation Layer Design has an important role in the overall performance
  - Smart codec/decoder system
  - Non-blocking I/O for protocol stack
  - Optimized runtime for specific needs of the benchmark

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Thank you !

Time for questions …