OSS BSS Technologies

Professional Services, Pre Sales

Application Testing and System Integration

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Application Testing and System Integration

1.1 Test Systems

ATS is a possibly solution to speed up the commissioning phase for the Mobile or IP Networks allowing to match‘s tight schedule.

To minimise cost and delays it is necessary to start testing of the different components as early as possible. To clearly identify possible problems the different units should be tested independently of each other if possible. To achieve this it is recommended to use simulators where available and not to costly so that single units can be tested thoroughly as early as they are available. These simulators would be used again later on when upgrading network components for new features.

1.1.1 References

Sun provides comprehensive and competent consulting in the area of Operations Support Systems (OSSJ). Special knowledge is available in preparation of API`s for Network Management (NM), Subscriber Provisioning, Inventory Management etc. and interfacing of OSS components to the network over API`s. Sun and other Customers, Clients are developing Standards for the OSSJ and the associated API`s and individual solutions for managing networks.

The first systems are in use at T-Mobil and Siemens as well as at several installations at Deutsche Telekom AG for about 7 years until now. During this time it showed clearly, that the test environment helped to reduce commissioning time and improved reliability of the systems drastically. There is no need anymore to delay testing until the last component of the system is available.

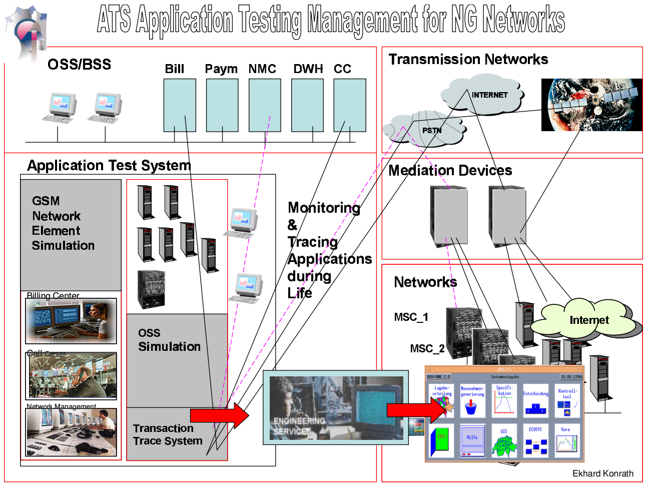


Figure 1

1.1.2 ATS in the context of test systems at Customer's site

The focus of all these test systems is to guarantee an error-free operation of the telecommunication network from the network user's point of view. The Network Element Simulator / Tester is a suitable and necessary completion of the test environment at Customer . ATS has its focus on the management network. It is able to test the network management system from the NE's point of view and the management network (or parts of it) from the "manager's" point of view by simulating the counterparts of the respective systems under test.

Tests using ATS are carried out as pre-launching-tests, i.e. before the systems under test are fully integrated into the network. Thus the tests can be completed and eventual malfunctions are detected *before* they can cause any delays in launching the network.

Pre-launching-tests are the ideal way to test complex systems (as the management network) at various states of integration. Another advantage is the possibility of testing the robustness of the system (or parts of it) provoking errors without endangering the network.

Due to the principle "testing by simulation" ATS can be used for acception testing in case of upgrades of parts of the management network, Billing or Accounting System or the Network Management System. This is especially useful and necessary if the delivery of needed counterparts is delayed.

To give an example: To test the Fault Management at Customer together with the mediation device without an automated tester the requested network elements (NE) would be needed. There are 7 NE types planned currently. For two reasons these might not be available for testing:

- development of NEs might not be finished	(delayed testing)
- to rent or buy the NEs might be too expensive	(cost)

The cost for renting a NE might typically be quite a lot per month. If you wanted to test performance as well, cost would increase even more. One computer simulating the different NEs would help here. In the following we will outline the Network Element Simulator / Tester ATS.

1.1.3 Test focus: what can/should be tested?

Among the aspects to test while commissioning the FMC and the mediation device are the following:

- Applications as Business Processes
- Does transfer of billing data from a given type of NE to the Billing System work properly (functionality)?
- Is the data transfer robust to different failure types?
- Is the performance of Billing System or mediation device sufficient to service numerous of NE's?
- Are alarms reported correctly to the network management centre?
- Is the bill assembled from the accounting data correct?

Given single NEs as system under test the aspects are similar:

- Does the file transfer work properly?
- Does the NE send the requested file at all?
- Is the data transfer robust to different failure types?

1.1.4 Testing the OSS/BSS application system to improve efficiency

The call file generators will generate data appropriate for the simulation of the network elements in question (i.e. switches of different kinds: MCS, HLR, VMS, SMSC, EMS, MMS, AAA etc.). They produce call data records and can be parameterised according to the various needs of the testing situation. For example, the number and type of records and files to be generated can be given. A simple user interface will be used to manage the generators.

In addition to the generators Sun will provide UNIX shell scripts. Working from the set of generated call data records these scripts will provide information to analyse the resulting output of a OSS/BSS Application.

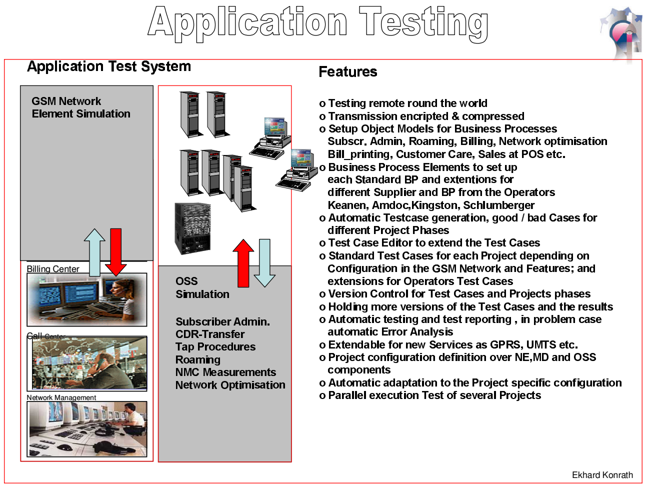
Logging will contain time stamps for each entry and therefore provide information for the analysis of possible bugs and performance constraints of the system under test. The FTP- and FTAM- servers will log the beginning and end of transactions. Also activity of the call file generators will be logged.

A user interface provides access to the logging data for the analysis of possible problems. This logging facility supplements the diagnostic tools which the MD system already provides.

1.1.5 Testing the Mediation System MD

The basic idea of a test system for the billing system is to provide for suitable call data records, let the MD and Kingston systems work on these records and compare the expected result with the result obtained from the Billing System.

These tests will be done for basic functionality, for common error situations as well as under boundary conditions regarding performance aspects. The main components of the test system are shown here:



Application Testing

Application Test System

OSS
Simulation

Subscriber Admin.
CDR-Transfer
Tap Procedures
Roaming
NMC Measurements
Network Optimisation

Features

o Testing remote round the world
o Transmission encripted & compressed
o Setup Object Models for Business Processes
Subscr. Admin, Roaming, Billing, Network optimisation
Bill_printing, Customer Care, Sales at POS etc.
o Business Process Elements to set up
each Standard BP and extentions for
different Supplier and BP from the Operators
Keanen, Amdoc,Kingston, Schlumberger
o Automatic Testcase generation, good / bad Cases for
different Project Phases
o Test Case Editor to extend the Test Cases
o Standard Test Cases for each Project depending on
Configuration in the GSM Network and Features; and
extensions for Operators Test Cases
o Version Control for Test Cases and Projects phases
o Holding more versions of the Test Cases and the results
o Automatic testing and test reporting , in problem case
automatic Error Analysis
o Extendable for new Services as GPRS, UMTS etc.
o Project configuration definition over NE,MD and OSS
components
o Automatic adaptation to the Project specific configuration
o Parallel execution Test of several Projects

Ekhard Konrath

Figure 2

1.1.6 Testing Network Elements

As mentioned above the testing device AST is able to act as Tester for the OSS/BSS applications and simulate the NE site and as Tester for the Network Elements as MSC, HLR, SMSC, MMS, EMS, GPSS, etc. and simulates the OSS/BSS Application.

Out of the Object Models, test cases (good and bad cases) will be automatically generated. The test cases will then be executed over the associated communication protocol and API. The reaction of the NE over the Protocols (CMISE, FTAM, FTP, SMTP, etc.) gives the success status of the transaction back.

The result from the Protocol will be automatically analysed. After all test cases are executed and analysed a automated Report will be prepared who gives a detailed overview on the execution.

1.1.7 Testing IP Networks

As mentioned above the testing device AST is able to act as Tester for the OSS/BSS applications and simulate the NE site and as Tester for the Network Elements as Routers, Switches, RAS, AAA, Intrusion detection, Firewalls etc. and simulates the OSS/BSS Application.

Out of the Object Models, test cases (good and bad cases) will be automatically generated. The test cases will then be executed over the associated communication protocol and API. The reaction of the NE over the Protocols (CMISE, FTAM, FTP, STMP, etc.) gives the success status of the transaction back.

The result from the Protocol will be automatically analysed. After all test cases are executed and analysed a automated Report will be prepared who gives a detailed overview on the execution.

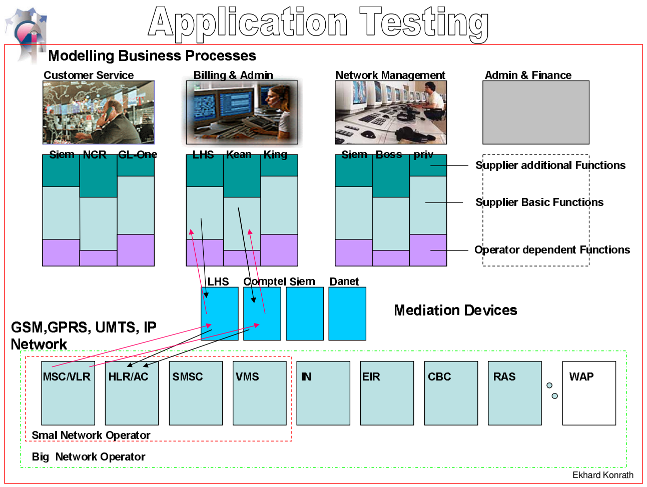


Figure 3

1.1.8 The Situation

The system under test is either the mediation device MD, together with the management systems (for example a Billing system for GSM, GPRS, UMTS and IP or a single Network Element.

In the first case the manager sends a set of service requests to the MD specifying commands to be executed by any of the various network elements (NEs). These service requests represent the manager's view of the network and the possible operations.

The mediation device transforms the incoming service requests into NE-specific MML-commands, thereby mapping the manager's view of the network onto the NE's view.

Our testing tool ATS simulates the various NEs at their interface to the mediation device, in order to test the MD (and thus implicitly all attached components).
Testing a network element ATS simulates the mediation device as far as necessary. MML-commands are sent to a specified NE and logged. At the same time ATS simulates the NE and predicts the correct result. Both results are compared then.

1.1.9 Principles of ATS

1.1.9.1 The MML-interpreters

The interface of ATS to the MD is given by MML-interpreters. Incoming MML-commands are translated into a generic common command language (CCL) understood by the MIB-builder. Considering the equivalence of the sets of service requests as an input to the mediation device and the outgoing MML-commands, it is useful to keep the CCL-design close to the specification of the service requests defined for the interface between FCM and MD. Keeping in mind the different purposes of different types of NEs, one MML-interpreter per type will be required. We will have as much as affordable MML-interpreters, corresponding to the following connected NEs e.g:

Cisco Router
SUN Firewall

Siemens MSC/VLR
Siemens HLR/AC
Siemens SCP via SMP/MDI
Ericsson MSC/VLR
Ericsson HLR/AC
Ericsson SCP via SMP/MDI
etc.
Comverce SMSC
Comverse VMS
Comverce EIR
Comverse EMS
Comverse UMS
Comverse MMS
etc.

Every MML-interpreter acts as a client to the MIB-builder as. The output data (i.e. the CCL-commands) are sent to the MIB-builder via inter-process communication.

The MML-interpreter converts expected responses that arrive at this ATS-internal interface to the MIB-builder according to the NE-specific protocol and passes them to the mediation device.

At the start of ATS all five MML-interpreter processes are instantiated. Each of them establishes a TCP/IP-connection to the service provided by the MIB-builder. The transferred information contains all data received from or bound to the system under test and an identifier (e.g. the addressed port number or X.25-sub-address) of the virtual NE. The latter is represented by an instance or a sub-tree in the MIB.

The modular architecture of the MML-interpreters supports easy extension to new additional NE-types in the future of the CUSTOMER network and the MD.

1.1.9.2 The MIB Management Information Base

A very important feature of any testing tool in the context of network management is a consistent view of the simulated or real managed network. Synchronisation of the testers view and the system under test gives necessary information about success or failure of the test.

The Network Element Simulator / Tester uses an abstract implementer-independent object-oriented model (OOM) of the network to build a management information base (MIB) that corresponds to the momentary state of the network. The OOM corresponds to the view of the network expressed by the service requests at the interface between the manager and the mediation device.

The OOM provides "templates" that may be instantiated (created), modified or deleted by commands given in a generic common command language (CCL). CCL-commands allow furthermore to extract data from the instances in the MIB.

Essentially the MIB is a data base containing instances of elements of the OOM that represents ATS's view of the network. In order to guarantee consistency between the MIB and the network view of the manager it is necessary to start testing with an empty MIB and an empty momentary state in the manager's view. Analogously the same is valid for network elements. In the contrary one might start with unsynchronised views to test robustness to illegal commands.

1.1.9.3 The MIB-Builder

The MIB-builder is an interface to the MIB.

MML-Interpreters translate MML-commands received from the real or virtual MD (SAS) into CCL and send the resulting commands via inter-process communication using TCP/IP to the MIB-builder.

A service is established in the MIB-builder (as UNIX standard procedure: entry in /etc/services). This service may be addressed by the MML-interpreters at a well-defined port number.

Thus we have a typical client-server architecture. Required responses are sent to the MML-interpreters, where they are adapted to the format expected from the NE and (dependent on the test situation) passed to the mediation device.

1.1.9.4 Communication to the Test System

The communication between the test system ATS and the mediation device MD or the attached network elements is twofold: we have an X.25-network using the OSI FTAM-protocol and TCP/IP on a LAN. This corresponds to the communication between the MD and the actual NEs.

Testing the mediation device MD significant parts of the real network are simulated by ATS represented by a single IP-address and a single X.25- address. Thus our test system expects IP port numbers and X.25-sub-addresses to identify a virtual network element. We assume that the MD can be configured to support this approach.

1.1.10 Hardware and System Software requirements

Though many simulations and tests can be done on the platform of the MD system itself, we recommends an independent testing device. Data collection using FTP or FTAM can thus be simulated closer to reality with no performance dependencies.

We recommend to acquire an additional Unix Machine. This system can be scaled within a wide range and fits to the main system which is also a Unix Cluster. Exact specification of the software components of the test platform will be given in a possible offer.

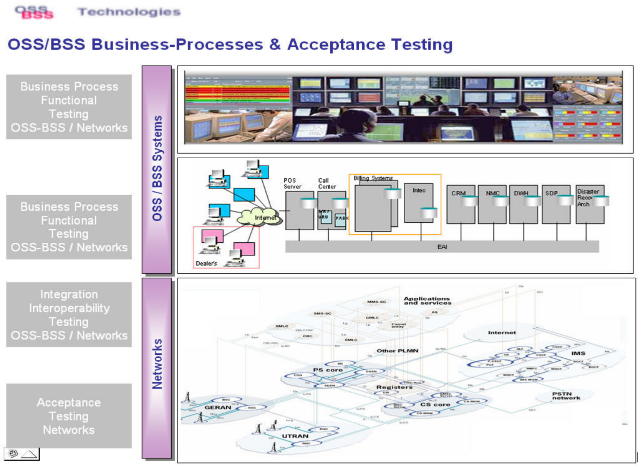
1.1.10.1 Acceptance Testing

Testing is required to check conformity of the OSS/BSS functions to GSM, GPRS,UMTS and IP networks and the associated international ETSI / ITU specifications. It helps to find bugs and problems in a early phase and helps to avoid serious trouble during operation. Testing has to cover the OSS/BSS functions as well as the OSS/BSS TMN Q3 Interface to the network elements and specialized API's for newer Service Elements .

For a high quality of test results and speed up the testing process it is highly recommended to install test tools. The testing period of four month is very short and can be only realized if the fault preparation by the supplier will be fast enough. To organize the tests not time consuming pre tests should be foreseen by the supplier and at delivery time all tests onsite by Operators Management. However the following points must be included

- test tools for the acceptance testing
- buying test tools for the OSS/BSS interfaces over API's and TMN Q3 interfaces
- preparing acceptance testing specification for the OSS/BSS Systems
- preparing acceptance testing specification for the API for TMN Q3 Interface
- preparing a test, execution and manpower plan for testing
- preparing pre test phases by the supplier
- test phases for pre testing the OSS/BSS by the supplier
- test phase for the OSS/BSS
- test phase for the TMN Q3 interfaces
- test phase for the API interfaces
- automatic analysing of test execution
- automatic preparation of the test report
- preparing test documentation
- preparing Handbook for Error reaction and correction lists and talks to the supplier about the correction

After successfully execution of the testing period the Operators Management get a demonstration of the running OSS/BSS system and the inter working with networks.



OSS BSS Technologies

OSS/BSS Business-Processes & Acceptance Testing

Business Process Functional Testing OSS-BSS / Networks

Business Process Functional Testing OSS-BSS / Networks

Integration Interoperability Testing OSS-BSS / Networks

Acceptance Testing Networks

Figure 4

1.1.10.2 Acceptance Testing of Remote Infrastructures

The ATS Testing System can be configured that the OSS/BSS functions for GSM, GPRS,UMTS and IP networks can also be tested remotely.

- configure ATS test system for remote acceptance testing
- buying test tools for the OSS/BSS interfaces over API's and TMN Q3 interfaces
- preparing acceptance testing specification for the OSS/BSS Systems
- preparing acceptance testing specification for the API for TMN Q3 Interface

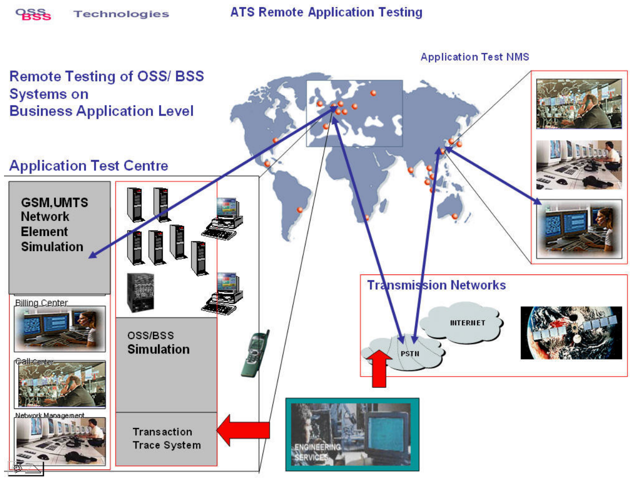


Figure 5