aartesys Communications

AMIRA Service Test System

Are you responsible for Service Fulfilment or Service Assurance? Active Service Test Systems by Aartesys AG make your work easier!

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Service Test System based on AMIRA / STU

Introduction and overview

The Service Test System of Aartesys AG supports the operators of telecommunication networks in various areas of service fulfilment and service assurance:

- Intelligent response functions simplify the process flow for the **activation and functional testing** of connections and/or end devices such as telephone, fax, PBX or data terminal devices.
- The analysis of defects in a telephone network with manually controlled, outgoing test calls provides a fast and cost-efficient solution to **fault triage**.
- The functions for automated, **pro-active quality measurement** by performing test calls on other system units of the AMIRA System or on response stations in national or international networks make AMIRA a mature end-to-end test system for evaluating service availability, measuring the quality of services and network transitions or verifying SLAs between customers and operators.

The Active Service Test System in new-generation networks

New requirements for test systems are created by the increasingly heterogeneous telecommunication environment and the growth of new generation networks with general packet transfer for voice data. The system AMIRA / STU has an open, scalable architecture and can therefore be adapted to these new requirements. Its combination of proven test functions and new technologies provides the user with added value.

In addition to the ISDN- and POTS-based test functions, ALMIRA now also provides VoIP-based services. The STU IP (Service Test Unit for IP-based services) is not connected to IDSN or POTS lines, as was previously the case. It is connected to a broadband line such as ADSL or VDSL, like a user. The functions are available in the system as H.323- or SIP-based services.

Extended test options have been implemented to cater in particular for the needs of VoIP users.

Architecture of the Service Test System

The Service Test System is based on the system elements AMIRA Management System and one or several STUs (Service Test Units), which are integrated as active, remote-controlled test units in the system.

The STUs are based on industry PCs and communicate via the LAN with the AMIRA Management SYSTEM, which includes the necessary communication interfaces and a central SQL database.

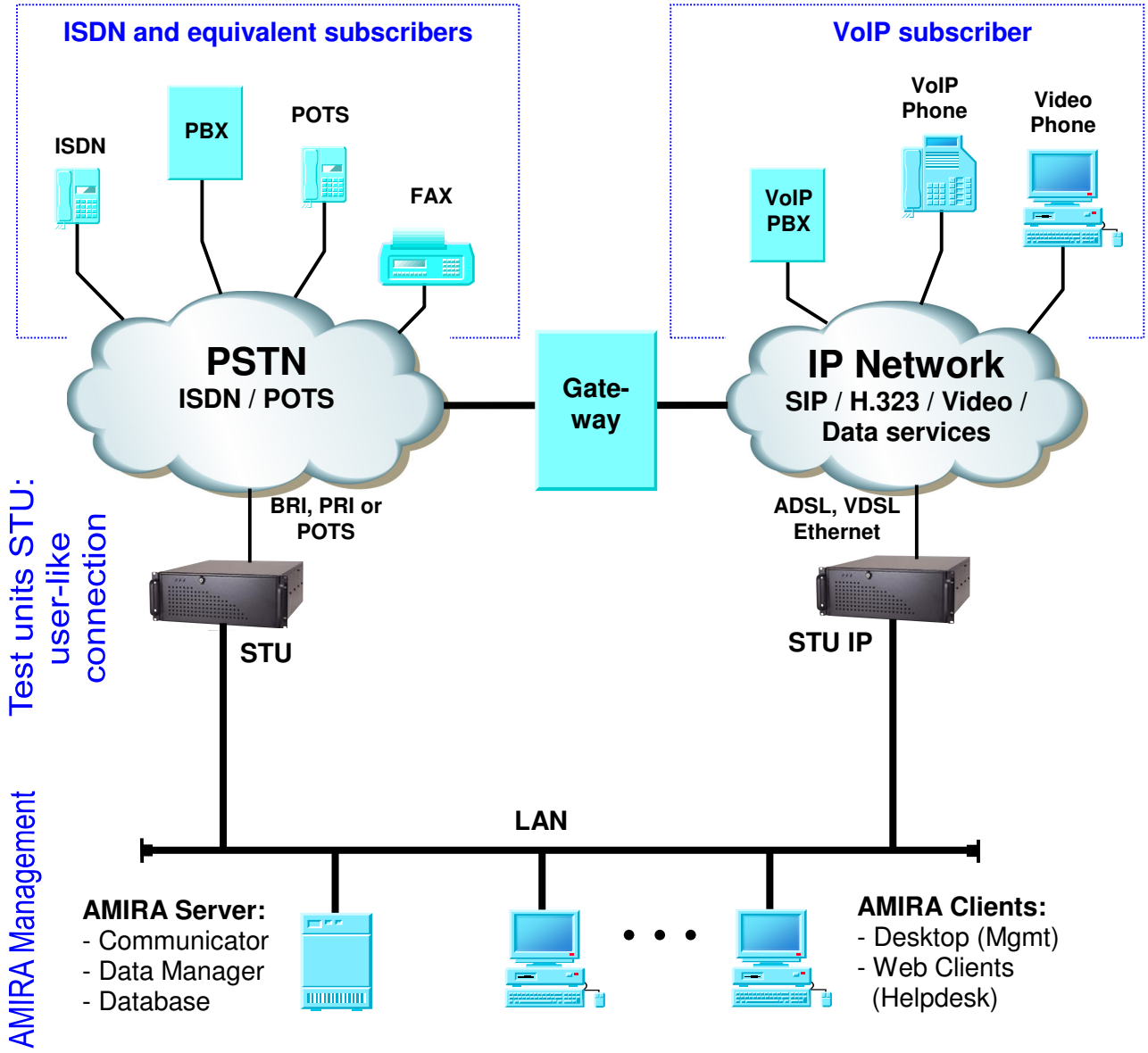

Figure 1: Overview of the architecture of the Service Test System

Connection of the STUs to the communication network

The STUs are connected to the appropriate communication network like users, using analog lines such as ISDN BRI or ISDN PRI. The STU IP is connected to an Ethernet port with an IP-capable broadband line to the IP backbone. This is normally done with an ADLS or VDSL line.

Intelligent response functions for activation and testing

Use of the response functions

The intelligent response functions are test functions that are simple to use and always available for the following purposes:

- Verification of the activation of connections at the customer side
- Functional test of connections at the customer side
- Verification of the activation of end devices
- Functional test of end devices and software installations for IP communication
- Setting and configuring of end devices and applications
- Functional test of additional services

All calls to the response functions and return calls are logged by the system and centrally stored.

Benefit of the response functions

The response functions are structured so that their use requires only a minimum of knowledge. The functions can be applied by specialists or directly by the end user, e.g. to provide initial functional tests or to complete an activation.

Additional benefits of the response functions:

- Require no special test devices on site, as the existing equipment is used for testing
- Response functions are available at all times of the day
- The end user has a test facility at his disposal that provides clear proof
- The response functions simplify activation and repair processes. Their use facilitates a higher test quality and the standardisation of tests
- The logging capability of the system makes it possible to generate activation records automatically.
- A history can by built up for tested connections

Basic structure of the response functions

The intelligent response functions are based on the basic services that are available according to the nature of the communication network, e.g. voice services (speech, audio, SIP, H.323), fax (G3 and G4) or data (ISDN X.75 or HDLC, IP data services PPP, TCP, UDP).

Additional services are sub-addressing, user information, line identification and call forwarding.

The response functions are based on various basic functions: call only, call acceptance, return call, compatibility test, call-up of functions, loop functions, etc.

The combination of the basic functions, mapped onto the basic services and additional services mentioned above, results in intelligent response functions that can be directly called by the user. Voice or fax services that must be compatible in different networks, can obviously also tested across network boundaries, e.g. ISDN → VoIP or vice versa.

Examples of intelligent response functions

- Response function with audio test and return call
- Response function with recognition of numbers and services and reply in speech form
- Callable BERT (Bit Error Rate Test) with return call and announcement of the BERT result

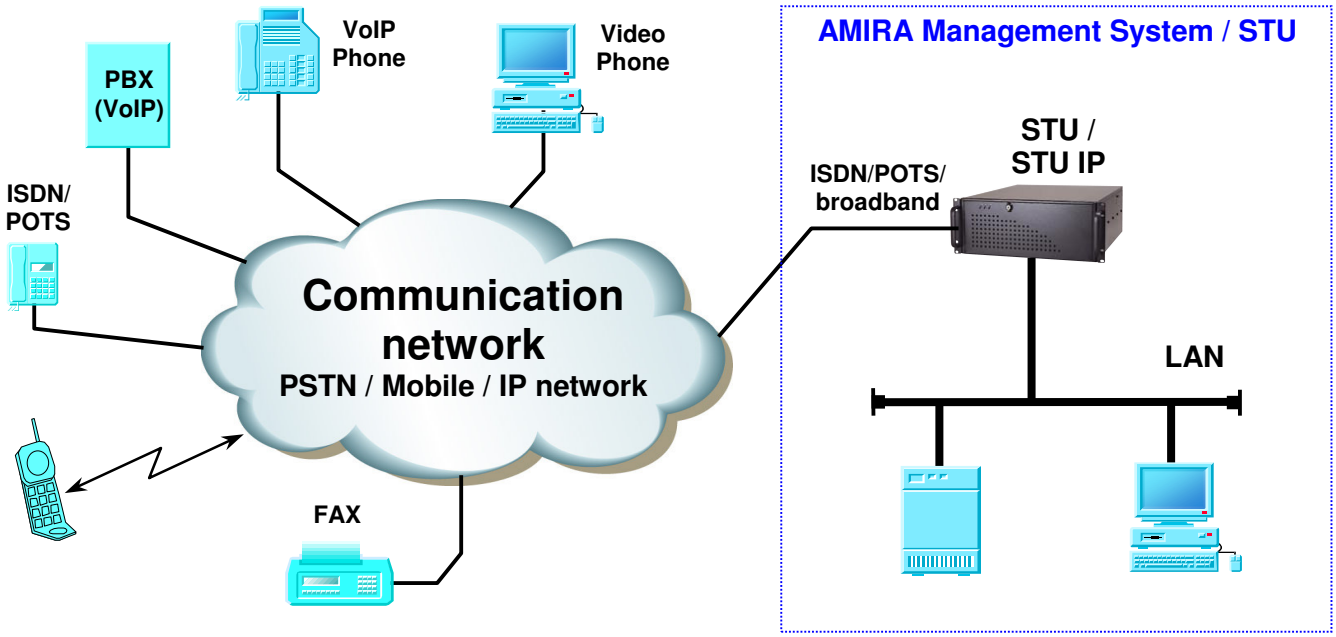

Figure 2: Intelligent response functions for different services

Integration of response functions in process flows

The architecture of the service test system facilitates tailor-made solutions for integration in process flows. A further strength of the system is the central storage of call data. This information can be processed within AMIRA or in external systems.

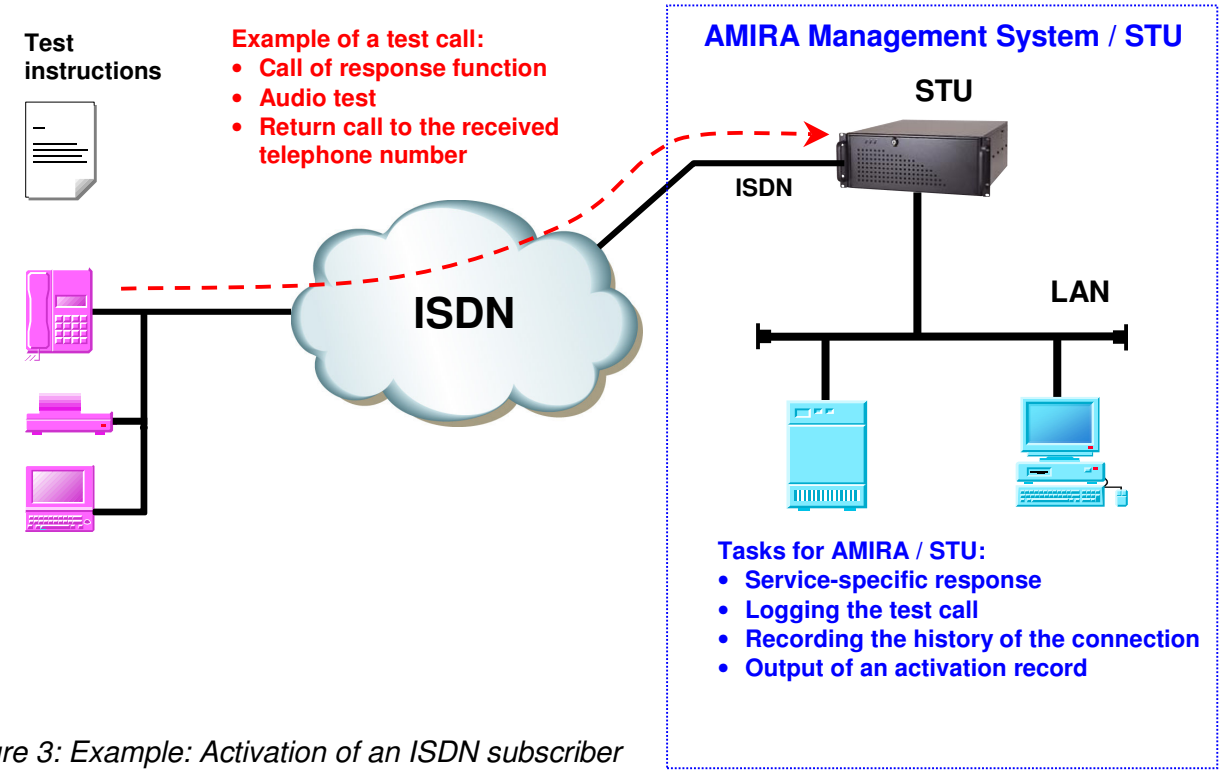

Figure 3: Example: Activation of an ISDN subscriber

Example:

The activation technician tests the function of the line or of the end device with a simple test procedure by calling a response function of the Service Test Systems. The response function is executed and the call is documented in the STU and stored in the AMIRA database. The system provides a test protocol as proof of the successful activation. If the test cannot be successfully performed or completed, the tester receives an appropriate message and no protocol is created.

Selection of different functions

Different dial-up options can be offered for the intelligent response function, depending on the type of connection. In the simplest form, these may be the MSN numbers of an ISDN line. If there are several parallel analog or ISDN lines, they may be combined to form a multiple connection and addressed by a DDI number range (Direct Dial-In).

The method involves normal subscriber lines, which may also be addressed through an IN number, e.g. a 0800 number, when the outside line is appropriately configured. This also applies to MSN and DDI number ranges.

Different URLs can be configured to address functions of the STU IP, which is connected to an IP network.

It is in all cases possible to use DTMF signalling after the dial-up to make a selection (see Chapter “User management of response functions”).

User control of the response functions

The response functions can be adapted to the needs of the customer to generate a wide range of options. Elements of active user control can be integrated into the measuring functions of the response functions, similar to an IVR system (Interactive Voice Response). Input and selection of options is possible with DTMF signals after dial-up. Output of text elements is possible, e.g. for providing a measuring result. Recording and replaying speech elements facilitates measuring the subjective speech quality.

User control for addressing external systems

The speech interface can easily be used for triggering external systems that are not directly integrated into the AMIRA management environment.

An existing measuring system for copper lines, for example, may be directly controlled by the caller through a response function, or a service test function can directly trigger a copper test if the test result is negative.

The output of measuring results as a speech test or in the form of an SMS is a basic function of the Service Test Systems. This function may also be used for the output of results of external systems.

Response functions based on IP voice services (VoIP)

In general, the IP-based speech services only differ from TDM-based speech services with regard to the connection technology. The same test philosophy that is used for POTS and ISDN connections is therefore also used for IP-based speech services.

The response functions are based on emulation of VoIP end devices in the STU IP. The protocols H.323 and SIP are supported.

Extended response functions for VoIP

IP-based speech communication poses new challenges for installations and end devices. The selection and settings of VoIP telephones may, for example, have a strong impact on the

subjective speech quality. An additional problem is often caused by the transmission of DTMF signals, which are used after dial-up to control additional functions or devices.

Callable speech quality test

The Service Test System offers a response function for the control of speech quality, which allows the user to measure the speech quality received in a dialogue and to receive the measuring result as speech text.

If this speech quality test is integrated in a teleconference, the speech quality for this teleconference can be measured as well.

DTMF transmission test

For testing the DTMF signalling after dial-up, a simple function is available that receives the DTMF signals and confirms them to the caller in speech form.

Test of network transitions and gateways with response functions

Network transitions are often hurdles in heterogeneous multi-carrier network that involve several network technologies (TDM and IP telephony). Information may be lost or only partially transferred, numbers may not be translated, etc.

As the Service Test System is established in both technology areas, it seems obvious to use the intelligent response functions in particular for testing these network transitions and gateway functions from the user end device onwards.

Manual test calls for triaging faults

Use of manual test calls

The manual test calls are used for rapid analysis of the fault situation in a network or for a customer line:

- Determining fault places and fault states by using generated test calls and interpretation of the network response
- Functional test of connections and end devices from the central station
- Functional test of network services
- Functional test of network transitions

All test calls are logged by the system and centrally stored.

Benefit of the manual test calls

The way the manual test calls work and the easy adaptation of the client application to existing systems make this function an ideal tool for fault triage in the helpdesk area.

- Rapid fault analysis to delimit the fault location and determine the necessary measures
- Simple user interface with interpreted response of the system
- Prevents ping-pong effects between offices

Basic functions of the manual calls

An AMIRA client starts a manual test call. A specific or predetermined STU performs the test call according to the parameters supplied. The STU analyses the call and transfers the results of the test call to the AMIRA Management System, where they are processed. The system sends an appropriate version of the results to the client and stores them in a CDR (Call Detail Record) with the processed additional information in the SQL database.

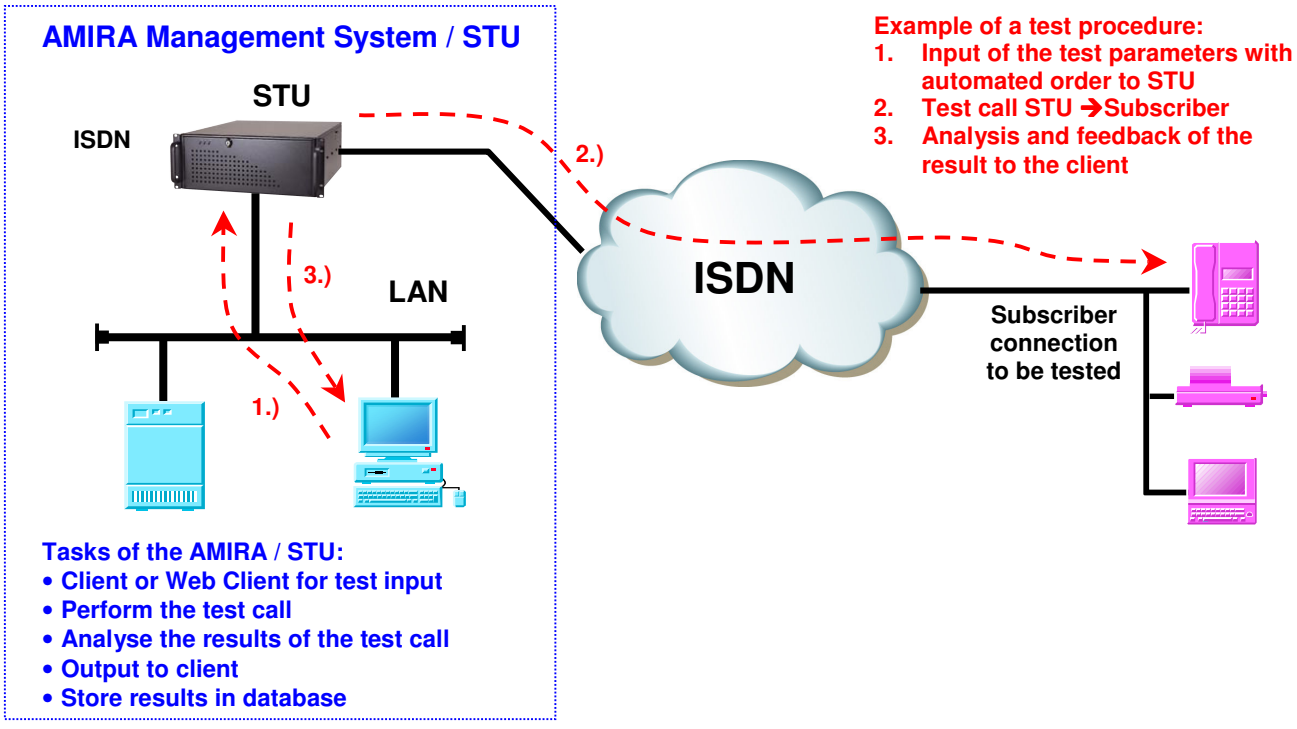

Figure 4: Procedure for a manual test call

Structure of the Helpdesk Client application

The client application can be adapted to the needs of the customer. A dedicated client application (AMIRA Desktop) is always available. It provides access to certain functions with configurable user rights.

Functions for the helpdesk area are also available on the Web clients. These functions can also be called through a Web interface by external applications.

Full functionality for the specialist

In addition to predefined profiles, the full version, which is available in the dedicated AMIRA Desktop Client or as “Full Web Client”, provides the option of changing all parameters for manual test calls to get all the information available from a test call.

The result of a test call is returned with an interpreted analysis and all details of the respective communication protocol (ISDN, H.323, SIP...), which provides the expert with all the in-depth information available.

Helpdesk Expert with interpretation

The Helpdesk Expert Client is available for users without detailed knowledge of protocols.

It can be called with a browser or, for example, integrated into a process tool. The parameters of the test calls are to a large extent predefined, so that only few inputs are required to start the test.

The response can be adapted to the user. It may range from a simple “good/bad” indicator to the output of defined process steps.

Helpdesk functions for VoIP

The new STU IP offers test options that are functionally identical to those on POTS- or ISDN-based STUs. The call is performed either as an H.323- or SIP-based test call. The call parameters can be set, depending on the client. The result of the test call is interpreted according to the application or sent with protocol details to the client. It is also stored in the database.

Test of network transitions and gateways with manual test calls

The Service Test System with the STU can perform TDM (ISDN, POTS) test calls. The STU IP can now also perform VoIP (H.323 or SIP) test calls.

This makes it easy for user to test network transitions and gateways.

Combination of the manual test calls with response functions

For network-related test calls such as the gateway tests mentioned in the last section, there is often no reply station immediately available. The Service Test System offers a complete solution for such cases, as it combines manual test calls with response functions. It is therefore of considerable value for helpdesk applications as well as for network operators.

Manual test calls for special functions

Complex test functions can easily be assembled from existing functional blocks to suit the customer requirements.

Proactive measuring of service quality

Use of automated test calls

The automated test calls are used for proactive measurement of several quality-relevant parameters in communication networks:

- End-to-end measurement of the service availability for several line interfaces and network technologies
- End-to-end measurement of quality parameters for several line interfaces and network technologies
- Connection test with evaluation of switch parameters
- End-to-end measurement of in-band parameters
- Speech quality measurement and analysis

All test calls are logged by the system and are centrally stored.

Benefit of automated test calls

- Automated monitoring and alarms concerning the quality characteristics of networks
- Automated monitoring and alarms concerning the availability of services
- Automated monitoring and alarms concerning network transitions
- Compiling quality reports for network monitoring and trend analysis
- Compiling availability and quality reports as proof for Service Level Agreements (SLA)

Basic functions of automated test calls

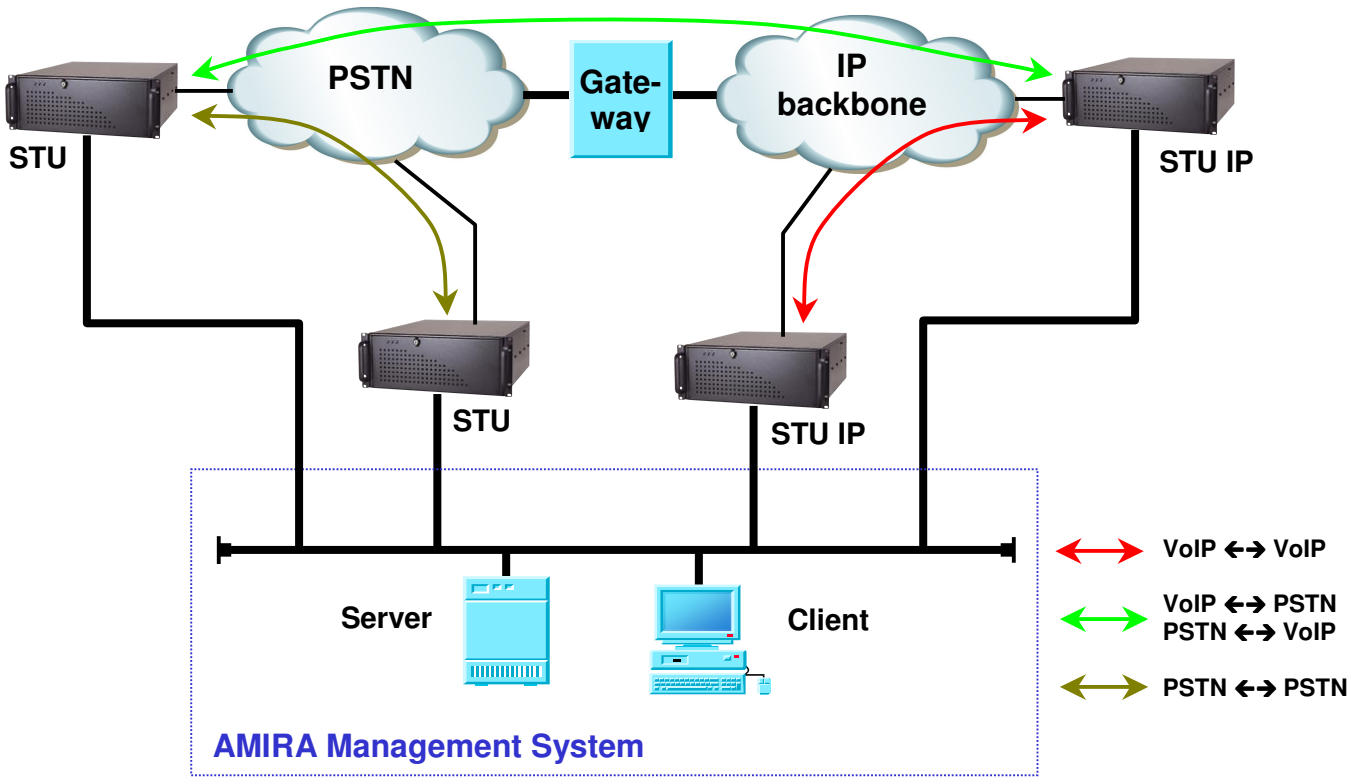

Figure 5: Automated test calls for quality tests

The automated end-to-end tests are planned on an AMIRA client and then loaded via the central database onto the various STUs as day programs. The day programs contain a list of test calls that are performed at specific times with predefined measuring parameters.

The test calls are either made to the response function of another STU, which provides maximum depth to the information, or the called unit is an external device, e.g. an answering machine or a normal fax, which provides limited measuring results. Test calls to external units are sufficient for connection tests.

The executing STU analyses the call, performs the in-band measurements required and sends the result of the test call to the AMIRA Management System. There, the information is processed and stored in appropriate form as CDR (Call Detail Record) with additional information in the SQL database.

The STU called analyses the incoming call and also creates a CDR that is stored in the database. The two CDR of the same test call are combined into one result by the user interface or in a report.

All measuring results can be integrated in reports for different sites by using a reporting tool. Normally, these reports are compiled with the application “Business Objects” (BO).

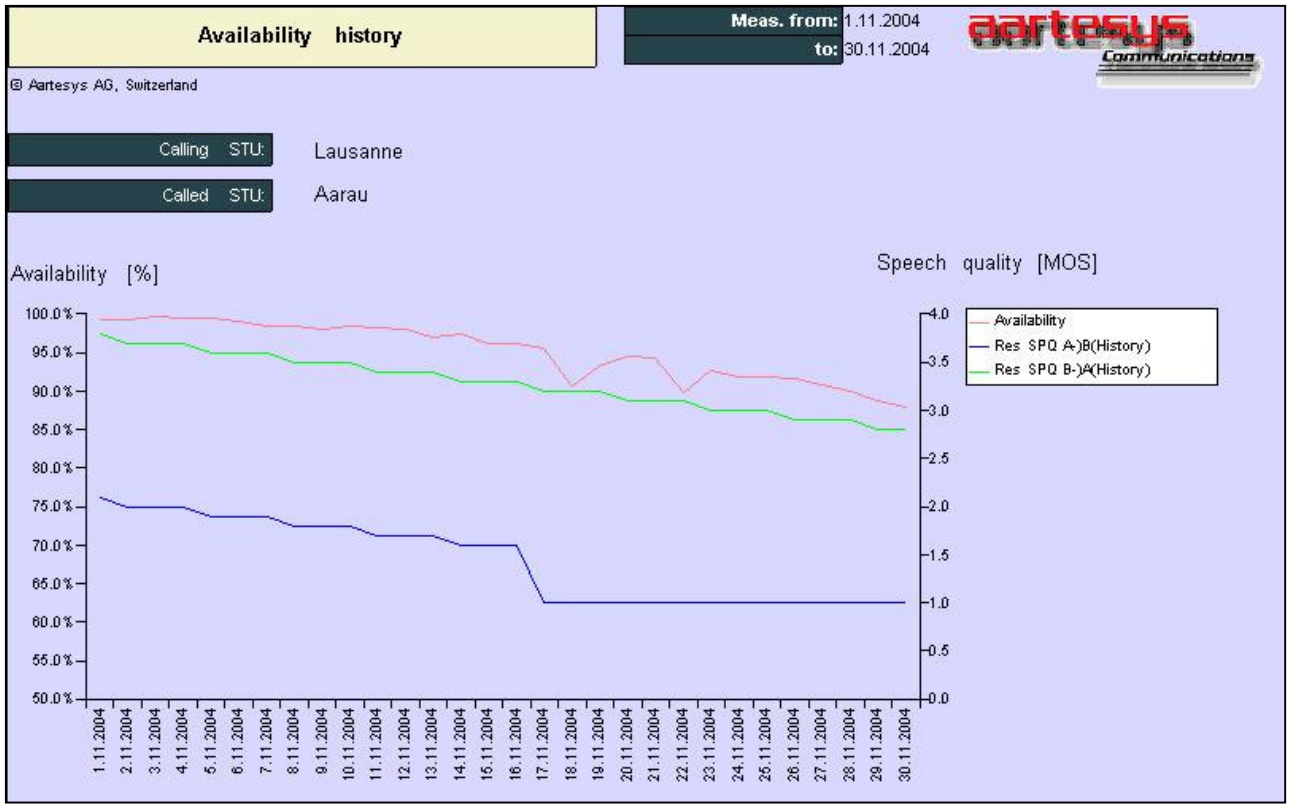

Figure 6: Example of a quality test report for speech quality

An alarm module supplements the application. If faults occur or specific parameter thresholds are exceeded, the results can be provided as alarms. They can also be forwarded by e-mail or SMS.

The open systems architecture facilitates the use of different interface technologies. This makes it possible to perform quality tests between PSTN (ISDN and POTS) connections and IP-based networks (VoIP H.323 und SIP).

Measuring parameters

The measuring parameters can be classified in switching parameters and connection parameters.

Switching parameters

The switching parameters mainly contain indicators concerning the build-up of a connection and the time delays between the various steps of the connection build-up. The parameters are stored for each call, also for calls that did not lead to a successful connection

Switching parameters are obtained from the signalling protocol (ISDN, H.323 or SIP) or the dial tone signals (POTS). Depending on the protocol and the signalling, more or fewer parameters are available.

Examples for switching parameters are timed for building up the connection, availability or number of prematurely terminated connections.

Connection parameters

Connection parameters can only be measured in successful connections. They are based on various measuring methods and cover aspects such as, for example Round Trip Delay, Bit Error Rate Test (BERT) or measuring the speech quality.

Connection parameters for VoIP connections

The measuring parameters for VoIP connections in IP networks are derived from the RTP / RTCP traffic and processed.

Examples of parameters measured are Packet Loss, Packet Delay, Jitter and Round Trip Delay or One Way Delay.

Connection parameters for ISDN connections

The switching parameters are obtained from the 64 kbps user channel (B-channel) of the BRI or PRI line.

Connection parameters for POTS connections

The switching parameters are obtained from the analogue user signal (analogue signal 300-3400 Hz bandwidth) of the line.

Speech quality test

The speech quality is measured with a standardised method according to ITU-T P.862. An STU sends a defined speech pattern of several seconds duration. The receiving STU compares the speech pattern received with the original and provides the result as a MOS value. This value is between 5 and 1, where 5 represents excellent speech quality and 1 indicates completely unintelligible output. A fault-free ISDN line has a maximum value of 4.3. VoIP connections have ideally values between 3.4 and 4.3, depending on the encoding method. Speech with an MOS value below 2.5 is considered hard to understand.

In addition to the MOS value, various other quality parameters are measured, e.g. noise, echo, clipping, etc.

DTMF test

The DTMF test measures the transmission quality for DTMF signals instead of speech quality. The network transparency of DTMF signals is very important for many additional and control functions.

Automated test of network transitions with alarm

The Service Test System generates test calls between different networks according to a predefined scenario. This may involve networks based on different technologies (PSTN, IP) and/or networks of different service providers. Based on the results of the test calls, the AMIRA Management System generates alarms that can be shown or forwarded by e-mail or SMS.

The test results are analysed with specific methods and immediately provide information with regard to type and location of a possible fault.

IVR test

Automated, interactive voice response systems with control options are nowadays used in many areas. Special test functions that test the functionality and thereby the quality of such systems, can be adapted to specific IVRs. The checking of the functions is automated and alarms can be provided in the event of problems.

Examples are tests of voice portal services for obtaining information and querying own (sensitive) data such as account balances, etc.

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