Centers 130 For Faults Maintenance In BTC

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Abstract **- The report presents centers 130 for fault service, data analysis and fault management to support qulity of service in fixed telecommunication distribution network.**
The main achievements of the presentation are:
- precise analysis of the quantitative quality of service data;
- data evaluation for a support of quality of service of fixed telecommunication network.

Key words **- Fault Maitenance, Telecommunication, QoS.**

I. INTRODUCTION

Telecommunication Network is a complex technical system, which has developed chronologically with the level of technology available in the moment of building. The main goal of the telecommunication network is to provide quality communication for exchanging information.

In telecommunication network have applied different stage of technology developments. There are used wireless technologies, satellite technologies, optical cables, coacsial cables and copper cables. Fast technology changing and new services lead to building of many complex telecommunication networks. In contemporary networks are connected different type and different generation of element and equipment, which must join suitable in order to provide subscriber services based on a connection end to end in the network. There are different type of elements and equipment digital and analogical, that means, it is increased complex functionality of network. It is important to provide for QoS (Quality of Services) of telecommunication network.

The new high technologies, which are applied in telecommunication don't support high quality of services of telecommunication network, because the level are determined of the oldest technological elements in network.

Telecommunication network requirements for reliability are very high and reestablishment (in case of faults) must be done fast. Its main components are in generally the following: subscriber cable net, cable net between exchanges, main cable net between towns, commutation equipments, transportation equipments, electricity units. To support of high quality of telecommunication services it is need to maintain parameters and functions of each of the main components of telecommunication network in the given boundaries. It is necessary continual control and supervision of parameters and processes in separate components of the net.

Digital exchanges have many function and software programs, which allow to do control and supervision of base net parameters and functions. Siemens analogiue exchanges A-29 have electrical-mechanical elements and their maintenance in good technical condition require doing continual preventive and technical survey.

II. CENTER 130 COMPONENTS

Center 130 is hardware-software product that combines communications and data processing technology to enable an organization to implement critical fault management strategies in telecommunication. Physically, Center 130 is a place where a group of people handles large volumes of incoming or outgoing calls for the purpose of customer service, fault management, technical support, or other specialized business activity. Center 130 is organized in every BTC region. The components of BTC Centers 130 include fault tests, fault management and rehabilitation.

III. CENTER 130 FUNCTIONAL STRUCTURE

Customers are usually given a free call number to ask questions about products or services. Functional structure of Centers 130 includes the following ways in depending operational implements:

- Oracle application for initial subscriber calls;
- Oracle application for fault management;
- Hardware-software application for rehabilitation.

Order processing Center 130 with the appropriate call management/tracking software can improve the customer service and the quality of service of telecommunication network. There are four phases:

Phase 1: Start test It is tested the status of subscriber line using distance automatic test. The start test includes measurement of electrical parameter of subscriber line and evaluation toward giving limited values. If only one of the parameter value don't satisfy the limit conditions, it is accept a fault.

Phase 2: Fault Localization It is executed the search algorithm, applied to the telecommunication network object, which can be out of order. As a result it is found at least one object in fault.

Phase 3: Fault Identification All hypotheses, connected with the object from previous phase, are tested and evaluated to fine exactly hypotheses.

Phase 4: Control test and rehabilitation After reparation the status of subscriber line is tested and the object is permitted to ordinary work.

IV. FAULT MANAGEMENT APPLICATION SYSTEM

In research center of BTC was developed integrated hardware-software system, which maintains Center 130 for fault requests, test, diagnosis and faults remove management. The system works in all regions of Bulgaria.

The system provides the following main functions:

- Acceptance of single call requests and their registration in Data Base (DB);
- Order calls and making faults diagnosis;
- Faults repair management and reestablishment;
- Automatic assignment;
- Support network data;
- Network maintenance;
- Supervision and telecommunication network quality of services (QoS).

Main system components, supporting the previous functions are the following:

- Access data module;
- Test module includes three components:

A/ automatic exchange test, which makes a list of telephone numbers with parameters out of prescribed default limits;

B/ test of single telephone number in exchange and subscriber lines (personal subscriber elements and units) or test of some network elements and equipments;

C/ intelligent software module for evaluation the test results.

- Faults management module;
- Network support module;
- Exchange and subscriber data support module.

There is a special module for testing and analyses the faults, which leas to a group of subscriber failures in the same net area, for example more than 20 pairs faults in one cable.

- The system support different work places:
- In Center 130 for faults diagnostic – there are some operators who work with entry-requests screen form, accept subscriber telephone calls and faults requests, start testing and save the information in DB.
- In exchanges and maintenance services, which are in different building for different exchange there are technical operators, who make additional tests, dispatching faults and control the process, print reports.
- System administrators, who control and supervise all system modules and support DB, aided with SQL program language can have access to the whole DB. The system creates and maintains centralization DB as Oracle DB.

The computer system for Center 130 is developed using Oracle Server 8.1.7, Designer/2000, Developer/2000 (Forms 6.0 and Reports 6.0), Discoverer 3.0, C++. The first realization is a client-server application. The second realization is developed as web application and it is used Oracle 8i, Web Application Server.

Data base structure is most complexity. Objects are used for modeling and representation of data and knowledge in the system. Knowledge is used for creating a suitable object structure, which design the subject area. The objects are all net elements and units. The data, which is need for system work, can separate to incoming data and system data. The incoming data include data for objects in the system, as the system data formulate and reflect the work environment of the computer system. Incoming data is taken into the system in the installation process. The system data is part of the system, but only part of it can update in current system environment.

Program realization is module designing, flexible and parameter ability. The system is prepared to different configurations and application using parameters. The system is prepared to different test units, digital exchanges and structures in BTC.

V. DATA ANALYSIS

In the system for Center 130 there are accepted, received, updated and saved many data and it allows the survey of both the statistical data processions of the test results of single call tests and automatic exchange tests. Using data criteria faults data supply the data to be grouped in error groups as the quality indexes, character and causes of failures.

There is created a quality matrix, which allows a full view to the operator by the testing network. The rows of the quality matrix are the subscribers calling, the columns are the units, which are called and tested. Quality matrix is generated when the tested values exceed the given limit values. Excess is given by three parameters: absolute error number, error rate and time interval. They can be defined individually in each test selectively to each error–group. Excess of limit occurs if in a given time interval the absolute error number or the calculated error rate of the incoming test results is greater than the relevant parameter. To the efficient use of the quality matrix adds that not only the excess limit but their display can be selected individually in each test and error-group. Consequently, information on a given problem (for example switching faults of domestic trunk calls in high traffic period) can be treated separately.

Here an overall analysis of calls ending up with a busy tone will be presented. It must be underlined that a busy tone can have three causes:

- Congestion while the call is being built up (it is due to the actual traffic load);
- Time out release while the call is being built up (it is due to a technical failure);
- The called telephone number is engaged (it is excluded by the system operation program in the testing network, the telephone number is not allowed to be busy by another “internal” incoming call).

In the course of the analysis congestion and timeout can be distinguished by the distribution of the built-

up time (the time passing until the ringing tone) of the successful calls. The distribution of the build-up time, the separation value is 12 sec.

Results of the processing by statistical programs are as follows:

- A summary table comprising the absolute number of calls and errors and the percentage error rate related to error-groups and calling-called party exchange pairs;

- Sorted lists by calling exchanges, called exchanges and error rates of the tests;

- Diagrams for the calls ending up with a busy tone by calling-called exchange type pairs; Matrices of test calls ending up with a busy tone with error rate arrangement according by calling and called exchanges in different traffic conditions such as:

A/ the total of the test calls;

B/ congestion in high traffic period;

C/ time-out in high traffic period;

D/ congestion in low traffic period;

E/ time-out in low traffic period;

Of the presented results the most important are the sorted lists, as they show the worst exchanges and relations on the top, therefore the work has to be started with them. The location of the weaker points of the network is supported by the matrices, they supply the join test results of the calling exchange to different called parties. If the error rate is similar in the direction of all called parties then the error detection has to be turned to the calling exchange. The matrix is in the same way useful to detect faults in the called exchange.

Instead of giving a presentation of how actual failures are located, a few actual failures are listed below to indicate their nature and variety:

- The call has reached the called party, a few minutes later the route has been cut off. The failure in the direction analogical exchange – mobile network in some exchanges has been witnessed with the occurrence of 90%. The failure was caused by a short time-out adjustment in the analogical exchanges (in the fixed network it did not cause any problems);

- In some cases the digital exchange did not sent a tariff signal to the analogical exchange. The failure was caused by the transient signal sent from the analogical exchange to the digital exchange following the answering signal;

- In case of calls from the digital to the analogical exchanges wrong number occurred in proportion of 1-2 % of the calls. The failure was due to insufficient transient protection solution embed by a software in the digital exchange;

- In calls following the directions of analogical exchange -> digitally transferred stage -> digital exchange -> international exchange, cut off was quite frequent after the call had been built up. The failure was the result of incorrect timing to accept the tariff receipts in the digital exchange.

- Level adjustment problems. Besides switching technology related problems they cause serious speech intelligibility problems (echo) especially in the new modern radio system applications.

The tests have shown that the failures are not significant of one system but they occur consequent to the introduction of new systems, software modification, etc. and are especially frequent at the interfaces of different systems. They can come up later in the real traffic even if the new systems have been thoroughly tested prior the installation. One of the results for this is, for example, that in a low capacity network of 100 thousand lines 50 million calls have to be handled monthly. Even if discrepancies occur only in 10 of a thousand calls, in amounts to about 5000failures. That how many of these failures will turn to be complaints, depends on the character and concentricity of the failures. Obviously, if a smaller range of the callers is concerned, the complaints will be growing in number.

An overall outcome of the test is that failures are not consequent to hardware faults but to software anomalies, which only occur under certain traffic conditions in certain exchanges or traffic routes in a certain phase of the call being built up. Due to the software nature of the deficiencies after they have been detected and impaired network improvement is expected to be long lasting. Failure detection in parallel with other tests and with investigations of complaints should be done continuously following a thorough planning of the work.

Further general experience is that congestion and overload is not caused by lack in circuits, but the congestion of common controlling and signaling transmitting-receiving circuits (software), and this is due to software malfunctions. Network overload, therefore in many cases in only illusive, thus solving these problems does not need costly network extensions.

VI. CONCLUSION

The developed computer system to support Center 130 in telecommunication network is useful to improve the quality of services of the network. The main achievements of the system are:

- Faster and precise subscriber service;

- Faster and precise processing of the failure data;

- Central acceptance and automatic test of subscriber lines, net elements and units, exchanges etc;

- Automatic track-keeping of the failures (the character and causes of them) and making of the necessary lookups;

- Access of the technical personnel to the Data Base through the use of suitable screens sets on a new

quality base the control of the quality of the technical services in telecommunication nets;

- The regular building-up of data and knowledge about failures enables analysis for finding of segments and elements of the net, which work unreliably and generate failures.

For this purpose Oracle Database was used for a full description of the elements of the telecommunication nets, the alterations in the network and their causes and all data about failures in the nets.

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