Paper

Applications of commercial data analysis software for testing a telecommunications network

Jerzy Paczocha

Abstract — This paper shows practical aspect in application commercial software to analysis data concerning information from telecommunication network. The following items are discussed: example of network estimation methodology, the main advantages of network testing system delivering information concerning quality of service (QoS) and network performance (NP) from the user's perspective, general testing system description and data analysis model and example forms of presentation.

Keywords — network analysis, network estimation, network performance, quality of service, PSTN/ISDN.

1. Introduction

Commercial analysis software (computer decision support) are usually dedicated to business operations. Many functions of this software can be useful for processing data from telecommunication equipment (user traffic) and testing devices (testing traffic).
Application is presented as an example PSTN/ISDN network testing system for a telecommunication operator. It is based on experience from projects (AWP-IŁ) prepared by National Institute of Telecommunications in Warsaw for Polish Telecom (TP SA) and Polish Telecom Regulator (URT). First version uses relational data base and special made analysis software.
Implementation of computer decision software was necessary, because large volume data are processed. Short time calculation and many presentation forms are obtained.
During the choice of analysis software there were considering the following aspects:

- user friendly interface for analyst and common users;
- easy and flexibility creating new report forms of analysis and drilling if it is required;
- modelling form results without programming;
- possibility of next evolution forms presentation and stages analysis;
- time of calculation;
- easy distribution and security access to information;
- export report form to other applications;
- warranty of the next development and support.

2. Network estimation testing system

For general estimation quality of service, network performance and diagnostics may use statistical analysis calculating data, which are collected from, on example:

- network management centre;
- user traffic – selected tariffs records;
- signalling network;
- test traffic – the main subject of this presentation;
- subscriber port monitoring of exchanges;
- customer complaints – interview;
- faults reports.

Usually test traffic is generated no more than 2% of users traffic. Number and frequency of test calls must be equivalent for required quality accuracy and network diagnostics.
Knowledge of network configuration and principles traffic routing is required for drilling data.
Typical PSTN network has a hierarchical structure.

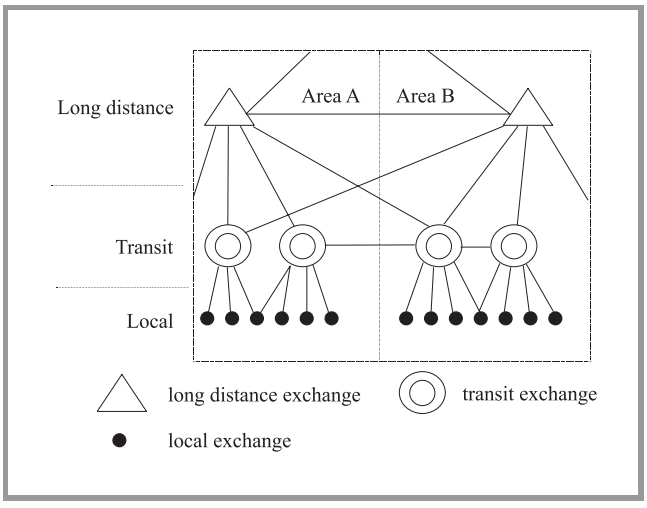

Fig. 1. Three levels of hierarchy of PSTN network configuration.

Figure 1 presents an example of network structure with three levels of hierarchy: local, transit and long distance. As a rule each exchange links minimum two trunk circuits to exchange in higher or the same level of network. Trunk circuit also connects transit exchanges.

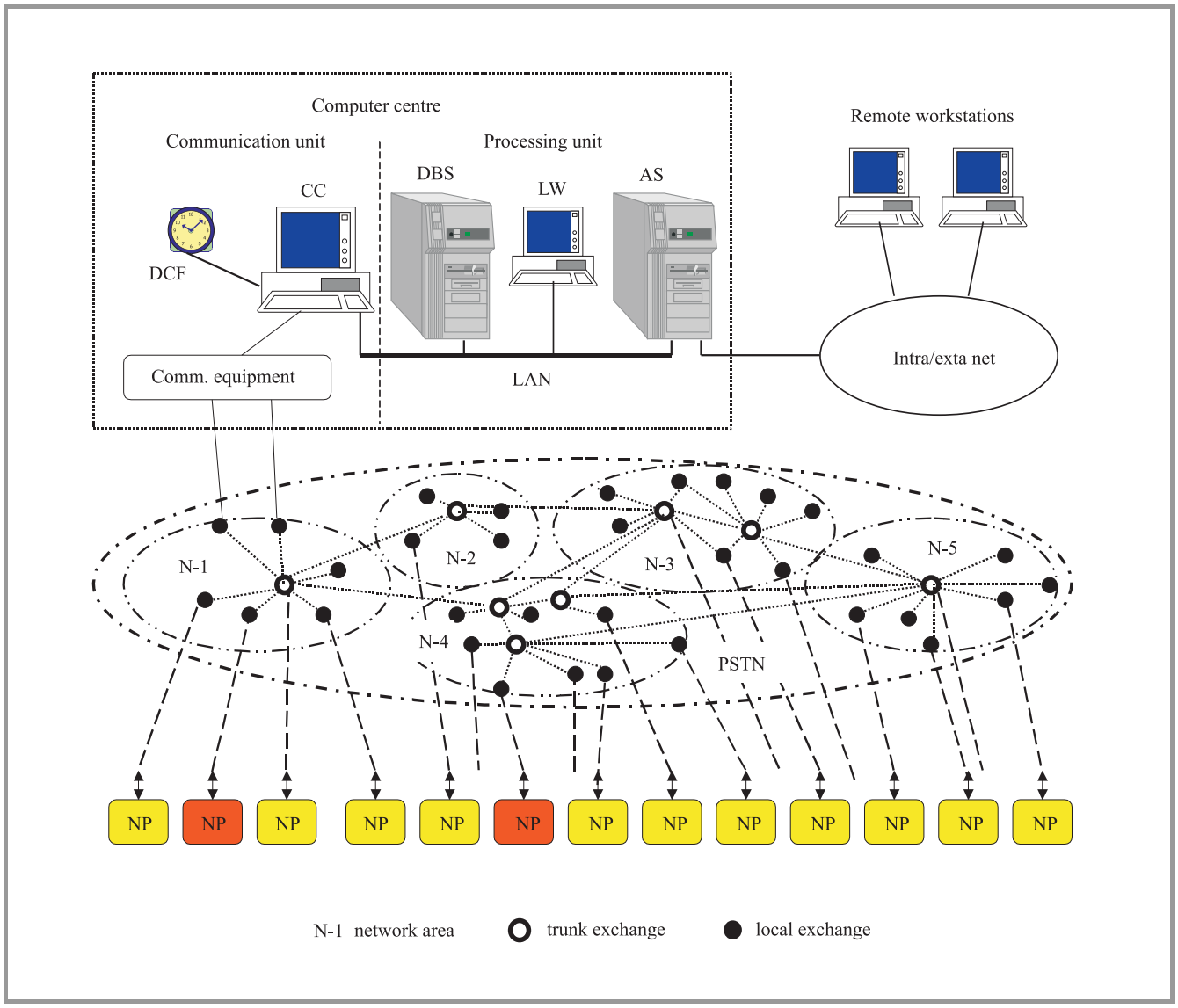

Fig. 2. Typical configuration of PSTN network test system.

Variants of connection string depend on traffic routing plan. Connection string is the result of call processing by exchange and it is depend on traffic load and failure. As a rule first route is selected to direct link, then to own trunk exchange and next to the other alternate routes.
System delivers information concerning the quality of service, network performance from the user's perspective. It indicates weak elements of the network.
System is useful for preparing the following estimation:

- quality of telephone services for calls: local, long distance and international;
- parameters: switching, transmission and billing integration;
- internetworking between the same sort of networks;
- internetworking between other sort of networks in the same service for example: voice and data;
- access to services for example: dialup Internet, information or audio services and other gateways.

System delivers comparative values independently from the sort of telecommunications equipment (exchanges) and personnel operation. It calculates statistics factors according to ITU-T and ETSI definitions.
These possibilities are helpful for telecoms in deregulated telecommunication market.
Typical testing system architecture consists of: network probes, computer centre and remote workstations (Fig. 2).
Computer centre is divided into processing and communication units.
Processing unit includes: data base server (DBS), analysis server (AS) and local workstations (LW).
Communication unit includes: communication computer (CC) and communication equipment for programming and transfer data with network probes.

Network parameters are measured by autonomous network probes (NP), which make test calls to each other. Network probes are connected to the network like normal subscriber. Network probes are controlled by computer centre.
Typical complete testing works includes following procedures:

- test planing – characteristics of testing traffic, number of test call and directions;
- generating control records for each test call;
- remote programming network probes;
- testing network by network probes;
- data collection;
- storage measuring record in data base;
- processing large data volume;
- presentation of results;
- distribution and control of the access to information.

Other useful functions are:

- reports from system configuration;
- access to the source measures record;
- security – distribution and qualify access to information and analysis according to the staff position in a telecommunication company;
- WEB user interface.

Data model includes definition and links for the following tables (for example):

1. Test description: test session, set of data probes which is used for test and time of test.
2. Data records from network probes: normalised data records are independent on coding data in probes and make it possible to compare to different telecommunication services.
3. Estimations of measuring records: values of data records are qualified to results in tree stage for drill.
4. Definition of calls: local, long distance and international.
5. Network probes configuration: port type, port number, place of installation and installation time.
6. Network test ports parameters: test port number, signalling parameters and electrical interface.
7. Network architecture description: network areas, hierarchy and telephone exchange.
8. Telecomm operator organization.
9. Country administrative organization.
10. Calendar: days of week, working days and holidays.

3. Examples of analysis

Interesting analysis presents behaviour of telecommunication network in time. Service accessibility performance parameter such as dial tone delay chart (Fig. 3) shows influence on the traffic intensity. It was chosen old electromechanical telephone exchange type PC 1000. It is sensitive to traffic load what is caused by equipment resources.

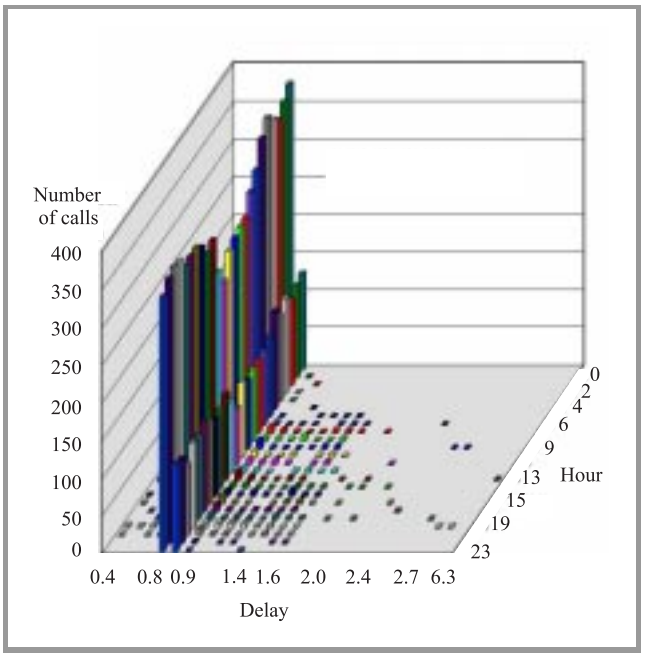

Fig. 3. Dial tone delay in hours for a PC 1000 telephone exchange.

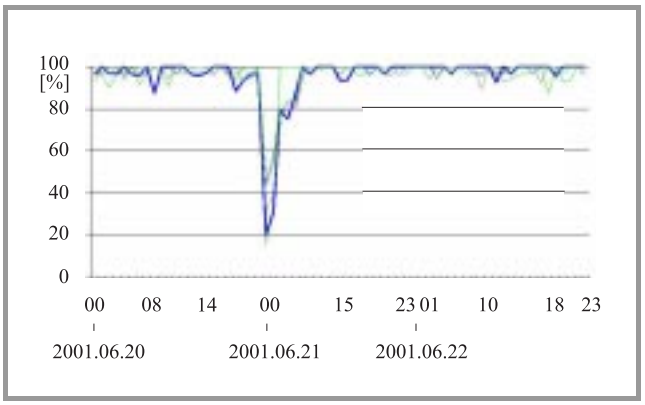

Fig. 4. Successful call ratio – relation from network area to the outside area.

During a peak of traffic at noon the share of lower values of dial tone delays goes down and higher delays go up. This situation is opposite at midnight. Usually peak of traffic is 10 times higher then average value of day and 10 times less at midnight.
Next chart (Fig. 4) shows the result of analysis of a part of PSTN network, which includes one transit and four sub-

ordinate telephone exchanges. The test calls were attempted from subscriber's ports of these exchanges to the other exchanges.
Because usually traffic from subordinate telephone exchanges is directed via superior transit exchange, successful call ratio parameter is related to superior transit exchange.This chart shows collapse of network about 2001.06.21 00.00 hour. This is the example how to apply this system to the network diagnostics.

4. Conclusion

Commercial software dedicated for business is useful only for simple statistics analysis for telecommunication.
It is possible to create reports in different configurations.
Analysis of telecommunications network, including hierarchy and change in time, needs data mining function with correlation.

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Jerzy Paczocha was born on 15 January 1995 in Łódź. Graduated as Master of Engineering at the Faculty of Electronics, Warsaw University of Technology (WUT) in 1981. The main area he has dealt with are data communication, packed data network, remote control, telecommunication marketing, specialised telecommunication systems for the government administration, telecommunication traffic engineering and telecommunication network validation for the following companies such as Railway Scientific and Technical Centre, PTT Centre of Computer Technics, Banking Telecommunication Company, Central Board of Customs. Since 1995 he has been working in the National Institute of Telecommunications, Warsaw, Poland in "Research & Manufacturing Center for Information Technology and Services in Telecommunications" in field of the project and implementation of specialised computer systems for telecom operators and consulting services.
e-mail: J.Paczocha@itl.waw.pl
National Institute of Telecommunications
Szachowa st 1
04-894 Warsaw, Poland