

## **xPhoNet – the Centre of Telephone Networks**

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*Abstract of history and motives of origin, basic idea of the system, architecture description, features and functions, description of register of networks, description of tester of networks, transit exchange description, description and exhibitions of the thin client, description and exhibitions of the thick client, experience with the register and tester operation, presentation of future intentions and further possibilities of use.*

### **1 History and motives of origin**

In 1990s, the company ProTel engineering, Ltd. created several SW supervisory centres for Czech Telecom corporation. SW for central dispatching of analogue transit exchanges (so called CD/Timos system) was the very first supervisory centre operating in Czech Republic. Another supervisory SW served for supervision of analogue local exchanges (so called OP/CTZK system). Then, at late 1990s, SW for supervision of remote fault signalisation (so called OP/DSP system) and SW for dimensioning of metropolitan networks (so called OP/DiMeS system) was developed. All this SW was utilised intensively at Czech Telecom, bringing considerable cost savings, higher quality of telephone traffic as well as shelter from fire. With all this, step by step, ProTel company was gaining practical experience with SW supervisory centres development.

At late 1990s, ProTel focused on development of 5<sup>th</sup> generation telephone exchanges called PhoNet and then - in 2007 - the company turned to development of SW for so called Centre of Telephone Networks. The effort was largely influenced by requirements of operators utilising PhoNet Internet exchanges. The reasons may be summarized as follows:

- ✓ A lot of suspicion, half-truths and purpose-built information about failure rate of particular networks circulate among VoIP operators. If a failure really appears in a telephone network, it shows up in other networks, too, so it is very difficult to distinguish causes from consequences. And, moreover, many failures are only detected with a delay, from customers' complaints. Therefore operators asked for SW enabling to monitor functionality of telephone networks, in order to be provided with credible information about failures.
- ✓ Among VoIP operators, more and more unclear polygons of telephone bundles serving for their peer-to-peer interconnections rise gradually. It is a situation very demanding for maintenance and very hard to be used for transit of telephone calls among networks that are not interconnected by means of direct bundles. Considering that there are approx. 200 telephone networks existing now in Czech Republic, almost 20000 telephone bundles should be theoretically necessary for their full interconnection!!! The cause logic brought some operators to ask for creating an overlay star of transit telephone bundles, where dozens of VoIP operators would be interconnected in the easiest way.
- ✓ At present, over 200 active VoIP networks exist in Czech Republic and it is practically impossible to have an up-to-dated information about their numbering plan. Telephone numbers attended by each network are made of a combination of numbers assigned by the Czech Telecommunication Office (CTO), borrowed from other operators, lent to other operators, taken over from other operators and handed over to other operators, all this being subject to permanent changes. Logically, all this called for creating a register of telephone networks.
- ✓ If anyone tries to map consistently the many offers of telephone operators (to optimize telephone charge expenses, for example), he or she will spend many hours on it. That is to say, no adequate relevant record of operators exists in Czech Republic. The CTO database contains about 2000 subjects that have been providing electronical communication services. It is a pretty difficult task to find the most suitable operator among them. Perhaps every operator has an Internet presentation, but it is a superhuman task to find one's way through them. A few spontaneously created lists published on websites contain mostly incomplete, inconsistent and old data.
- ✓ All telephone operators have to insert the same data into their exchanges so that their networks function properly. For instance: calendar of working days, NRN codes for routing of emergency calls, lists of transferred numbers, call routing tables and alike. Data changes are often handed over via emails only and it is then by pure chance if they are all properly and completely inserted off-line into the telephone networks of all operators. On-line distribution of the data appears to be a much higher-quality and efficient way.
- ✓ Every large telephone operator uses his own supervisory centre for purposes of his own network. There is no centre in the Czech Republic competent to supervise all Czech fixed, mobile and VoIP networks. Small operators have neither resources nor experience sufficient for building at least a small supervisory centre. However, a possibility exists to operate a "national" supervisory centre which particular operators will be connected to, utilising jointly its features.

Based on the reasons introduced above, a very ambitious idea of so called Centre of Telephone Networks flourished in ProTel company.

## 2 Basic concept of the centre

The Centre of Telephone Networks - **xPhoNet** - consists of three basic parts: a register of networks, a tester of networks and a transit exchange. Logical diagram of **xPhoNet** is introduced in fig. 1.

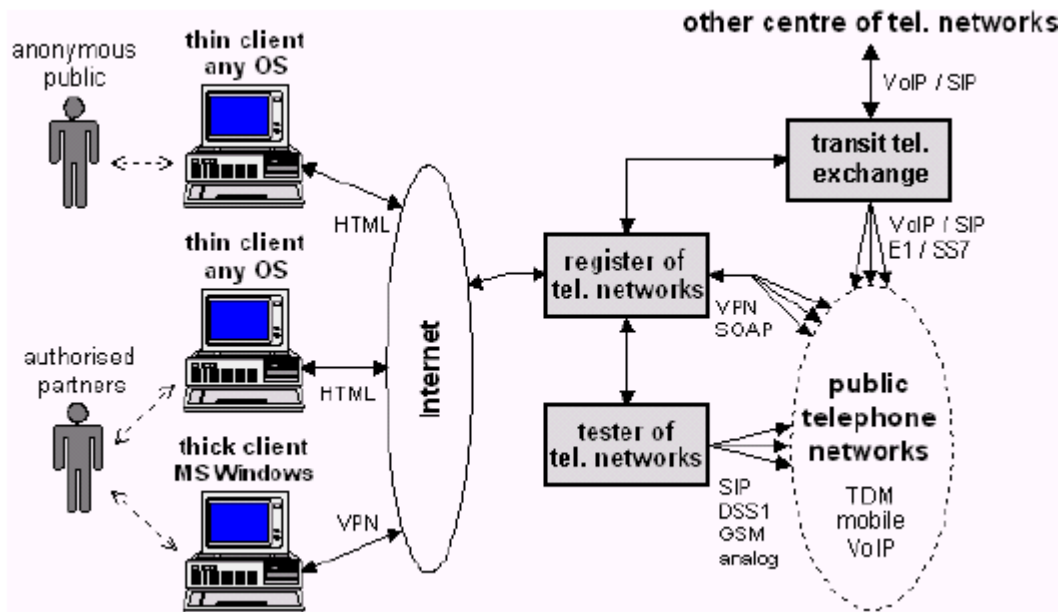


Fig. 1 – Centre of Telephone Networks - logical diagram

**xPhoNet** Centre of Telephone Networks is equipped with the following interfaces:

- ✓ **Thin client for anonymous users** - web pages accessible for all Internet users (i.e., for professional and non-professional public). A freely accessible part of the **xPhoNet** website which does not require a name and a password and displays for public majority of information saved in the register of networks.
- ✓ **Thin client for authorized users** - web pages accessible via Internet exclusively for authorized workmen of operators. Normally non-accessible part of the **xPhoNet** website is concerned. The name and the password are required. This interface allows to operators to display or edit information saved in the register, related to their network.
- ✓ **Thick client for authorized users** - SW for MS Windows NT/2000/XP designated for authorized workmen of operators only. Group of programs implementing functions of supervisory centre and sharing the data continuously being saved in the database of register of networks.
- ✓ **Telephone ports for testing of networks** - VoIP, ISDN30, ISDN2, GSM type interface or standard telephone sets simulating HTS. From the point of view of particular networks, these interfaces seem to be groups of telephones where telephone traffic is simulated among them.
- ✓ **Telephone ports for interconnection of networks** - VoIP/SIP and E1/SS7 interfaces implementing transit of telephone calls of star-type connections. From the point of view of particular networks, connecting bundles allow transit of calls to all other networks connected to any **xPhoNet** centre.
- ✓ **Telephone ports for interconnection of centres** - VoIP/SIP interface mutually interconnecting various installations of centres of telephone networks. It is intended for international transit of calls or for national transit of calls among **xPhoNet** centres operating in parallel.
- ✓ **Data interfaces for operator's IS** - interface for data transmissions between the centre of telephone networks and operator's control servers. Secured VPN is concerned via which a SOAP secured interface, serving for taking over of data from **xPhoNet** and delivering data to **xPhoNet**, is accessible.

From the **xPhoNet** point of view, telephone networks are divided into partner ones and others. Partner networks obtain access names and passwords for their authorized workmen, these networks are connected to the tester of networks and to the transit exchange and their IS may be connected to **xPhoNet** data interface. The operator of the centre of networks initiates a partner network in the register and then workmen of the operator can initiate or update all other data about their network, by means of thin client. Workmen of the operator (or operator's supervisory centre) also gain the possibility to utilize **xPhoNet** thick clients. Information about other networks shall be possibly initiated by the centre operator. Information about partner networks is guaranteed by respective operators and information about other networks is without a warranty. **xPhoNet** is a telecommunication service offered and provided to partner networks.

### 3 Register of telephone networks

Logical diagram of the **xPhoNet** register of telephone networks is shown in fig. 3. In principle, it is a database of main technical and commercial data (including references to operator's web pages), enabling comparison and search for providers of telephone services. It also serves also for entering parameters and record of results produced by the tester of networks and by transit exchange. Majority of information from register of networks is available for public on the [www.xphonet.cz](http://www.xphonet.cz), [www.xphonet.sk](http://www.xphonet.sk), ... etc. web pages.

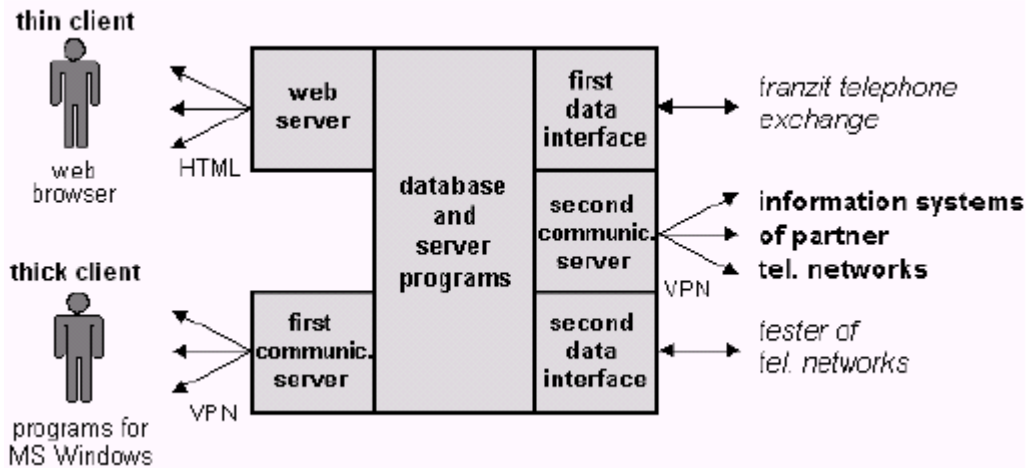


Fig. 2 – Logical diagram of the register of telephone networks

The database of the register of telephone networks contains the following data groups:

- ✓ **Basic data** – network specification (such as network name, kinds of services, name and identification of the operator, possessed ISPC and SPC codes, partnership in NPAC and assigned OpID codes, partnership in xPhoNet and assigned NetID code, reference to web networks and operator), network parameters (such as active size of a network, capacities of assigned, borrowed, lent, handed over or taken over telephone numbers, capacities of connection trunks) and network numbering plan (i.e. a list of telephone numbers in operation). All this is available to all **xPhoNet** users (incl. anonymous).
- ✓ **Possessed numbers** - list of telephone number ranges used by a given network. This is about the telephone numbers assigned by a regulator or numbers borrowed from another operator, who then vice versa registers the numbers as lent. All this is available to all **xPhoNet** users (incl. anonymous).
- ✓ **Transferred numbers** - list of telephone number ranges that a given network took over from other networks or, on the contrary, these are handed over by a given network to other networks. For every range, the respective network from/to which the numbers were transferred is identified. Only those actual data are available where the network is a partner of NPAC and also a partner of xPhoNet. All this is available to all **xPhoNet** users (incl. anonymous).
- ✓ **Interconnection of the network** - list of connection trunks creating tie-lines between telephone networks as well as trunks creating a star configuration where the centre is the transit telephone exchange. All trunks are identified by its kind (outgoing, incoming or bi-directional), telephone signalling and capacity (max. number of simultaneous calls). All this is available to all **xPhoNet** users (incl. anonymous).
- ✓ **Contact data** - list of web and email addresses, telephone and fax numbers and other contact data to technical and business staff of an operator. This information is available to all **xPhoNet** users (incl. anonymous). Besides, direct contacts to top technical and business staff is listed for prompt communication between operators; these are available only to authorised persons of partner networks (not to public).
- ✓ **Price data** - list of prices for calls within own network, for calls to directly connected VoIP networks, for calls to other VoIP networks and to fixed TDM networks and for calls to mobile networks. All this is differentiated for heavy and light traffic and with specification of tariff periods (i.e. 1:1 or 60:30 s). This is mostly available to **xPhoNet** users (incl. anonymous).
- ✓ **Operational reports** – information, continuously published by the operator, about planned service interruption, or his statement to unexpected failures within his telephone network, with possible reference to more detailed reports published on operator's own website. This is mostly available to **xPhoNet** users (incl. anonymous).
- ✓ **Commercial reports** - place for any current text or graphic commercial information that can be supplemented by a reference to other sales promotional, commercial and/or price information published on the operator's website. This is mostly available to **xPhoNet** users (incl. anonymous).

- ✓ **Test assignments** - list of tests assigned by the centre administrator and made on the given telephone network, including information about test initialisation or suspension (for more info, see tester of telephone network). This list is available to all **xPhoNet** users (incl. anonymous public). Besides, detailed test parameters (such as tested IP addresses and telephone numbers) can be displayed to the operator of the given telephone network.
- ✓ **Test results** - list of current (or, the latest) results of all tests (i.e. „no failure“ or „failure of function“), running directly on the given network. These results are available to all **xPhoNet** users (incl. anonymous).
- ✓ **Failure summary** - a simple analysis of failures at a given telephone network, divided according to the kind of tests at various time periods. The data are available to all **xPhoNet** users (incl. anonymous).
- ✓ **Reaction summary** - a simple analysis of reactions of a given telephone network, divided according to the kind of tests at various time periods. The data are available to all **xPhoNet** users (incl. anonymous).

Majority of information is entered and edited by authorized persons of partner networks. The operator of a centre of networks just provides for downloading of a telephone network into the register and insertion of key identification data. Also, the operator of the centre is responsible for specification of tests of networks and for parameters of function of transit exchange. The tester of networks and the transit exchange extra insert results of their activities into the register of networks.

Majority of information recorded in the **xPhoNet** register is continuously available for public via web browser (passive unsecured interface of the thin client type - see chapter 6). Authorized workmen of operators with assigned name and password have access to even more data (for instance details of specification and test results or direct contacts to chief workmen of operators), they are entitled for administration of data about the networks operated by them (active secured interface of thin client type - see chapter 6). In addition, they are entitled to utilize a group of special programs designated for supervisory centres and service technicians of operators (secured interface of thick client type - see chapter 7). Further, **xPhoNet** partners obtain the rights to connect their information systems to the server of register of networks and to read or write some data by means of a secured data interface.

**xPhoNet** users communicate with the register of networks only. From the point of view of a user, the tester of networks and the transit exchange are hidden behind the register. Users of the centre of networks may be divided by their access rights into levels as shown below:

- ✓ **Anonymous users** - have no login and password assigned and so represent occasional visitors of public accessible web pages of the centre of telephone networks;
- ✓ **Active users** - have their login and password assigned, have access even to detailed data and, in addition, have right to edit data saved in the register, related to a defined group of telephone networks except the data affecting call routing and except the specification of tests of networks;
- ✓ **Special users** - have equal rights as active users and more, they are entitled to edit numbering plans of defined groups of telephone networks and thereby affect routing of telephone calls;
- ✓ **System administrator** - persons entitled to edit all data for all telephone networks, both enter and delete items in the register of networks and define specifications of tests of telephone networks.

System administrator position is designated for workmen of **xPhoNet** operators. The rights corresponding to active or special user are designated for two groups of workmen of operators. Workmen of operators may be entitled to edit data about a defined telephone network or a group of networks (i.e. networks operated by them).

Czech and Slovak **xPhoNet** registers are still under so-called trial mode. The SW has proved to function properly, just a few small adjustments and completion of data structure in the register are still to be done. Only small parts related to transit exchange remain unfinished for the moment. Completion of the register of Czech networks field trial is scheduled to the end of 2008 and the register of Slovak networks to the beginning of 2009. Recently Czech and Slovak **xPhoNet** registers have been filled with a list of networks (composed for trial purposes) that possibly offer and operate TDM, mobile or VoIP voice services. The companies that offer CS or CPS services only are not included into this record (i.e. into the register). In sum, over 200 networks are now registered in Czech **xPhoNet** and approx. 50 networks in Slovak **xPhoNet**. For trial purposes, 33 Czech and 8 Slovak networks are defined as partner networks.

During trial period, all information is without warranty!!!

#### 4 Tester of telephone networks

Logical diagram of the **xPhoNet** tester of telephone networks is shown in fig. 3. In principle, it is about a high-capacity simulator of IP telephones, ISDN telephones, analogue telephones, GSM gates and subscriber bundles ISDN30. Number of terminals simulating telephone traffic is almost unlimited (up to thousands).

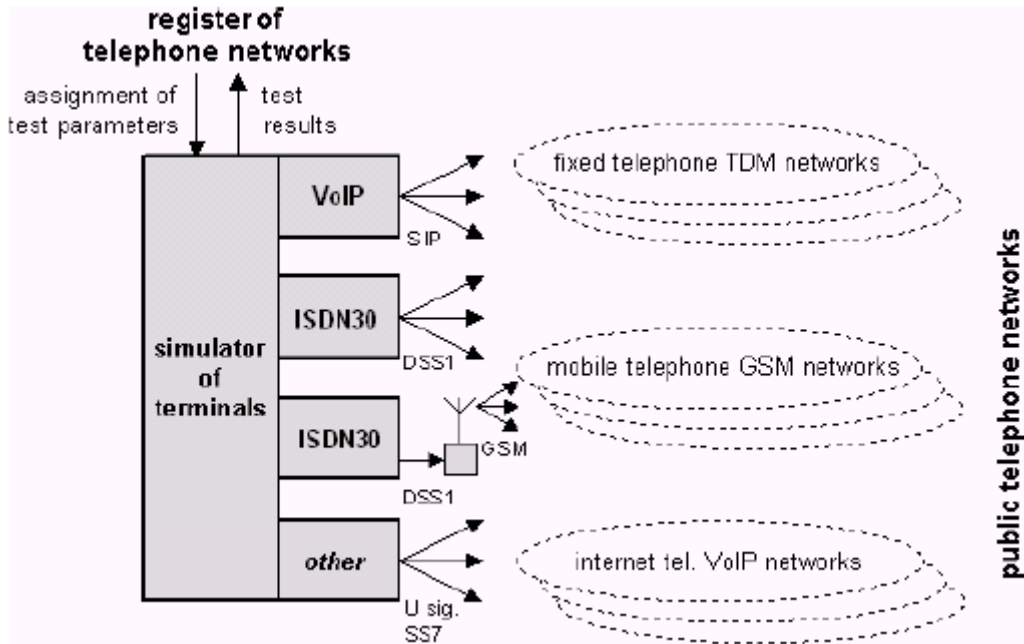


Fig. 3 – Logical diagram of the tester of telephone networks

Tester of telephone networks executes the following checks of functionality:

- ✓ **IP communication** - the ability of an IP server to react to an ICMP message (so-called „ping“). The test assignment contains, among others: server IP address, length of tested packets, batch of tested packets and time limit to server reaction. As a result, the test shows information about network availability of the tested server and total time needed for transmission of messages „Echo Request“ and „Echo Reply“.
- ✓ **SIP registration** - the ability of SIP server to accept registration of VoIP terminal. The test assignment contains, among others: IP address and UDP port of SIP server and UDP port, login and password of the terminal and time limit for successful termination of SIP registration. As a result, the test shows information about operability of tested SIP server and total time needed for registration.
- ✓ **Internal call** - the ability to call within the network from one telephone number to another. The test assignment contains, among others: telephone number of the calling and the called subscriber (both within tested network) and time limit for start of ringing. As a result, the test shows information about telephone reachability within the given network and total time between termination of dialling by the caller and beginning of ringing.
- ✓ **Outgoing call** - the ability to make a call from a telephone number within the given network to other network. The test assignment contains, among others: telephone number of the calling and the called subscriber (the former within the tested network and the latter belonging to the target network) and time limit until the ringing begins. As a result, the test shows information about telephone reachability at target network and total time between termination of dialling by the caller and beginning of ringing.
- ✓ **Incoming call** - the ability to make a call from another telephone network to a telephone number of the given network. The test assignment contains, among others: telephone number of the calling and the called subscriber (the former coming from a source network and the latter within the tested network) and time limit until the ringing begins. As a result, the test shows information about telephone reachability from a source network and total time between termination of dialling by the caller and beginning of ringing.
- ✓ **Telephone conversation** - the ability to make a high quality telephone conversation. The test assignment contains, among others: telephone number of the calling and the called subscriber (no matter if within the same or different networks) and time limit needed to make a call connection. As a result, the test shows information about call connectivity and about quality of connection expressed in MOS scale.

All parameters of a specification together with results of particular tests are saved in the register of telephone networks.

Parameters of a required test are entered into the **xPhoNet** register by its administrator and the test is subsequently marked as running. The tester of networks then takes over parameters of test from the register, executes test activities continuously and cyclically (continuously simulates activities of telephone sets) and delivers test results back to the register. If a partner network is under test then its operator may participate in the agreement about the extent of tests. Extent of tests of non-partner telephone networks depends on **xPhoNet** operator's consideration only. Namely, neither the respective operator's consent nor his cooperation is necessary for initiation and exercise of tests of any network. Several testers may be operated within a centre of telephone networks and this allows almost unlimited increase of number of simultaneously running tests.

Test results are as follows: information about condition of each test ("without faults" or „fault“), information about particular faults (number of test, fault code, start and end of a test) and each 15 minutes also time data about particular tests (minimum, average and maximum network reaction). To each fault record, it is possible to calculate its length and complete all data recorded within the specification of given test. Further information may be then acquired by successive processing of results (for instance average fault length, failure rate determined by one test or by all tests executed against a given network).

With **xPhoNet**, VoIP networks can be tested by IP communication and SIP registration, while other networks can only be tested by the remaining four kinds of tests. In VoIP networks, IP addresses and UDP ports of SIP servers and names & passwords of VoIP terminals make a part of specifications of tests. In fixed and mobile networks, these data are specified from internal scope of the tester and test calls and conversations are done via subscriber lines of networks under test of HTS, ISDN2, ISDN30 t or GSM type provided by default by the operator of a given network. Networks with non-standard technology (for instance U:fon or Skype) may be tested via converters (so called gates) between standard and special telephone interface.

Presently, approx. 90 Czech telephone networks are in **xPhoNet** trial mode. Approx. 150 tests of IP communication, 40 tests of SIP registration, 35 tests of internal calls and 25 tests of outgoing and incoming calls are being done, in continuous cyclic mode. Tests of call interconnection and its quality will be initiated in the first half of 2009. Tests of IP communication are now repeated each 60 s (without fault condition) or each 15 s (fault condition). Tests of SIP registration are so far repeated each 90 s (without fault condition) or each 30 s (fault condition). Tests of internal, outgoing and incoming calls are presently repeated each 300 s (without fault condition) or each 30 s (fault condition). There are no reasons for shortening the test period. At trial mode, the fixed network O2 (or own ProTel company PBX connected to Internet via 4/4 Mbps line and to O2 networks via ISDN30 extension-line) is temporarily used as the opposite side. 15 s is now considered the limit acceptable for IP communication and 30 s for SIP registration, internal, outgoing and incoming call.

At the turn of 2008/2009, a self-contained PBX is planned to be used for **xPhoNet** tester. Together with the tester, it will be placed in a "telehouse", and these will be connected directly to the backbone of Czech Internet. Beside O2 fixed network, also other fixed networks and later also mobile networks O2, T-Mobile and Vodafone (all these connected via ISDN30 bundles of GSM gates) will be used as opposite sides for outgoing and incoming calls. Number of tested networks will grow step by step, and testing of customary-built technologies of U:fon or Skype type may also be done. For first half of 2009, the plan is to put a Slovak **xPhoNet** tester into operation, too.

Non-stability and major faults in the tester SW having been successfully debugged, **xPhoNet** tester now provides appropriate credible results. Small residual faults in the tester of networks does not have substantial influence on test results, not even on evaluating the reliability of particular telephone networks. Besides, negative or positive influence of would-be faults of the tester is applied equally towards all telephone networks under test.

Occurrence and quality of speech interconnection is the only test that has not been put into operation so far, this test is expected for 2009. The intention is to complete this test until 2009 by checking speech transmission quality that should be expressed in so-called MOS. Minimum, average and maximum MOS values for internal calls within given network as well as for calls against main telephone networks will be then known for each network.

Another intention for the future is to collect records (a print-out or a log-file) of all registered and signalled faults. The records will be saved in the **xPhoNet** register, available exclusively for respective operators. Thanks to this, technicians managing the given network can later analyse reasons of the faults revealed by the tester and recorded in the **xPhoNet** register. This way, operators will get a feedback to each detected fault: a definition of parameters of the given test, a record about occurrence of the particular fault and a record about the sequence of SIP, DSS1 or U signalling (depending on the used type of subscriber interface).

## 5 Transit telephone exchange

Logical diagram of the **xPhoNet** transit exchange is shown in fig. 4. In principle, it is the central interconnecting point of telephone networks (i.e. nation-wide nodal point creating a star of telephone networks). The transit exchange fulfils the same role as so called NIX (Neutral Internet eXchange) ensures for Czech internet networks or so called SIX (Slovak Internet eXchange) ensures for Slovak internet networks.

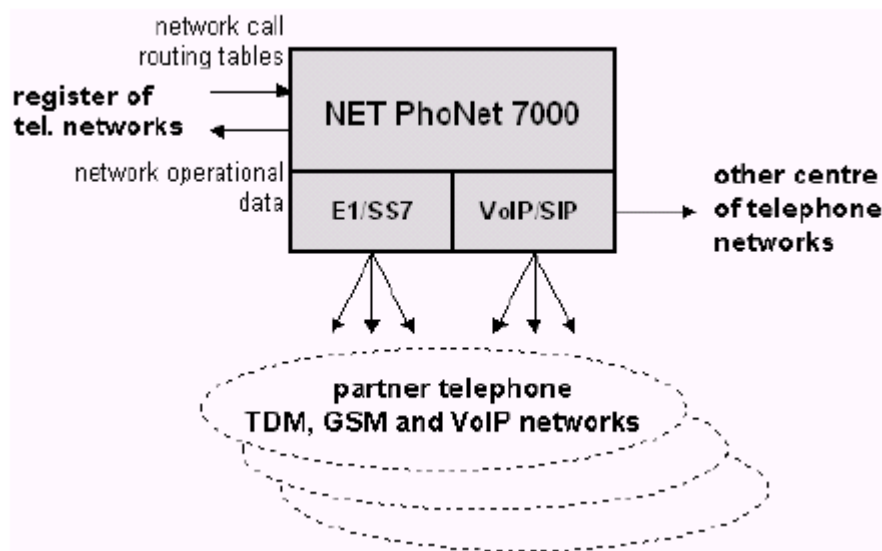


Fig. 4 – Logical diagram of transit telephone exchange

It is a common NET PhoNet 7000 internet telephone exchange, with a special algorithm for call routing implemented, its routing tables being generated from numbering plans of so called **xPhoNet** partner networks (i.e. from the data saved in the register of networks). This way, call routing is in compliance with the data about numbering ranges assigned by Czech Telecommunication Office (CTO), extended by telephone numbers borrowed and taken over from other networks and narrowed by telephone numbers handed over and lent to other networks. Telephone calls among all **xPhoNet** partner networks then need not be done by transit via one or more large classic TDM networks. Source telephone network need not utilize service of another network represented by completion-routing of telephone calls routed to transferred numbers. Destination network need not necessarily take over the calls routed to borrowed numbers via the operator which has these numbers assigned by CTO. Each telephone network connected newly to **xPhoNet** automatically acquires connection to all other partner networks. From the point of view of VoIP networks, transit exchange is thus able to create an overlay telephone network interconnecting VoIP networks into a common national voice network working on packet switching principle.

Towards partner networks, the transit exchange may be connected via VoIP bundles with SIP signalling or via E1 bundles with SS7 signalling. Various **xPhoNet** centres may be mutually interconnected via VoIP bundles with SIP signalling. Each **xPhoNet** national centre then will be connected to supra-national centre of telephone networks (to several supra-national centres, possibly). This way, an overlay packet telephone network determined for transit of international calls will arise.

Star-type interconnection shows an advantage of least number of bundles necessary for complete interconnection of all TDM, mobile and VoIP networks. However, this topology shows a disadvantage of easy vulnerability of transit since a fault of one bundle will cause "cut-off" of the damaged network from all other networks and a fault of transit exchange then would damage all networks. Reliability of star-type interconnection may be partially enhanced by a tandem of two transit exchanges where each TDM, mobile and VoIP network may be connected to both centres. However, in practice, a combination of direct voice peer-to-peer connections with star-type connection created by **xPhoNet** is expected. Peer-to-peer connections are and will be advantageous for basic interconnection of networks with significant mutual telephone traffic.

Small and new VoIP networks will easily and quickly acquire an interconnection into large group of other networks. Large VoIP networks will acquire a path towards other networks without peer-to-peer interconnections and furthermore as back-up path for cases of overloading or fault of peer-to-peer connections. Via **xPhoNet**, small networks will acquire basic interconnection and large networks alternative interconnection to other networks in a given country.

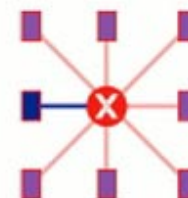
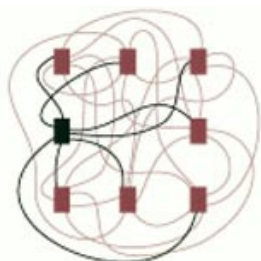
Interconnection of networks by means of **xPhoNet** is by principle „in the middle of the way“ between the interconnection method of classic or mobile networks and the method known as eNUM. **xPhoNet** centre of telephone networks is a product that combines principles known in the area of classic TDM telephony with principles used in modern VoIP telephony. Its part designated as transit exchange is (or will be) the most fundamental asset. From the area of „TDM world“, **xPhoNet** takes over principles of inspectional hierarchical topology and unambiguously defined national and international business relations among networks (or among operators). From the area of „VoIP world“, **xPhoNet** uses modern principles of Internet transmission of voice and SIP signalling.

The present mutual interconnection of Czech and Slovak telephone networks has topology of incomplete polygon whose historical centres are TDM networks of former "Czech Telecom" and "Slovak Telecom". The classic international interconnection of telephone networks has also the topology of incomplete polygon the basis of which is a triplet of incomplete stars with main world-wide TDM exchanges in New York, London and Osaka. Classic national and international interconnection of telephone networks is based on the multiplex of E1/T1 type bundles (i.e. multiples of 32 or 24 conversations). Classic method of national and international interconnection of telephone networks utilise almost exclusively the robust SS7 signalling system. Dispersed VoIP networks are connected partly to classic national TDM networks (i.e. by means of E1 bundles with SS7 signalling) and, at the same time, these networks operate national and international connection via VoIP bundles with SIP signalling.

Over 200 telephone networks today exist in Czech Republic but less than 10 of them attend 90 % telephones. A very similar situation exists in Slovakia. Today, new VoIP networks arise very simply but only few will succeed in development of the capacity up to at least a few dozen thousand telephones and such a development takes a very long time. One of the reasons is technological and interconnection barriers represented naturally by the fact that small or medium operators sometimes established an interconnection to large networks utilising E1/SS7 type bundles. So today, all VoIP networks are still dependent on functional interconnection towards TDM networks. The eNUM principle has been widely discussed already and does not seem to be the one enabling further dynamic development of VoIP networks. The author of this article admits to be „eNUM doubter“ and considers this principle as a so-far unsuccessful attempt in telephony evolution.

**xPhoNet** transit exchange has an ambition to be a unifying platform for inspectional interconnection of VoIP networks. Even small newly arising VoIP networks can be easily connected to the transit exchange via SIP signalling. As compared with eNUM, **xPhoNet** is identified more unambiguously, mostly from the point of view of time limits for establishing telephone connections, full identification of calling subscriber and also commercial relations among operators that take part in establishing of particular telephone calls. **xPhoNet** centre of telephone networks allows to organize, in a well-arranged way, national and international VoIP networks, restrict their dependence on classic TDM networks, preserving at the same time the commercial principle "profit from telephone charges", very important for VoIP operators.

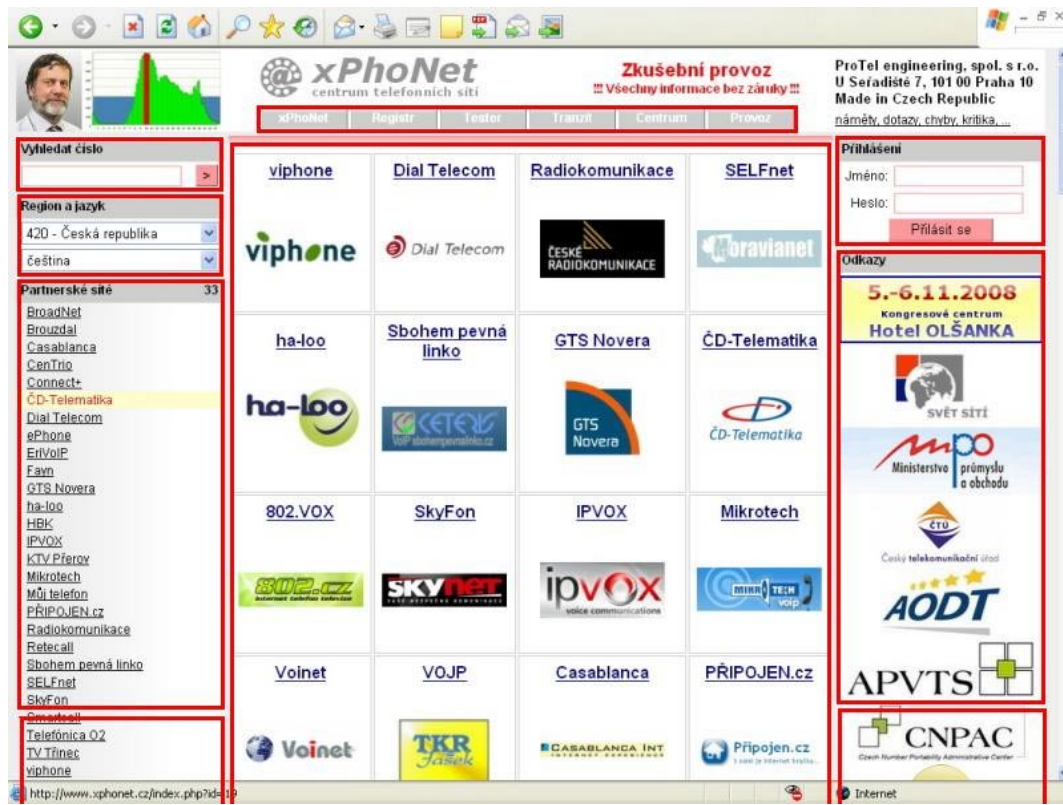
Transit telephone exchange has not been put to trial mode yet, it is planned for first half of 2009. Putting into standard operation of the Czech and Slovak national **xPhoNet** transit exchange and their interconnection by means of European **xPhoNet** transit exchange is scheduled for first half of 2009. Already now, big interest is shown by potential partners (i.e. operators of centres of telephone networks) in Australia and New Zealand, the **xPhoNet** centres could be put into operation there by the end of 2009. In the course of 2009, it will be possible to make sure about fulfilling of these visions and plans, on [www.xphonet.eu](http://www.xphonet.eu), [www.xphonet-au.com](http://www.xphonet-au.com) and [www.xphonet-nz.com](http://www.xphonet-nz.com) websites.



**xPhoNet** transit exchange may also be extra connected to large fixed or mobile non-partner TDM networks (via E1/SS7 bundle), carrying out interconnection (or transit call connection) of small VoIP networks to large TDM networks. This way, small VoIP operators need not neither urgently master sophisticated technical principles of SS7 nor procure rather costly technology of E1/SS7 bundles. Thus, small VoIP operators can reserve (or lease) themselves a portion of capacity of speech interconnection between **xPhoNet** and large TDM networks.

## 6 xPhoNet thin client

View of main Internet web page of **xPhoNet** thin client is shown below. The page will be displayed after the website address is entered or after the *xPhoNet* key is pressed.



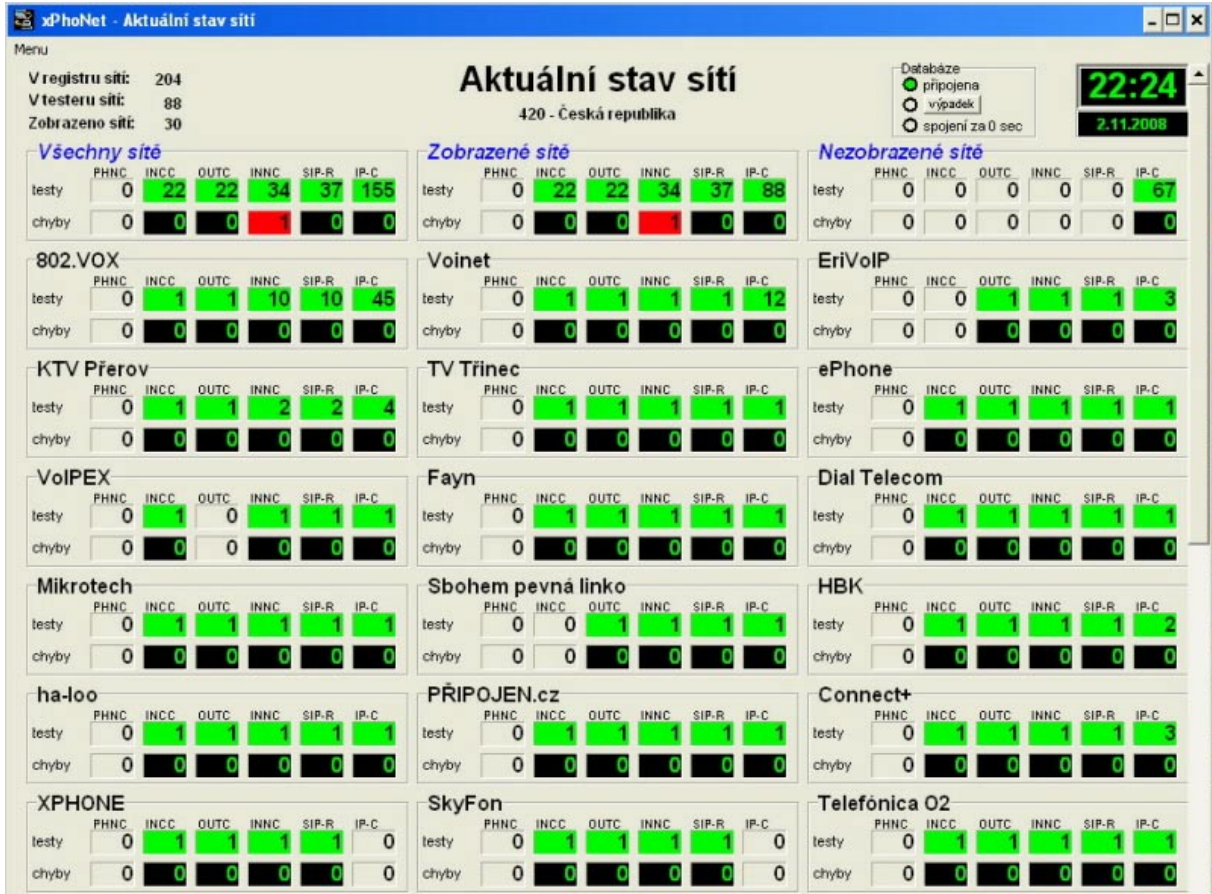
**xPhoNet** thin client is arranged into 9 following sections:

- ✓ **Main menu** - allows access to the information recorded in the register of networks (*Register* key), access to data about tester of networks (*Tester* key), access to the information about transit exchange (*Transit* key) and further to information about the centre of networks (*Centre and Operation* keys).
- ✓ **Search number** - allows to enter a subscriber number and get searched the telephone network where this number is attended, namely with respect to the assigned, handed over/taken over and lent/borrowed telephone numbers.
- ✓ **Region and language** – allows to browse among various national centres of telephone networks (selection of country) and the languages that thin client is able communicate (Czech, Slovak, English and further languages in the future).
- ✓ **Partner networks** - alphabetical list of telephone networks having character of partner networks that serves also as the offer (i.e. menu) of the information displayed about networks in operational section.
- ✓ **Other networks** - alphabetical list of telephone networks without character of partner networks that also serves as the offer (i.e. menu) of the information displayed about networks in operational section.
- ✓ **Login** - section for entering the name and password of an authorized workman and his subsequent login into thin client as an active user, a special user or a system administrator.
- ✓ **Links** - section for display of banners and websites of companies where various information is available free of charge, relevant for telephony in a given country.
- ✓ **Advertisement** - section for display of banners of companies or organizations which are advertised at website of the centre of telephone networks, paid service.
- ✓ **Operational area** - middle section. Depending on the selection from main menu and alternatively also on the selection from the menu of partner or other networks, information recorded in the centre of networks are displayed or edited here. If main page of thin client is displayed, logos of partner telephone networks are displayed here in random order.

When a region is selected (or changed), **xPhoNet** reacts internally by going-over to individual website of the given region (or by switching over to the thin client of respective country). After successful login of an authorized workman the unsecured HTTP protocol will be always replaced by the secured HTTPS protocol. In the right top part of the web page, there is (or will be) introduced the company operating the centre of networks in a given country.

## 7 xPhoNet thick client

A group of programs intended for MS Windows NT/2000/XP , serving for supervisory centres or service technicians of telephone networks, is designated as thick client. Thick client SW is available for authorized technicians of partner networks only. An example of the program for displaying the *Current condition of networks* is shown below.



This SW serves for monitoring of instant situation of selected telephone networks. The condition of a network is displayed in so called panel. Numbers of rendered tests (black in green field) are displayed in the upper row and numbers of currently existing faults (black in red field) are displayed in the bottom row. From left to right, the following tests are displayed in the panel: IP communication, SIP registration, internal calls, outgoing calls, incoming calls and telephone conversations. Number of panels to be displayed is defined by dimensions of the used monitor.

First group of xPhoNet thick clients consists of seven programs: History of failure-rate of networks, Comparison of failure rate of networks, Daily statistics of failure rate, Monthly statistics of failure rate, Yearly statistics of failure rate, Current status of tests, Current status of networks. Trial mode of these programs is being initialised now, step by step. To run the xPhoNet thick client, the computer running this SW will be connected to VPN.



## 8 Development, operation and support

Entire development of special parts of HW and SW of **xPhoNet** centre of telephone networks is a product of the ProTel engineering, spol. s r.o. company, not using any patent or license rights from third parties. Internet search has not found any product allowing equal telecommunication functions. The **xPhoNet** centre of telephone networks is an original Czech product.

The *PBX PhoNet 3000* (one from blocks of tester of networks) and *NET PhoNet 7000* Internet exchange (basic part of transit exchange) are components of the centre of networks. The PBX is able to serve also for prompt standby call connections among workmen of various partner networks. Internet exchange then may serve for the connection of special terminals (for instance test telephone numbers, for audiotext services, ... and the like) and these then will be available to all partner telephone networks.

Beside ProTel, no other operator runs xProTel centre in Czech or Slovak Republics. AODT, APVTS or NIX could be potential operators of the Czech centre, VUS or SIX could be operators of the Slovak centre. Retail and wholesale price terms for services of **xPhoNet** centre of networks are available upon request. Approx. 10 operators participate in trial operation of the centre of networks, having provided their telephone numbers and participating on analysis of problems with inspection of proper function of tester of networks (i.e. inspection of its SW). Many thanks to them.

Functions of **xPhoNet** centre of networks allow also to create large VoIP networks with several telephone exchanges (or autonomously functioning SIP servers). **xPhoNet** system can also be used for creation of private telephone networks. In this case, the object of tests will not be public telephone networks but individual PBXs. Similarly, the transit exchange will not serve for interconnection of public telephone networks but for voice interconnection of PBXs and their joint connection to public TDM, mobile and VoIP networks. SW of thick clients will serve for needs of supervisory centre of private telephone network. In the course of 2009, a few projects of this kind will be carried out.

ProTel engineering, spol. s r.o. will support operators of national and private centres of telephone networks and ensure further advancement of functions of respective SW in future.



## Literature

- [1] Commercial sheet of **NMC PhoNet 9000** centre of telephone networks - available at <http://www.xphonet.eu>
- [2] Catalogue sheet of **NMC PhoNet 9000** centre of telephone networks - available at <http://www.xphonet.eu>
- [3] <http://www.xphonet.cz> - Czech **xPhoNet** centre of telephone networks
- [4] <http://www.xphonet.sk> - Slovak **xPhoNet** centre of telephone networks
- [5] <http://www.xphonet.eu> - European **xPhoNet** centre of telephone networks
- [6] <http://www.xphonet-au.com> - Australian **xPhoNet** centre of telephone networks
- [7] <http://www.xphonet-nz.com> - New Zealand **xPhoNet** centre of telephone networks
- [8] <http://www.xphonet.ru> - Russian **xPhoNet** centre of telephone networks