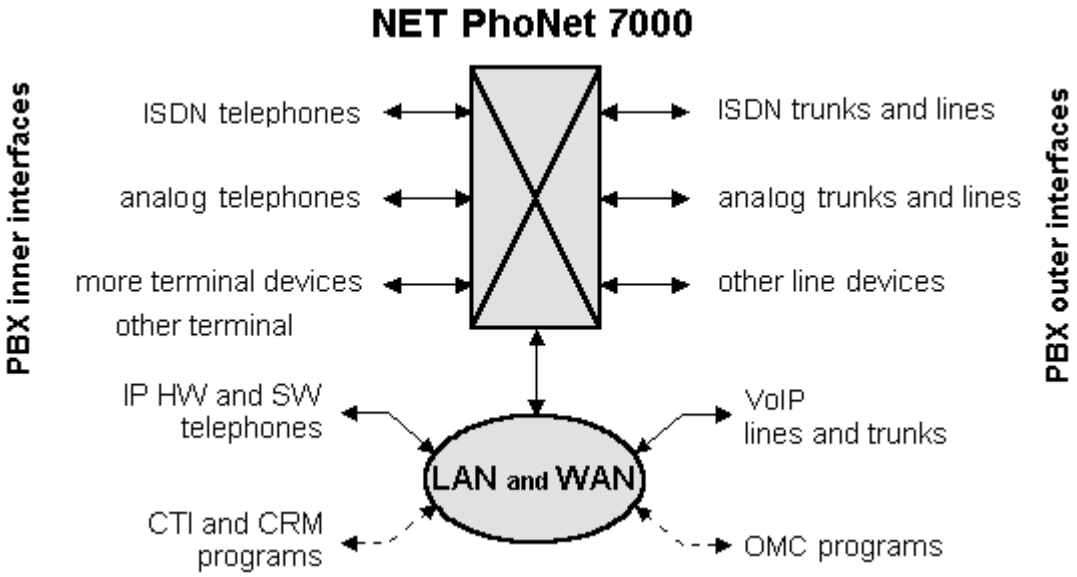
NET PhoNet 7000 – the internet telephone exchange

NET PhoNet 7000 is a 5th generation internet telephone exchange applying consistently all of the most advanced principles of packet commutation in telephone calls (or, VoIP technology).

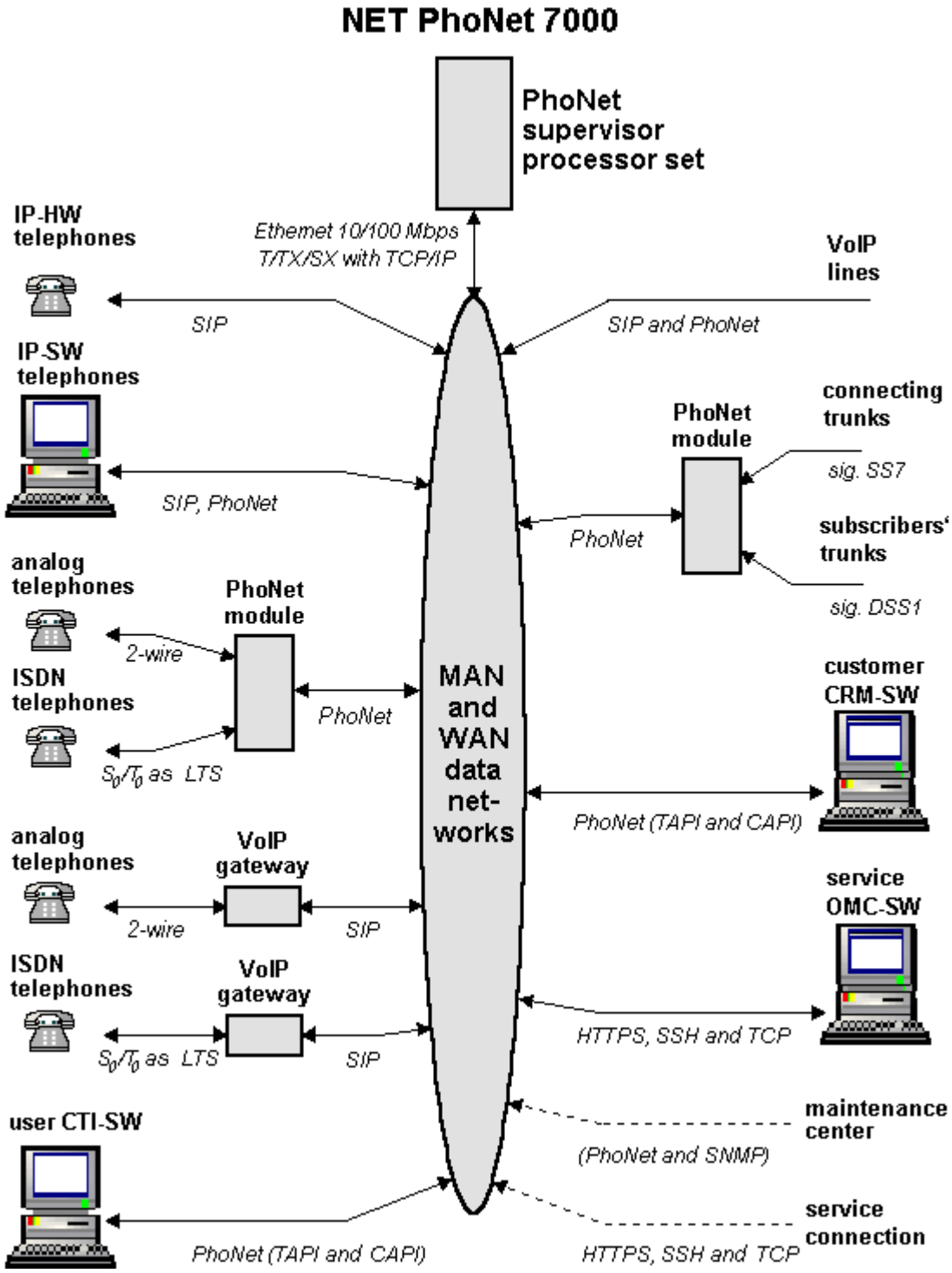
The PhoNet internet telephone exchange provides public telephone services in the environment of data networks supporting TCP/IP-type protocols (within MAN – Metropolitan networks, or WAN - Wide Area networks).

Total capacity of all subscriber and line interfaces of a **NET PhoNet 7000** may be 100 to 3,000 ports (so-called „middle-sized NET") or 1,000 to 120,000 ports (so-called „large-sized NET" and "extra large-sized NET"). A **NET PhoNet** can handle as many as 1,000 simultaneous telephone connections. Peripheral boards are dimensioned to operate 100 % of their capacities. Peripheral board modules are dimensioned to manage 60 simultaneous calls, which corresponds to min. 99,99 % control of all required calls. Statistical tests of **PhoNet** system have proved the error rate below 5 x 10^{-4}.



A **PhoNet** internet exchange may either have its own telephone numbers assigned, or may use ranges of subscriber numbers from co-operative operators. In the first case, the **NET** is in the position of a public telephone exchange, connected to other telephone exchanges via connection trunks with SS7 signalling system, and telephone numbers belong directly to the owner of the exchange. In the second case, the **NET** is in the position of a private branch exchange, connected to other exchanges via subscriber trunks with the DSS1 signalling, and telephone numbers belong to owners of the connected exchanges.

NET PhoNet 7000 has three kinds of interfaces: subscriber, line and system ones. Subscriber interfaces are connectible with IP-HW and IP-SW telephones and other kinds of terminal equipment (such as VoIP gateways or faxes or modems). Line interface are connectible with telephone line equipment and other kinds of line devices (such as VoIP gateways, GSM gateways or transmission systems). And system interfaces can be connected with a variety of computer programs (such as CTI, CRM, or OMC applications). A supervisor processor set makes the basis of a **NET** internet exchange, and components performing various kinds of subscriber and line interfaces are connected to it (their features are specified in data sheets of particular items).



The **subscriber interfaces of NET** can be connected with both VoIP terminal devices (such as IP-HW telephones, IP-SW telephones or IP gateways) and classical terminal devices (ISDN or analog telephones, faxes and modems). VoIP interfaces are made up by Ethernet LAN network 10/100 Mbps of T/TX/SX type (with SIP signalling). Classical terminal devices are then connected either via VoIP gateways or with help of distributed PhoNet modules. The ISDN-type 2B+D interface is composed of an LTS bus connectible with 1 to 8 ISDN telephones (with DSS1 signalling). The analog 2-wire interface type is connectible with 1, or rarely 2, analog telephones (with U signalling complemented by CLIP-DTMF or CLIP-FSK).

Board	Terminal equipment	Kind of interface	Nr. of ports	Signalling
TEL_SIP	VoIP	Ethernet 10/100 Mbps T/TX/SX	1	SIP
DUS_16	ISDN 2B+D	8 x S_0/T_0 as LTS	16	DSS1
DUS_8	ISDN 2B+D	4 x S_0/T_0 as LTS	8	DSS1
DUS_4	ISDN 2B+D	2 x S_0/T_0 as LTS	4	DSS1
AUS_16	analog	16 x 2-wire	16	U+CLIP
AUS_8	analog	8 x 2-wire	8	U+CLIP
AUS_4	analog	4 x 2-wire	4	U+CLIP

The **line interfaces of NET** are connectible with connection trunks with SS7 signalling or VoIP lines, or subscriber ISDN trunks or lines. Connection trunks usually have an E1 modem connected to the respective E1 port of the exchange (with SS7 signalling). Virtual connection VoIP lines are created by WAN network connected to the exchange via LAN network Ethernet 10/100 Mbps of T/TX/SX type (with SIP signalling). Subscriber trunks ISDN 30B+D are terminated with E1 modem connected to a respective E1 port of the exchange (with DSS1 signalling). Subscriber lines ISDN 2B+D are terminated with the NT converter linked to a two-point LTT port of the exchange (with DSS1 signalling). Line interface of ISDN 2B+D type are defined primarily for GSM gateways that may connect internet exchanges to mobile networks.

Board	Telephone lines	Kind of interface	Nr. of ports	Signalling
SS7_30	PCM 32/30	1 x 2 Mbps E1	31	7
VED_SIP	VoIP	Ethernet 10/100 Mbps T/TX/SX	1	SIP
PRI_30	ISDN 30B+D	1 x S_2 on E1	30	DSS1
DUV_16	ISDN 2B+D	8 x S_0/T_0 as LTT	16	DSS1
DUV_8	ISDN 2B+D	4 x S_0/T_0 as LTT	8	DSS1
DUV_4	ISDN 2B+D	2 x S_0/T_0 as LTT	4	DSS1

Telephone interfaces of NET of type E1 (that is, SS7_30 and PRI_30) are delivered only with outlets on the front part of the board (for 4-wire cables). Interfaces TEL_SIP and VED_SIP stand for „virtual boards" only (SW drivers). Other telephone boards of subscriber and line sides (that is, ISDN or analog) are delivered with outlets on the front side (for patch cords of structured cabling) as well as with outlets on the rear side (for SYKFY cables of classical distribution systems).

The **system interfaces of NET** are connectible to the following software:

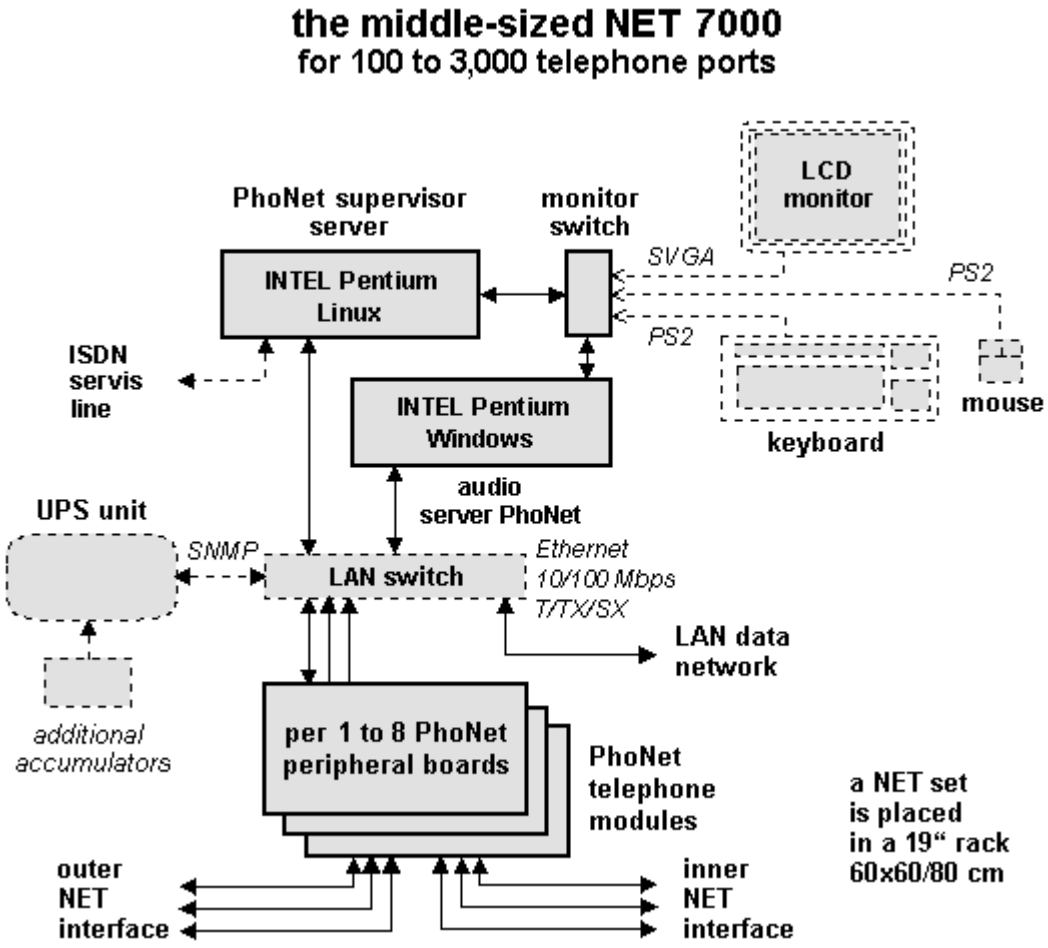
- **User software of CTI type** (Computer Telephone Integration) is made up of a number of applications that support activities of users, secretaries and operators, making the use of telephone functions and services easier. **The Thick Client PhoNet** is an optional part of the exchange. It is a set of programs for PCs with MS Windows 98/NT/2000/XP using PhoNet proprietary interfaces. This SW enables to control functions of the exchange (such as connection through or forwarding a call), control of voice mail (such as play and erase a record), display information about calls (such as list of missed calls), store telephone numbers (for instance in contact directory or in speed dial directories) and complement the exchange with some other user services (such as the client's SMS or attendance register). Moreover, the support of the standard TAPI and CAPI interfaces, is under preparation.
- **Customer software of CRM type** (Customer Relationship Management) is made up of a variety of applications that support activities of marketing, sale, service, information or clerk relations towards customers (or, to calling or called persons). Therefore, description of programmers´ proprietary **PhoNet data interface** makes a part of the documentation of the exchange. The exchange can be connected to information systems that may serve to administer subscribers (such as introducing, blocking or cancelling telephone numbers), to charge calls (such as pre-paid call charges or handing over records about calls). Therefore, training of authors of the connected CRM application may become a part of an exchange delivery. Also, support of TAPI and CAPI standard interfaces is being developed.
- **Service software of OMC type** (Operations and Maintenance Centre) is made of applications that support administrators of telephone exchanges and serve to supervise its operation or to administer its configuration. The so-called **PhoNet Thin Client** is always a built-in part of the exchange. It is a web application, and it is sufficient to have an ordinary browser connected to the exchange to be able to use it. This interface is accessible via local LAN network (for local administrator's use), via private WAN network (for company operation centre's needs), via public WAN network (for needs of outsourced services), or via public telephone network (as a back-up method of remote access). The range of parameters of an exchange administrable by a service interface is given by access rights. This web interface may also be partly used by PBX users, as they can get an access to data related to their subscriber's numbers (so-called **My telephone** page).
- **Maintenance centre** is being developed to centralize the supervision of operational and failure conditions of a group of operated exchanges (that is, to collect record about calls, failure alarms or load measurement) and for administration of parameters of subordinated exchanges (for instance to distribute new versions of control SW or changes in price programs of call charges). So-called **RePIC system** (Regional operational information system), linked to exchanges via PhoNet proprietary interface, is an optional part of the exchange. Also, support of SNMP standard interface is being developed, in order to enable co-operation with maintenance applications from other suppliers (such as OpenView).

Descriptions of **PhoNet** thick and thin clients, as well as proprietary and standard interfaces, are to be found in separate documents.

Main technical features of **NET PhoNet 7000** are the following:

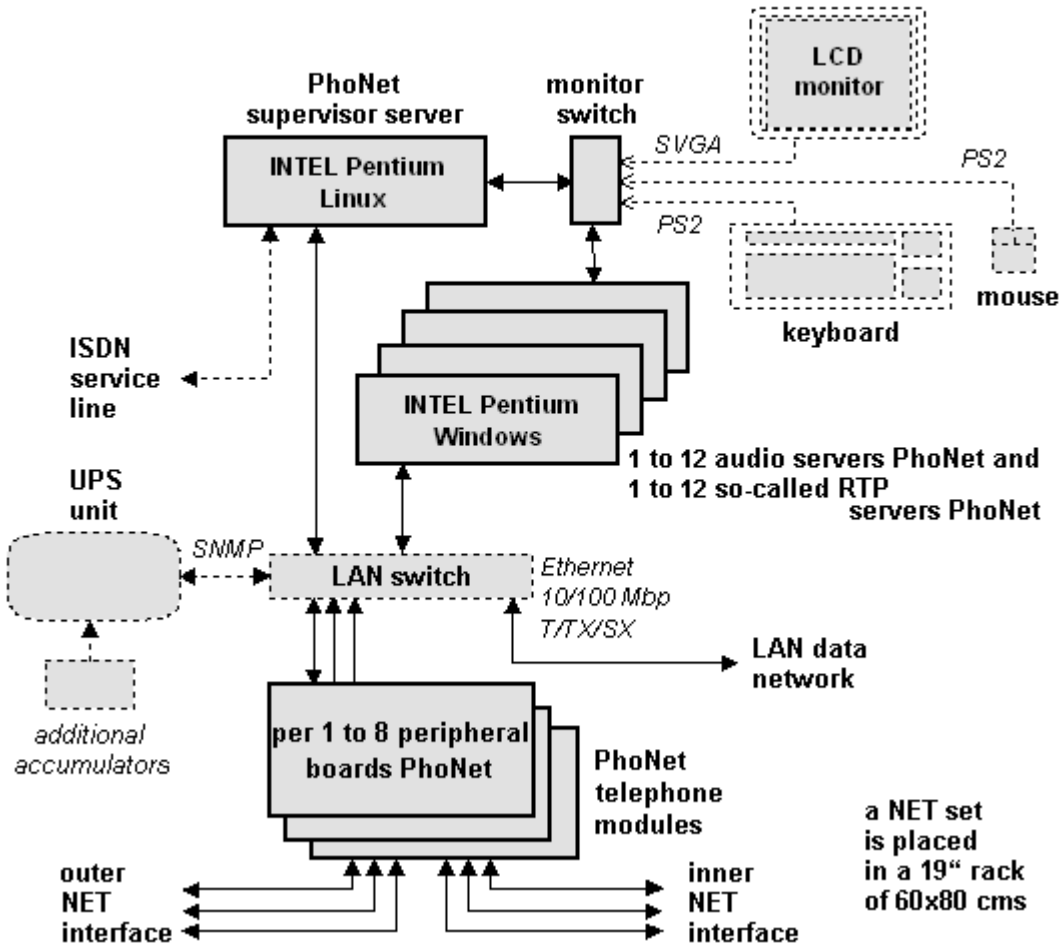
Basic features of internet exchanges:	100 to 3,000, 1,000 to 30,000, 10,000 to 120,000 ports Voice mail is available for any terminal equipment Registration and recording of all telephone calls Loss of calls is less than 0.01 % Reliability of NET is minim. 5×10^{-4} and typical 1×10^{-4}
Ports for VoIP terminal equipment:	No special HW (only special PhoNet system SW) Connection via LAN type Ethernet 10/100 Mbps T/TX/S SIP sig. according to RFC 2543, RFC 3261 and RFC 2833
Ports for ISDN terminal equipment:	DUS boards with 8, 4 or 2 interfaces 2B+D of S_0/T_0 type as LTS Front RJ45 for patch cord or rear connector for SYKFY DSS1 sig. according to ITU-T Q.721 and Q.731
Ports for analog terminal equipment:	AUS boards with 16, 8 or 4 interfaces of 2-wire type Front RJ45 for patch cord or rear connector for SYKFY U sig., DTMF/DEC dialling, transmission CLIP type DTMF/FSK
Ports for connection E1 trunks:	SS7 board with 1 interface of 2 Mbps type E1 32/30 Front RJ45 for patch cord or an individual 4-wire
Ports for connection VoIP lines:	No special HW (only special SW of PhoNet system) Connection via LAN type Ethernet 10/100 Mbps T/TX/SX SIP sig. according to RFC 2543, RFC 3261 and RFC 2833
Ports for subscriber ISDN trunks:	PRI boards with interface 30B+D type on S_2 as 2 Mbps E1 Front RJ45 for patch cord or for individual 4-wire DSS1 sig. according to ITU-T Q.721 and Q.731
Ports for ISDN telephone lines:	DUV boards with 8, 4 or 2 interfaces 2B+D of S_0/T_0 type as LTT Front RJ45 for patch cord or rear connector for SYKFY DSS1 sig. according to ITU-T Q.721 and Q.731
Interface for user CTI-SW applications	**PhoNet Thick Client** (application for MS Windows) Protocols: proprietary PhoNet and standard IP (support of TAPI and CAPI standards is developed)
Interface for customer CRM-SW applications:	**PhoNet data interface** (programmer interface) Protocols: proprietary PhoNet, standard IP and SOAP (support of TAPI and CAPI standards is developed)
Interface for service OMC-SW applications:	**PhoNet Thin Client** (web application) Protocols: standard HTTPS, SSM and TCP (support of SNMP standard is developed)
Basic parameters of power supply:	Feed 230 VAC / 50 Hz, internal distributing frame 24/35/48 VDC Analog terminal equipment with current 18 mA at 24/35/48 VDC ISDN terminal equipment 40 VDC at max. 8 x 0.05/20 mA
Basic mechanical configuration:	Special boards are placed in 19-inch frames of 6U height Special 19-inch frames and other components of NET assembly are located in 19-inch racks of 60 x 45/60/80 cm (w x d)

A **PhoNet** internet exchange can be delivered in tree versions. The middle-sized **NET** can be used for capacities of 100 to 3,000 ports, the large-sized **NET** for capacities of 1,000 to 30,000 ports and extra large-sized **NET** for capacities of 10,000 to 120,000 ports.



The middle-sized **NET PhoNet 7000** contains a double supervisor server and usually at least one telephone module. Both servers consist of half-industrial HW (a PC suitable for a 19-inch rack) and of system SW (a server with OS Linux and DB Postgres, the other server with OS Windows). In the supervisor server, a central part of application SW is included (so called supervisor processor) and the other part in audio server (so-called audio processor). The telephone module has 1 to 3 main processors and 1 to 8 peripheral boards. The peripheral boards can be connected with classical connection and subscriber trunks and line or terminal equipment. Advanced VoIP terminal and line devices (IP-HW telephones, IP-SW telephones, VoIP gateways etc.) are connectible via LAN. External calls can come in and go out through classical telephone connections as well as through advanced VoIP communication (via LAN and WAN data networks). Besides, LCR function takes part in routing of outgoing calls. To run a middle-sized **NET**, a LAN switch is needed (Ethernet 10/100 Mbps T/TX/SX) and a UPS unit is necessary (800 to 3,000 VA). The customer may buy these items as optional parts of a sale order, or get them on his own. A middle-sized **NET** can be placed in a 19-inch rack, another optional complement of a sale order (or, a free space in a customer’s own 19-inch rack is sufficient).

large-sized configuration of NET PhoNET 7000
for 1,000 to 30,000 telephone ports



The large-sized NET **PhoNet 7000** differs from the middle-sized one just in two features: may contain 1 to 12 audio servers and 1 to 12 RTP servers. As HW of all servers (that is, supervisor, audio and RTP ones), branded servers with high reliability are used. Every audio server is able to handle capacity of max. 2,400 VoIP ports (terminal equipment or connection lines). A supervisor processor is able to serve traffic intensity generated by capacity of up to 30,000 VoIP ports (or, up to 1,000 concurrently built internal, outgoing, incoming or transition telephone connections). The use of branded HW servers with high value of MTBF (that is, with high reliability) make preconditions for high reliability of the whole **NET** set.

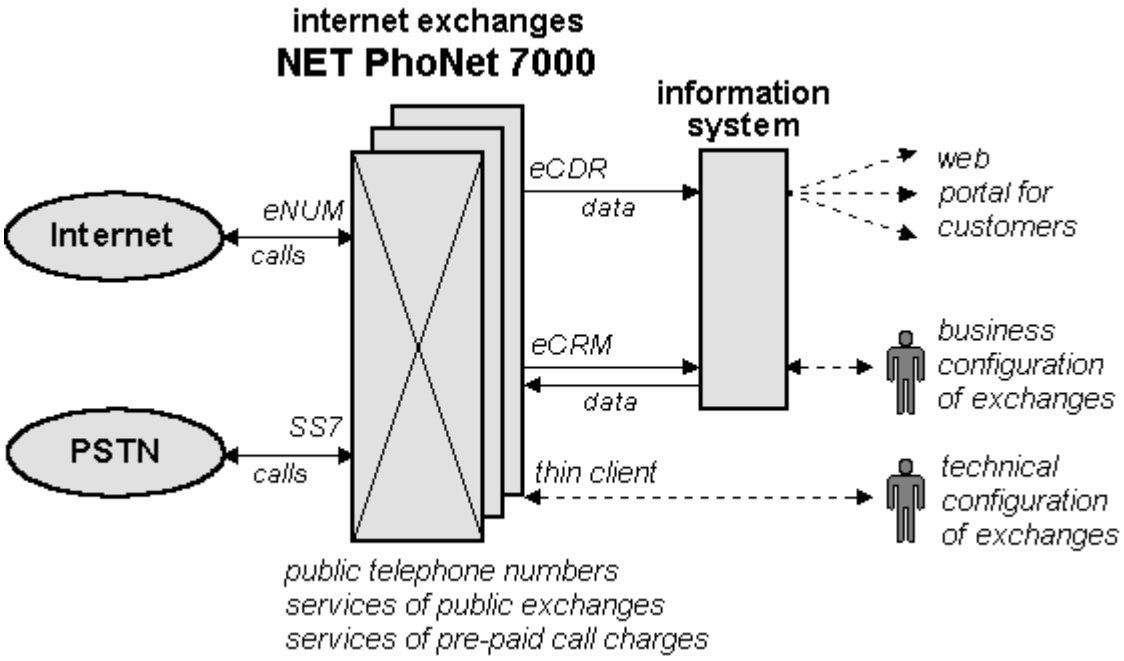
In real life, it is practical to put into operation a middle-sized **NET** first, and as soon as the number of subscribers has increased significantly (above 1,000, for example), it can be rebuilt to a large-sized **NET** configuration (that means, to exchange types of servers). Similarly, a capacity of a large-sized **NET** can be increased by adding more HW servers until the capacity of the exchange reaches the limit serviceable by the given configuration (that is, a multiplication of 2,400 VoIP ports). When the capacity of 30,000 VoIP ports is exceeded, the extra large-sized **NET PhoNet 7000** with the capacity of 120,000 ports has to be applied.

The internet exchange **NET PhoNet 7000** has some features that are specific for public telephone exchanges:

- **Public telephone numbers** assigned to a **NET** exchange may belong to the range owned by the operator of the given telephone network, and so the operating agency of the exchange has created the basic condition for negotiation about interlink of its own telephone network with networks of other operators and about routing the outgoing telephone traffic (or, about purchase prices of outgoing calls and about share in prices of incoming calls). So, the operating agency of a **NET** exchange can offer advantages of so-called transferability of telephone numbers to its subscribers, when subscribers coming over to this network may preserve their original telephone numbers.
- **Telephone interface SS7** serves to connect the **NET** network to classical telephone exchanges integrated to telephone networks of other operators, thus carrying out the classical way of mutual connection of public telephone networks (that is, via E1-type telephone trunks with SS7 signalling). A similar connection of telephone exchanges and networks may also be created by VoIP telephone lines (if subsequent telephone exchanges are accessible via data networks and equipped with VoIP interfaces with SIP signalling).
- **Services** of Public exchange type belong to the SW functions normally not required in private branch exchanges. It is mostly about taking the national numbering plan into account when analyzing dialled codes and routing of telephone calls. Also, it is about a possibility to inhibit incoming call attempts according to number of the calling person and/or called person. Correct servicing of emergency calls is also very important as these have to be routed to local call centres. Charging of incoming traffic is another important function as it serves to define the share of the NET operating agency in incoming telephone traffic. Statistical spreadsheets showing traffic intensity may serve for optimizing traffic conditions of an exchange.
- **Prepaid call charge services** enable to optionally charge calls with help of so-called prepaid service. The payment of calls (or credit) is ensured by an information system run by an operator giving information about an increase of a credit to a **NET** exchange and the exchange enables to make calls only within a limit of the prepaid amount. If the subscriber does not have any prepaid credit for calls, the required telephone connection will not be done for him. If duration of a phone call exceeds the amount of the prepaid credit, the telephone connection will be interrupted. Besides, the **NET** exchange is able to provide the information system with data about current credit values.
- **eCDR data interface** hands on prompt delivery of data records about all internal, outgoing, incoming and transit calls, made from the telephone exchange to the connected information system run by the operator of the given telephone network. When a phone call has been terminated, this interface serves to hand on information from the **NET** exchange via this interface about number of the calling and called persons, about beginning and duration of calls as well as some more information necessary in particular for payment of call charges (so-called TCP interface).
- **eCRM data interface** interconnects a telephone exchange with the follow-up information system run by the operator of the given public telephone network, and enables to transmit parameters of particular ports of the NET exchange subscriber's side to/from the exchange. So, the information system of the operating agency can carry out any business agenda of the customers (with help of a web portal, for example) and information necessary for functions of the telephone exchange are automatically transferred in data form (so-called SOAP interface).

- **eNUM telephone interface** determines whether the called telephone number is available via Internet (in the form of a VoIP terminal equipment or a telephone exchange, for example), enabling to create a temporary internet tie-line determined for outgoing calls. Therefore, a **NET** exchange is able to co-operate actively with so-called eNUM servers. Also, the telephone interface enables to create a temporary internet tie-line determined for incoming calls, and integrate the **NET** exchange passively within eNUM servers scope.

Larger telephone networks may consist of more installations of **NET PhoNet 7000** internet exchanges, connected to a single common information system that is run by an operator to register data about clients.



In certain cases, a private branch exchange can possibly be applied instead of an internet telephone exchange, but it cannot create an autonomous telephone network as it lacks the controlling SW of a **NET** public exchange (that is, it cannot have assigned its own telephone numbers, it is not equipped with SS7, eCDR, eCRM and eNUM interfaces and it provides neither services of a public exchange nor services of pre-paid call charges). A private branch exchange can have assigned only a range of subscribers‘ numbers owned by another operator, and the exchange must be connected to it via an ISDN 30B+D trunk, or exceptionally by ISDN 2B+D lines.

A **NET PhoNet 7000** exchange is equipped, unlike a PBX, with controlling SW determined to carry out the above described features typical of public telephone exchanges. Although NET internet exchanges are based upon the same special and standard HW as PhoNet private branch exchanges, their SW has an extra extension by a module for servicing interfaces and services of public telephone exchanges.

The SW of PhoNet telephone exchanges does not offer features of information systems for operators to keep accounting about their customers. This application SW is usually provided by the operators themselves, “tailor-made” for their specific needs, or is offered by some co-operative companies.

More trade and technical documentation and used abbreviations and concepts, related to **PhoNet** telecommunication system, is outlined in document ***PhoNet_doku_EN.pdf***.

In trade and technical documentation of **PhoNet** system, names of companies, products or services may appear that may be intellectual property of the respective companies.

The intellectual property to **PhoNet** technical solution is in exclusive ownership of company **ProTel engineering, spol. s r.o**. The company provided the rights to production of this telecommunication system to the licensed producer mentioned below.

The intellectual property to **PhoNet** trademark, in its word and graphical appearance, is in ownership of company **ProTel engineering, spol. s r.o**. The company provided rights to use this trademark to its licensed producer and contractual dealer mentioned below

System PhoNet ® Czech Republic
licenced by
ProTel engineering, spol. s r.o.

CE Internet telephone exchange is defined to operate in conformity with technical standards of EC member states CE

The product is licensed for production by ProTel engineering, spol. s r.o. (Ltd.)
www.phonet.eu **www.phonet.cz** **www.phonet.ru**