The Peering with CESNET VoIP Network

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1   About this document

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2   Contents

3 About this project

The project goals are testing of new technologies for the transmission of voice over data networks (VoIP), deployment of IP telephony in the CESNET2 network and development of new tools and components for VoIP technology. As a part of the project, interoperability of products of different vendors are tested. We intend to cooperate on selected issues with telecommunication operators and other projects in VoIP area.

4 History of the project

The IP telephony group in CESNET, operating the CESNET2 network (which was preceded by the TEN-155 CZ network) was established in the mid-1999. The aim of the group has been set to perform testing, measurement, development and practical deployment of technology for the transmission of voice over a data network. The group is supported by CESNET.

The goal of the first phase of our project was to interconnect telephone exchanges (PBXs) of several universities across the country using Voice over IP and to connect this IP telephony network to the public telephone network, see configuration of the pilot project in Fig.1. The motivation was to reduce cost of telephone calls, create a testbed for IP telephony experimental work and prepare for development of new services in the next phase.
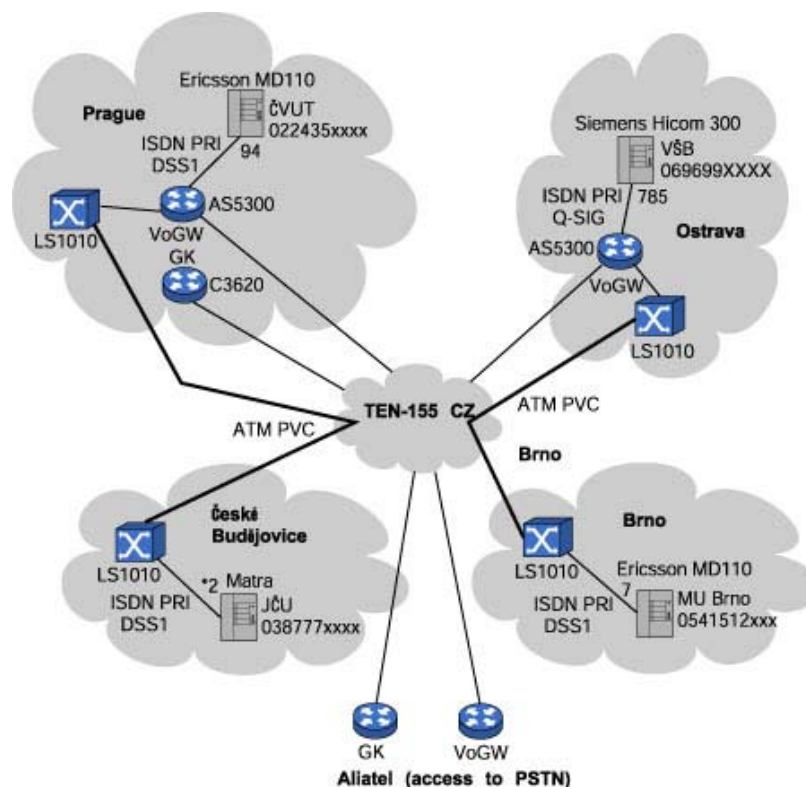

Fig. 1: Configuration of the pilot project

We interconnected PBXs of four universitites in different cities across the country in a pilot project. The configuration is shown in Fig. 1. There were two voice gateways based on Cisco AS5300 routers located in Prague and Ostrava. The PBXs of the other two universities were also connected

to these two voice gateways over ATM PVC tunnels. Call routing was performed by the gatekeeper based on Cisco 2620 router.

The network is based mainly on Cisco routers. We performed a series of experiments with various telephony equipment, particularly testing available PBX interfaces for their suitability for the connection to IP telephony network. Upon completing these tests, we decided to use the VoIP (voice over IP) technology (as oposed to voice over ATM) and digital ISDN PRI/BRI and analog E&M and FXS interfaces. Based on our further experience, we finally decided to use only digital ISDN PRI/BRI interfaces.

IP telephony network has been enlarged in the second phase of our project and is running in routine operation now. Supported signaling protocol in this phase of the project was only ITU-T H.323 (H.323 version 2 and higher).

We are solving the third phase in which is supported IETF SIP protocol too and registration of individual SIP phones with LDAP authentization.

5   Current situation

Several thousands of users of regular phones in these institutions can call each other over the IP telephony network free of charge and can make a connection to public teleph. network for low charges.

See in Figure 2., each of these connected PBX's institutions has the access prefix into CESNET2 network (red-marked), user must dial this acces prefix and next dialling numbers are in accordance with valid Czech dialling plan, we have fixed lenght of numbers in Czech Republic. All Czech tel. numbers have nine digits, area code is integral part of national subscriber number, Czech teleph. network have been renumbered in the September 2002. If the users want to make a call outside the Czech Republic, then must add a country code.

The incoming dial from the peering institutions to CESNET IP telephony network must start with 420. Czech Gatekeepers and Voice Gateways require the receiving of the incoming called number in sequence : **420 XXX XXX XXX**. Replace XXX XXX XXX with the number listed in the list below. (you can find it in Fig. 2. too), called destinations are allowed only within CESNET2 (the restriction only for the peering institutions).

There are two possibilities of the peering to CESNET IP telephony:

-    directly to Voice Gateways, easy for configuration, difficult for management because appropriate record into VoIP endpoint must be individually inserted to every Voice gateway

-    via Gatekeeper, more exacting for configuration, easy for management because the record into VoIP endpoint is single (all +420... call routing is provided by Czech Gatekeeper)

List of the phone numbers connected institutions:

Czech Technical University, Institute of Chemical Technology, Prague	420 22435xxxx
Charles University, rectorate in Prague	420 224491xxx
Charles University in Hradec Kralove, Faculty of Pharmacy	420 495067xxx
Charles University in Prague, Faculty of Education	420 221900xxx
Palacky University, Olomouc	420 58563xxxx
	420 58732xxxx
	420 58744xxxx
The Academy of Sciences of the Czech Republic	420 26605xxxx
Technical University of Ostrava	420 59699xxxx
	420 59732xxxx
Technical University of Liberec	420 48535xxxx
University of Pardubice	420 466036xxx
	420 466037xxx
	420 466038xxx
University of Pardubice in Ceska Trebova	420 465533006
	420 465533008
Brno University of Technology	420 54114xxxx
University of Veterinary and Pharmaceutical Sciences Brno	420 541561xxx
	420 541562xxx
Masaryk University, Brno	420 54949xxxx
University of Economics in Prague	420 224094xxx
	420 224095xxx
University of Economics (Prague) in Jindrichuv Hradec	420 384417xxx
Silesian University, Opava	420 553684xxx
Silesian University (Opava), School of Business Administration in Karvina	420 596398xxx
University of Hradec Kralove	420 495061xxx
University of South Bohemie, Ceske Budejovice	420 38777xxxx
	420 38903xxxx
University of Ostrava	420 597460xxx
	420 596160xxx
University of West Bohemia, Plzen	420 37763xxxx
Tomas Bata University, Zlin	420 57603xxxx

List of abbreviation CESNET VoIP telephony network in figure 2. :

abbreviation in schema	Name of Institution
CUNI Prague	Charles University, Prague
CUNI in Hradec Kralove	Charles University in Hradec Kralove
PU Olomouc	Palacky University, Olomouc
CAS Prague	The Academy of Sciences of the Czech Republic
CTU Prague	Czech Technical University, Praha
TU Ostrava	Technical University of Ostrava
TU Liberec	Technical University of Liberec
University of Pardub.	University of Pardubice
UPA Ceska Trebova	University of Pardubice in Ceska Trebova
UT Brno	Brno University of Technology

UVPS Brno	University of Veterinary and Pharmaceutical Sciences Brno
MUNI Brno	Masaryk University, Brno
UE Prague	University of Economics in Prague
UE in Jindrichuv Hradec	University of Economics (Prague) in Jindrichuv Hradec
SU Opava	Silesian University, Opava
SU in Karvina	Silesian University (Opava) in Karvina
Univ. of HK	University of Hradec Kralove
USB Ceske Bud.	University of South Bohemie, Ceske Budejovice
Univ. of Ostrava	University of Ostrava
UWB Plzen	University of West Bohemia, Plzen
TBU Zlin	Tomas Bata University, Zlin

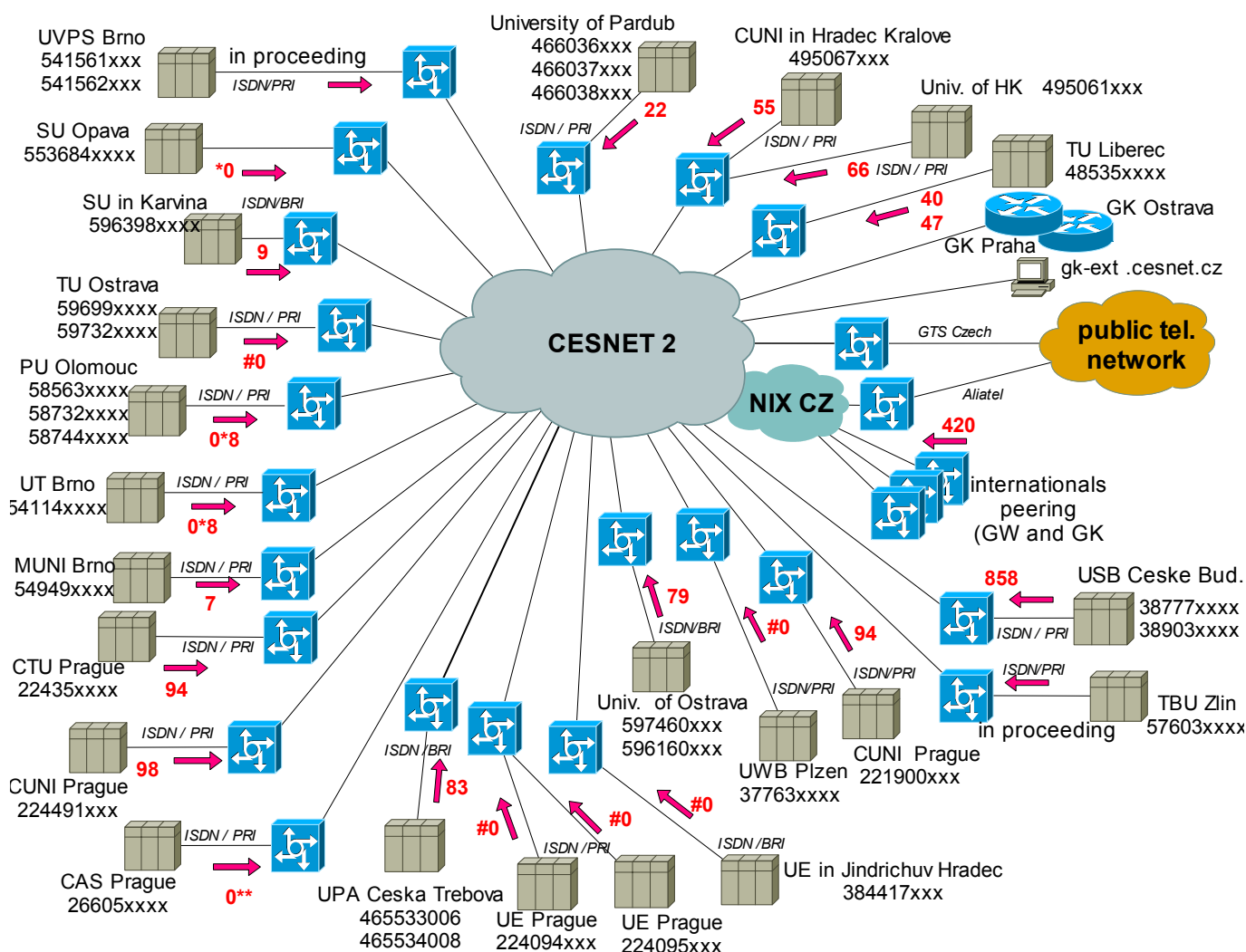Current topology of the CESNET IP telephony network is below in the figure 2.

Fig.2: Current topology of the IP telephony network in CESNET2.

6 H.323 peering configuration

We welcome peerings with other IP telephony networks. The peering will allow you to call any of our connected universities and research institutes over IP. We expect that we will be able to call institutions connected to your network. The service is considered as experimental for research purposes and as such it is without financial obligations on either side and without guarantee.

However, we have substantial experience with operation of production IP telephony network and we consider our network highly reliable.

Advice about collecting CDR (Call Detail Record)
We need to account calls coming from your network to our network (for network maintenance purposes, we assume no billing unless agreed otherwise). We need that your signalling messages include the calling number (or at least the institution prefix) and the called number (both preferably full international phone numbers) such that we can use RADIUS messages from our voice gateways to account the calls.

Type of the peering
There are several possibilities how to make a H.323 connection, the control part is defined in ITU-T H.225.0 recommendation (see Fig. 3.). We can recommend two types of the peering :

- directly to Voice Gateways, only H.225.0/Q.931 is used in control part of H.323 (chapter 6.1.)

- via Gatekeeper, H.225.0 / RAS signaling provides the communication with the Gatekeeper in addition to previous operation mode (chapter 6.2 , 6.3)
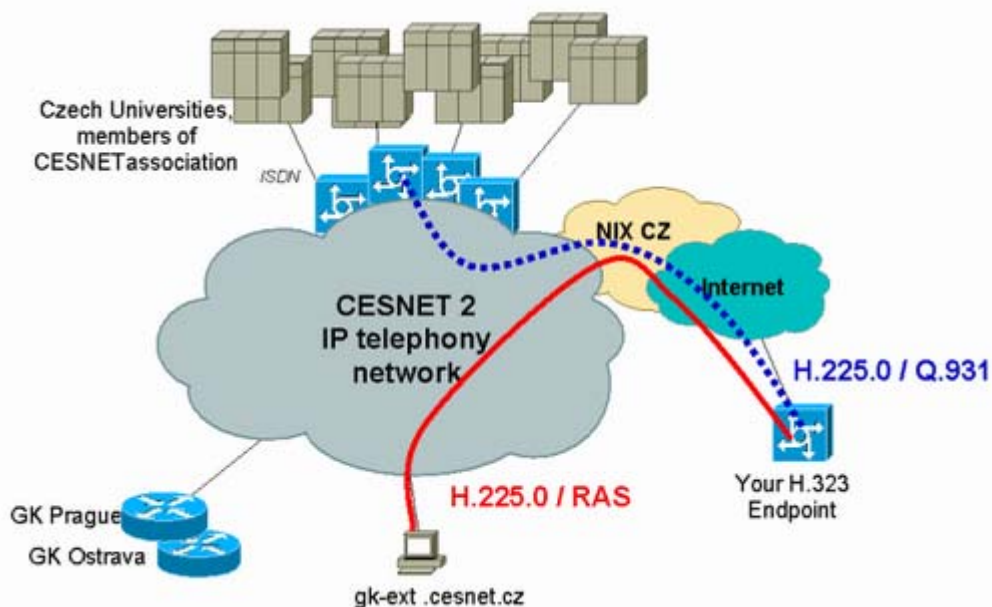

Fig.3: H.225 Signaling route.

In order to peer with your Gatekeper or endpoint, we need the following information:

Step 1.

Please, send these informations (mailto:miroslav.voznak@vsb.cz , mailto:radek.holy@cuni.cz)
- *Send IP address of your H.323 gatekeeper or your H.323 endpoint (gateway, IP phone) and type of the peering (see in chapter 6.1, 6.2 , 6.3).*
- *Send phone number prefix(-es) of institutions connected to your network and some testing phone number (such as voice mail or local weather service).*
- *Send e-mail contact of the person responsible for peering setup and resolving trouble.*

Step 2.
Wait for the response. You'll get the announcement "We are prepared to make a peering".

Step 3.
Perform the correction in your setting by the instruction shown in the chapter 6.1,6.2 or 6.3 and dial the testing number **420 596 991 192** *where you can hear the voice announcement (Voice mail box phone number).*

6.1 Direct Peering to Voice Gateways

Direct peering to specific Gateway is a prefered option if you want to achieve a interconnection only between two gateways. We present practical configuration of Cisco System Voice Gateway.

- Technical University of Ostrava
> *dial-peer voice 101 voip*
> *destination-pattern 42059699....*
> *session target ipv4:195.113.144.77*
> *codec g729r8*
> *no vad*

- The Academy of Sciences of the Czech Republic
> *dial-peer voice 102 voip*
> *destination-pattern 42026605....*
> *session target ipv4:147.231.19.90*
> *codec g729r8*
> *no vad*

- Czech Technical University, Institute of Chemical Technology, Prague
> *dial-peer voice 103 voip*
> *destination-pattern +42022435....*
> *session target ipv4:195.113.144.76*
> *codec g729r8*
> *no vad*

You can ask for the next peering information to any Institution which is connected into CESNET IP Telephony network.

6.2 Peering between your Gateway and CESNET Gatekeeper

Peering between your Gateway and our Gatekeeper is a prefered option if you do not have a Gatekeeper. IP address of our H.323 gatekeeper: 195.113.156.184 (gt-ext.cesnet.cz). We present practical configuration of Cisco System Voice Gateway.

```
interface FastEthernet0                      /* modify configuration on Ethernet interface
.........
h323-gateway voip interface
h323-gateway voip id gk-ext ipaddr 195.113.156.184 1718
h323-gateway voip h323-id YOUR-ID            /* please insert your ID
h323-gateway voip tech-prefix 4212           /* please insert your prefix
                                              (destination pattern on selected pots)
```

Insert the new dial peer (Czech, 420) with session target ras (H.225.0 / RAS Signaling protocol) and at once you'll get a solution for the call termination into whole CESNET IP telephony network.

```
dial-peer voice 112 voip
destination-pattern 420.........
codec g729r8
session target ras
no vad
```

6.3 Peering between your Gateeeper and CESNET Gatekeeper

Peering between your Gatekeeper and our Gatekeeper is a prefered option if you have a Gatekeeper. We present practical configuration of Cisco System Gatekeeper.

cesnet-ext is the zone name of our Gatekeeper.

```
gatekeeper
 zone remote cesnet-ext cesnet.cz 195.113.156.184 1719
 !
 zone prefix cesnet-ext 420*
```