Videoconferencing with VRVS: an Overview

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CERN, Geneva - Switzerland

Outlines

- VRVS: Background Information
- VRVS Deployment
- VRVS Usage and Statistics

➔ From VRVS To EVO:
An End-to-End Self Managed RTC Infrastructure

Objective

The "Virtual Room Videoconferencing System" (VRVS) has been developed since 1995 in order to provide a low cost, bandwidth- efficient, extensible means for videoconferencing and remote collaboration over networks within the High Energy and Nuclear Physics communities.

January 2006:

- **about 21,000 Users Registered from 132 Countries, more than 1200 world wide meetings involving more than 4500 users (total 6000 hours) per month**
- **It's the first Very Large Distributed System deployed and used today in Production.**

VRVS Project Timeline

Version

v0.4 • 1995 Caltech/CMS group started the development of a full Web based user interface for videoconferencing.

v1.0 • In January 1997, pushed by strong demands from the LHC experiments, the Caltech/CMS group started a production prototype Web-based service named Virtual Room Videoconferencing System (VRVS).

v2.0 • During 1998-2000 VRVS was widely recognized by the Research and Education Communities worldwide. It became a core technology for IP-based video & multimedia services in Internet2.

v2.5 • July 2001 VRVS is the first system to support multiple protocols (Mbone, H.323, MPEG) for collaboration over IP networks.

v3.0 • February 2003, 1st re-architecture of the VRVS System (97% Code redone) – User Authentication, Database, AccessGrid Support, ..

v4.0 • July 2005, 2nd re-architecture of the VRVS System to become a Globally Distributed Self Managed End-to-End Real-time Infrastructure

As of January 2006: 21000 users registered, more than 22000 meetings performed

VRVS: What is it?

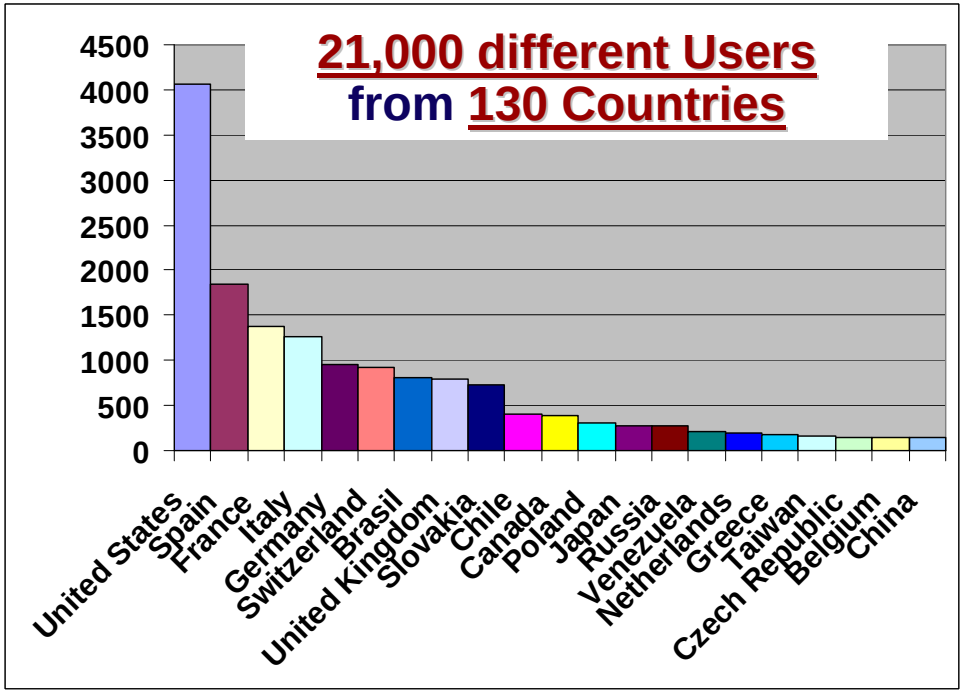
- VRVS is a realtime distributed system which provides a scalable communication infrastructure for large collaboration dispersed all over the world.
- Different technologies and protocols are supported (and mixed) and allow users to connect their preferred videoconference.
- Supports Mbone, H.323, SIP, QuickTime, Access Grid.
- The system is composed of 1 main server and several reflectors (network servers) spread around the world.

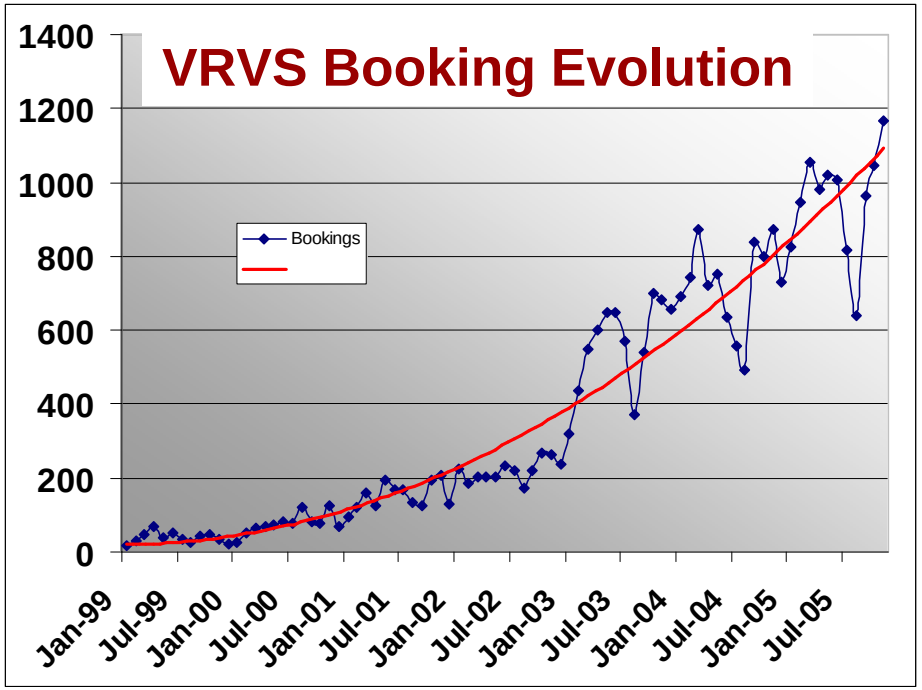
VRVS Web Service Design

- **Unified Web User Interface:** ***to schedule and join/leave a meeting*** **independently of the application**
- ***Multi-platform:*** **Windows, Linux, MacOS and Unix**
- **Easy to use:** ***Everybody knows how to click on a web page today***
- **Virtual Room Concept** ***Scheduling: Create a virtual space were people can exchange real-time information.***
- **Join or Leave a Collaborative session anytime:** ***Do not need to know in advance how many participants and booked ports capacity. Just announce the meeting and people will join from anywhere.***
- ***Full*** **Documentation and Tutorial**
- **Self service:** ***Don't need a technician or expert to organize and join a conference***

VRVS Reflectors Deployment World Wide

VRVS registered users and current usage





Average of 1200 world wide meetings involving more than 4500 users (total 6000 hours) per month

Workshops/ Conferences	Since 2005/01/01
Workshop	240
Conference	239
Lecture/Seminar	190
Tutorial	27

VRVS Worldwide Collaboration

The VRVS team collaborates with Research and Education Networks and major Research Projects around the globe to provide the academic community with a unique and reliable real-time infrastructure supporting all protocols for advanced collaboration

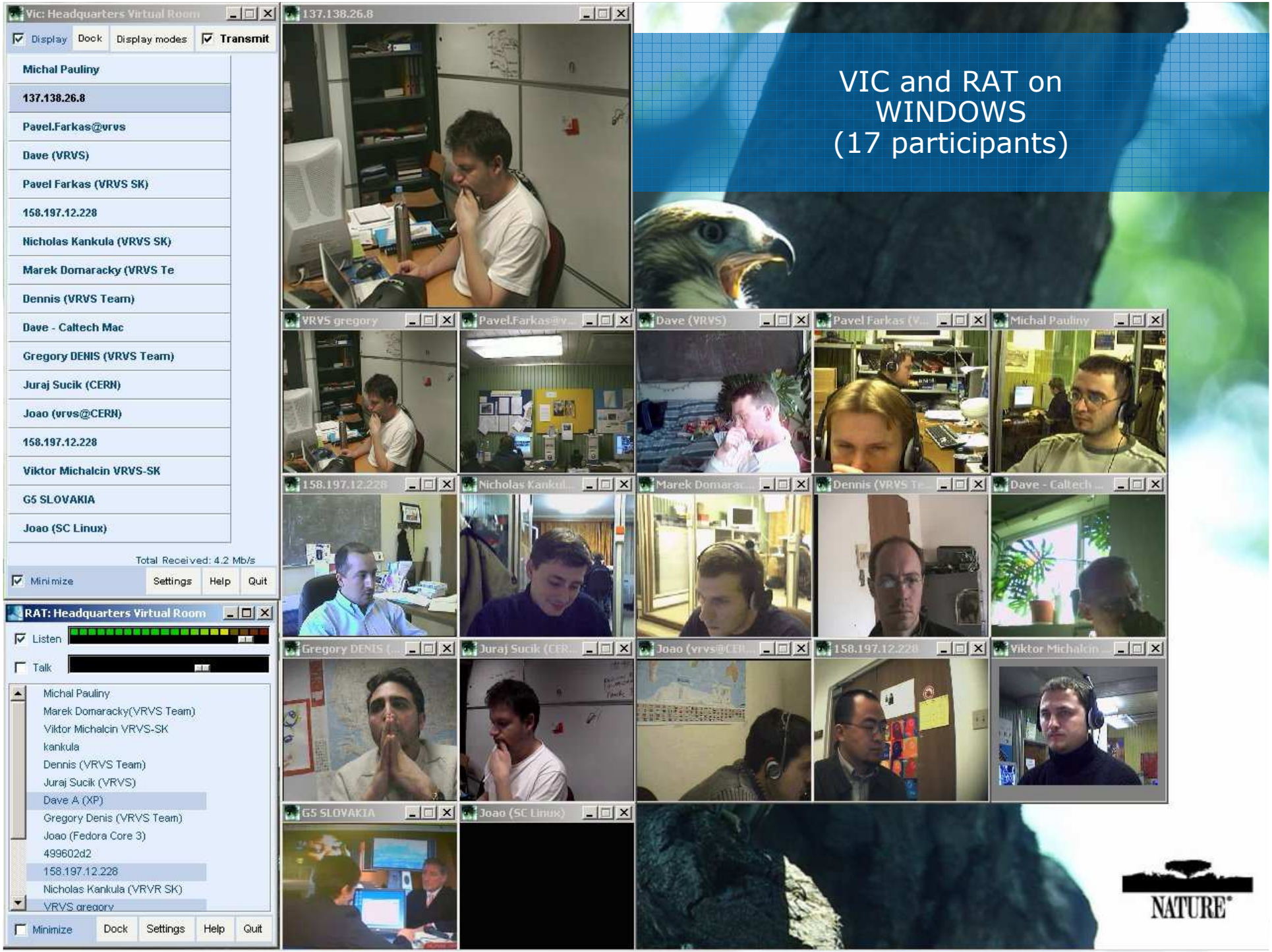
VRVS National Research and Education Network (NREN) Communities and Projects:

Internet2 **(U.S)**, GEANT2/DANTE **(Europe)**, RedIRIS **(Spain)**, RNP **(Brazil)**, REUNA **(Chile)**, RENATER **(France)**, SANET **(Slovakia)**, INFN **(Italy)**, FUNET **(Finland)**, REACCIUN2 (Venezuela) and AMPATH **(America)**, **GLORIAD**

Others are in process.

At CERN:

- **100% of the installed videoconference rooms are VRVS compliant**
- **4 reflectors installed 2 of them for CERN internal usage**
- **support, operation and integration with other systems provided by CERN/Caltech agreement**


Vic: Headquarters Virtual Room
Display
Dock
Display modes
Transmit
Michal Pauliny
137.138.26.8
Pavel.Farkas@vrvs
Dave (VRVS)
Pavel Farkas (VRVS SK)
158.197.12.228
Nicholas Kankula (VRVS SK)
Marek Domaracky (VRVS Te
Dennis (VRVS Team)
Dave - Caltech Mac
Gregory DENIS (VRVS Team)
Juraj Sucik (CERN)
Joao (vrvs@CERN)
158.197.12.228
Viktor Michalcin VRVS-SK
G5 SLOVAKIA
Joao (SC Linux)
Total Received: 4.2 Mb/s
Minimize
Settings
Help
Quit
RAT: Headquarters Virtual Room
Listen
Talk
Michal Pauliny
Marek Domaracky(VRVS Team)
Viktor Michalcin VRVS-SK
kankula
Dennis (VRVS Team)
Juraj Sucik (VRVS)
Dave A (XP)
Gregory Denis (VRVS Team)
Joao (Fedora Core 3)
499602d2
158.197.12.228
Nicholas Kankula (VRVR SK)
VRVS gregory
Minimize
Dock
Settings
Help
Quit
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VRVS gregory
Pavel.Farkas@v...
Dave (VRVS)
Pavel Farkas (V...
Michal Pauliny
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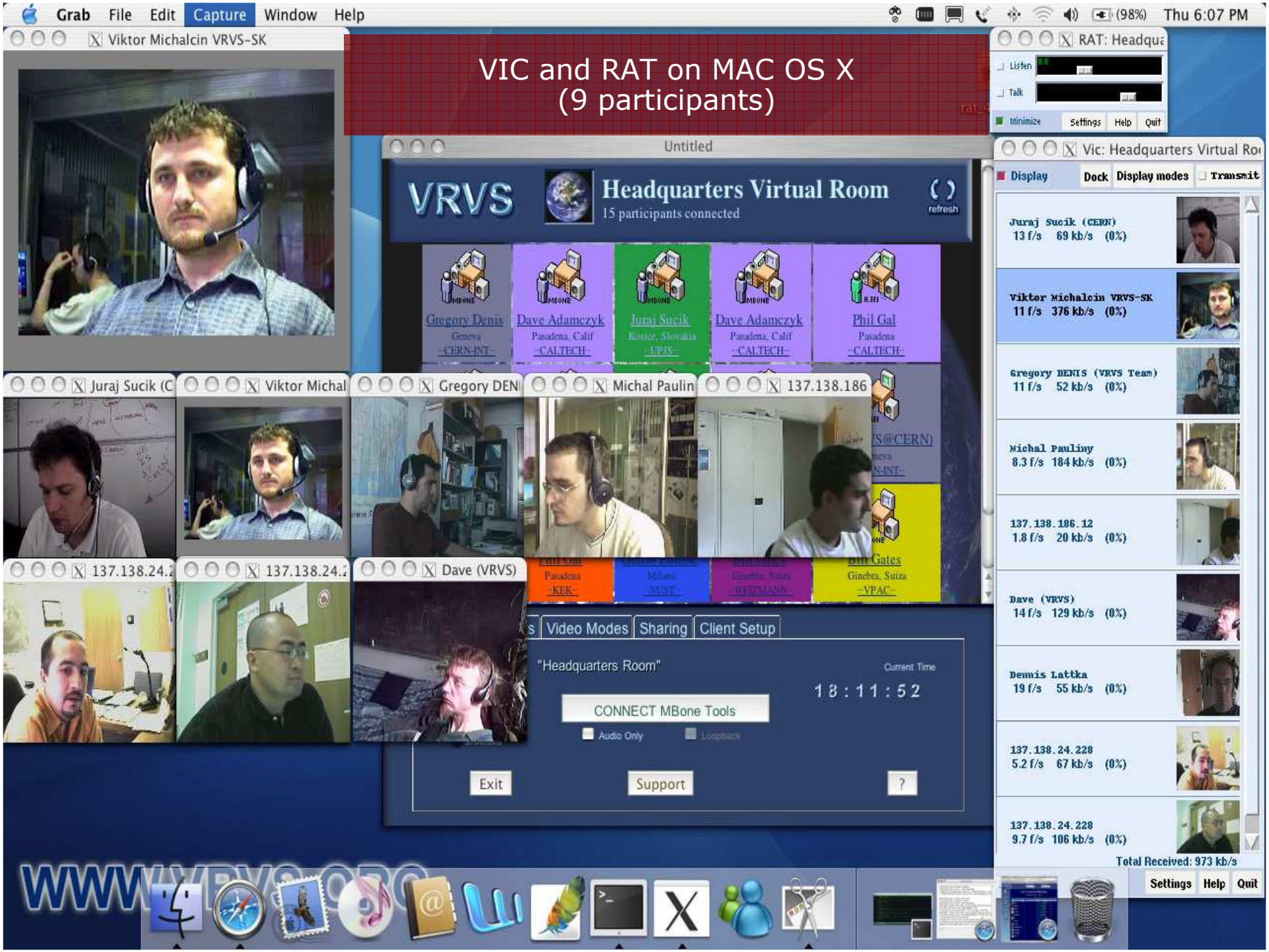
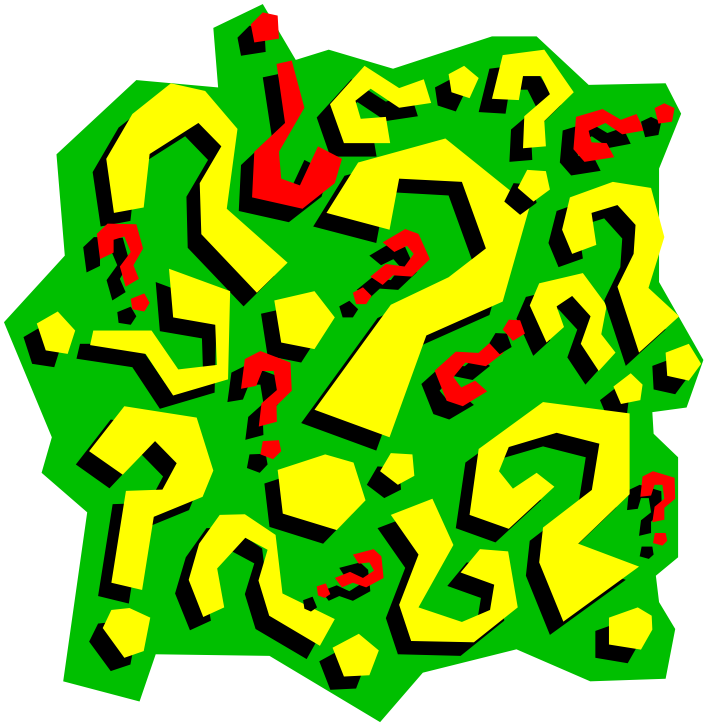
Nicholas Kankul...
Marek Domarac...
Dennis (VRVS Te...
Dave - Caltech ...
Gregory DENIS (...
Juraj Sucik (CER...
Joao (vrvs@CER...
158.197.12.228
Viktor Michalcin ...
G5 SLOVAKIA
Joao (SC Linux)
VIC and RAT on
WINDOWS
(17 participants)
NATURE


MSSR - KM
Dennis (VRVS Team)
Juraj Sucik (CERN)
Gregory DENIS (VRVS Te
TnUAD2 - Trencin
Iosif Legrand
U of Zilina (Melo,Gintner)
TUKE Kosice (CNL)
Viktor Michalcin (VRVS-SK
U of Zilina (Melo,Gintner)
TnUAD - Trencin
131.215.116.60
MSSR - KM
UMB Banska Bystrica
Julian Bunn
PF UPJS Kosice
128.227.89.161
Dave (VRVS)
bbkeys
VIC on LINUX
(17 participants)


VIC and RAT on MAC OS X
(9 participants)
Grab File Edit Capture Window Help
Thu 6:07 PM
Viktor Michalcin VRVS-SK
RAT: Headqua
Listen
Talk
Minimize
Settings
Help
Quit
Untitled
VRVS
Headquarters Virtual Room
15 participants connected
refresh
Gregory Denis
Geneva
-CERN-INT-
Dave Adamczyk
Pasadena, Calif
-CALTECH-
Juraj Sucik
Kosice, Slovakia
-UPJS-
Dave Adamczyk
Pasadena, Calif
-CALTECH-
Phil Gal
Pasadena
-CALTECH-
Vic: Headquarters Virtual Ro
Display
Dock
Display modes
Transmit
Juraj Sucik (C
Viktor Michal
Gregory DEN
Michal Paulin
137.138.186
Juraj Sucik (CERN)
13 f/s 69 kb/s (0%)
Viktor Michalcin VRVS-SK
11 f/s 376 kb/s (0%)
Gregory DENIS (VRVS Team)
11 f/s 52 kb/s (0%)
Michal Pauliny
8.3 f/s 184 kb/s (0%)
137.138.186.12
1.8 f/s 20 kb/s (0%)
137.138.24.2
137.138.24.2
Dave (VRVS)
Phil Gal
Pasadena
-KEK-
Milano
-NUST-
Bill Gates
Ginebra, Suiza
-VPAC-
Dave (VRVS)
14 f/s 129 kb/s (0%)
Dennis Lattka
19 f/s 55 kb/s (0%)
137.138.24.228
5.2 f/s 67 kb/s (0%)
137.138.24.228
9.7 f/s 106 kb/s (0%)
Total Received: 973 kb/s
Video Modes
Sharing
Client Setup
"Headquarters Room"
Current Time
18:11:52
CONNECT MBone Tools
Audio Only
Loopback
Exit
Support
?
Settings
Help
Quit


From a Boeing 747 at 12,000 m
over the Ocean

What’s Next ?

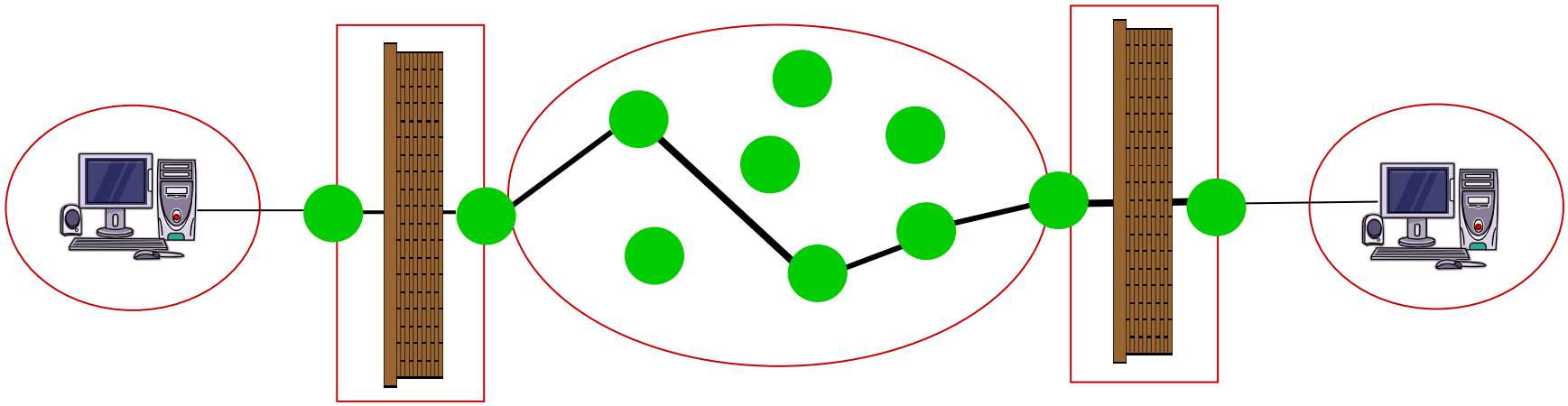


Caltech

From VRVS To EVO: End-to-End Self Managed RTC Infrastructure

Why can we not achieve total reliability/robustness when deploying a RTC Infrastructure ?

- **The Real-Time Collaborative environment is a living environment, constantly changing, evolving. In addition devices/domains/nodes are managing by several independent technical and administrative entities**



Solution:
Building an Overlay Network by deploying intelligent Software Agents

Panda Software Agent

Intelligent Software Agent to create an Overlay Network

Some functionalities:

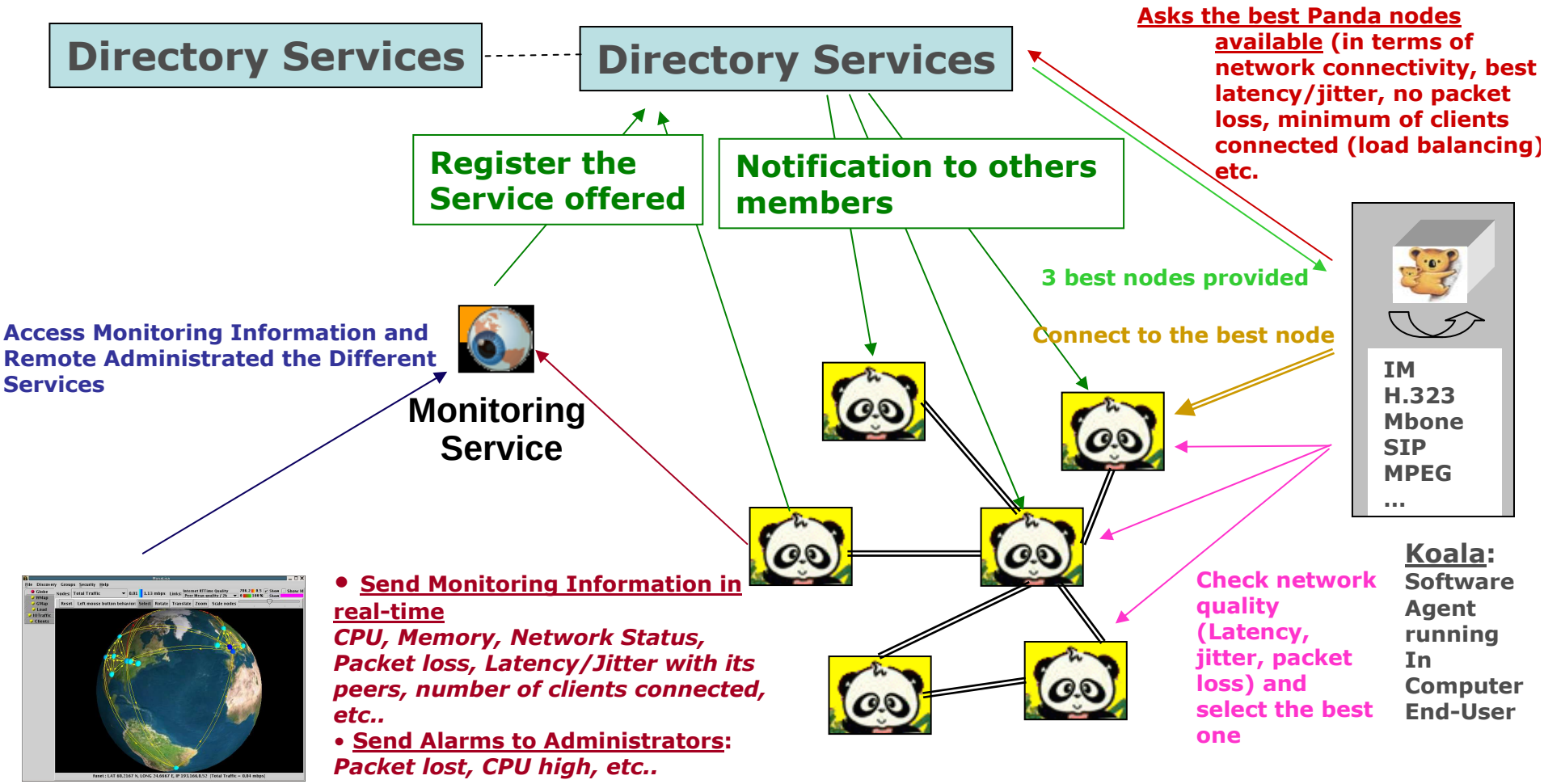
- **Dynamic registration** to high level directory services
- **Automatic re-activation** of components and services
- **Automatic and secure** code update
- **Continuous monitoring** of network quality (packet loss, jitter, latency) between its peers and its possible peers
- **Automatic rerouting** to obtain the best performance/quality
- **Encryption** between pandas and between pandas and clients
- **Automatic Alarm notifications** when monitored parameters (system or network) go beyond a **preset threshold**
- **Dynamically provides services** (video, audio, data,..) that matches the current **resources/capabilities** to the end users/applications
- Access to **real-time and historical data**

Koala Client

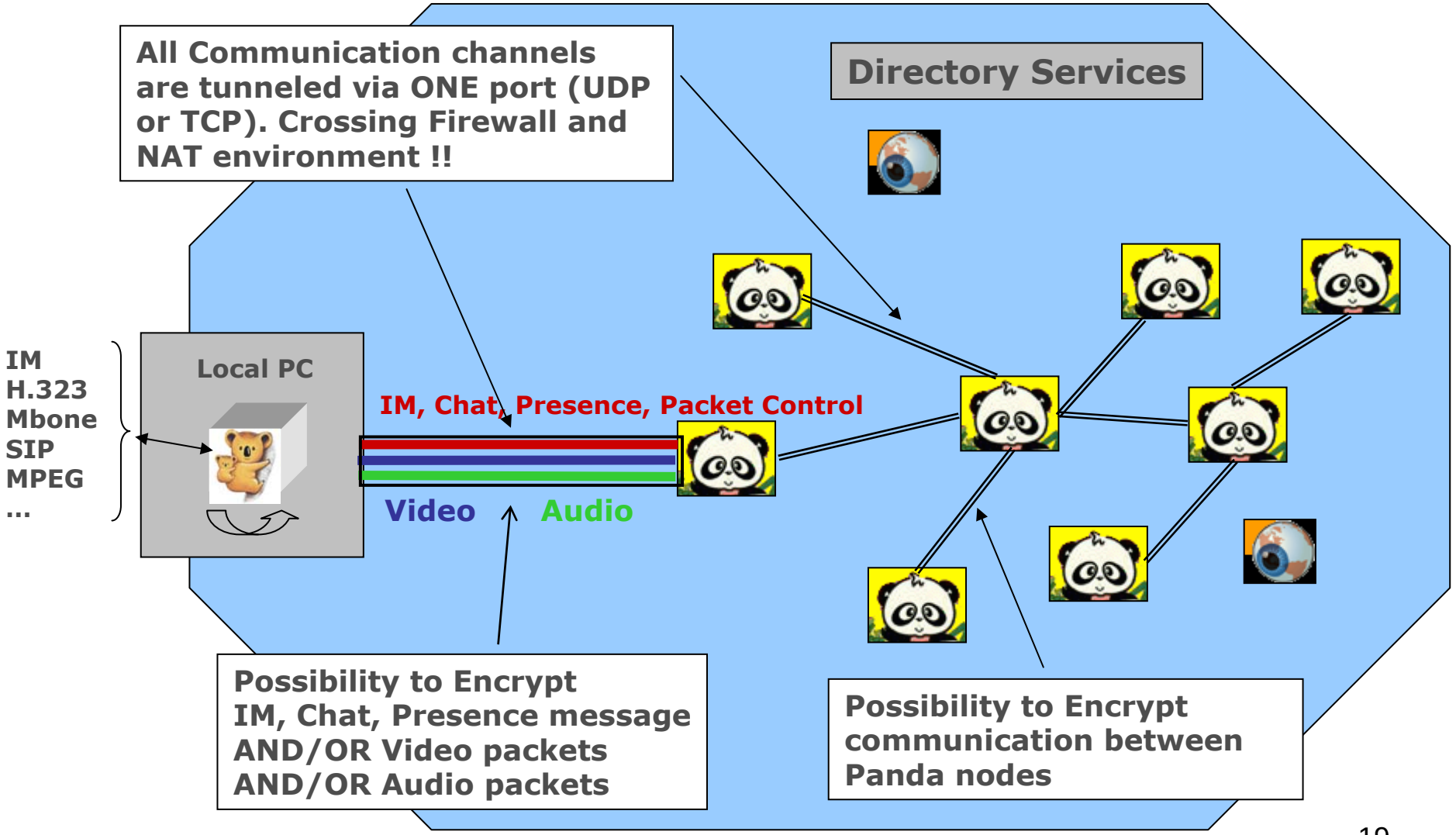
Some functionalities:

- **Bookings:** Book a schedule meeting; Start an Ad-hoc meeting, invite a buddy to a private meeting, have permanent meeting room
- **Presence** information, **Group and Private** concurrent chat
- UDP and TCP tunnelling in one Port. **Network Address Translation and Firewall transversal**
- **Encrypt** Video and/or Audio and/or IM/Chat and/or other data
- Meeting management: Become a **meeting moderator**; Mute/Umute video/audio of a participant, kick-out a participant, add a new participant as moderator
- **Shared files** in a virtual meeting space or send a file to individuals
- **Plug-in concept:** so others data types can be sent over the EVO infrastructure (authentication, calendaring, etc..). **API** for external development will be provided
- **Multilanguage** support, **IPv6** Compliant,

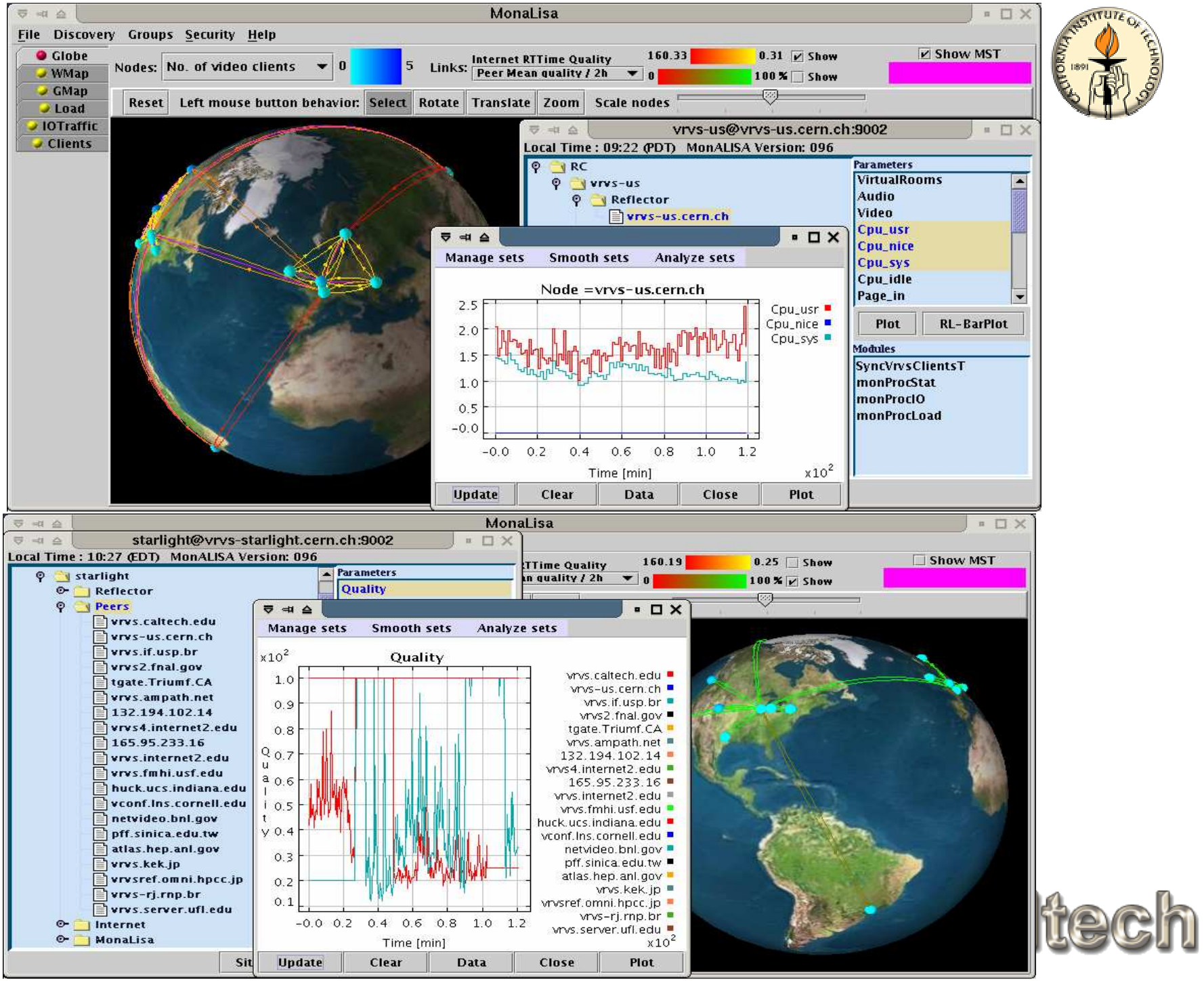
Building a Core RTC Infrastructure



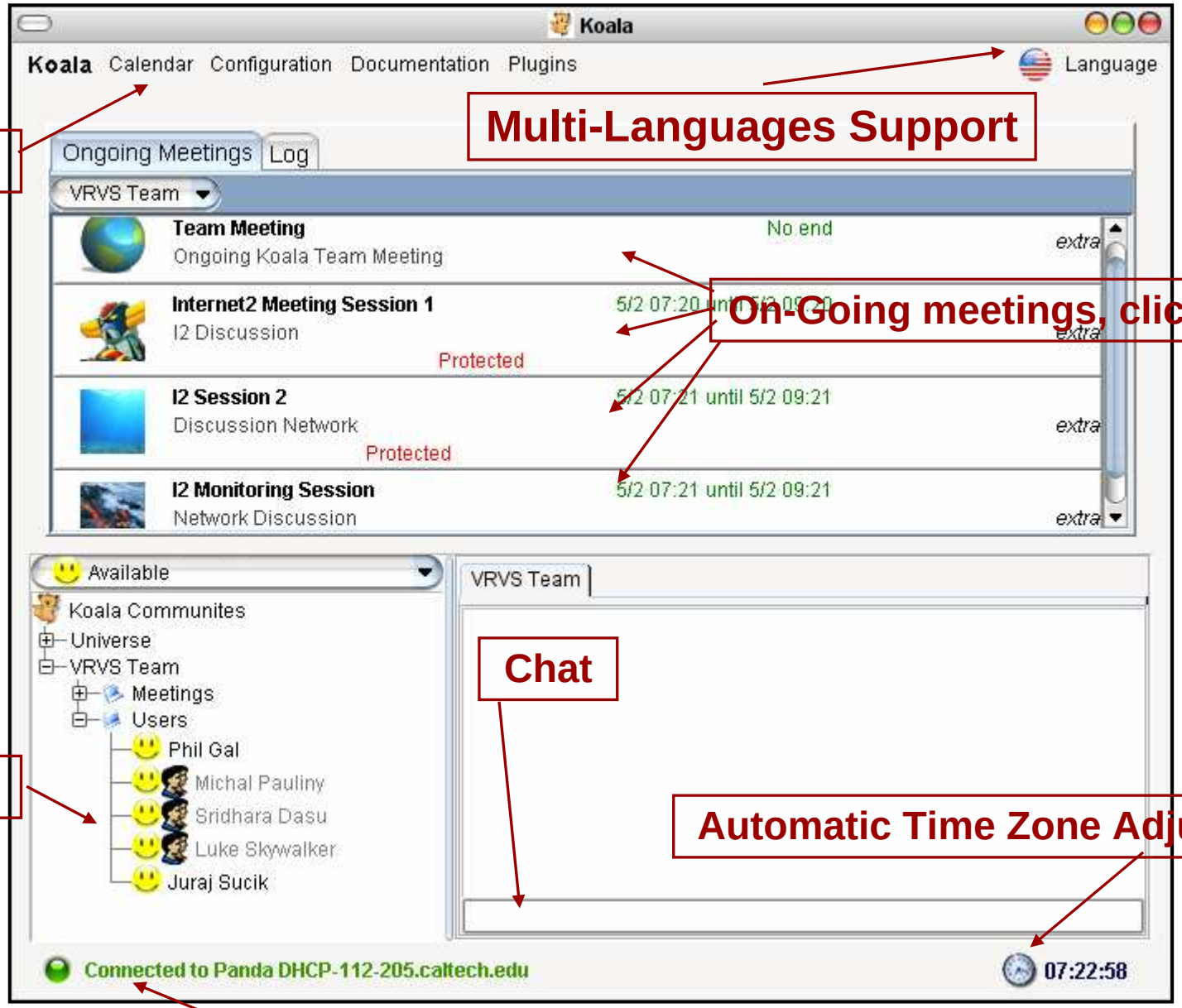
Building an End-to-End Self Managed RTC Infrastructure



End-to-End RTC Self Managed Infrastructure


MonaLisa
File Discovery Groups Security Help
Globe
WMap
GMap
Load
IOTraffic
Clients
Nodes: No. of video clients
Links: Internet RTTime Quality
Peer Mean quality / 2h
Show MST
Reset
Left mouse button behavior: Select Rotate Translate Zoom
Scale nodes
vrvs-us@vrvs-us.cern.ch:9002
Local Time : 09:22 (PDT) MonALISA Version: 096
RC
vrvs-us
Reflector
vrvs-us.cern.ch
Parameters
VirtualRooms
Audio
Video
Cpu_usr
Cpu_nice
Cpu_sys
Cpu_idle
Page_in
Plot
RL-BarPlot
Modules
SyncVrvsClientsT
monProcStat
monProcIO
monProcLoad
Manage sets
Smooth sets
Analyze sets
Node =vrvs-us.cern.ch
Time [min]
Update
Clear
Data
Close
Plot
MonaLisa
starlight@vrvs-starlight.cern.ch:9002
Local Time : 10:27 (EDT) MonALISA Version: 096
starlight
Reflector
Peers
vrvs.caltech.edu
vrvs-us.cern.ch
vrvs.if.usp.br
vrvs2.fnal.gov
tgate.Triumf.CA
vrvs.ampath.net
132.194.102.14
vrvs4.internet2.edu
165.95.233.16
vrvs.internet2.edu
vrvs.fmhi.usf.edu
huck.ucs.indiana.edu
vconf.lns.cornell.edu
netvideo.bnl.gov
pff.sinica.edu.tw
atlas.hep.anl.gov
vrvs.kek.jp
vrvsref.omni.hpcc.jp
vrvs-rj.rnp.br
vrvs.server.ufl.edu
Internet
MonaLisa
Quality
Manage sets
Smooth sets
Analyze sets
Quality
Time [min]
Update
Clear
Data
Close
Plot
Show MST

The Koala Client (Java)



Bookings

Multi-Languages Support

On-Going meetings, click to join

Chat

Presence

Automatic Time Zone Adjustment

Connection to the Panda

Video and Audio Client improvements

- improvements done on decoder side have influence mainly on compatibility with H.323 hardware devices
  - RTP part was changed to avoid artifacts in decoded video from some H.323 clients and to fix bad positions of macroblocks in video stream from MCUs and Polycom VSX
  - bug which causes skipping of the last macroblock in RTP packet was fixed (avoids artifacts in decoded video)

Polycom VSX7000 - before

Polycom VSX7000 - now

New Codec Integration : H.263

- comparing to H.261, there are two significant differences:

Resolution of video signal

- 5 standardized resolutions: sub-QCIF (128x96), QCIF (176x144), CIF (352x288), 4CIF (704x576), 16CIF (1408x1152)
- custom resolution up to 2048x1152

Level of compression and quality

- Arithmetic Coding instead of VLC - significantly fewer bits produced
- Unrestricted Motion Vector Mode - larger vectors and vectors can point outside the picture
- Advanced Prediction Mode - 4 8x8 vectors instead of one 16x16 vector - results in less blocking artifacts
- PB-frames mode - two pictures encoded as one unit
- enhanced error resilience capabilities
- half pixel precision used for motion compensation + many others

For the same quality it has 30-50% of H.261 bit usage

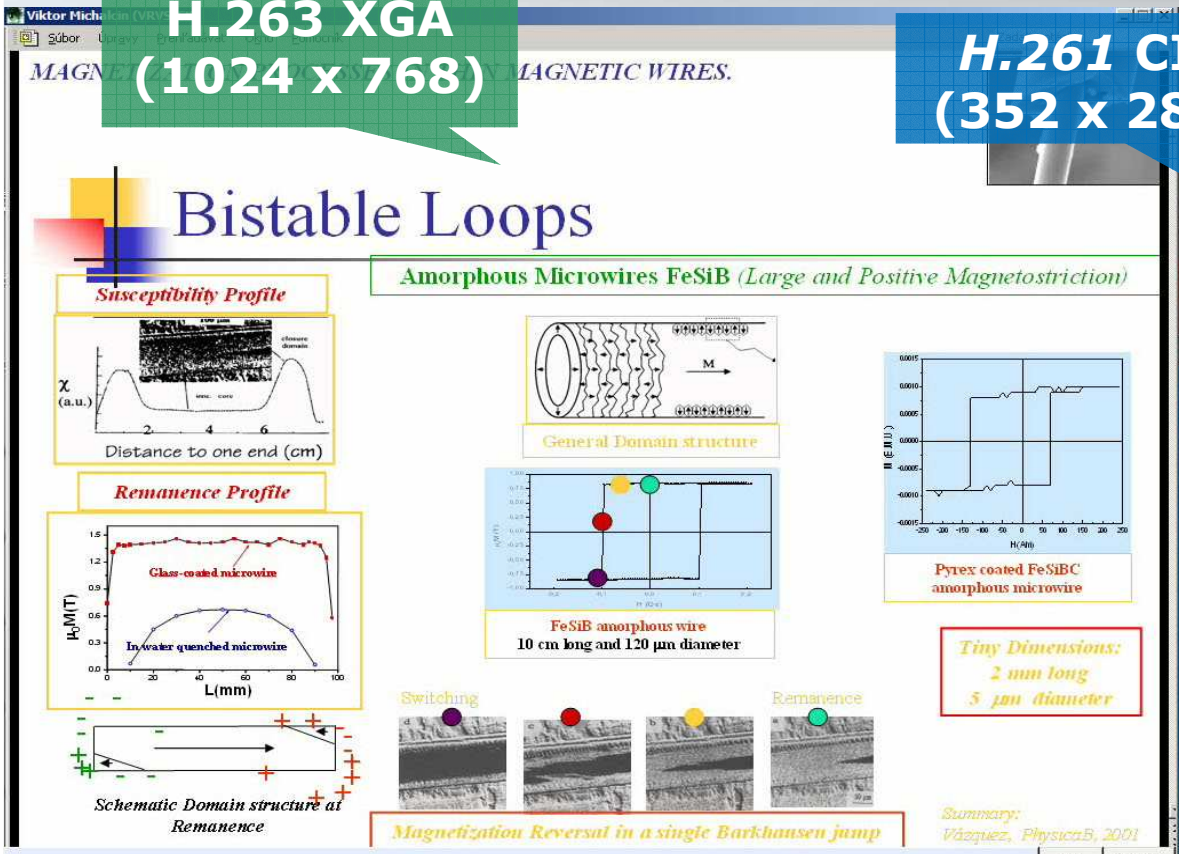
H.263 - Desktop Sharing

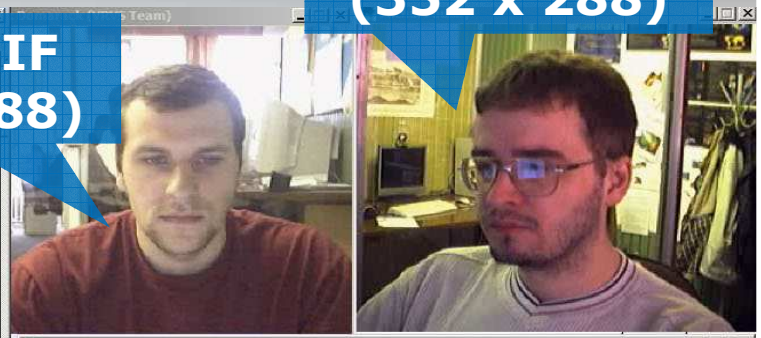
H.263 XGA (1024 x 768)

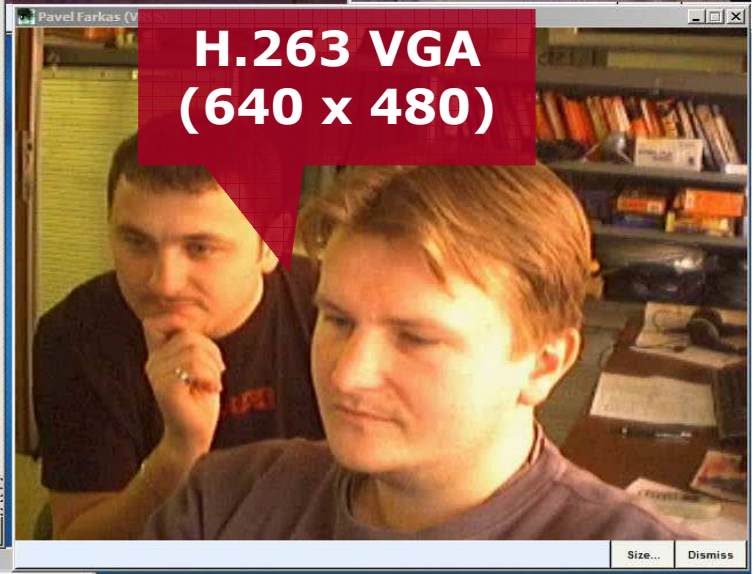
H.261 CIF (352 x 288)

H.261 CIF (352 x 288)

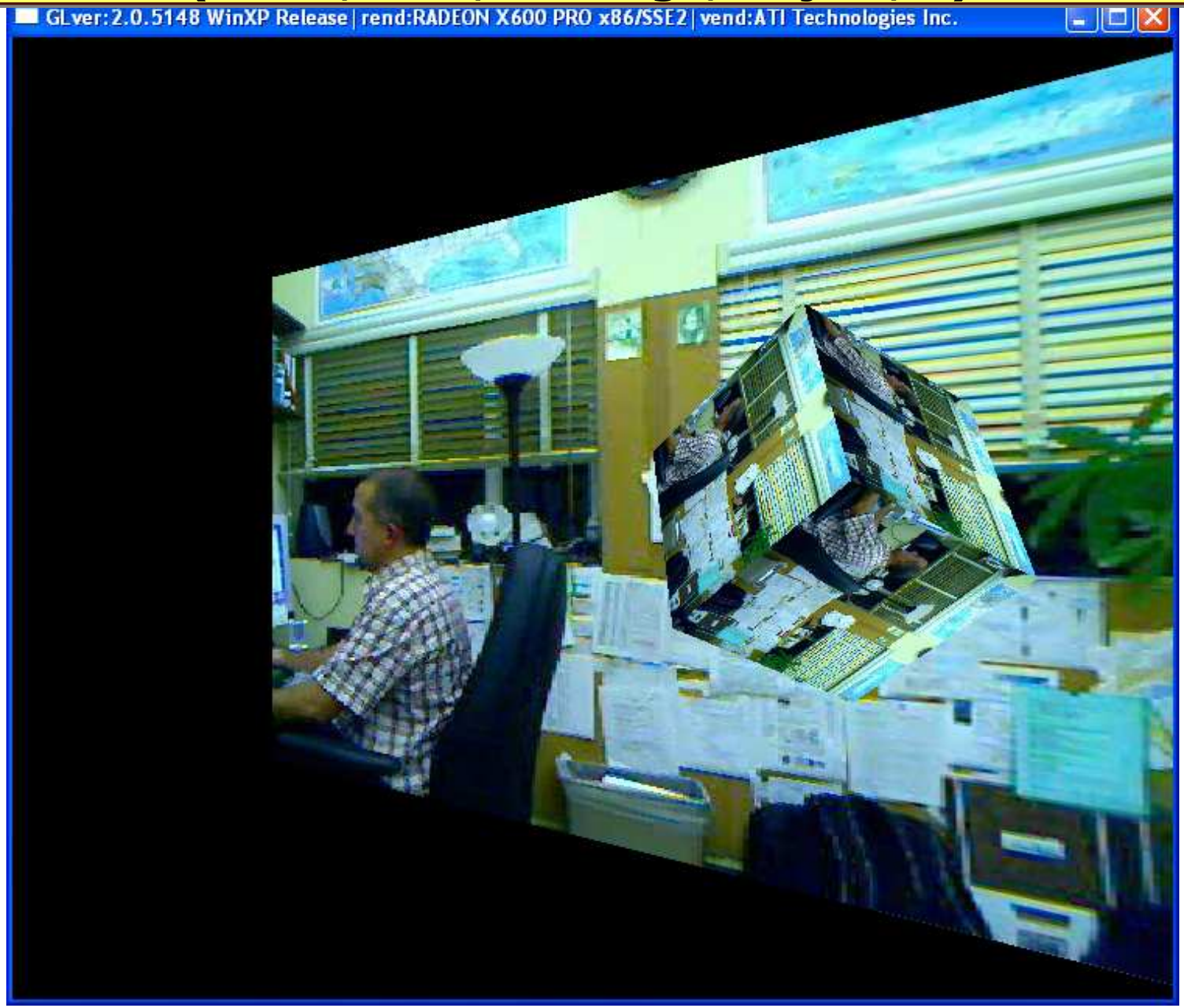
H.263 VGA (640 x 480)







OPENGL Display
(Video, Text, Message, Object, ..)



Audio Equipments

Major hardware improvements has been done the last few months pushed by the VoiceOverIP (VoIP) market (i.e. Skype and Others)

- **For individual: a headset is a affordable working set-up ($60)**

- **For individual, small or medium rooms: New hardware with build-in speaker and microphone with echo cancellation are available. Their quality are good to excellent. Ex: USB Phoenix devices (~$250)**

- **For Large rooms / amphitheaters: Specific investment has to be done for the local audio set-up and remote communication (wireless microphone, echo cancellation device, …)**

PocketVRVS – the mobile solution

Documentation

Download PocketVRVS package

Booking

Connect to any ongoing meeting

PocketVRVS
web interface

Control Panel
Talk, Listen, Send and Receive controls

Video Screen
Remote Video, Own Video in PIP window

Session Info
Virtual Room, Participant's name, …

Program Menu
Connection and Session Settings

PocketVRVS
application GUI

EVO: End-to-End Self Managed and Secure RTC Infrastructure

Thank you

www.VRVS.org

Contact@VRVS.org

Support@VRVS.org