

VRVS System Status and Plans



Virtual Collaborative Grid Infrastructure

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ESnet Workshop, Caltech
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Outlines

- VRVS history
- VRVS current system; Version 3.3
- VRVS worldwide collaborative production service
- Next Generation System
- Demo

VRVS History

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.

October 2004:

- 12000 Users Registered from 106 Countries, more than 800 world wide meetings involving more than 3000 users (total 4600 hours) per month**
- It is first Very Large Distributed System (using the Grid concept) 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 the **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 **first system** to support **multiple protocols** (Mbone, H.323, MPEG) for collaboration over **IP network**.

v3.0

- February 2003, first **re-architect** of the VRVS System (97% Code redone) – User Authentication, Database, AccessGrid Support, ..
As of July 2004: **10700 users registered, 11185 meetings performed**

v4.0

- January 2005, second **re-architect** of the VRVS System to become a **Globally Distributed Self Managed End-to-End Real-time Infrastructure**

VRVS Current System

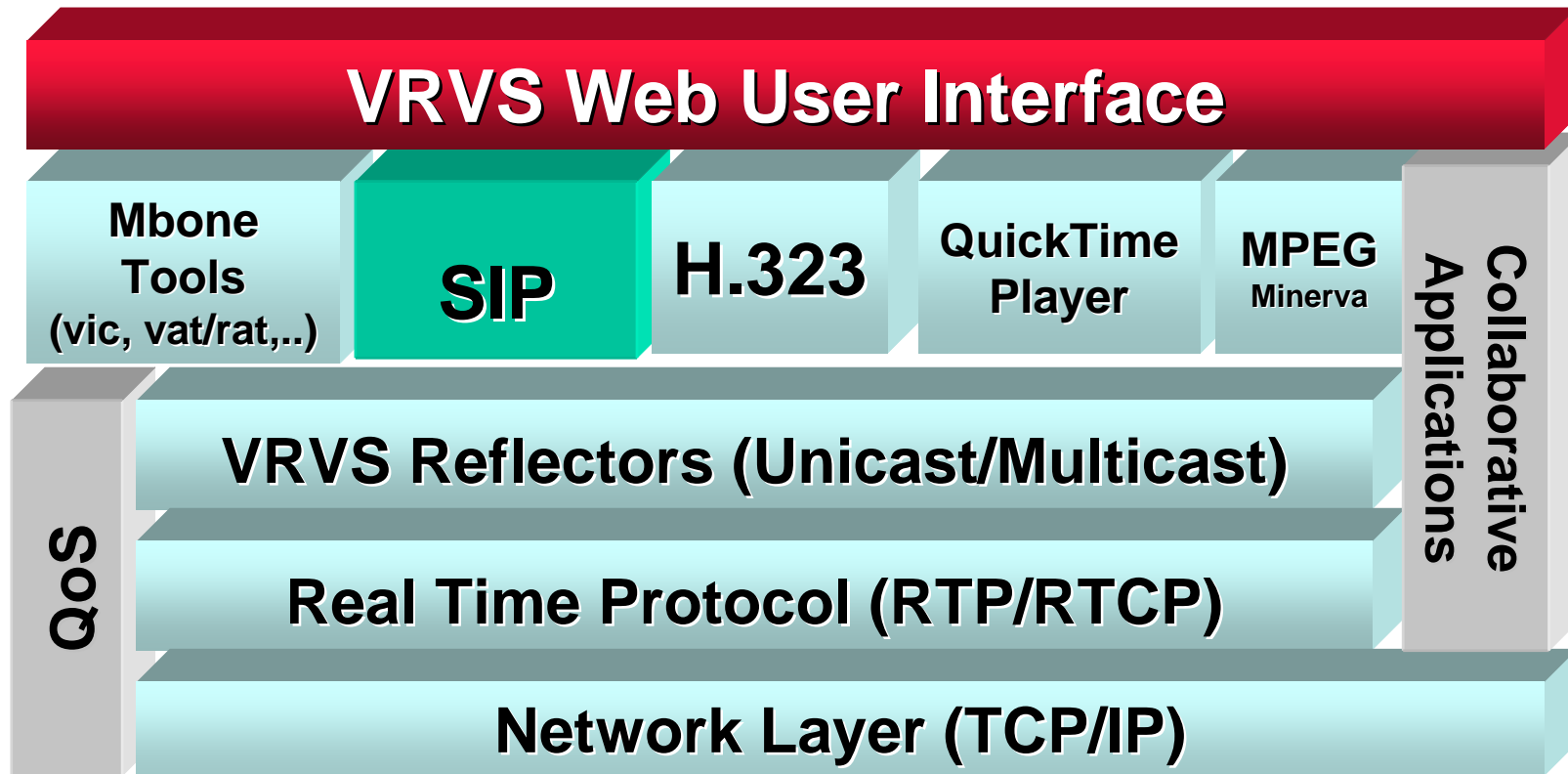
VRVS: What it is ?

- **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, JMF and MPEG2.**
- **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 (from 4 to 77 years old) knows how to click on a web page today. Not true for running a VCR.
- **Virtual Room Concept, Scheduling;** Create a virtual space where 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 Model Implementation



VRVS Reflectors



- The reflectors' backbone provides a **pure software-based MCU** (Multipoint Connection Unit) supporting **all protocols** (H.323, SIP, etc..) with **unicast/multicast** compatibility. It provides a sophisticated real time multipoint algorithm with **low cost and maintenance**.
- In addition to dramatically improving the **scalability and security**, the system provides **tunneling** between peer reflectors, TCP connection and **NAT** (Network Address Translation) support.
- A reflector computes which participant is the current speaker and treats each type of videoconference client connected in a **different way**.

VRVS Booking System

- VRVS provides a **web based booking system** where participants can organize meetings manually or through a **“booking wizard”**
- User can easily **cancel, move or copy** his reservation
- User can **prevent abuse** access to a meeting with an **additional password**
- VRVS manages **multi international time zones** in a transparent way

The screenshot displays the VRVS Booking System interface. At the top, there is a navigation bar with 'Desert' on the left and 'YEAR MONTH DAY' on the right. Below this is a calendar for June 2003, showing days from Sunday to Saturday. The calendar entries include various meetings and events, such as 'MonaLisa CalPoly', 'ossf mee ihep tes TEST VRVS-SK', 'T0/TOF c test GANMVL t LHCb Lig', 'L3 Edito KTEC LCG appl USCMS Fa', 'IQoM ossf mee Rio-SP INFN Per', 'Meeting X# Wp3.1 pamel a c Pierre A', 'test h32', 'MEG-J te XXIV HTA ChannelW', 'ChannelW test KEK test KEK test', 'kddi-jte VRVS VRVS wit MUST Tes', 'KDDI-Glo test Test Ari CLEO Mee', 'ternier ternier CLEO Ple', 'Collabor Geant4 P X# WP3.1 LCG Semi', 'KDDI-Glo kddi-jt MEG meet Phobos c', and 'Phobos c'.

The main window shows a meeting details page for a 'Phobos collaboration meeting'. The meeting is scheduled for 14:00 on 27 Jun 2003 to 00:58 on 28 Jun 2003. The title is 'Phobos collaboration meeting, day 2'. The meeting is protected by a password. It is reserved by Marguente Tonjes (belt@bnl.gov). There are icons for 'delete' and 'move' at the bottom. Navigation buttons for 'previous', 'need help?', and 'next' are also present.

At the bottom, there is a detailed view of the meeting schedule for July 2, 2003, showing a list of 'AIDA Workshop 2003' sessions from 09:00 to 11:30 and 'BNL ATLAS Physics A' sessions from 12:00 to 23:30.

VRVS Connection

- **VRVS user can see all of the on-going meetings and can decide to join the one he chooses - simple click on a dynamic web-based interface transparently connects the user to the nearest reflector**
- **Via a java panel, the user can:**
 - **Connect / Disconnect** selected videoconference client (H.323, SIP, Mbone VIC and RAT, QuickTime)
 - **Choose different video** modes (Voice Switched, Timer Switched, Selected Streams, All Streams)
 - **Use CHAT and send Private messages**
 - **Remotely control** selected video cameras
 - **Broadcast URLs**
 - **See participant connected in real time**
 - **Share computer desktop** with other participants

What is new in the version 3.3?

released at the end of August 2004

VRVS Version 3.3: Key Features

- Improved java applet **automatically downloads newer versions** of VRVS audio and video applications and is able to **automatically start and stop RAT and VIC clients**
- **New web navigation** allows users easily obtain overview of **all ongoing meetings** in all communities and then clicking on selected virtual room join the meeting
- Users can obtain **overview of all booked meetings** in all communities depending on selected date
- **Communities can contain different groups** of users which allows to organize users in a more clear and flexible way

VRVS Version 3.3: Key Features

- Version 3.3 brings **new enhanced** versions of VIC and RAT clients with support to the most popular OS (**Windows, Linux, Mac OS X**). **Unified source code**
- **New GUI is more user-friendly** and allows these applications to behave (visually) like one audio/video client
- **New VIC has better compatibility with hardware H.323 devices** and has a **video update feature**.
- **VIC is able to send still image** instead of live video, which can be useful in case when a user doesn't have camera
- **New display modes allow managing and arranging video windows on the screen - possible choices are:**
 - ✓ **normal windows size (tiled CIF windows)**
 - ✓ **small windows size (tiled QCIF windows)**
 - ✓ **speaker only (only CIF sized video of the current speaker)**
 - ✓ **all with speaker (speaker in CIF window and others in QCIF windows)**

VRVS on Pocket PC

Pocket PC web based interface

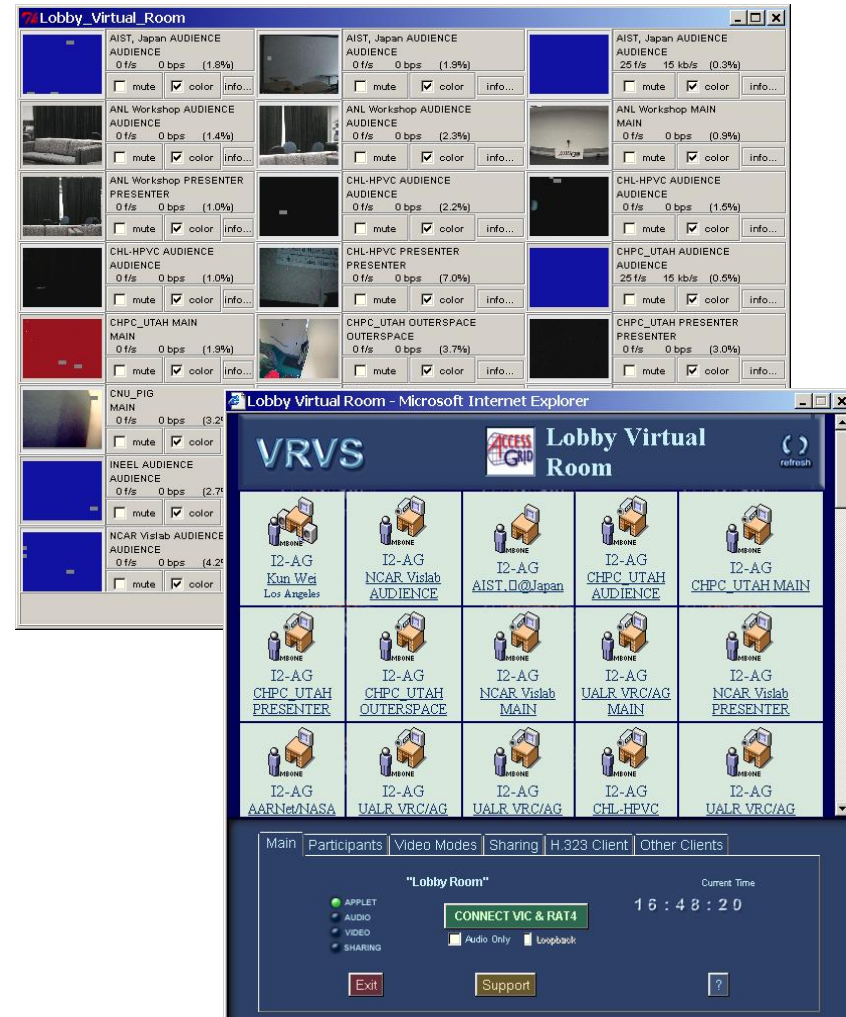


PocketVRVS videoconferencing client



Virtual Access Grid (VAG)

- ▶ VRVS provides VRVS AG Gateway; or Virtual Access Grid) which has **full connectivity** to the **Access Grid** and full functionality
- ▶ VRVS users connected to Access Grid Virtual Venues or any multicast videoconference, have the **maximum flexibility** to choose from Mbone RAT and VIC, H.323, SIP, QuickTime, JMF (Java Media Framework).



New features coming soon..

(Already working in our test lab)

- **Possibility to connect a VRVS Virtual Room to an ad-hoc H.323 meeting running on conventional H.323 hardware MCU.**
- **An highly enhanced mixing functionality will allow to provide better audio reception for end device that can decode only one audio stream (e.g. H.323 devices).**
- **A new transcoding functionality will provide better connectivity to AccessGrid meeting for H.323 devices.**
 - **The transcoding function will be capable on transcoding any audio codec supported by RAT at any packet size to a G.711 codec supported by the H.323 device.**
- **A new version of PocketVRVS for PocketPC will support Network Address Translation (NAT) environment.**

The screenshot displays a virtual meeting environment titled "Headquarters_Virtual_Room". It features several video windows showing participants: Dennis Lattka, Gregory Denis (VRVS Team), David Collados (VRVS Team), Pavel Farkas (VRVS SK), and Michal Pauliny (VRVS-SK). A "Trash" icon is visible in the top-left corner. On the right, a participant list shows names, IP addresses, and bandwidth usage. At the bottom, a control panel for "RAT v4.3.0" includes audio controls for Listen (61.3 kb/s) and Talk (0.0 kb/s), and a list of participants. The system tray at the very bottom shows various icons and the system clock: "Thu Feb 05, 09:49:50".

VRVS ON LINUX

VRVS ON WINDOWS

A grid of eight video feeds showing participants in a virtual meeting. The feeds are arranged in two rows of four. Each feed shows a different person, mostly men, wearing headsets and sitting at desks in office environments. The video feeds are overlaid on a window titled 'Vic: Headquar...'. To the right of the video feeds, there is a control panel with a 'Display' checkbox checked, and three rows of statistics for different participants, including IP addresses and bandwidth usage.

 <u>Juraj Sucik</u> Kosice, Slovakia ..CERN-INT..	 <u>Phil Gal</u> Pasadena ..CALTECH..	 <u>Dave Adamczyk</u> Pasadena, Calif ..CALTECH..	 <u>Dave Adamczyk</u> Pasadena, Calif ..CALTECH..	 <u>Juraj Sucik</u> Kosice, Slovakia ..UPJS..
 <u>Gregory Denis</u> Geneva ..CERN-INT..	 <u>Dennis Lattka</u> Pasadena ..CALTECH..	 <u>Michal Pauliny</u> Kosice ..UPJS..	 <u>Kun Wei</u> Pasadena ..CALTECH..	 <u>Joao</u> (VRVS@CERN) Geneva ..CERN-INT..

Main | Participants | Video Modes | Sharing | Client Setup

"Headquarters Room" Current Time

09:15:46

● APPLET
● AUDIO
● VIDEO
● SHARING

DISCONNECT H.323

Audio Only Loopback

Exit Support ?

POLYCOM

Transfer
Hang Up
Directory
Speed Dial

2.1 Mb/s
Quit
email us

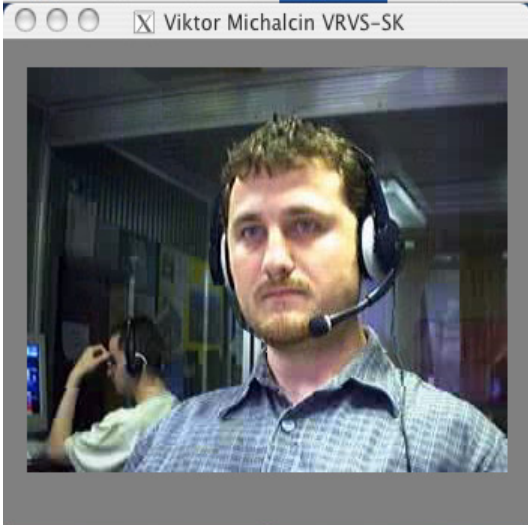
VRVS H323 Agent/434765616 00:05:07

Volume Mute PIP Full Screen Video Only

VideoMail Controls

Windows taskbar with Start button, application icons, system tray, and clock showing 9:11 AM.

VRVS on Mac OS X



Untitled

VRVS Headquarters Virtual Room 15 participants connected

 Gregory Denis Geneva -CERN-INT-	 Dave Adamczyk Pasadena, Calif -CALTECH-	 Juraj Sucik Kosice, Slovakia -UPIS-	 Dave Adamczyk Pasadena, Calif -CALTECH-	 Phil Gal Pasadena -CALTECH-
---	---	---	---	---------------------------------------

RAT: Headqu...

Listen []
Talk []

Minimize Settings Help Quit

Vic: Headquarters Virtual Ro...

Display Dock Display modes Transmit

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%)	
Dave (VRVS) 14 f/s 129 kb/s (0%)	
Demis 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

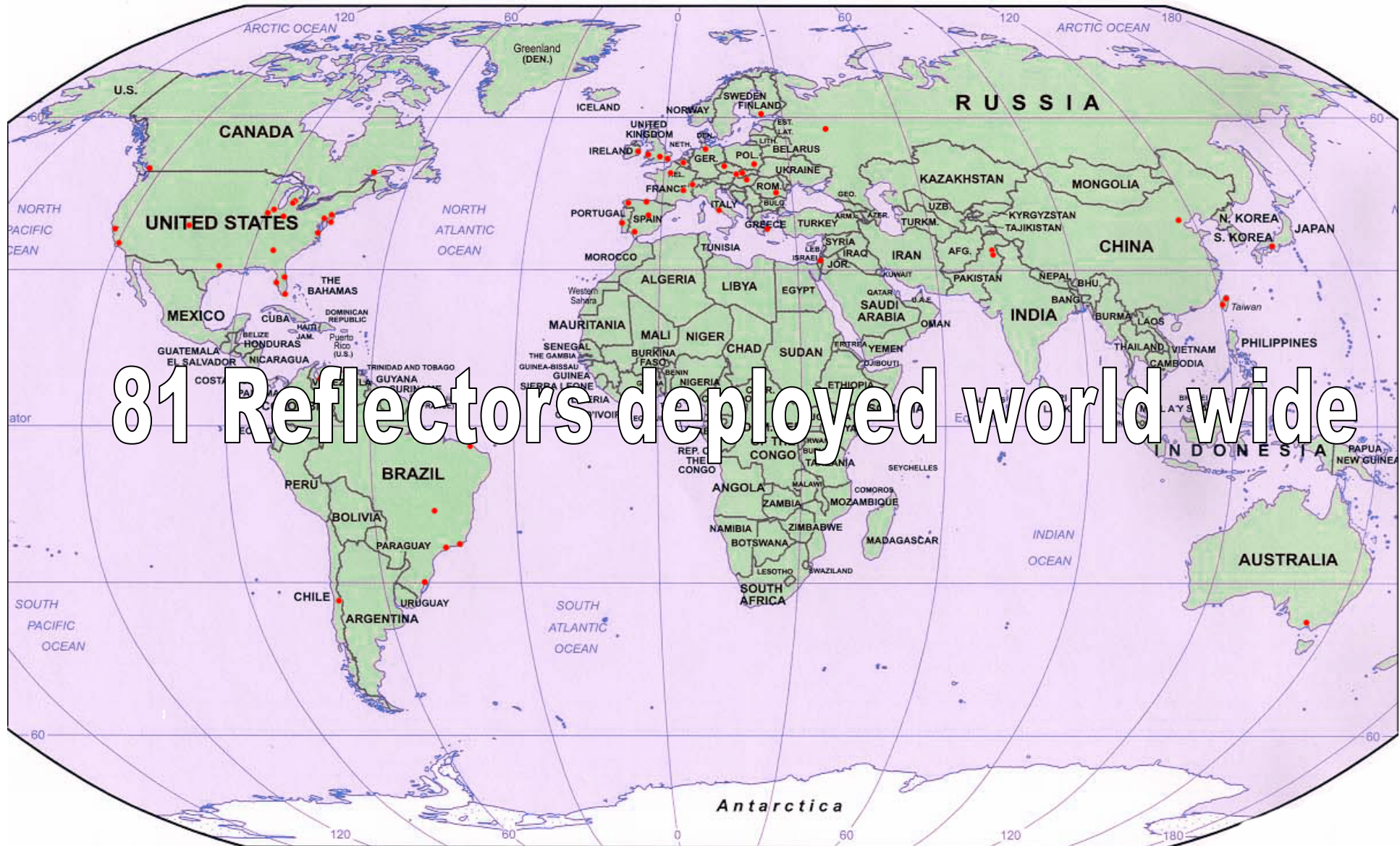
Audio Only Loopback

Exit Support ?

VRVS Worldwide Collaborative Production Service



VRVS Reflectors Deployment World Wide



81 Reflectors deployed world wide

VRVS Reflectors Deployed World Wide



81 Reflectors Deployed World Wide in 28 Different Countries

USA	24
Brazil	6
Spain	5
Switzerland	5
UK	4
France	4
Slovakia	3
Canada	2
Venezuela	2
Greece	2
Portugal	2
Israel	2
Japan	2
Pakistan	2

Italy	2
Romania	2
Chile	1
Poland	1
Taiwan	1
Hungary	1
China	1
Ireland	1
Russia	1
Czech Republic	1
Belgium	1
Romania	1
Australia	1
Finland	1

VRVS registered users and current usage

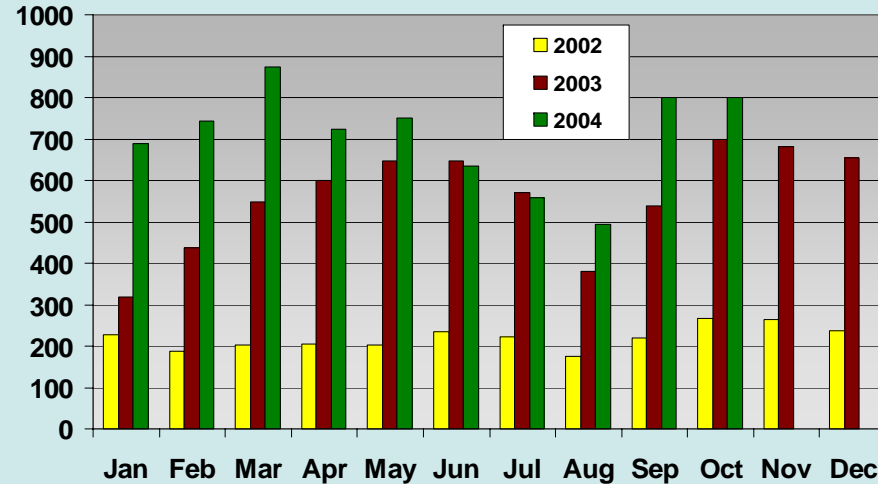


12000 different Users
Registered
from 106 Countries

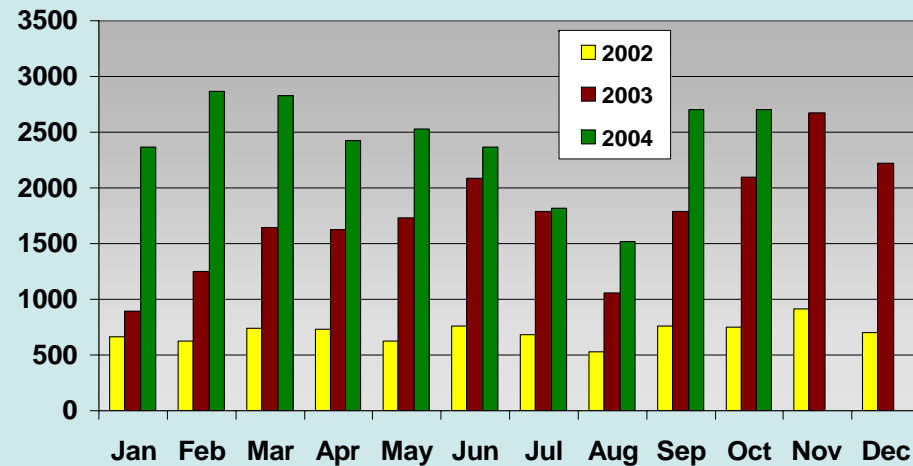
USA	2780
Spain	1474
Italy	830
France	800
Switzerland	704
Germany	607
Brazil	573
UK	535
Slovakia	391
Canada	251

Taiwan, Chile, Greece, Argentina,
 Japan, Russia, Canada, etc...

Scheduled Multipoint Videoconference Sessions



Scheduled Multipoint Videoconference Session Hours

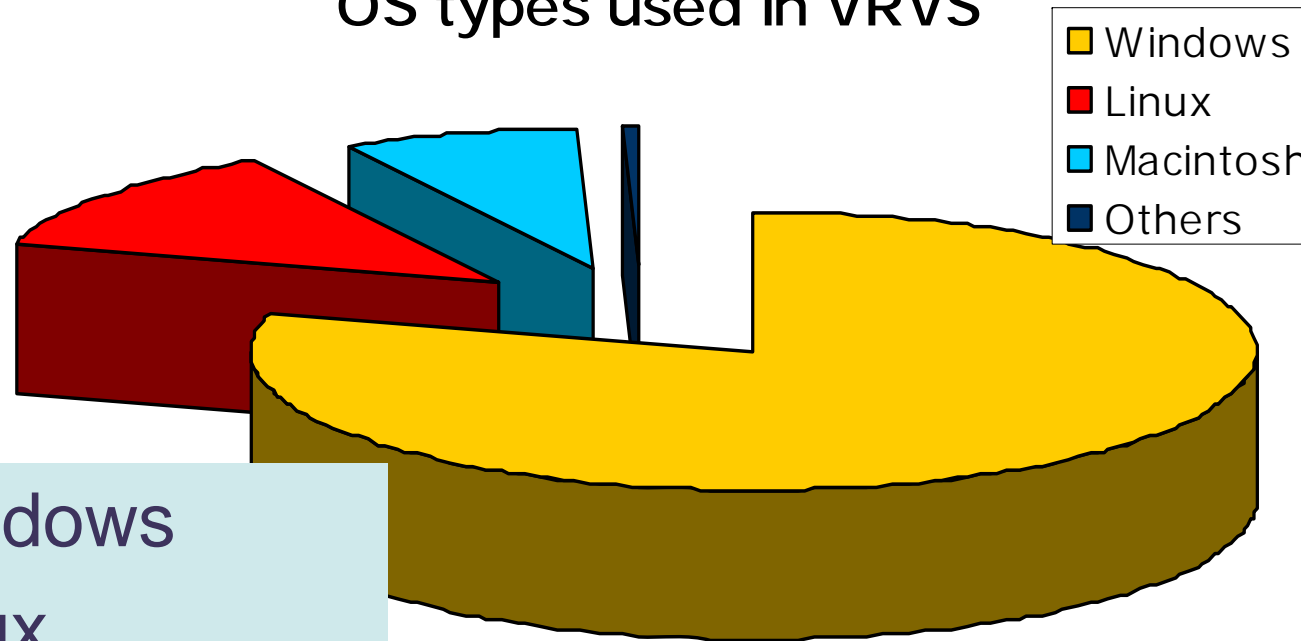


VRVS support for all Operating Systems



VRVS supports different Operating Systems according to the need and the demand of the users: It is **vital** for the **HENP community**

OS types used in VRVS



- 1st : Windows
- 2nd: Linux
- 3rd: Macintosh
- 4th: Other UNIX

VRVS News; October 14th, 2004

- ***Caltech's VRVS Project Extends Its Research Collaboration Worldwide***

The VRVS team will collaborate 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 Communities Set-up

- **VRVS National Research and Education Network (NREN) Communities:** **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). Others are in process.
- **VRVS Disciplines communities:** **HENP, ASTRO, FUSION, MEDICAL**
- **VRVS Particular Project Communities:** **VRVS TEAM, ACCESSGRID**

Next Generation System



VRVS Features Roadmap



3.0

4.0

- Use of JINI/RMI/Web Services/Grid Technologies
- Monalisa becomes part of the core system
- End-to-End control and monitoring
- End-to-End Encryption
- New Codec (H.263, H.264, ..)
- ...

- New
- New
- MyS
- Com
- Indef
- User
- New
- Auto
- Book
- Better
- Enhancem
- Initial Integration of Access Grid
- ...



v2.5

VRVS 2.x

VRVS 3.x

VRVS 4.x

Feb 03

May 03

Dec 03

Aug 04

Jan 05

Support for NAT and Firewall
several bugs fixed

Enhancement of Monitoring
the Reflector
Management vi

Enhanced
Windows
• Better H.3
• Enhanced
• Support for
• Use of Mon
Administra
• ...

Automatic and secure code update
Continuous monitoring of network
quality
Customize GUI (Seminar, Teaching,..)
New Java-based reflectors
Infrastructure
End-to-End Encryption communication
Enhanced Mbone tools with
codec (H.263, H.264, ..)
• ...

Web Services/Grid
MonaLisa for System
Management
VRVS Java client
...
Grid

VRVS Main Technical Trend Evolution



V3.(0,1):

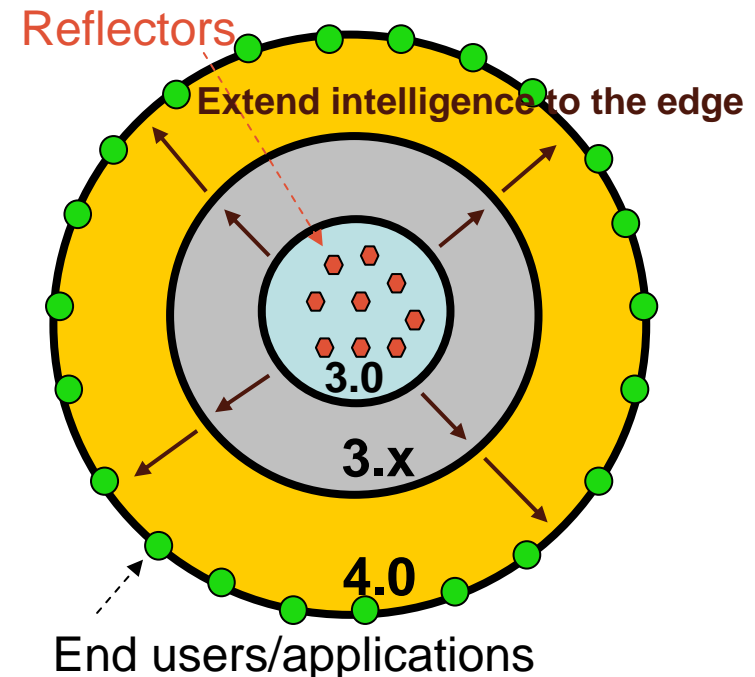
VRVS core infrastructure is **statically and manually** configured and operated

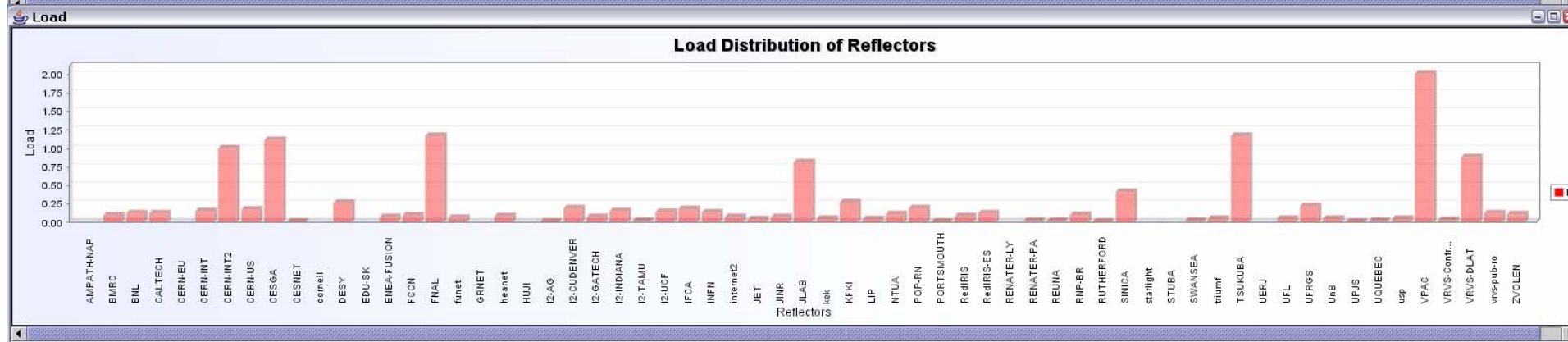
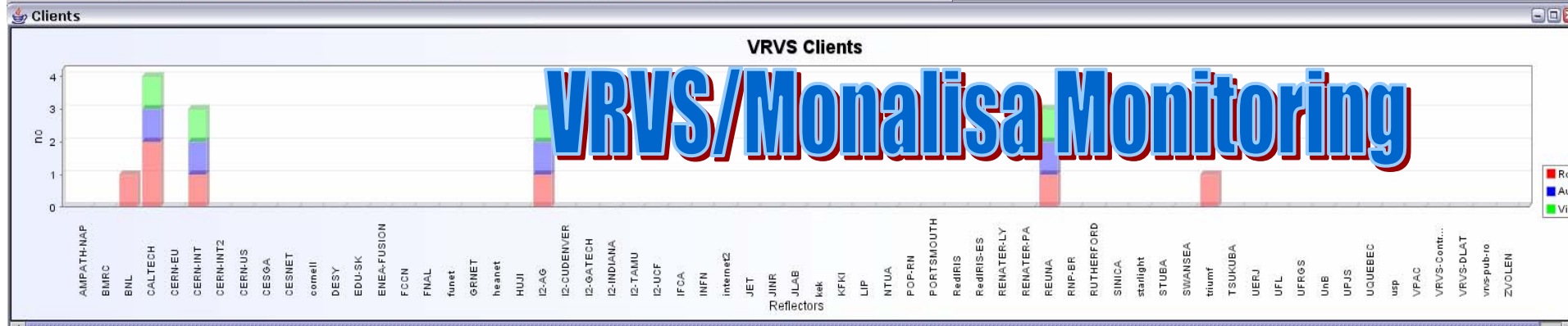
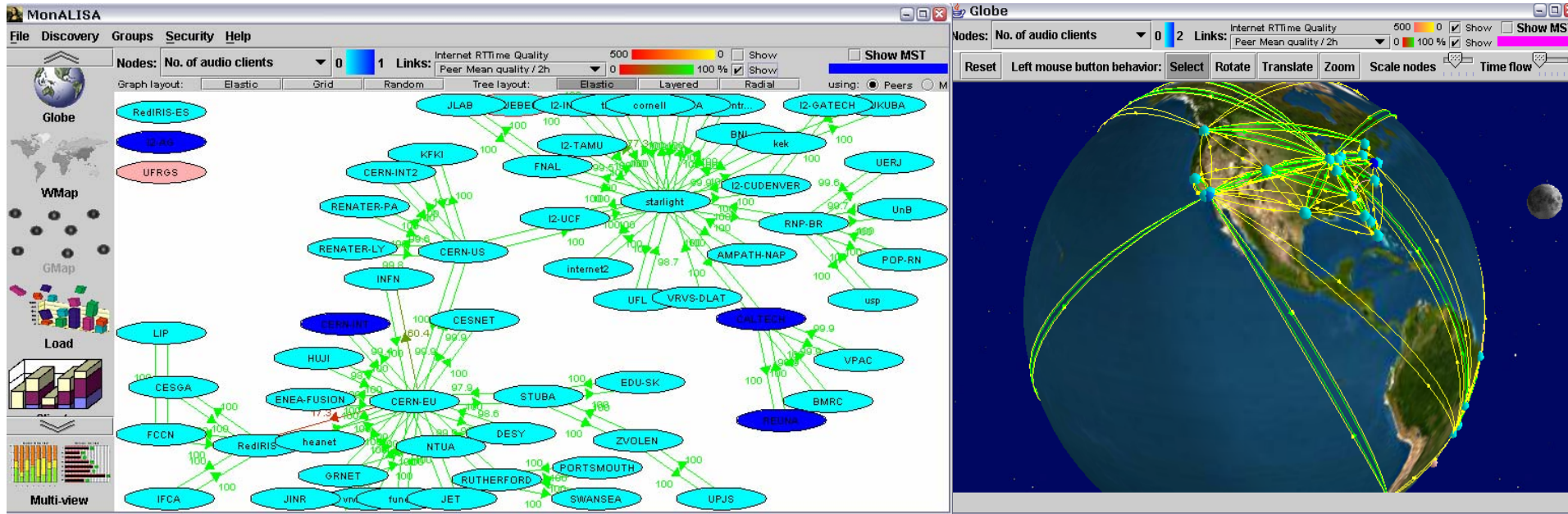
V3.(2,x):

VRVS core infrastructure is **automatically** configured and monitored. The core software is **self dependant** and can **itself make decisions to improve** performance/quality **without** manual intervention

V4.0 and beyond:

- This is a **Globally Distributed Self Managed End-to-End Real-time Infrastructure**. It provides the best quality and performance possible by extending the core intelligence to **the edge**.





End users/applications functionalities (v4.0)



- Support for **all protocols** (H.323, SIP, QT, Mbone). We adapt to **new hardware and software technologies**.
- Enhance Mbone Applications: **add Motion Vector and Motion Compensation Primitives**.
- Develop **new Codecs** (H.263, H.264, MPEG) using the **IPP** (Intel Performance Processor) Libraries.
- Work on **Macintosh** with the integration of the **iChat** videoconference software including the newly announced support for **MPEG4, HDTV** standards.
- Provide **Instant Messaging** functionality with **interoperability** with other Instant Messaging Standards and Systems.
- We will provide **Plug-ins** and **API** to be used by external applications or projects.

VRVS Reflector functionalities (v4.0)



- It will provide **communication channel** not only for audio/video but also for **shared applications, Instant Messaging**.
- **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 reflectors and between reflector and VRVS 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
- Provides access to **real-time and historical data**

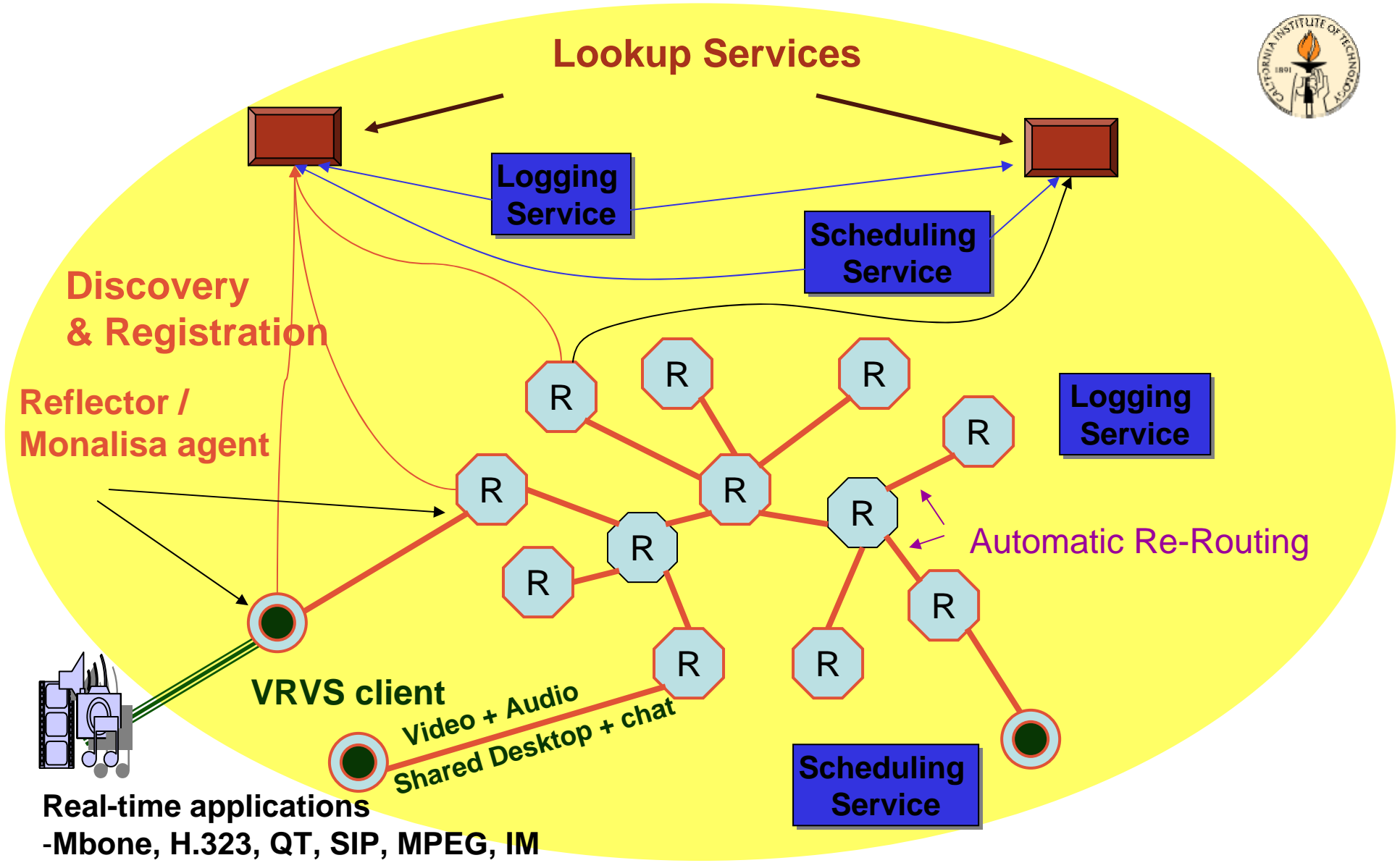
End users/applications functionalities (v4.0)



- New **Java-based VRVS client** that will perform **Dynamic Registration** to high level directory services – (Multi-OS support)
- **Automatic detection** of the **system parameters** (CPU, Memory,..) **hardware components** (Audio card, video card, ...), **services capabilities** (video, audio, ...), **network environment and capabilities** (wireless environment, DSL, available bandwidth, ...)
- **Dynamically** gets services (video, audio, data,..) that matches the current **resources/capabilities** to end users/applications
- **Continuous monitoring** of network quality (packet loss, jitter) latency) and Automatic **rerouting of packets**
- **Automatic Alarm notifications** when monitored parameters (system or network) go beyond a **preset threshold**.

Globally Distributed Self Managed End-to-End Real-time Infrastructure

Virtual Collaborative Grid Infrastructure



Real-time applications
-Mbone, H.323, QT, SIP, MPEG, IM

Real World for Collaboration



Summary



- VRVS heavily used within **HENP community** and in the Research and Academic community at large (e.g. Average of **800 meetings** per month involving more than **3000 Participants**).
- Continue to enhance support for **all Operating Systems** including **PDA** running in **all network environments**.
- Continue to provide/develop support for **advanced end user applications and codecs** (H.263, H.264, MPEG,...).
- Close Collaboration with **National Research Networks** for National and International **deployment and support**.
- Re-architect the system to become a **Globally Distributed Self Managed End-to-End Real-time and Secure Infrastructure** to support all type of collaborations via video, audio, shared applications, Instant Messaging serving the **Research and Academic community**.

Thank you

www.VRVS.org

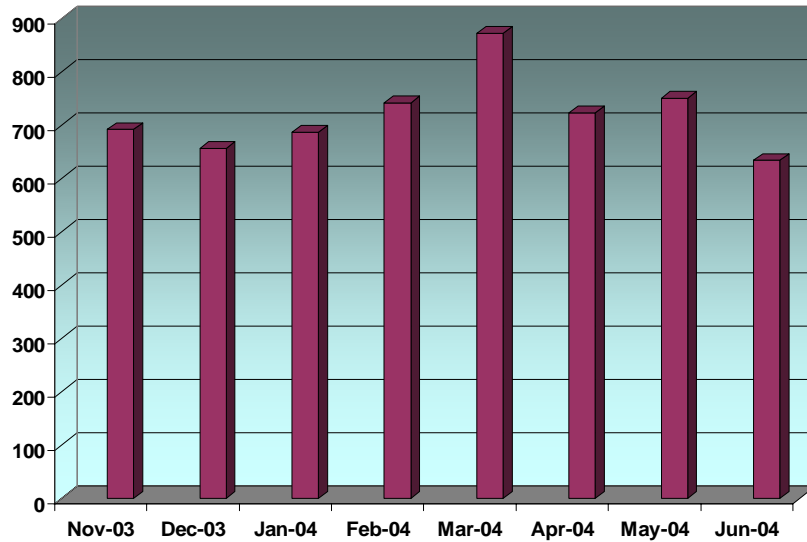
Contact@VRVS.org

Support@VRVS.org

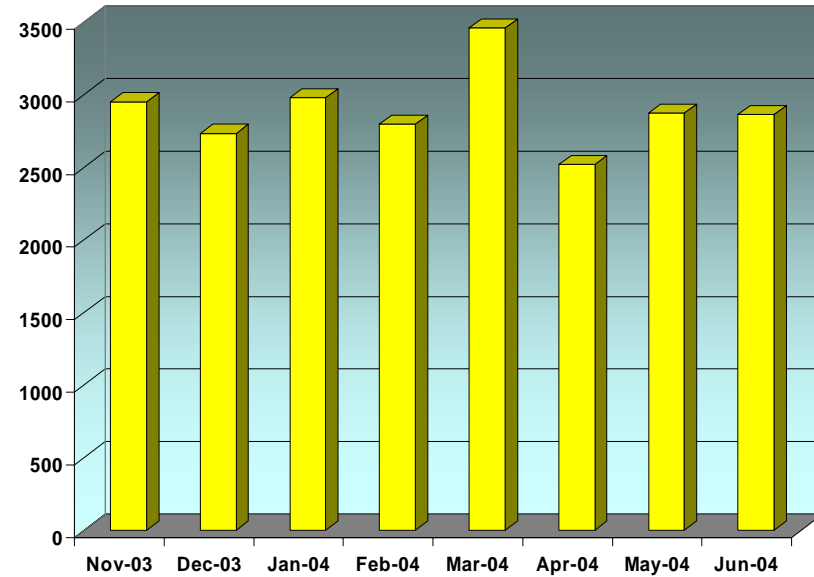
Additional Slides

Call Details Record (CDR) – Monthly Statistics

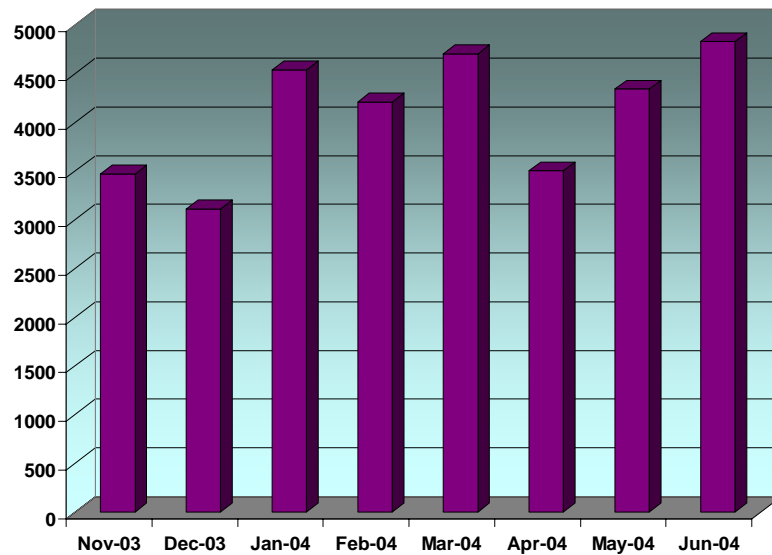
Number of Meetings



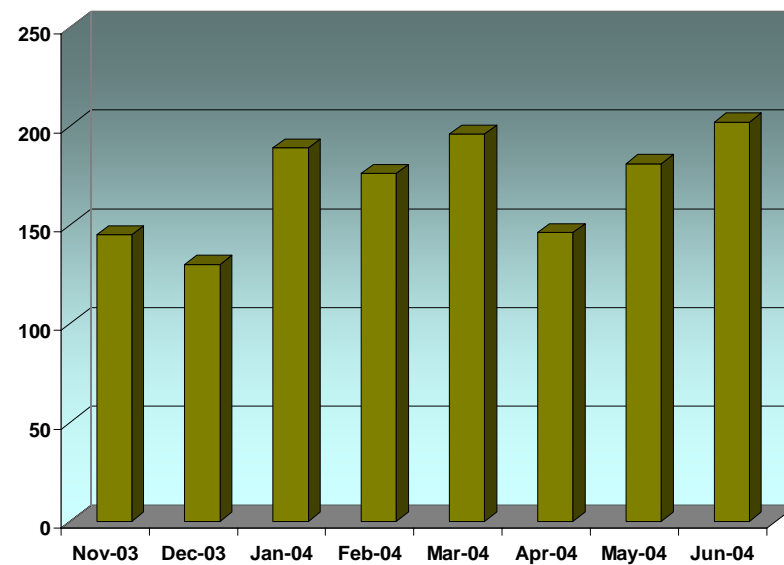
Number of Participants



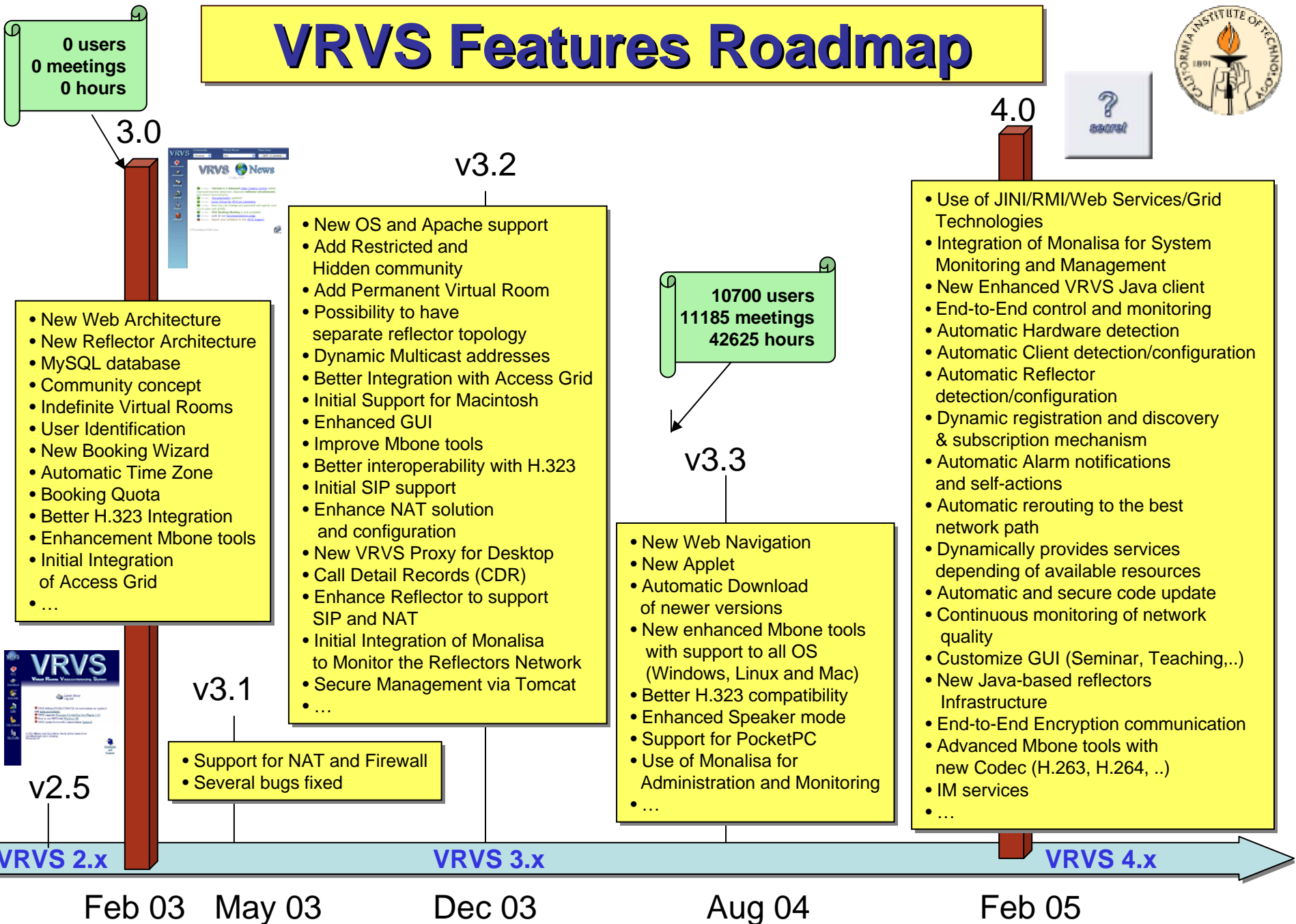
Total number of Hours



Total Number of Days



VRVS Features Roadmap



VRVS Main Technical Trend Evolution



V4.0 and beyond:

- This is a **Globally Distributed Self Managed End-to-End Real-time Infrastructure**. It provides the best quality/performance possible
- Extend the core intelligence to **the edge**.
- Have a full **End-to-End control and monitoring**
- The **self managed infrastructure** has a full knowledge of all the **critical/sensitive** parameters (*all network layers, hardware and software at the end nodes, resources allocated and available,..*) in order to take **adequate decisions** (*alarms, automatic rerouting of traffic, disconnection, remove/add services,..*)
- Administrator is **fully aware** of the operational status via constant feedback (via UI, email, phone,..) from the **self managed core software**

VRVS on Pocket PC

- PocketVRVS
 - ▶ Version 3.3. introduces a VRVS **audio/video client** (called Pocket VRVS) that runs on a **Pocket PC** platform
 - ▶ It supports **H.261** video standard and **G.711 (μ-Law)** audio standard
 - ▶ Doesn't allow sending of live video from Pocket PC camera; however users can **send** CIF sized **still image** stored in **JPEG format**
 - ▶ New **web based interface** for Pocket PC clients (designed for smaller screens) has been created and it includes all the controls available for all the clients (meeting scheduler, booking, etc.)
 - ▶ Possibility to **connect H.323** device