

H.323 for medical application and Virtual Laboratories

Petr Holub

<hopet@ics.muni.cz>

Laboratory of Advanced Networking Technologies

CESNET, Czech Republic

Masaryk University



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TERENA

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Talk Overview

Intro

H.323 Medical Usecase in Brno

H.323 at NLM

VirtCloud

VirtCloud – Cluster Tunneling Usecase

Conclusions



Why do we need E2E?

(revisited since 12/08 ... 12/09)

- Different design goals of production networks and networks for specific applications
 - 1) bandwidth
 - 2) access restrictions and privacy
 - 3) specific properties
 - 4) to get things done really end-to-end



Why do we need E2E?

(revisited since 12/08 ... 12/09)

1) Get bandwidth to somewhere

- cheaper L2 equipment \implies can get more ports
- sometimes easier to solve last hop problem
- sometimes easier to get funding for



Why do we need E2E?

(revisited since 12/08 ... 12/09)

2) Access restrictions and privacy

- Traffic isolation
 - ◆ avoiding mixing different traffic with different properties
- Infrastructure guarantees
- To what extent can this be implemented in production networks?
- To avoid various middle-boxes
 - ◆ firewalls, NATs, proxies (maybe even monitoring & IDS systems that slow down network)
 - ◆ hard to get exceptions on a device that serves whole institution
 - ◆ some “paranoid” institutions run weird configurations (e.g., multi-layered proxies in one Czech hospital)

Why do we need E2E?

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3) Specific properties

- Low-jitter network
 - ◆ well defined path
 - ◆ important, e.g., for HW devices with low buffering
- Some special properties
 - ◆ consistent IP multicast support
 - ◆ introduction of various devices on defined positions in the network
 - ◆ reflectors, optical multicasting switches, traffic monitors, etc.
- To give user both functionality and *responsibility*
 - ◆ discussed later for VirtCloud



Why do we need E2E?

(revisited since 12/08 ... 12/09)

4) To get things done really end-to-end

- Application to application, not PoP to PoP
- What if ...
 - ◆ something breaks down?
 - ◆ the network doesn't perform as user (= service requester) expects?
- We need precise finger-pointing tool(s) for the end-users (= service requesters)!
 - ◆ create tools that show what admins (= service providers) needs to be contacted by the end-user (and possibly who else needs to be notified)

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- Reasons for using automated E2E services?
 - sharing and efficient use of resources



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 - sharing and efficient use of resources
- Reasons for not using automated E2E services?
 - additional hassle for users, unless integrated into the applications
 - scheduled vs. *ad hoc* allocation
 - allocation conflicts among users

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 - sharing and efficient use of resources
- Reasons for not using automated E2E services?
 - additional hassle for users, unless integrated into the applications
 - scheduled vs. *ad hoc* allocation
 - allocation conflicts among users
- Reasons for not using them should be eliminated
 - technology development
 - overprovisioned enough on-demand infrastructure to minimize conflicts
- Danger of per-use cost scheme

Teaching Medicine



Source: <http://www.life.com/image/53327604>

Teaching Medicine



How to get best teaching for the students?

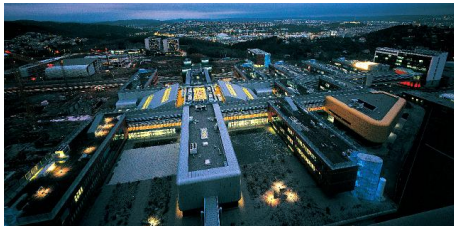
Source: <http://www.life.com/image/53327604>

Setup in Brno

- Masaryk Univesity
 - second largest university in the Czech Republic
 - one of only 3 universities with medical faculties
 - cca 3,500 students of medicine
 - need to collaborate with faculty hospitals on education
- Faculty Hospital at Bohunice
- St. Anna Faculty Hospital
- Masaryk's Institute of Oncology

University Campus of MU

- New campus finished in 2010
 - built during 2006–2010
 - home of Faculty of Medicine, Faculty of Sciences, Faculty of Sport Studies



- each lecture hall is equipped with H.323 equipment
- seminar rooms can be supported by software H.323 clients

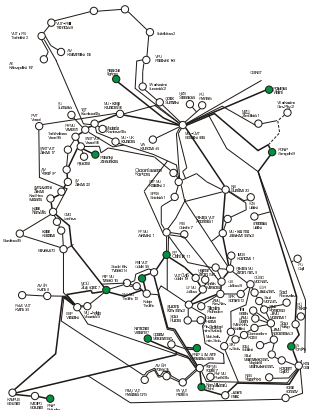
Teaching Medicine with H.323

How to get the H.323 to the hospitals?



Getting H.323 to Hospitals

- Masaryk Univesity
 - one of largest fiber owners in Brno
 - connections to all major hospitals in Brno



Getting H.323 to Hospitals

- Hospitals

- direct negotiations with network administrators
- previous experiences MU ↔ hospitals in MediMed project
- major push from teachers/physicians
- VLAN tunneling to hospital network
 - ◆ directly to individual H.323 nodes (endpoints)
 - ◆ strict traffic separation
- H.323 equipment purchased by a AKUTNE.CZ project shared by MU and hospitals
- frequent demonstrations at medical conferences and workshops

Getting H.323 to Hospitals

- Teaching & conferences
 - great feedback from students



... implemented with AKUTNE.CZ

CoUniverse – NLM Usecase

- We want to have videoconferencing with National Library of Medicine at National Institute of Health (NLM NIH), but...
 - there's not enough bandwidth to use UltraGrid (even DXT)
 - there's enough firewalls for H.323/SIP not to work
 - ... and we would like to have both
 - and for pathology, we'd even love to do SAGE-based tiled screen



CoUniverse – NLM Usecase

- Washington, DC – Bethesda, MD
 - collaboration with National Library of Medicine
- Washington, DC – Houston, TX
 - collaboration with Memorial Hermann Texas Medical Center
- What do we need to make this happen?
 1. network initialization
 2. monitor network and wait until it comes up
 3. startup of all applications and components
 4. monitor everything and react to events
 5. termination of all applications and components
 6. network tear-down
- ... we don't want this by hand, do we?

Network Topology for NLM Usecase

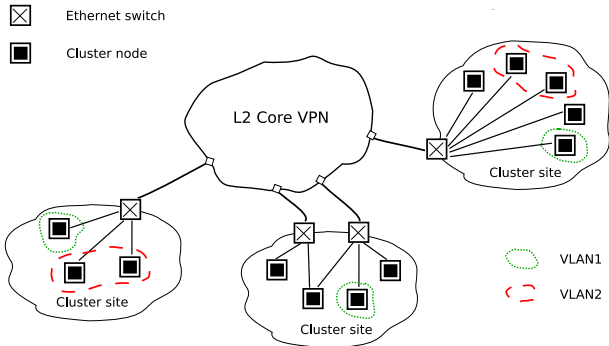
- CoUniverse can
 - orchestrate not only applications, but also on-demand network circuits
 - orchestrate several types of H.323 Polycom devices
 - <http://couniverse.sitola.cz>
- Texas has decent Internet2 DCN connection after several demo events
- Bringing DCN to NLM showed much easier
 - on-demand network is strictly separated from normal NLM traffic
 - avoids problems with breaching security of network carrying patients' data
 - has sufficient performance

VirtCloud

- Virtualization changes the way Grids can work
 - interactive jobs based on preemption
 - migration of virtual (typically computational) nodes
 - nodes may run insecure (user-provided) virtual machines
- We need networks that can support these usecases
 - reasonable setup time
 - private network by default
 - migration of IP addresses (which need to be retained by the applications in order to ensure uninterrupted operation)
 - high performance, low latency, low jitter needed (data transfers, MPI communication, etc.) \implies minimize the penalty

VirtCloud

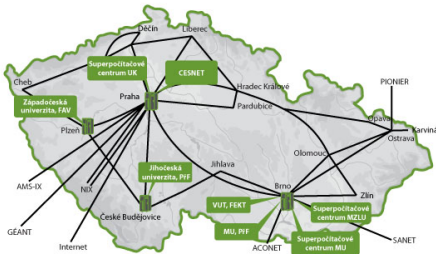
- Virtual network for virtual clusters
- Managed by the virtual cluster management system
- Architecture



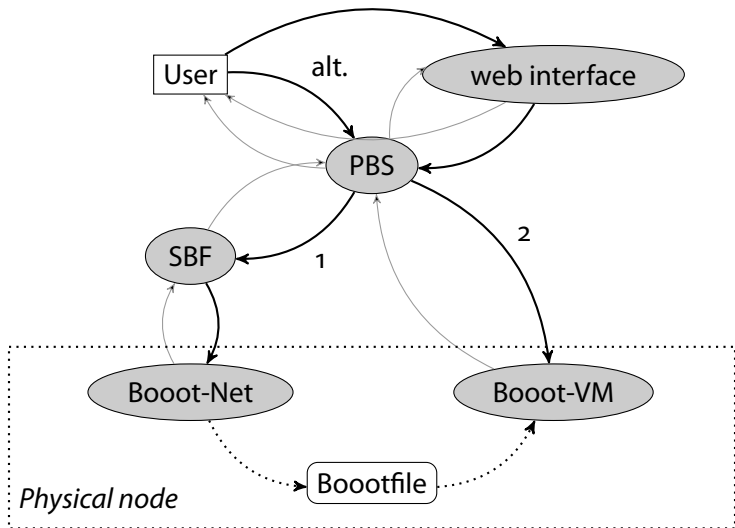
- flat private L2 network for each virtual cluster

SBF: Slartibartfast Prototype

- Simple implementation, that virtual cluster management system Magrathea can interact with
- Uses Ethernet over CESNET2 network
- Core network: VPLS or Xponders
 - VPLS uses production MPLS backbone (shares traffic)
 - Xponders run over a separate λ over production DWDM system
- Site networks: Brno, Prague, Pilsen
 - L2 equipment from multiple vendors: HP, Force10, Cisco



SBF: Slartibartfast Prototype—Interactions



VirtCloud – Cluster Tunneling Usecase

- Giving user access to the cluster
 - to have impression it's *my* cluster
 - there is often many various middle-boxes between the cluster and the user
- Defaults to simple SSH to cluster headnode
- Gives an OpenVPN option
 - service node running service image that provides OpenVPN server with public address
 - bridged mode gives user impression that his station is part of the cluster
 - OpenVPN works surprisingly well
 - OpenVPN is easy to get not even across firewalls & NATs, but also most HTTP proxies
 - VLAN tunneling for high-performance applications
 - ◆ SBF can control ports toward customers (add VLANs)
 - ◆ GRE tunneling: widely supported, HW acceleration



VirtCloud – Cluster Tunneling Usecase

- Accessing user's resources from within the cluster
 - access to data from user's site
 - access from within the cluster to Internet is limited for security reasons
- OpenVPN-based approach
 - using OpenVPN allows incorporation of most resources from user's site
 - bridging on the OpenVPN client allows to interconnect whole networks
 - multiple connections to OpenVPN server: certificate-based authentication
 - ◆ getting multiple machines without whole network: e.g., NFS server,
- When user's site is available through on-demand service, it can be reached directly



VirtCloud – Cluster Tunneling Usecase

- Publishing cluster within user's own responsibility realm
 - virtual cluster can run arbitrary user-provided images
 - no access is provided to public internet
 - ◆ limited on Layer 2
 - user can use OpenVPN tunnel to publish the cluster under own address space
 - ◆ NAT—cluster behind single user's address
 - ◆ optional customized DHCP server for the cluster to provide addresses from user's address range
 - ◆ user has sole responsibility
 - ◆ segregated on Layer 2 from other clusters
- Only certified images are allowed to access internet directly



VirtCloud – Cluster Tunneling Usecase

- setup for Kit Digital transcoding
 - video transcoding with data source at the customer site
 - virtual nodes running MS Windows
 - tunneled through NIX.cz on 10 Gbps links
 - IP addresses from KitD range, assigned by DHCP server on service node
 - tested even publishing of the cluster through AS of KitD

Conclusions

- New scenarios possible in
 - collaborative environments,
 - high-performance computing,
 - data sharing.
- Many challenges still...
 - finger-pointing tools for troubleshooting,
 - various types of automated setups,
 - having on-demand tools stabilized,
 - self-* behavior.

References

- (1) LIŠKA, Miloš – HOLUB, Petr. CoUniverse: Framework for Building Self-organizing Collaborative Environments Using Extreme-Bandwidth Media Applications. In Lecture Notes in Computer Science vol. 5415 Euro-Par 2008 Workshops - Parallel Processing. Las Palmas de Gran Canaria, Spain : Springer Berlin / Heidelberg, 2008. ISBN 978-3-642-00954-9, pp. 339-351. 2008, Las Palmas de Gran Canaria, Spain.
- (2) LIŠKA, Miloš – HOLUB, Petr – LAKE, Andrew – VOLLBRECHT, John. CoUniverse Orchestrated Collaborative Environments with Dynamic Circuit Networks. 2010 Ninth International Conference on Networks, 2010. ISBN 978-0-7695-3979-9, s. 300-305. France.
- (3) ANTOŠ, David – MATYSKA, Luděk – HOLUB, Petr – SITERA, Jiří. VirtCloud: Virtualising Network for Grid Environments–First Experiences. In The 23rd IEEE International Conference on Advanced Information Networking and Applications AINA 2009. Bradford, UK : IEEE Comp. Soc., 2009. ISBN 978-0-7695-3638-5, pp. 876-883. 26.5.2009, Bradford, UK.

Thank you for your attention!

Q?/A!

<hopet@ics.muni.cz>

