



« *networking the networkers* »

GLIF Tech Winter meeting

*Hong-Kong, China  
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**TERENA**

**End-to-End (E2E) Provisioning Workshop  
series**

TRANS-EUROPEAN RESEARCH AND EDUCATION NETWORKING ASSOCIATION



## About TERENA

- 
- › TERENA offers a forum to collaborate, innovate and share knowledge in order to foster the development of Internet technology, infrastructure and services to be used by the research and education community.
  - › TERENA is first and foremost a collaborative organisation.
    - › Its core business is to bring together managers, technical specialists and other people in the research networking community with their counterparts from other countries in Europe, mobilising the expertise and experience of hundreds of professionals in the research and education networking area.



# TERENA Community

- › National members

- › 39 NRENs

- › International members

- › CERN, ESA

- › Associate members

- › DANTE, NORDUnet, vendors...

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- › Peers

- › Internet2, APAN, CLARA, Ubuntunet...

- › Affiliated communities

- › EGI, EUNIS, GLIF, Europeana...

- › research and education communities...





# Technical Programme Special Interest Areas

- › Network Services and Technologies
- › Security
- › Middleware
- › Media Services
- › Virtualisation and Cloud Services
- › Campus and End-to-End issue coordination
- › Grid collaborations



# Activities

- › TERENA Compendium
  - › Printed
  - › On-line: <http://www.terena.org/activities/compendium/>
- › TERENA Networking Conference
  - › Seminars
  - › Technical workshops
  - › Trainings
- › Task Forces
  - › Meetings
  - › Small projects
  - › EC funded projects
- › Services
  - › TACAR, REFEDs, SCHAC, TI, TCS, eduroam...





## Activities

TERENA gives the secretariat for GLIF



Global Lambda Integrated Facility





# Motivations, history

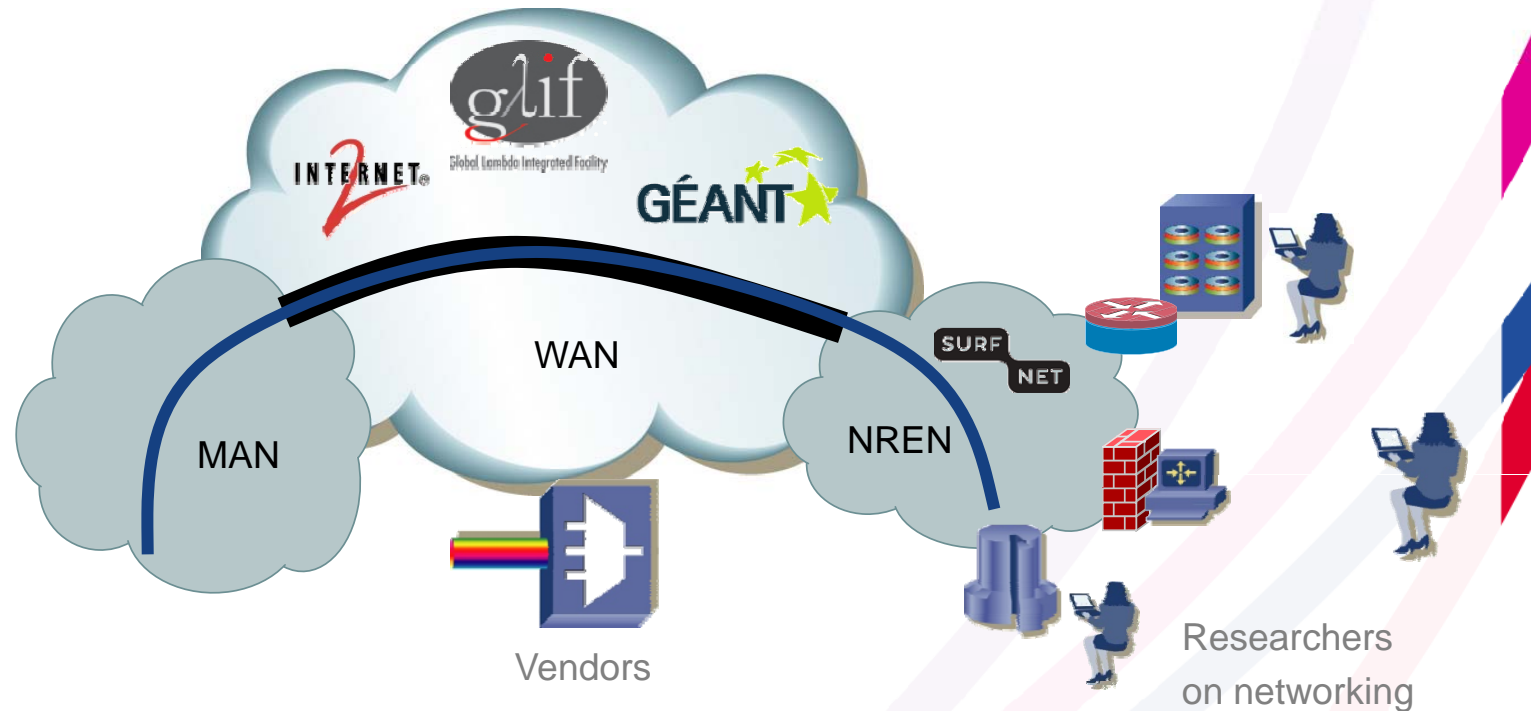
## 1st E2E Workshop in 2008

### 1st "Establishing Lightpaths"

- › E-science applications can generate network flows measured in Gb/s, enduring hours, days or even weeks, often between a well-defined set of nodes, and with tight constraints on quality of service
- › The needs of such applications are best met by traffic engineered point-to-point circuits, rather than best effort routed networks like the public Internet.
- › End-to-end lightpaths (i.e., Gigabit Ethernet circuits or even lambdas) are becoming very important in the service portfolios of NRENs



# End-to-end networking context



Researchers on networking

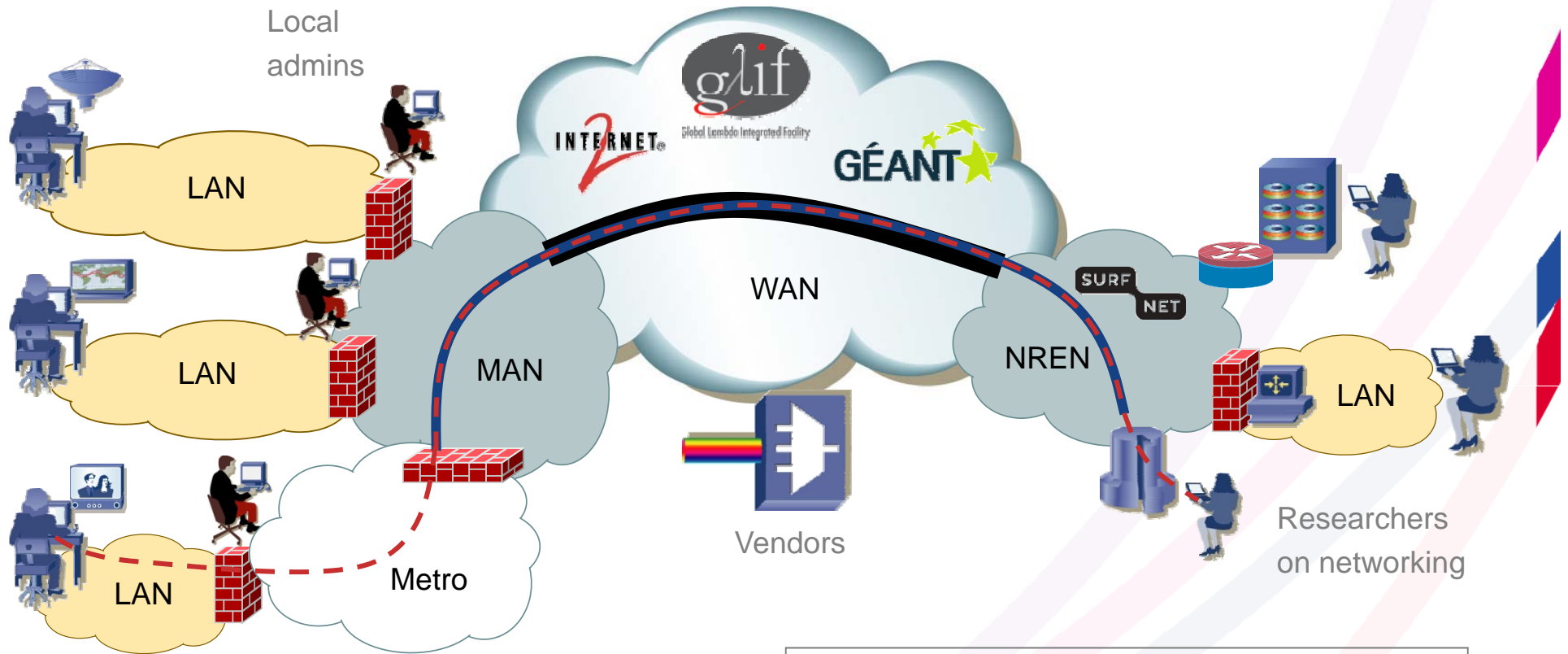
Researchers on non-networking related topics

- Optical networking technologies
- Multi-domain provisioning tools
- Bandwidth on Demand services





# End-to-end networking context



Local  
admins

LAN

LAN

LAN

MAN

WAN

NREN

LAN

Metro

Vendors

Researchers  
on networking

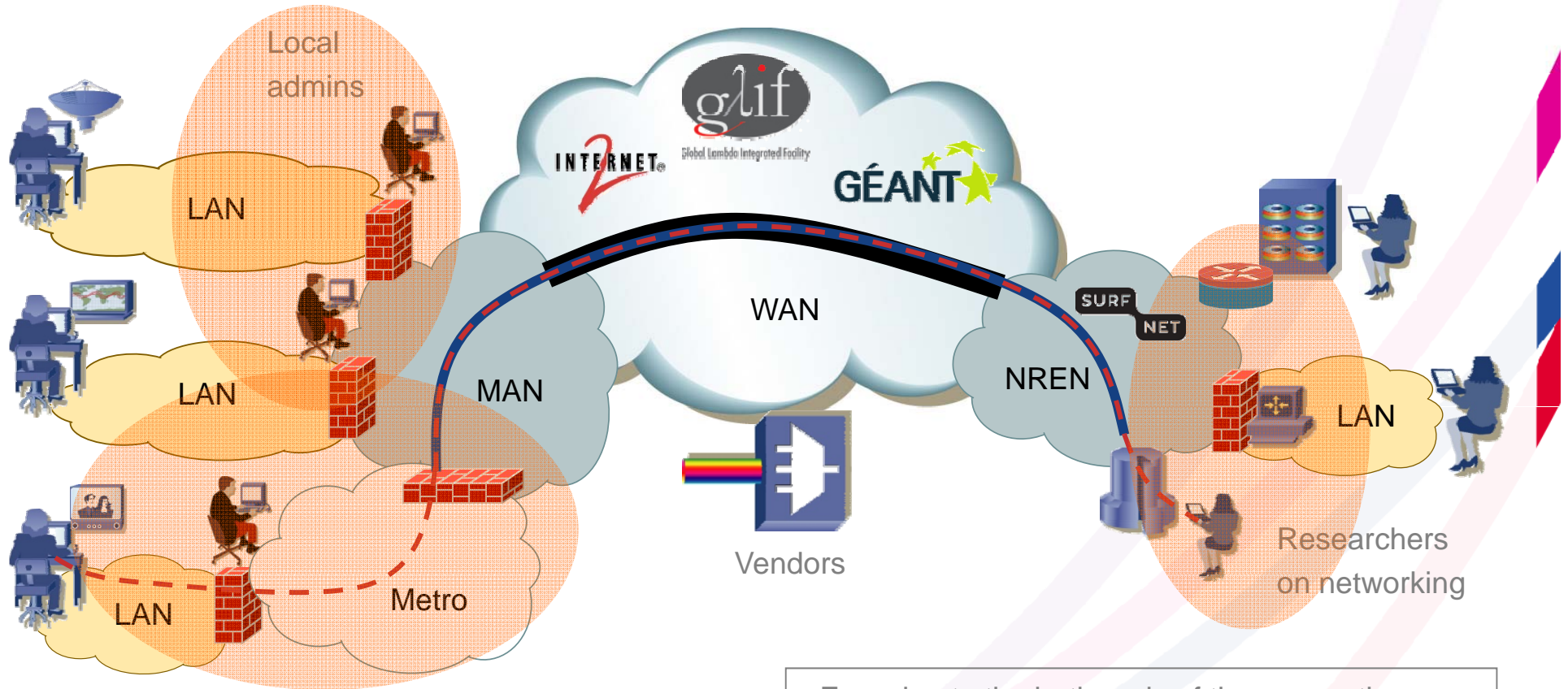
Researchers  
on non-networking  
related topics

Third-party

- End user (application) to End user (application)
- Easy for user to deploy
- Easy for operator to support
- Flexible to existing networks/mechanisms



# End-to-end networking context



- Focusing to the both ends of the connections
- Challenges on networking level / application level



# Outcome of the discussions

## interest areas

### End-to-End Provisioning Workshop series

1. Unified/Standardised network architectures for end-to-end provisioning
2. Simplicity of the provisioning processes and software tools
  - › Faster provisioning has still highest priority over dynamic provisioning nowadays
  - › Fast and automated restoration of the broken connections
3. Availability of resources, especially in the last mile
  - › Fibre availability, Spectrum efficiency
  - › Access technology (PONs, Ethernet-based platforms), Cost efficiency
4. Reliability of point-to-point circuits
5. Implication of end-to-end connections on security (firewalling) aspects, routing integrity and IP addressing issues
6. Operational issues: cooperation between network engineers and application engineers
  - › AuthZ and AuthN, Scheduling, Fairness
7. Business models and cost analyses for end-to-end lightpaths
  - › Commercialization
- +1. Facilitating tutorials on the provisioning systems' implementation and usage by the campuses



# Motivations, history

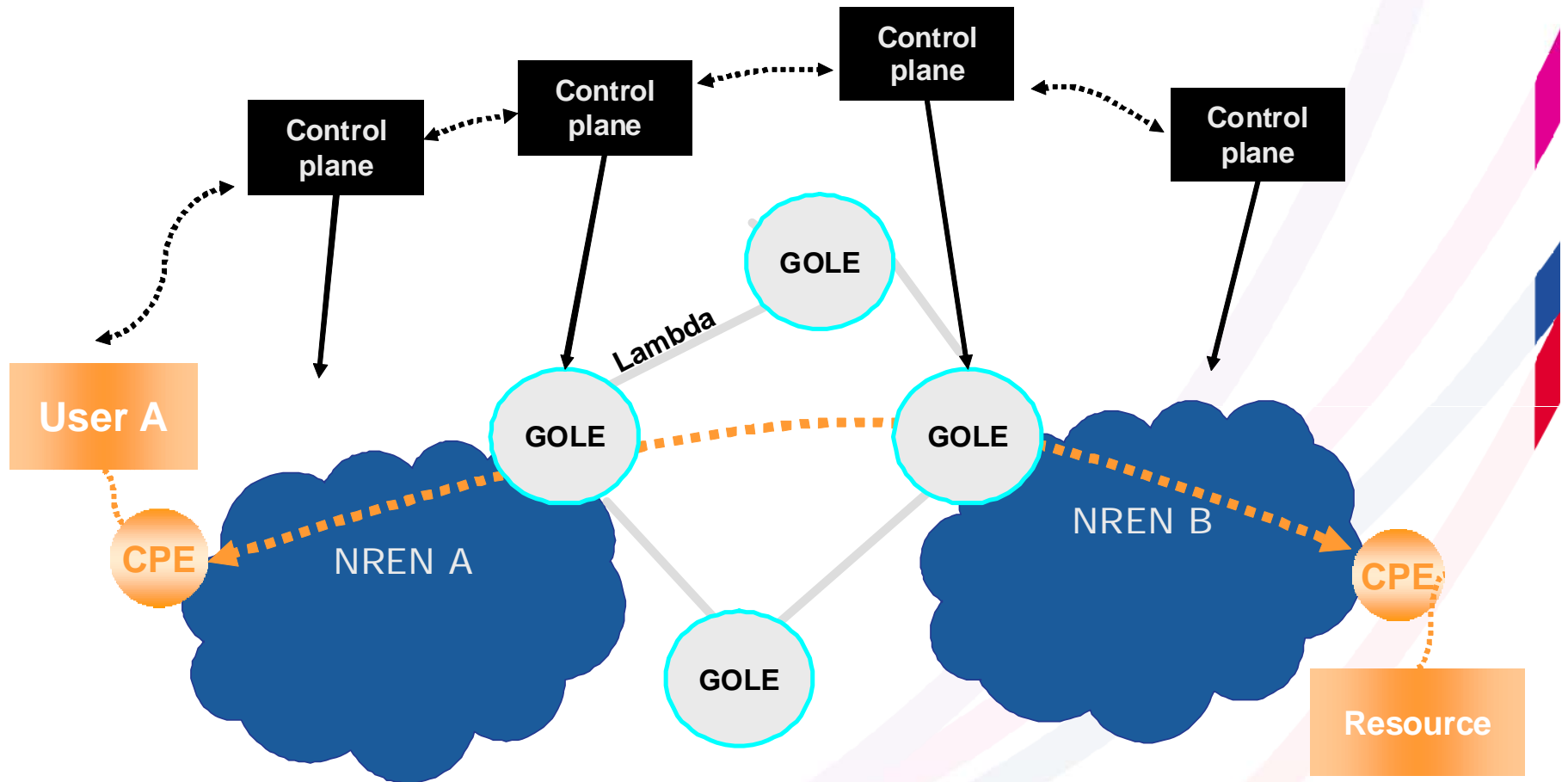
## 2nd E2E Workshop in 2009

### 2nd "Provisioning E2E Services"

- › Technical session on provisioning issues:
  - › End-site challenges
  - › Ethernet-based architectures
  - › IP network provisioning
  - ➔ **"On-demand Infrastructure Services Provisioning Workshop" on Day 2**
  
- › Operational issues:
  - › Service oriented approach
  - › GÉANT and Pan-European level
  - › NRENs level (...the missing bits)
  
- › Regional, research and campus networking:
  - › Campus issues (network admins' perspective)
  - › Researchers' perspective
  - › Regional network operators' perspective



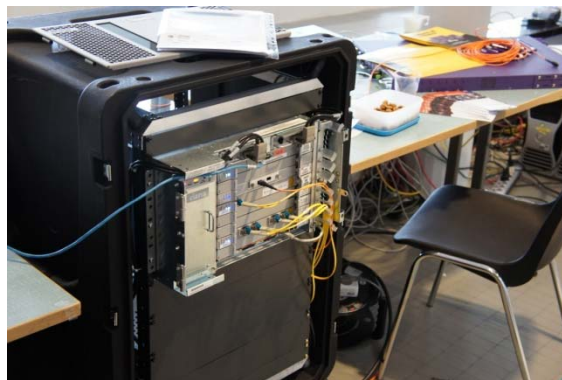
# GLIF – Campus Networking Issues Task Force





# Last mile issue

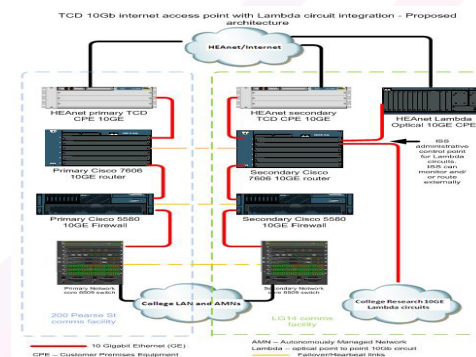
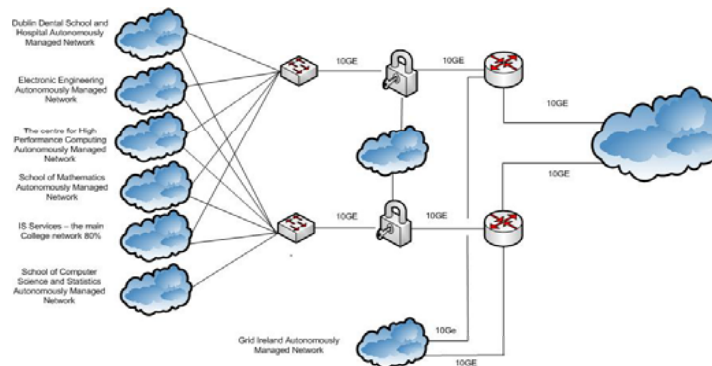
1) 40G demo at GLIF2010



Medical demo at APAN2011



2) HEAnet–TCD: 10GE plus Lambda service support project





## Recently...

### 3rd E2E Workshop in 2010

#### 3rd "Applications and Services"

- There is an issue with the lack of applications requiring e2e connections: We need to identify the key applications and promote e2e services for end-users.
- We should include the application developers/designers: We need to deal with real application-to-application services and not just edge-to-edge connection services.
- We need to understand the campus policies.
- We need attractive business models and we need to understand and explain the cost implications of e2e services for users.
- Discussions about tools and architectures as well as the roles and responsibilities undertaken by various players of the whole end-to-end (i.e. application-to-application) workflow.



# APAN – Tuesday afternoon demo by CESNET

A world map showing network routes for a robot-assisted operation. A white line with red dots connects several locations: Europe (labeled MNUL CZ Robot da Vinci), Asia (labeled HKG), and North America. Text on the map reads "Robot assisted operation from Czech Republic 3D fullHD video transmission". A small inset photo shows a man in a white lab coat. Another inset shows a large screen displaying a 3D model of a robot. A yellow box at the bottom right of the map contains the text "HKCEC S421 Tue Feb 22nd 2011 4pm". At the bottom of the map, there is a dark blue banner with several logos: KREONet2, ST\*RLIGHT, SURF NET, CESNET, canarie, and NL Light. The logo for The Chinese University of Hong Kong is also present on the left side of the banner.

Robot assisted operation  
from Czech Republic  
3D fullHD video transmission

MNUL CZ  
Robot da Vinci

HKG

HKCEC S421  
Tue Feb 22nd 2011 4pm

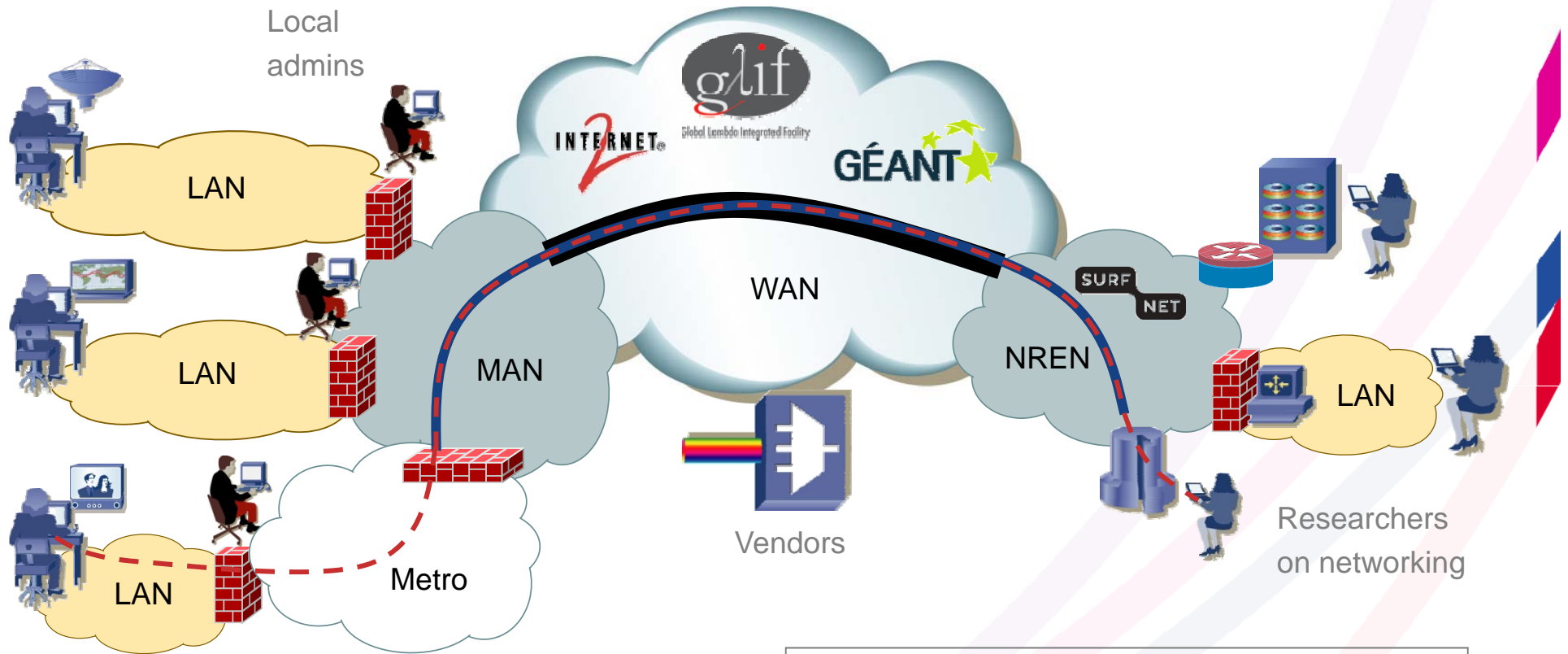
KREONet2 ST\*RLIGHT SURF NET CESNET  
canarie NL Light

香港中文大學  
The Chinese University of Hong Kong





# End-to-end networking context



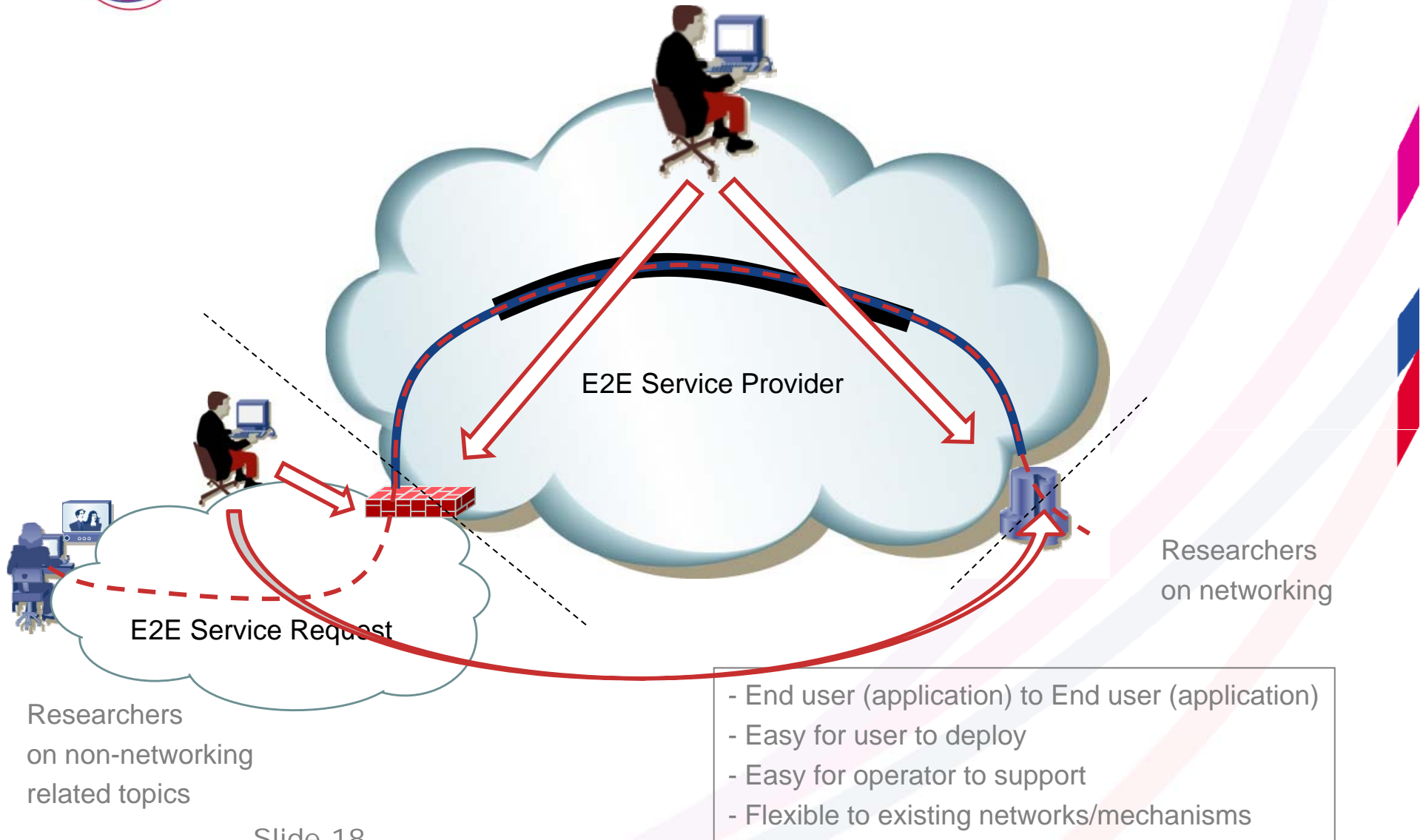
Researchers on non-networking related topics

Slide 17

- End user (application) to End user (application)
- Easy for user to deploy
- Easy for operator to support
- Flexible to existing networks/mechanisms



# End-to-end service verification





# Community around the workshop series

- › Amsterdam, 2008:
  - › 29 members of the mailing list
    - › Balanced Uni, NREN, Research
  - › **62** registrants of the workshop (no remote)
    - › Hard to mobilise Uni's people
- › Amsterdam, 2009:
  - › 119 members of the mailing list
    - › More Unis on the list (44%)
  - › **72** registrants of the workshop (of which 20 remote)
    - › 40% overlap with the 1st workshop
- › Prague, 2010:
  - › 164 members of the mailing list
  - › **32** registrants of the workshop (of which 9 remote)
    - › More local people!!!



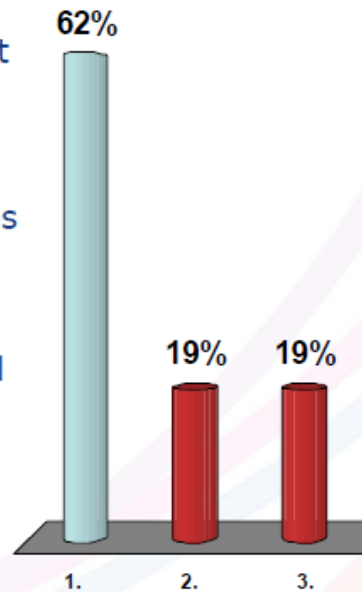
# Outcome of the discussions (2009) audience responses

## Anonymous feedback



**The workshop series mainly targets the end-site network operators/managers.  
Do you think this is the right target group?**

1. Yes, NRENs need to understand the end-site challenges from them and can teach them what and how to do to set-up e2e lambda connections
2. No, NRENs know the challenges but should discuss the strategy towards providing e2e connection services to our users. Therefore NRNEs should be the main focus
3. I have no idea

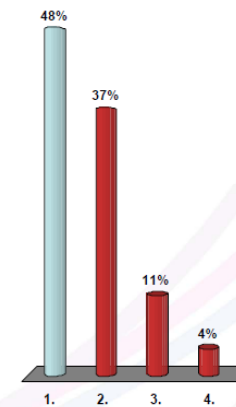


Slide 20



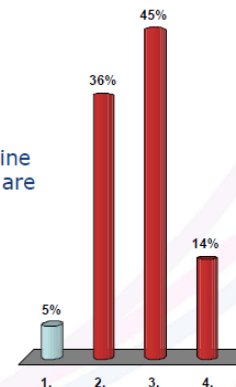
**If yes, what would be the suitable format of the future coordination?**

1. More workshops, like this
2. New TERENA task force
3. Practical hands-on trainings
4. other



**Would you like to have a common space and/or on-line materials available?**

1. Wiki space to collect the ideas would be fine
2. Wiki space and some on-line materials would be fine
3. Wiki, website and edited on-line teaching/hands-on materials are necessary
4. No





# Outcome of the discussions (2010) advisory committee

## The group members are:

- Petr Holub (CESNET/Masaryk)
- Victor Reijs (HEAnet)
- Yuri Demchenko (UvA)
- Ronald van der Pol (SARA)
- Maria Isabel Gandia Carreido (CESCA)
- Emma Apted (GN3/DANTE)
- Stefan Liström (GN3-SA2-T2/NORDUnet)
- Klaas Wierenga (Cisco)
- Peter Szegedi (TERENA)

## Public Wiki:

<https://confluence.terena.org/display/e2e/>

## Draft a White Paper:

on common understanding and basic definitions for E2E services



# Outcome of the discussions (2011)

## GLIF Campus TF survey

### Technical issues:

*"Providing a fiber or 10GE link with enough level of unused bandwidth from the circuit touch-down point to an user's site."*

*"To provide lightpaths to real end users (i.e. desktop)"*

*"Incompatibility between campus and NREN equipment"*

*"Campus network are not build for such things (sometimes only Ethernet)"*

*"BoD software must supports wide scope of network equipment used in campus network"*

*"Security management, Monitoring, Control, technical accounting management"*



# Outcome of the discussions (2011)

## GLIF Campus TF survey

### Non-technical issues:

*" Involvement of several layers within organisation (researcher, network staff, ...) - Putting it all together"*

*"Getting researchers and campus IT people of all participating parties involved in the project."*

*"Need more understanding about lightpath itself to campus network user or operator"*

*"More secure communication framework over lightpath"*

*"Campus are not really incorporated in end2end service design (more an after thought)"*

*"Who can use lightpaths and who will pay for it"*



## Next steps...

### "E2E Service Architecture Verification" discussion

1. GLIF: Jerry is coming...
  2. BoF at TNC2011
  3. Bof at NORDUnet 2011
  4. Others...
- › Linking together communities, ideas ...
    - › TERENA is willing to support this highly multi-domain community!
  - › How to facilitate/support what...?





**THANK YOU!**

