A Report on CERNET2 Construction

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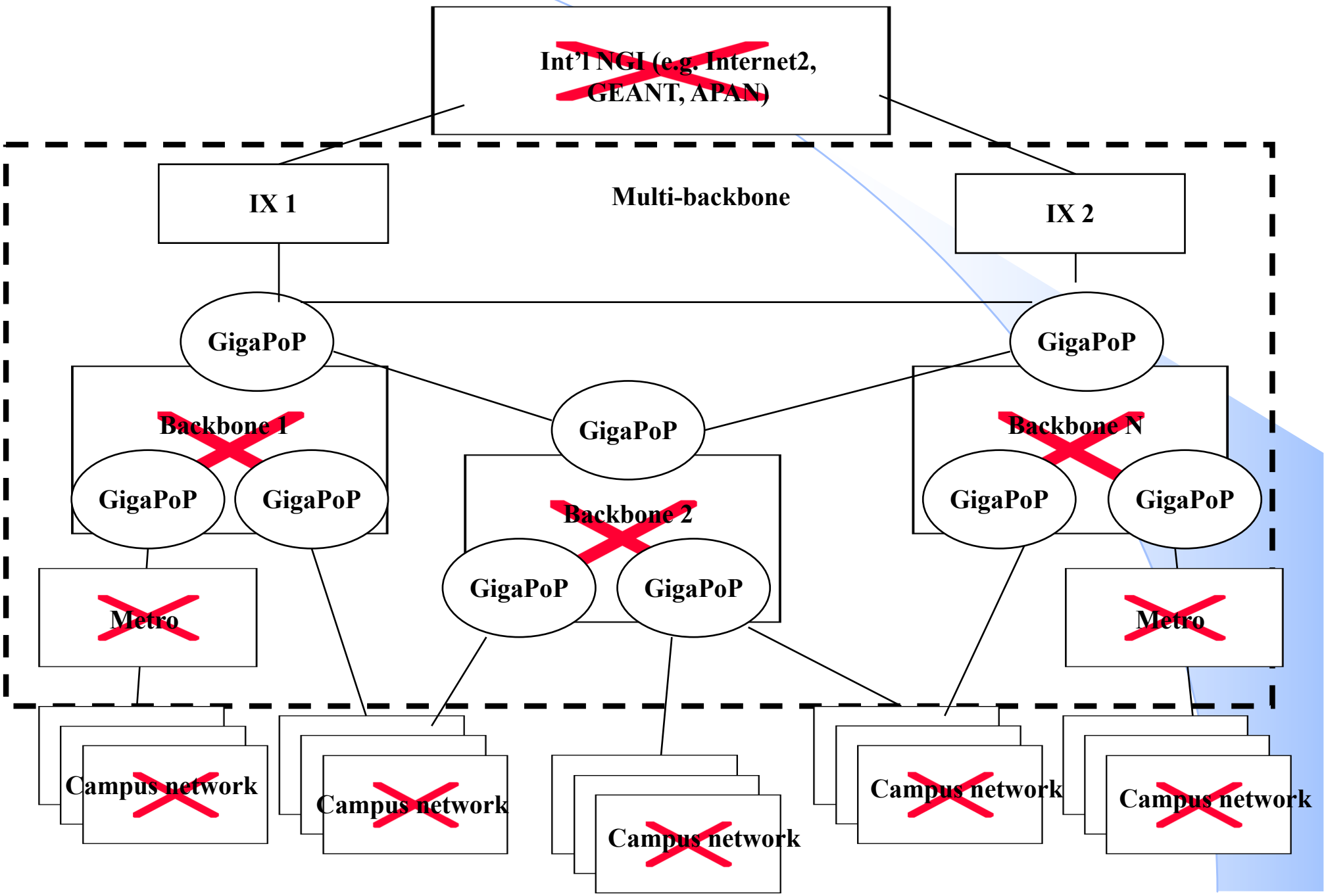
Outline

- Introduction
- CERNET2 Design Goals
- CERNET2 Backbone
- CERNET2 Characteristics
- CERNET2 Operation
- Current Status
- Conclusion

Why Next Generation Internet in China (CNGI)

- While the global NGI-related projects achieves rapid progress, China was arguing on issues:
  - Whether we need one such project?
  - When we should start the project?
  - Who can fund it?
  - How to organize……
- Preliminary study from August 2002
  - Conclusion: CNGI project is indispensable
- CNGI project was officially started since Aug.2003
- 3 major goals of CNGI
  - As advanced network platform to support future research need
  - As new technology and business-oriented app. testing env.
  - To promote industrialization of IPv6-oriented products

CNGI Structure



CERNET2

- CERNET2 is a sub-project of CNGI, and is also the sole and biggest backbone network of CNGI project:
  - support next generation internet applications development
  - provide an advanced network testbed
  - demonstrate next generation operational and QoS capabilities
  - create facilities for network research

Why CERNET2

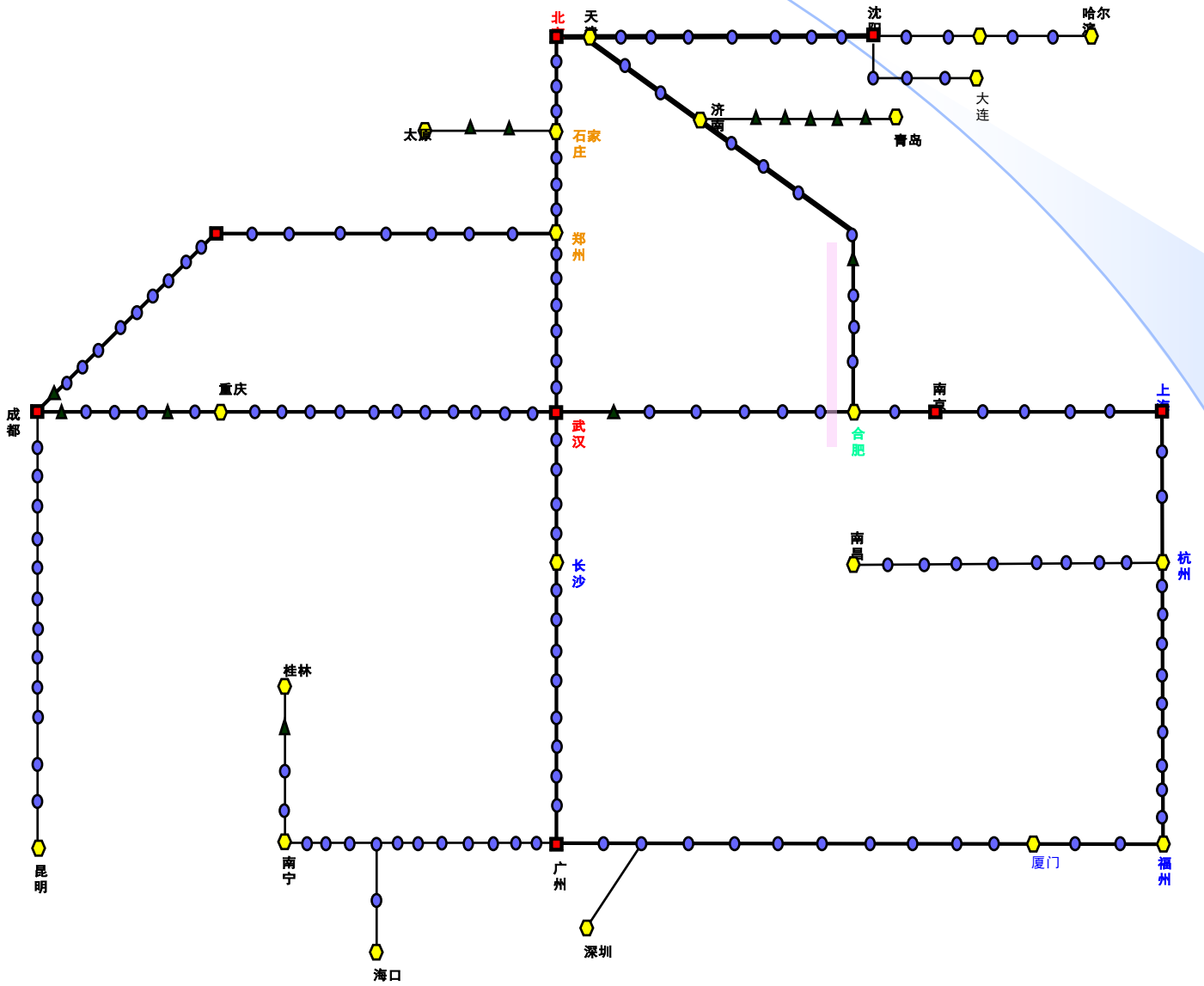
- Research and Education networks must be at forefront of new network architecture and technologies, a unique backbone can't fully meet the 3 goals of CNGI
- Growing recognition that research community needs a permanent advanced network platform to support future research need
- More and more science and research is becoming network based e.g. eScience, Grid

CERNET2 Design Goals

- Next generation academic internet in China, one of CNGI backbone networks
- Connect 20 GigaPOPs located in 20 cities across the country with 2.5 to 10Gbps links
- Peering with int'l next generation internets from north America, Europe, and Asia-pacific rim with 2.5Gbps links
- Connect national top 100 universities and other academic and research institutions with 1 to 10Gbps.
- Interconnect with other backbone networks of CNGI
- To be the critical infrastructure of next generation networking technology research, application development, and promoting the industrialization of NGI

CERNET Dark Fiber Layout

CERNET Transport Network



CERNET2 Topology

CERNET2 Design Details

- Use Packet/IP over Sonet technology (PoS)
- Network architecture
  - Backbone：native IPv6
  - Customer networks：
    - protocol： IPv6； IPv4/IPv6； IPv4；
    - access： 6 to 6； 4 over 6； high performance 4/6 NAT
- Address assignment
  - CERNET2： 2001:0da8::/32
    - Backbone and GigaPOPs /36； Customer networks /48
- Routing policy
  - Separate ASes for backbone and customer networks
  - Intra-domain： OSPFv3、iBGP4+
  - Inter-domain： eBGP4+、Static routes

Connections to CERNET2

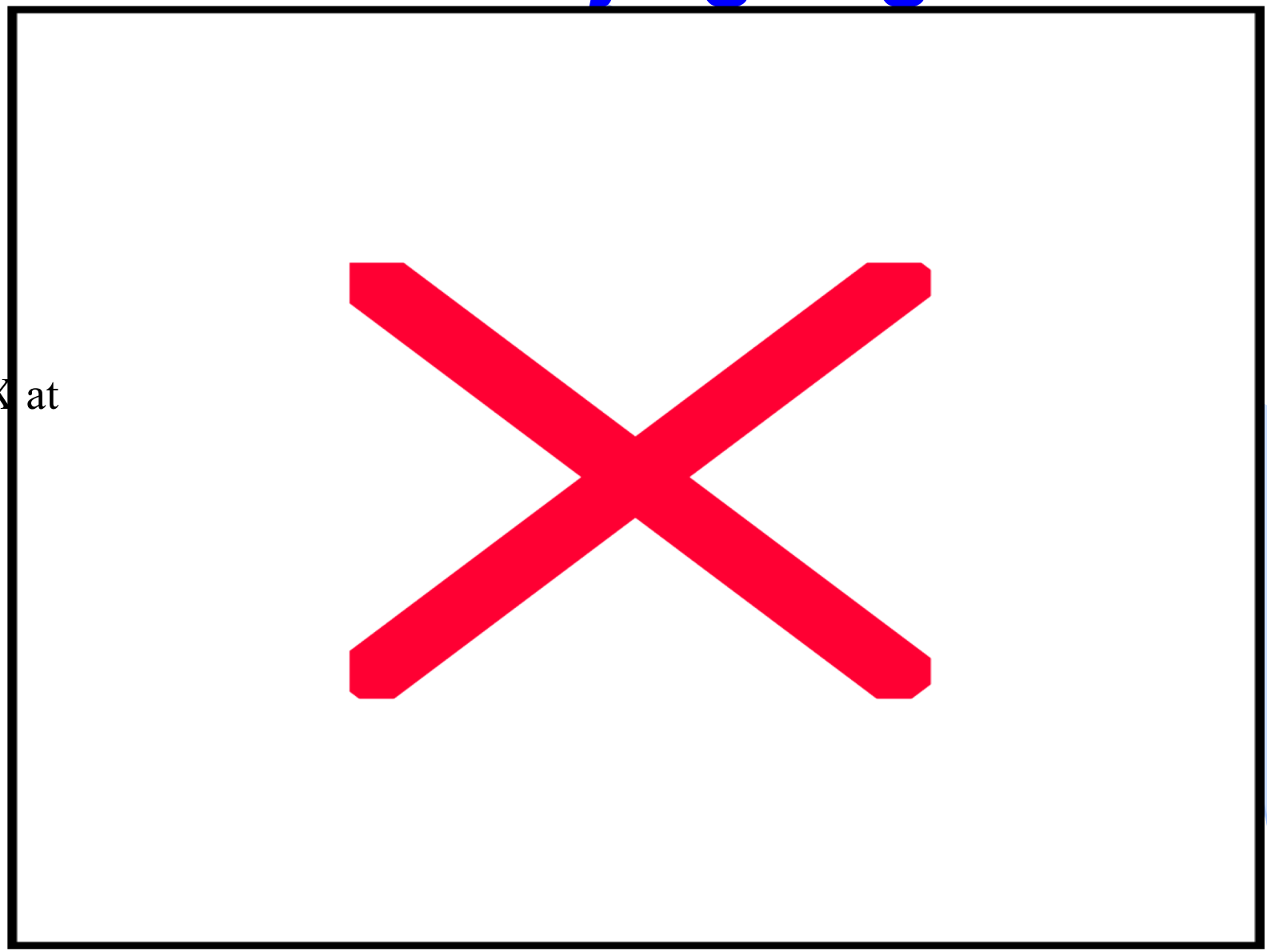
CERNET2 Address allocation Scheme

- CERNET2 observes the future geographical aggregation of IPv6 addresses , We assigned the IPv6 based on the GigaPOPs service points：
  - 2001:0da8:0000::/36 Backbone use
  - 2001:0da8:1000::/36 Beijing
  - 2001:0da8:2000::/36 Tianjin
  - 2001:0da8:3000::/36 Xi’an
  - 2001:0da8:4000::/36 Lanzhou
  - 2001:0da8:5000::/36 Chengdu
  - 2001:0da8:6000::/36 Chongqing
  - 2001:0da8:7000::/36 Guangzhou
  - 2001:0da8:8000::/36 Wuhan
  - 2001:0da8:9000::/36 Nanjing
  - 2001:0da8:a000::/36 Hefei
  - 2001:0da8:b000::/36 Shanghai
  - 2001:0da8:c000::/36 Xiamen
  - 2001:0da8:d000::/36 Shenyang
  - **Customer networks Prefix /48**

CERNET2 GigaPOPs

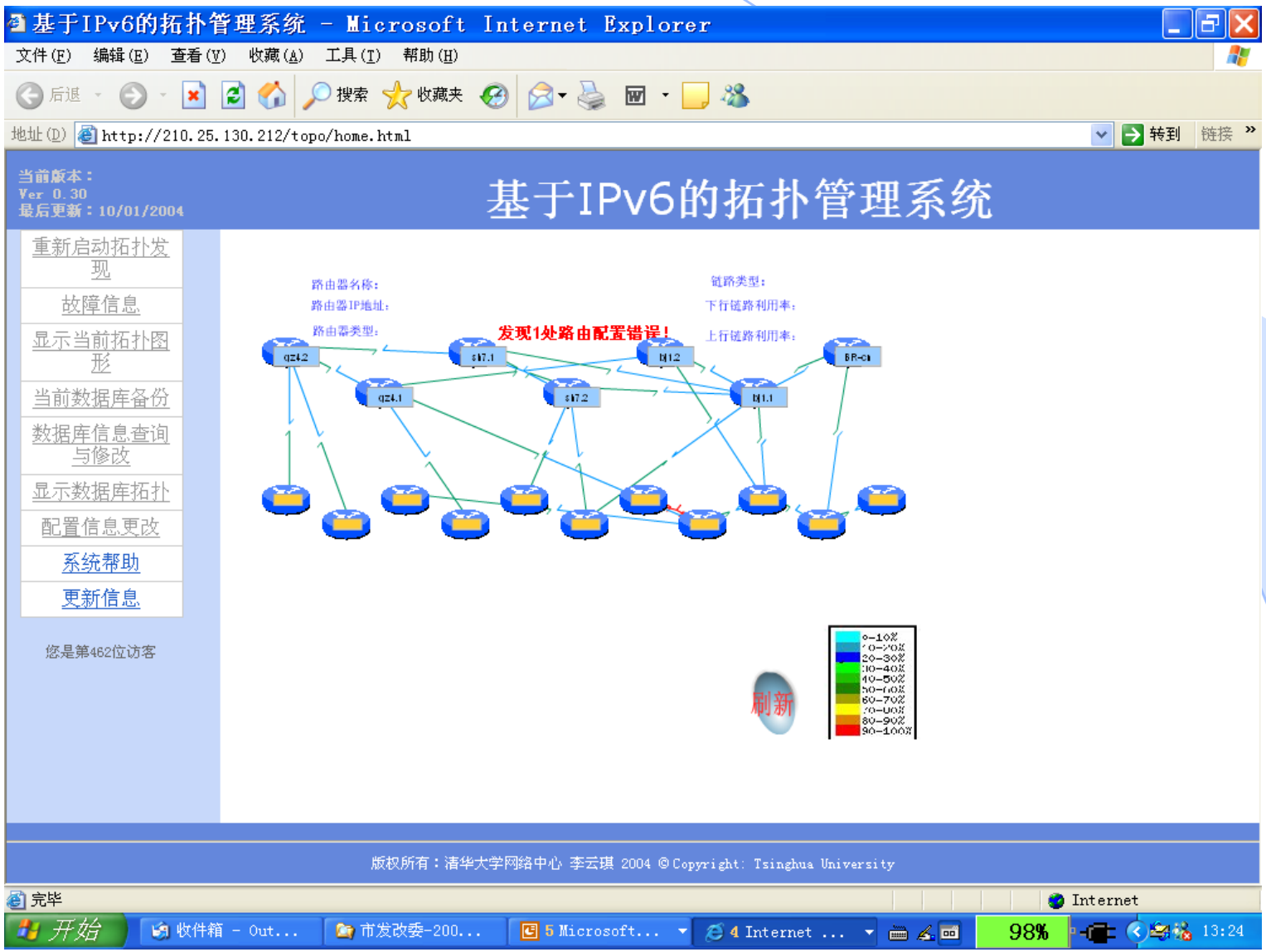
- Functionalities
  - Provide machine and power supply
  - Operate backbone core routers
  - Operate access routers，provide connection services for customer networks
  - Assist in managing and monitoring backbone network
- Connections capabilities
  - Provide 10+ customer networks connection，30+ for Beijing GigaPOP
  - Link rate : 1 ~ 10G (1GE, OC48, 1*N GE, or 10GE), some at 155 Mbps (OC3)

CERNET2 Beijing GigaPOP



CNGI-IX at Beijing

The CERNET2 Network Operations Center at Tsinghua University



The CERNET2 Network Operations Center at TU

- Operated by Tsinghua University
- Housed at Central Main Building
- Co-located with the TUNET, NSFCNET, CNGI-6IX, DRAGONTAP and IPv6-CJ experiment network
- Will be 7 x 24 Operation
  - Dedicated front-line operators
  - Engineers on duty
- http://166.111.8.99/cerm/default.htm

The CERNET2 NOC Services

- Problem management
- Network monitoring
- Change management
- Documentation
- Reports
- Security management
- Engineering
- Testing & evaluation

CERNET2 Applications and Services

- High performance
  - Grid applications
- Real-time
  - Video and virtual Lab. applications
- Mobility
  - Distributed monitor/sensor and control
- multicast
  - Large-scale video conferencing

Security
Management
QoS
Accounting

Current Status

- Oct. 2003， experimental CERNET2 backbone was up
- The experimental CERNET2 backbone connected Beijing, Shanghai and Guangzhou with 2.5Gbps links, the total distance is 6000+ Km， and provide native IPv6 service
- Jan. 2004， CERNET2 peered with US, Europe, and Japan
- Mar. 19, 2004， CERNET2 officially announced to provide access service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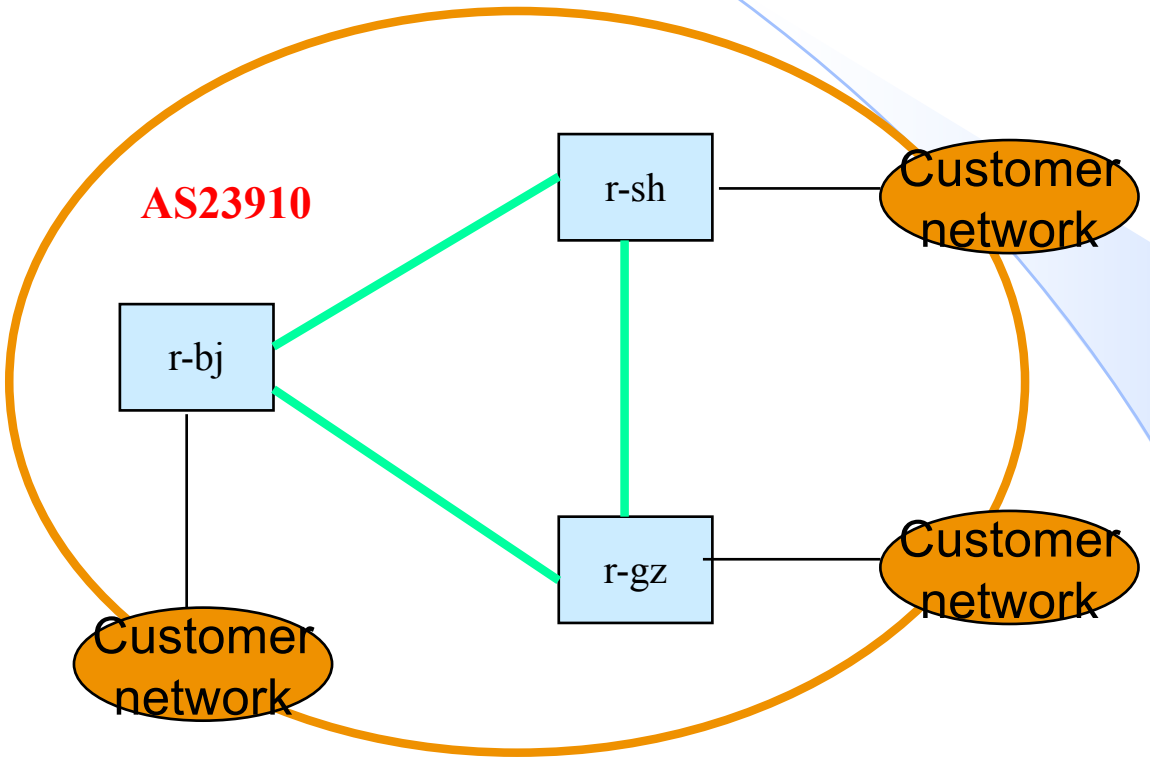
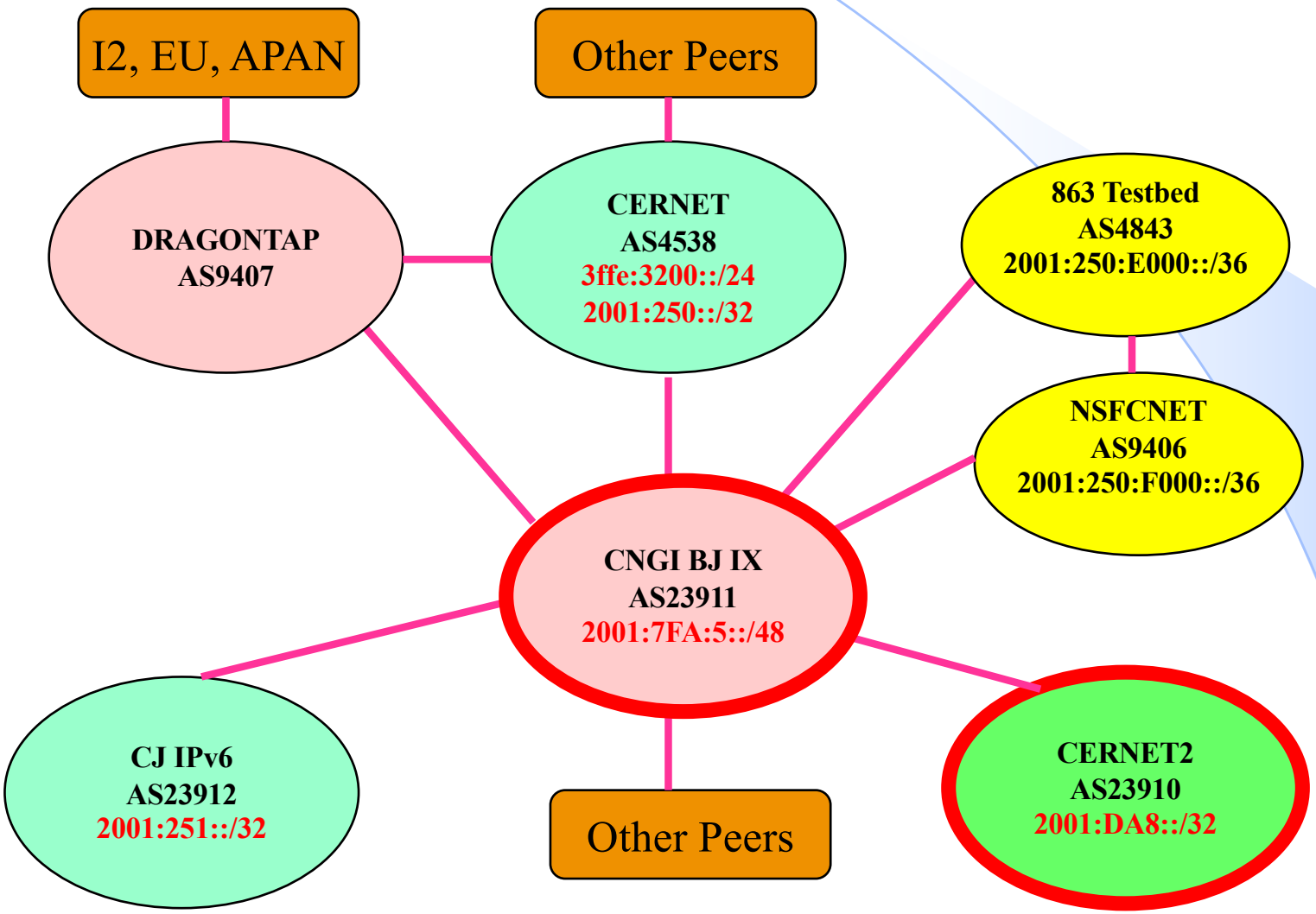
城乡互动"写华章

CERNET2 Launching Ceremony

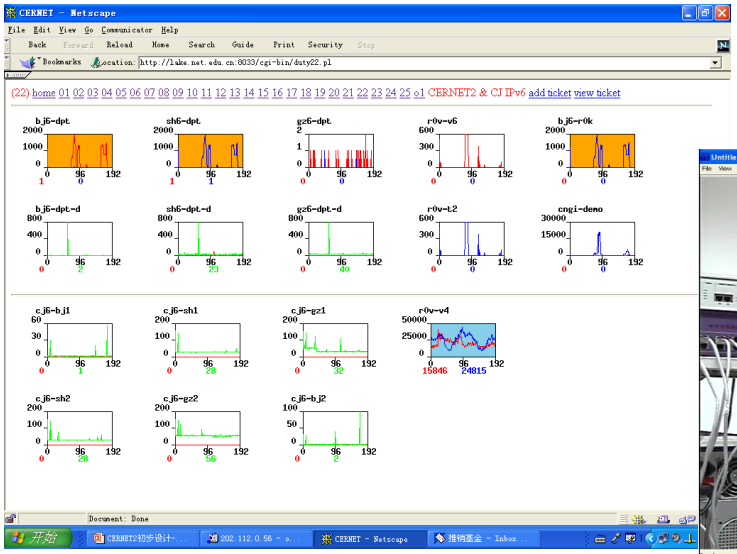
Experimental CERNET2 Topo.

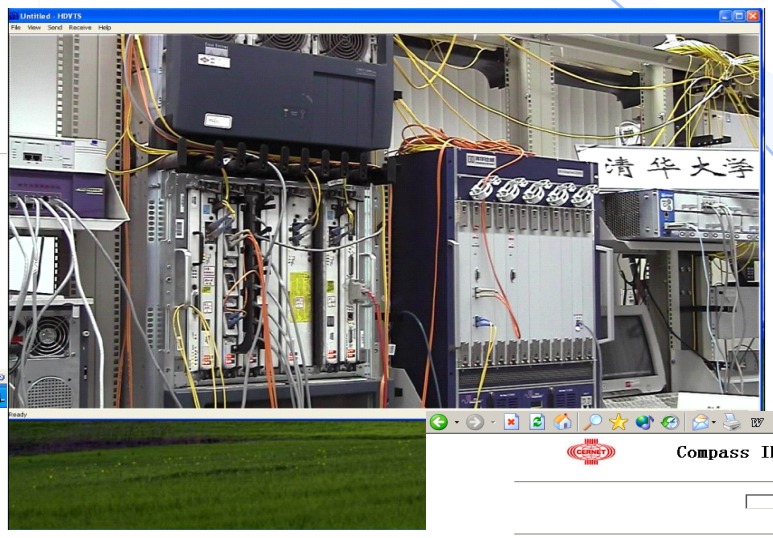


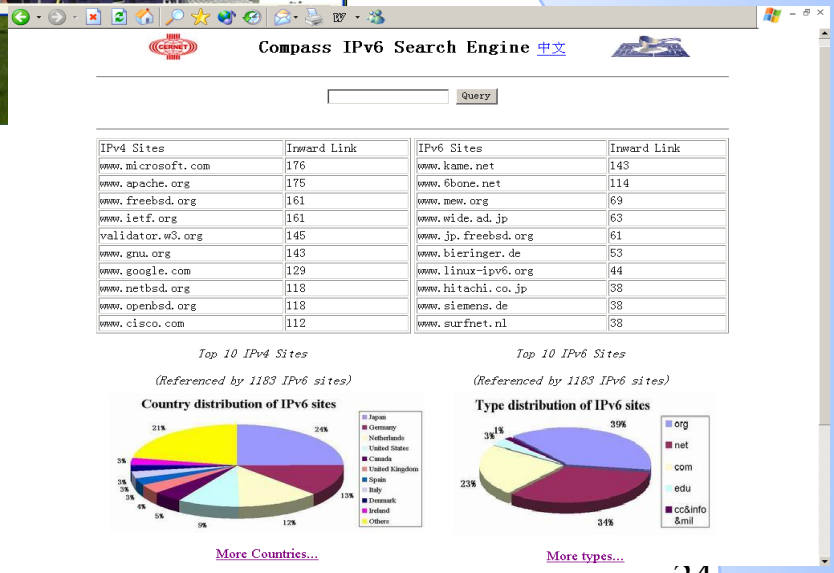
CERNET2 Current Interconnection Status



Research and Applications







IPv4 Sites	Inward Link
www.microsoft.com	176
www.apache.org	175
www.freebsd.org	161
www.ietf.org	161
validator.w3.org	145
www.gnu.org	143
www.google.com	129
www.netbsd.org	118
www.openbsd.org	118
www.cisco.com	112

IPv6 Sites	Inward Link
www.kame.net	143
www.6bone.net	114
www.mew.org	69
www.wide.ad.jp	63
www.jp.freebsd.org	61
www.bieringer.de	53
www.linux-ipv6.org	44
www.hitachi.co.jp	38
www.siemens.de	38
www.surfnet.nl	38

Project Schedule

- By the end of 2004：
  - 20 GigaPoPs and CERNET2 backbone with 2.5Gbps links will be finished
  - CNGI-6IX will be finished，provide basic peering services
  - Connection to several tens universities, research institutions
- By the end of 2005：
  - CERNET2 backbone upgrade to 10Gbps
  - Peer with other CNGI backbone at Shanghai and Guangzhou
  - More connections to customer networks
  - Fully production network to support CERNET2 applications R&D
  - Establish limited network quality of service (QoS)
  - Support IPv6 native multicast

Conclusion

- It's the right and critical decision to start the CNGI
- CERNET2 as the unique academic next generation internet in China will be more than important to promote the mass deployment of IPv6-based internets in China.
- TU's exceptional commitment to engagement in local, national and int'l networking makes a major contribution at TU to:
  - the facilitation of global scientific collaborations
  - network technology research and development
- This involvement is important strategically to the research and education missions of the University and to the development of rich connections and relationships in global research communities.