IPv6 Activities in China

2005.02.23

Hualin Qian
Chinese Academy of Sciences

Government's decision

Chinese State Development and Reformation Commission made decision to support IPv6, HDTV, and 3G as three important special projects in 10th five-year-plan in IT section

Major IPv6 Player in China

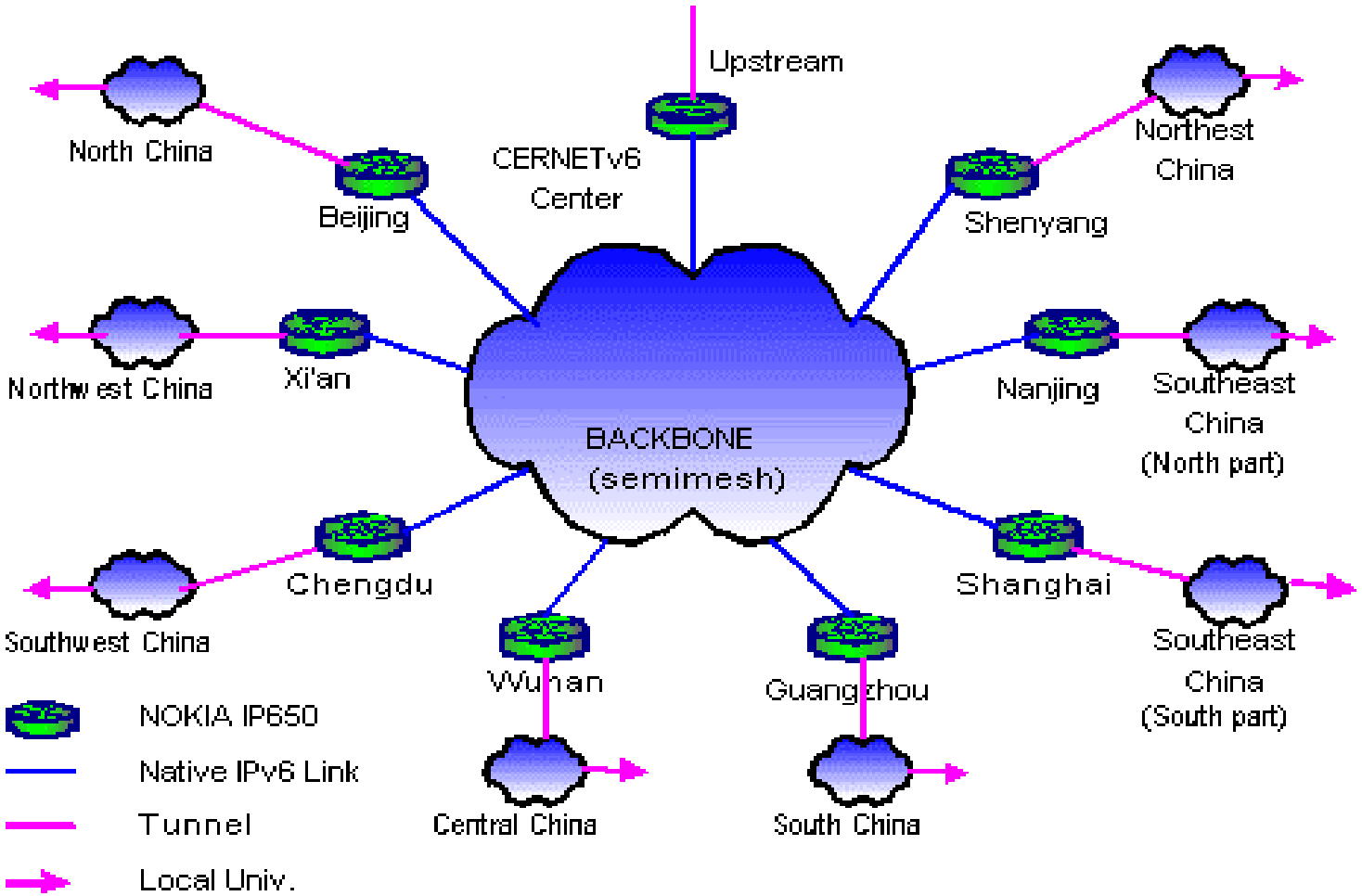
In China, IPv6 research, trial, test, deployment, and application are developed in:

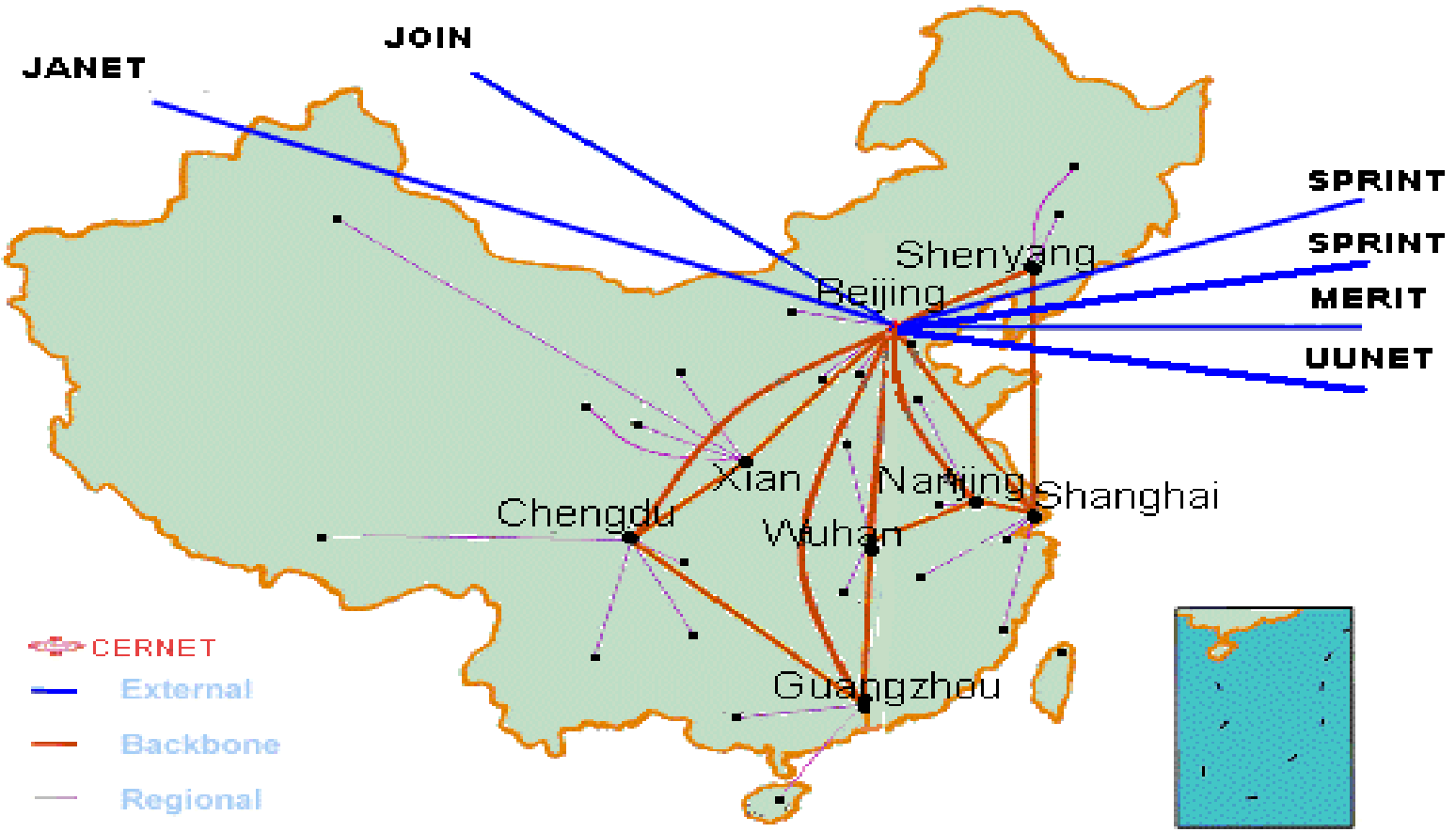
- **universities**
- **research institutes**
- **equipment vendors**
- **commercial ISPs**

Universities

Recently, universities have finished a new IPv6 backbone covering 20 cities, this is one of the 6 backbones in CNGI project and called CERNET2

IPv6 Testbed of CERNET2




JANET
JOIN
SPRINT
SPRINT
MERIT
UUNET
Shenyang
Beijing
Xian
Nanjing
Shanghai
Chengdu
Wuhan
Guangzhou
CERNET
External
Backbone
Regional

Early activities in universities

- Research teams were formed in 1998
- Test-bed deployed and connected to 6Bome for experiment：
  - North China (NO-EXPR): 3FFE:3211::/32 1999.03
  - Northwest China (NW-EXPR): 3FFE:3212::/32 1998.12
  - Central China (CE-EXPR): 3FFE:3215::/32 1999.05
  - East and Northeast China (EN-EXPR): 3FFE:3216::/32 1999.06

University activities on the IPv6 Test-bed

The test-bed was built to

- study and implement the tunnel broker technology for IPv4/IPv6 transition
- develop IPv6 searching engine for IPv4 and IPv6 Web pages
- develop IPv6 prototype router
- research on mobile IPv6 (together with mobile phone vendors)
- develop IPv6 applications

Chinese Academy of Sciences

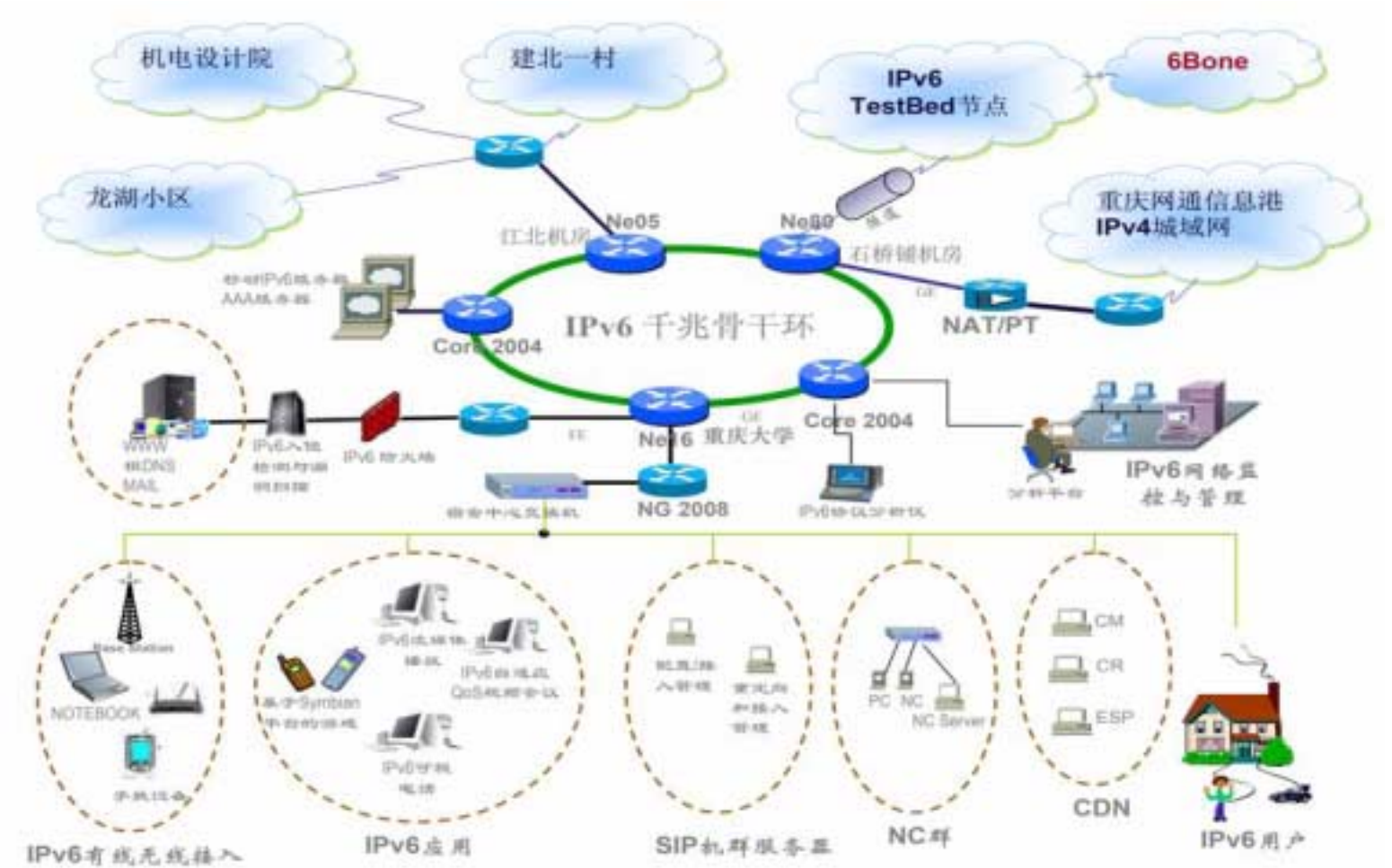
Chinese Academy of Sciences (CAS)
supported 20 Million RMB Yuan
for its research institutes in IPv6 related
research and development since 2001

Part of this IPv6 project was done together with
China NetCom (CNC)

IPv6 Testbed of CAS and CNC

- The key project of Knowledge Innovation Program of CAS "**IPv6 network key technology research and MAN demo system**"was started in 2001 and finished in June 2004 in Municipal city Chongqing
- The IPv6 MAN is operated by CNC Chongqing and is also the first IPv6 commercial metropolitan trial network
- IPv6 services and typical applications can be run on it
- Supporting the interoperability between the new IPv6 MAN and the existing IPv4 network.

Chongqing IPv6 Trial MAN



CAS research activities on IPv6

Main research area of CAS IPv6 projects were concentrated on:

- IPv4/IPv6 transition technology
- Technology for IPv6 conformance test and interoperability test
- IPv6 real time video application
- Information distribution technology for IPv6
- IPv6 DNS system
- Mobile IPv6

China Telecom

China Telecom has been working on IPv6 with five projects:

- **IPv6 WAN trial network**
- **CN2**
- **Hunan province trial IPv6**
- **participating the 6Tnet initiated by BII**
- **CNGI**

China Telecom IPv6 Trial WAN

IPv6 Video Conference

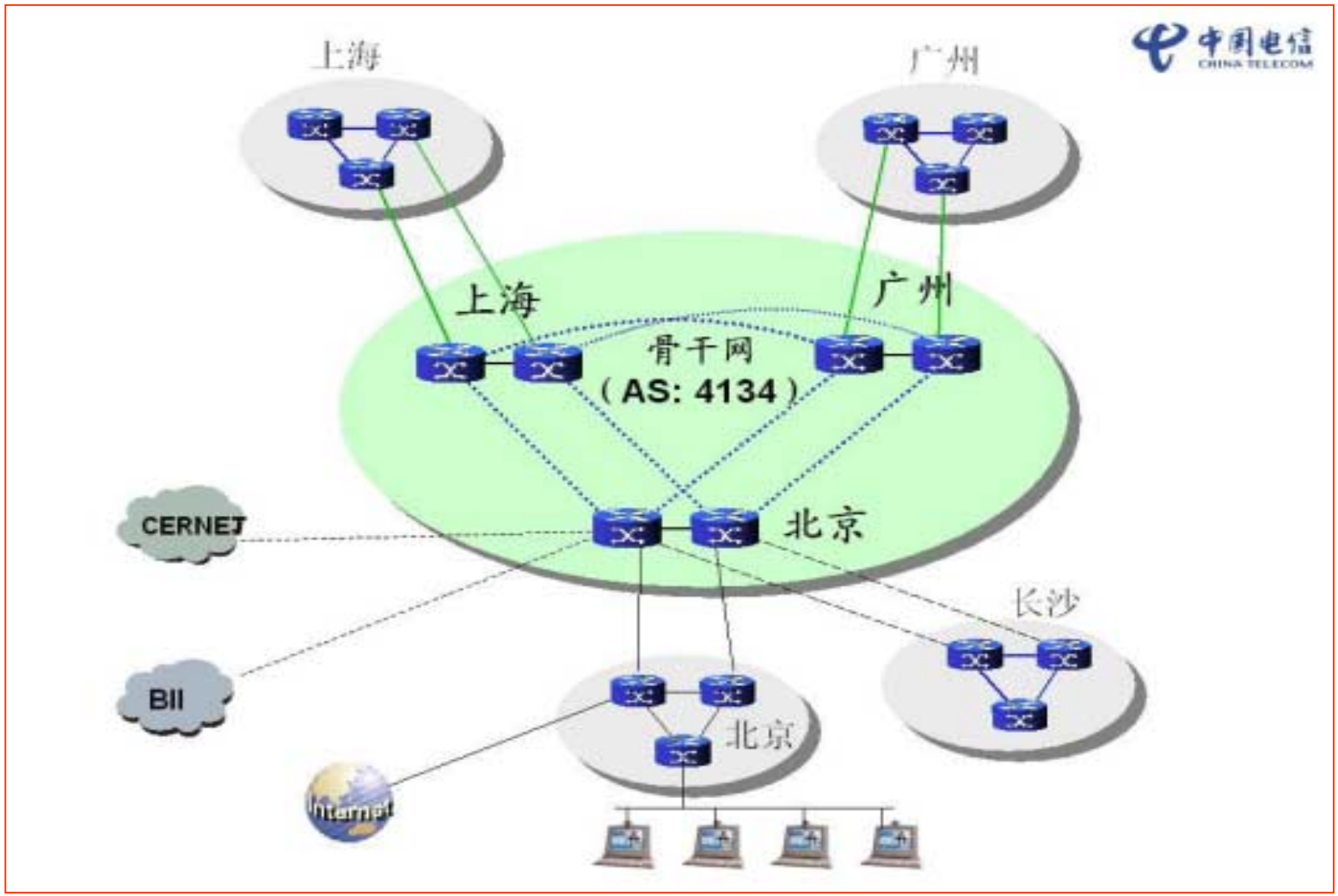
PDA

WLAN Access

IPv6 VOD

IPv6 Remote Monitor

IPv6 Web/FTP



IPv6 Trial WAN Network（CHINANET6）

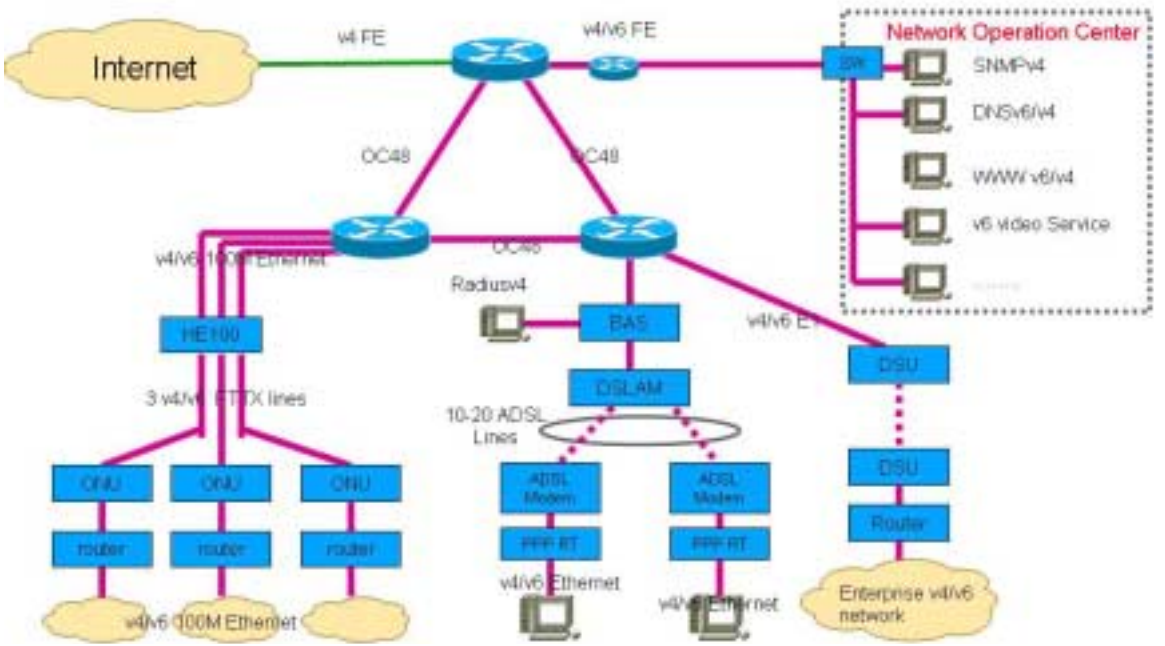
China Telecom CN2 Network

1. CN2 is under construction and is the new IP backbone of CHINANET, supporting IPv6
   - CHINANET is expanding its IP network for the sixth time
   - CN2 is for commercial use
2. Greatly enhanced the capacity. All link capacity are mainly 10G and can be upgraded to 40Gbps in future.
3. All the vendors for CN2 promised to support the smooth transition to IPv6.
4. Main cities in China will be capable of providing IPv6 services.

China Telecom: IPv6 Application and Services

1. Hunan Telecom IPv6 Demo Network

   The first IPv6 application demo network of carriers established on March 2002 has been successfully operated for 3 years. It has passed many different tests including IPv6 access services and IPv6 audio and video services tests which provides precious experiences for new services development.



2. Research on Telecom Carriers' IPv6 Integrated Services Platform

   IPv6 "pure network" is not capable enough to support IPv6 value added services development. It needs to set up a service platform between the IPv6 infrastructure and application services, change the IPv6 technology into appealing services and realize the sustainable development of services.

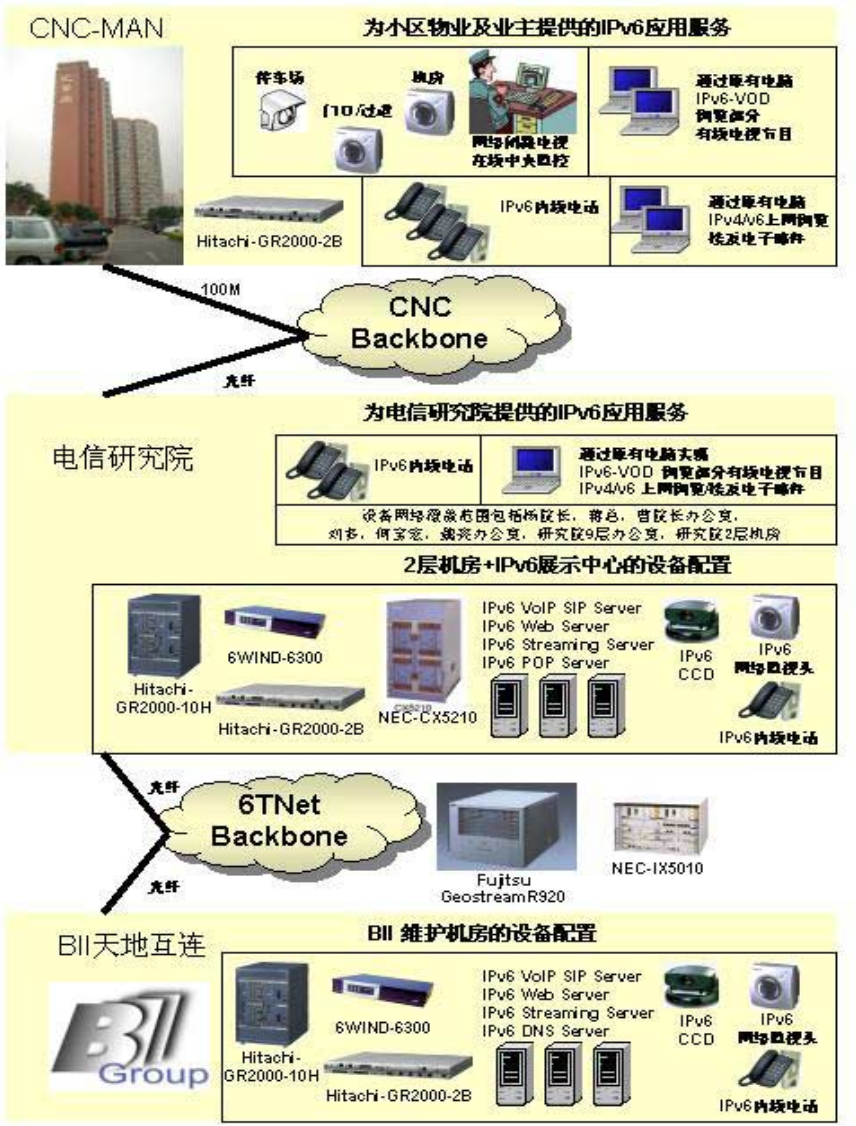
China NetCom (CNC)

China NetCom has been working on IPv6 with four projects:

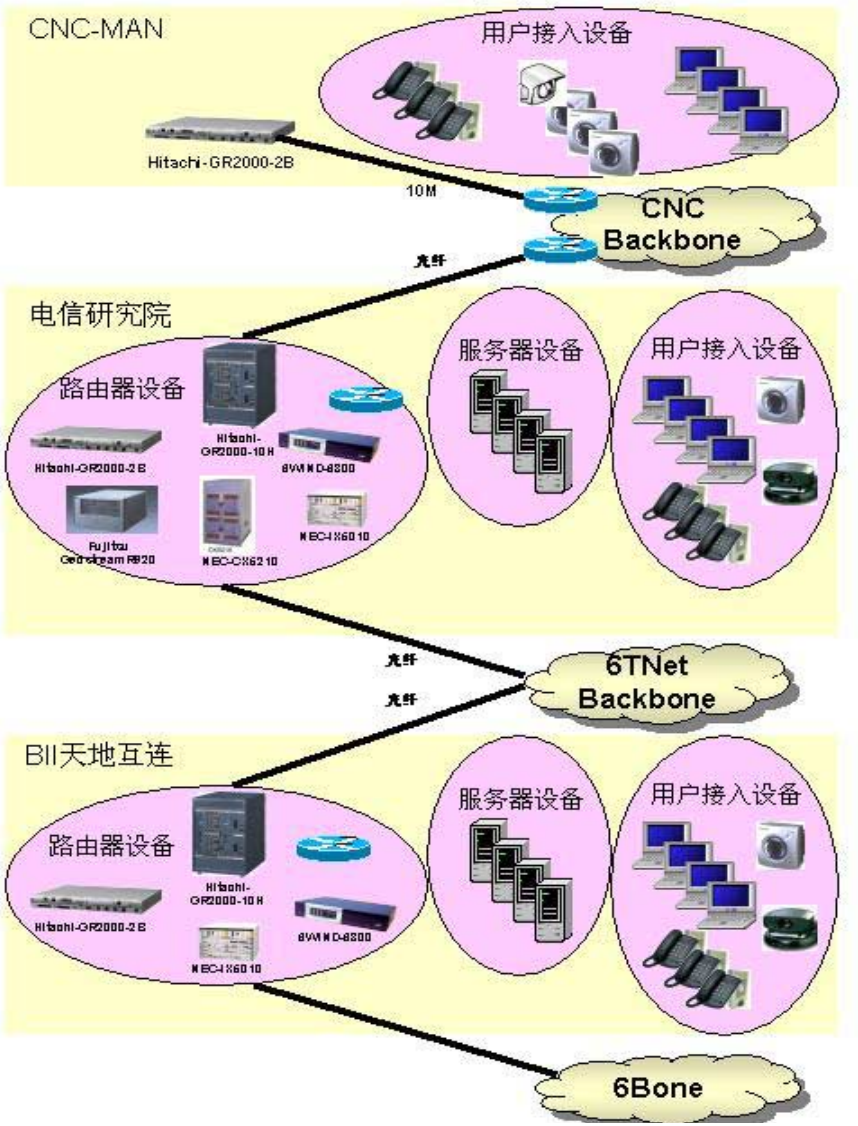
- **6Tnet with BII**
- **Chongqing IPv6 WAN with CAS**
- **CN2**
- **Hunan province trial IPv6**
- **participating the 6Tnet initiated by BII**
- **CNGI**

6TNet IPv6 Application Demo: CNC part

6TNet 实验网应用服务整体布局



6TNet 实验网 网络设备总图



CNC: IPv6 Application and Service

1. Digital Olympics

By developing applications for digital broadband Olympics 2008, CNC formally became fixed telecommunication service cooperation partner of Beijing Olympics Games 2008 on July 22, 2004 to provide service during the period of Olympics Games, CNC will develop IPv6 Video Multicast, Olympics sites monitoring system and other services.

2. IPv6 Innovative services Application

1. Video Conference
2. VoIPv6
3. Internet Monitoring System
4. Online Education
5. Olympic Applications
6. .....

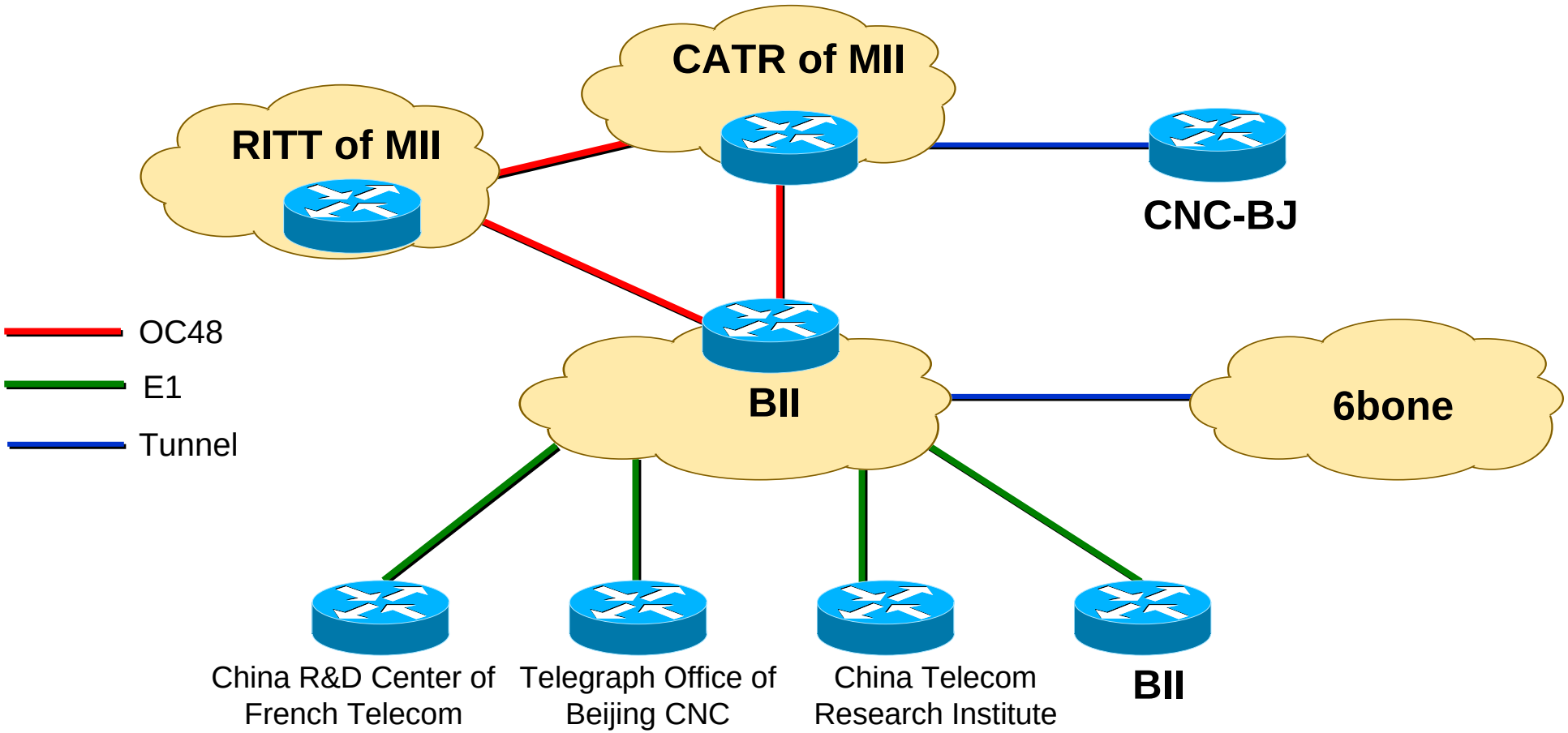
Beijing Internet Institute (BII)

BII is the first commercial entity initiated IPv6 equipment demo and application demo in China

BII organized participants from telecom carriers, univercities, research institute, equipment vendors

BII 6TNet: IPv6 Telecom Trial Network

6TNet is a next generation IPv6 telecom trial network established by RITT and BII with the support of MII on March 2002.

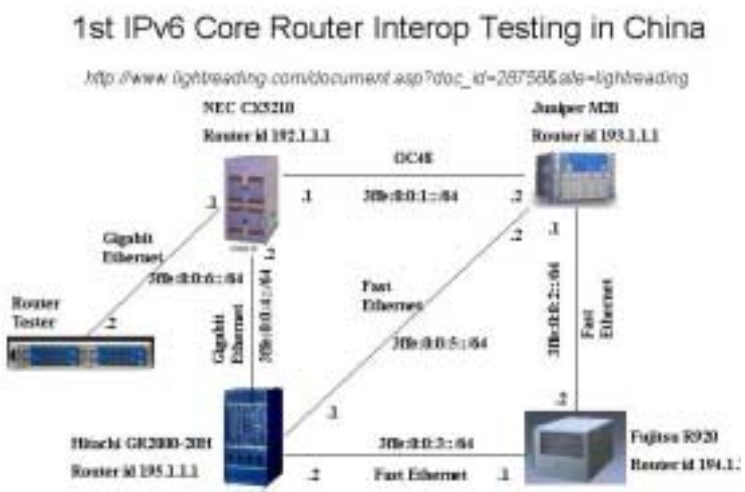


Purpose & Achievement of 6TNet

1. Purpose: Construct a multi-vendor and multi-carriers IPv6 network, cooperate with domestic and abroad industry. To promote and deploy IPv6 in China through developing IPv6 network application research, study and test according to the specific requirements of Chinese carriers.
2. Achievements:

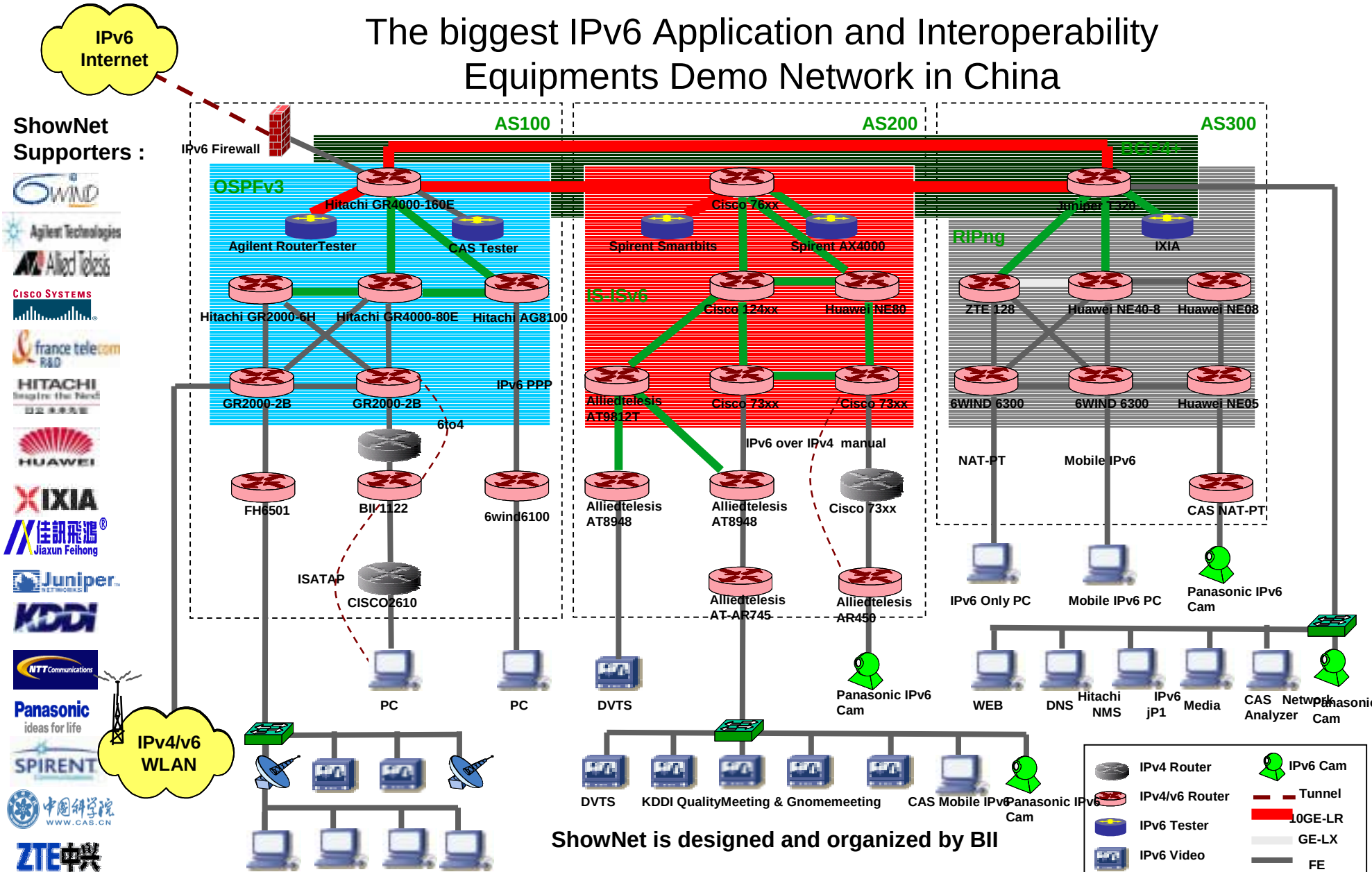
2002 Completed 2.5G backbone loop network construction, begun application development
China first open interoperability test for IPv6 high-performance router
China first demo for IPv6 application services and terminals

2003 IPv6 Application Demo Project of Beijing CNC department.
Connection with Japan IPv6 trial network through IPv6 special line provided by NTT (finished at 2004/4)
Connection with European IPv6 trial network through IPv6 special line provided by French Telecom



BII IPv6 ShowNet

The biggest IPv6 Application and Interoperability Equipments Demo Network in China



ShowNet is designed and organized by BII

Vendors' Efforts in IPv6

Vendors developed IPv6 core routers

- Huawei
- Zhongxin
- Biwei
- ……

CNGI Deployment

CNGI – China Next Generation Internet project

- Multi-government department's support

- Multi-service provider's participation

- Biggest IPv6 deployment in China

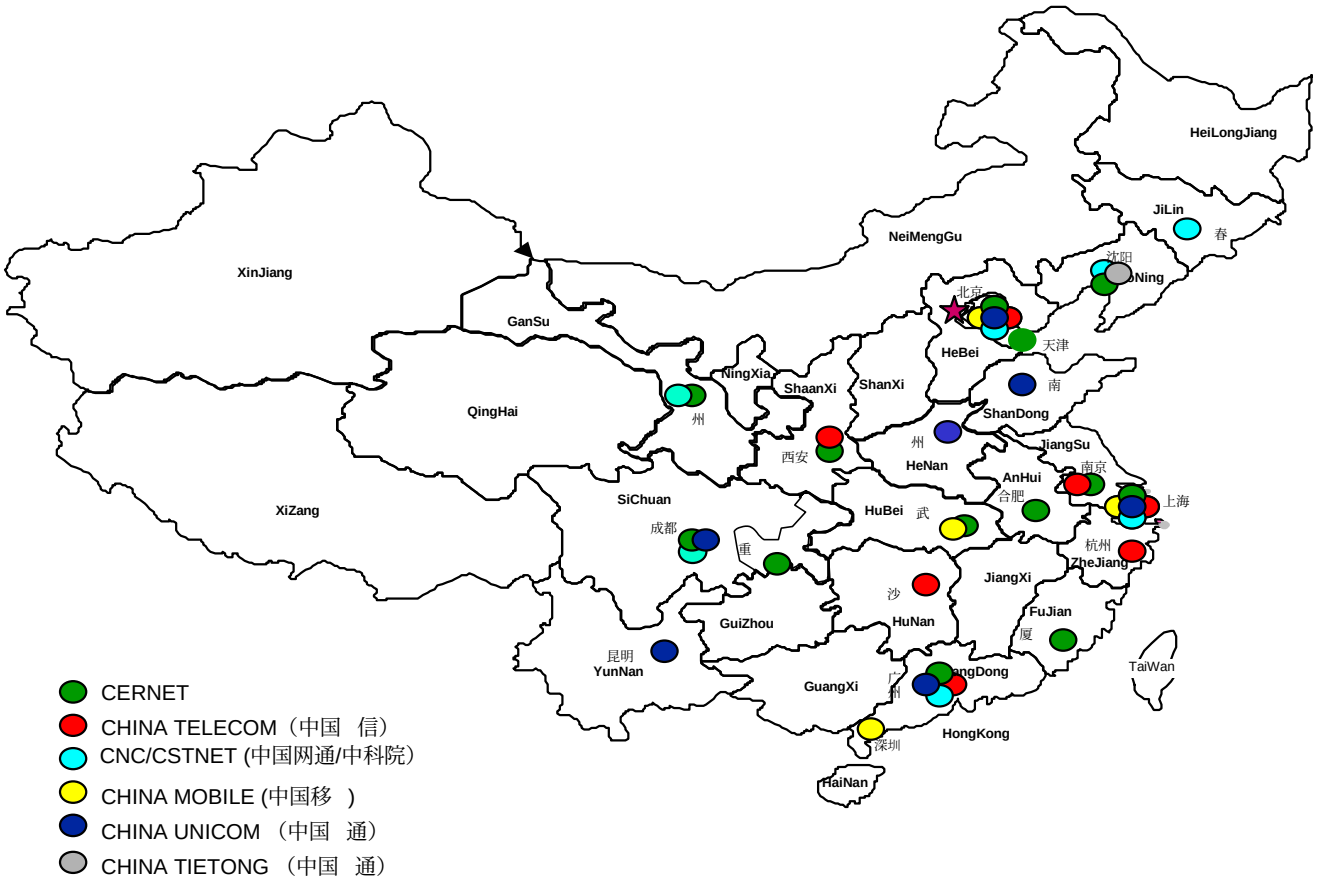
- 2002, Based on the proposal of 57 Academicians, CAS, MOE, NSFC and MOST jointly proposed to develop China Next Generation Internet to provide high performance scientific and research environment.
- NSFC was the original funding source for this project

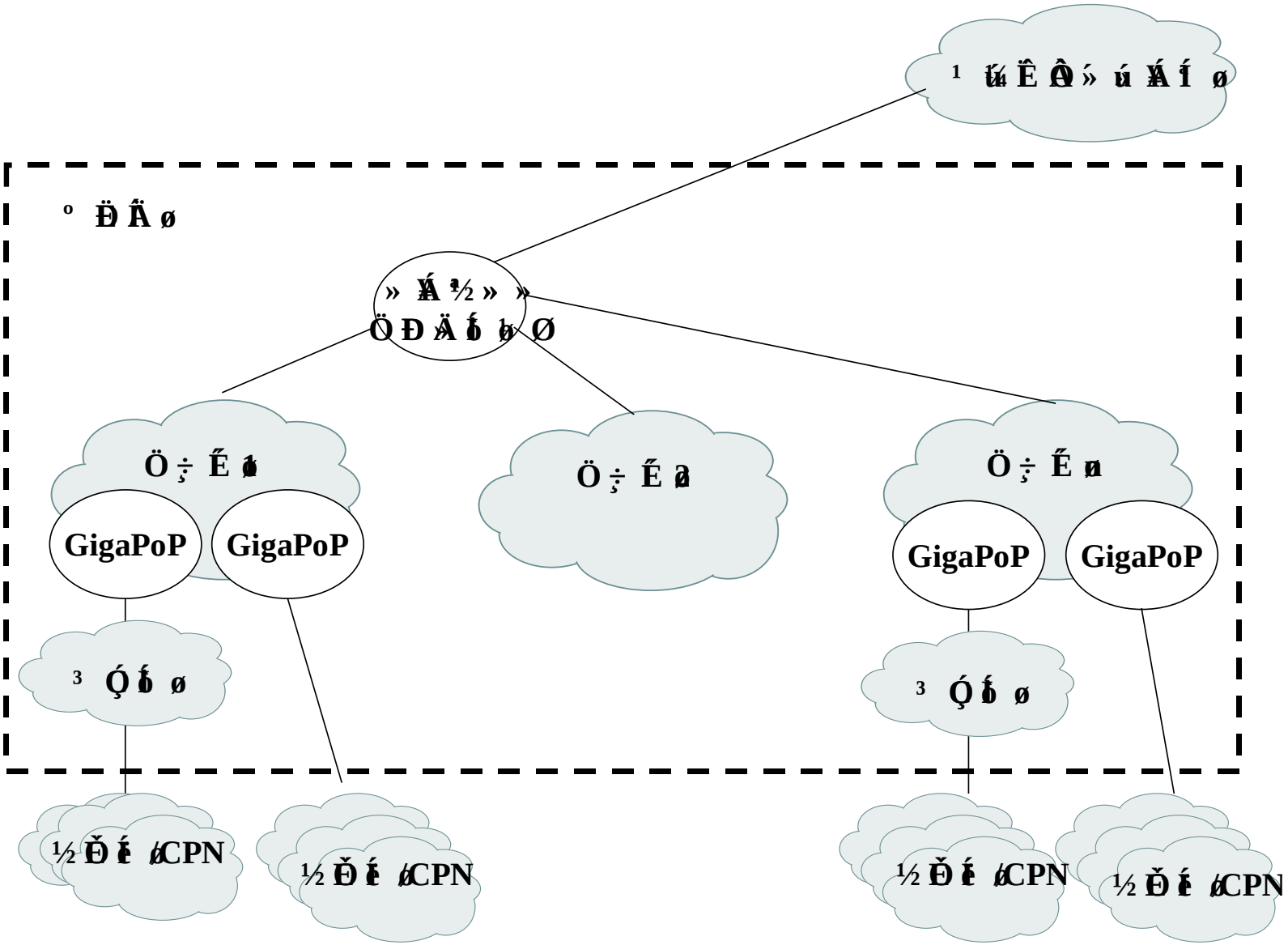
- 2002.8, State Development and Reformation Commission took over the proposal and formally started the project CNGI with other 7 governmental departments

- The core network of CNGI covering 20 cities including Beijing, Shanghai, Guangzhou and so on. It fully supports IPv6 protocol and provides the access capability for both IPv6 and IPv4 users
- The purpose of CNGI
  - form an open trial platform for developing China's Next Generation Internet
  - provide environment for relevant research on IPv6 related technology and new equipment
  - develop IPv6 applications
  - promote Internet industry in China

- Among 7 backbones of the CNGI core network, CERNET2 has been finished its construction by the end of 2004.
- The total fund for CNGI project is 1.4 billion RMB. It will construct a network composed of core network (including MAN), access network, customer premises network and Internet exchange center with IPv6 technology, which can connect the international next generation Internet at high speed.

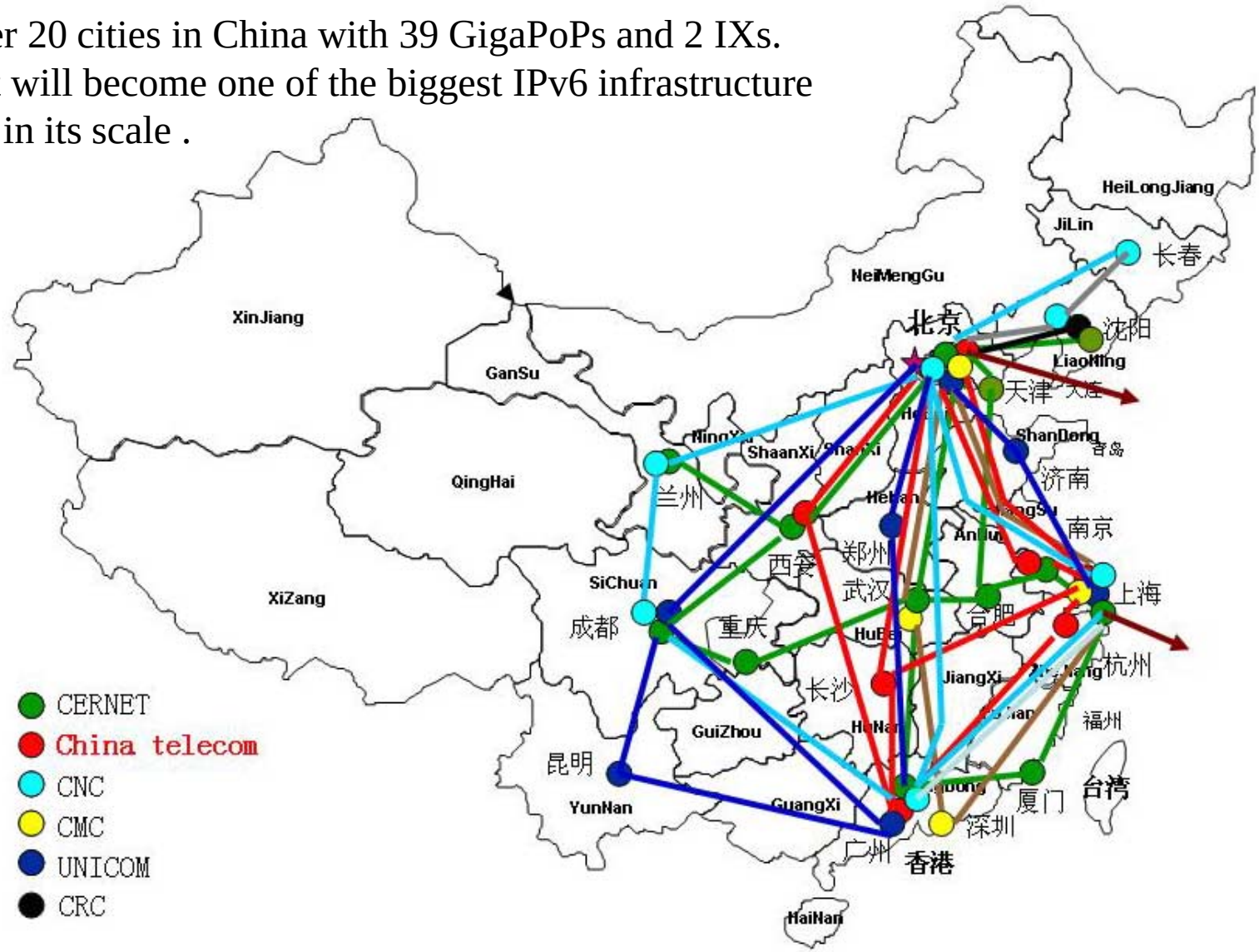
CNGI GigaPoPs in 20 Cities



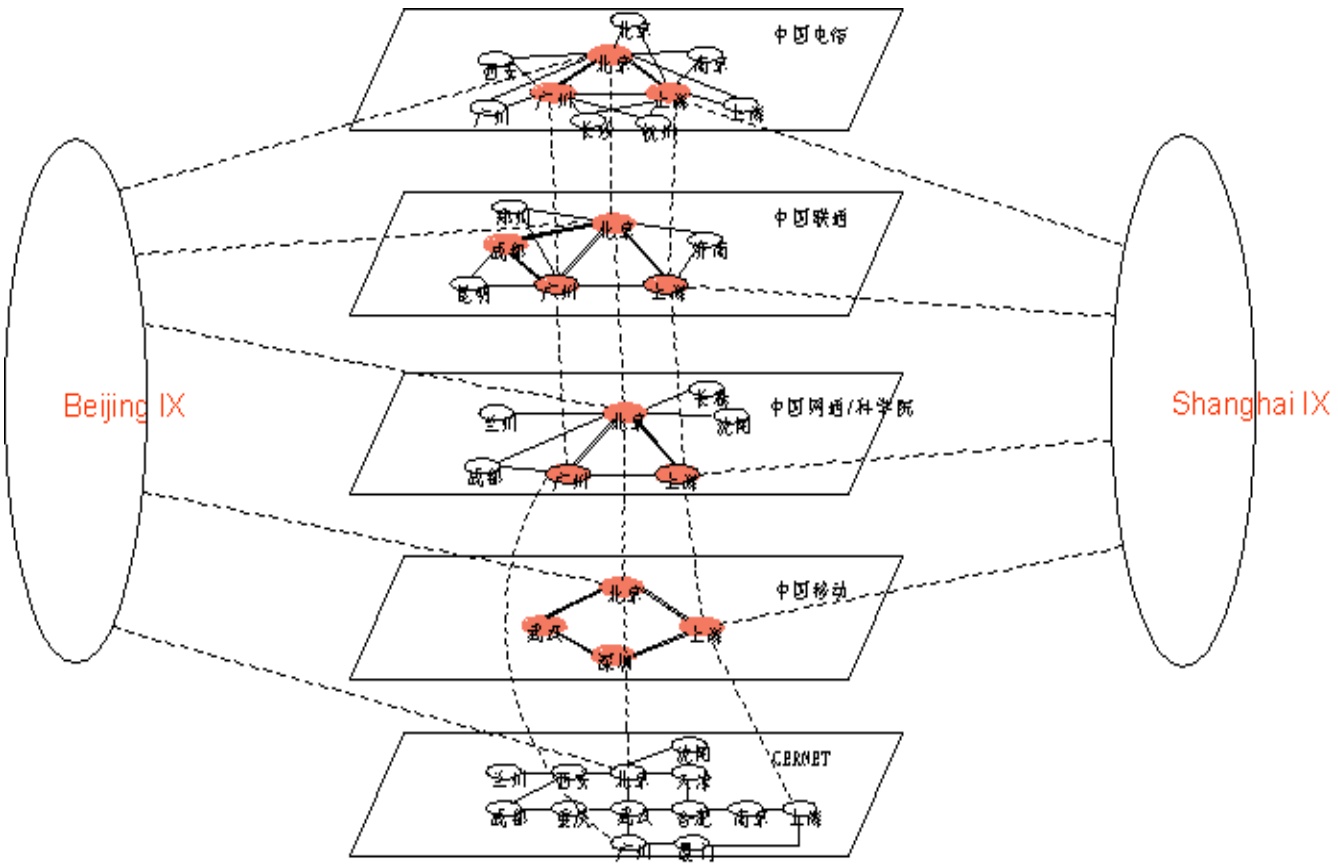

GigaPoP
GigaPoP
GigaPoP
GigaPoP

The first stage Network Layout of CNGI

It will cover 20 cities in China with 39 GigaPoPs and 2 IXs.
By 2005, it will become one of the biggest IPv6 infrastructure worldwide in its scale .



CNGI Interconnect among ISPs



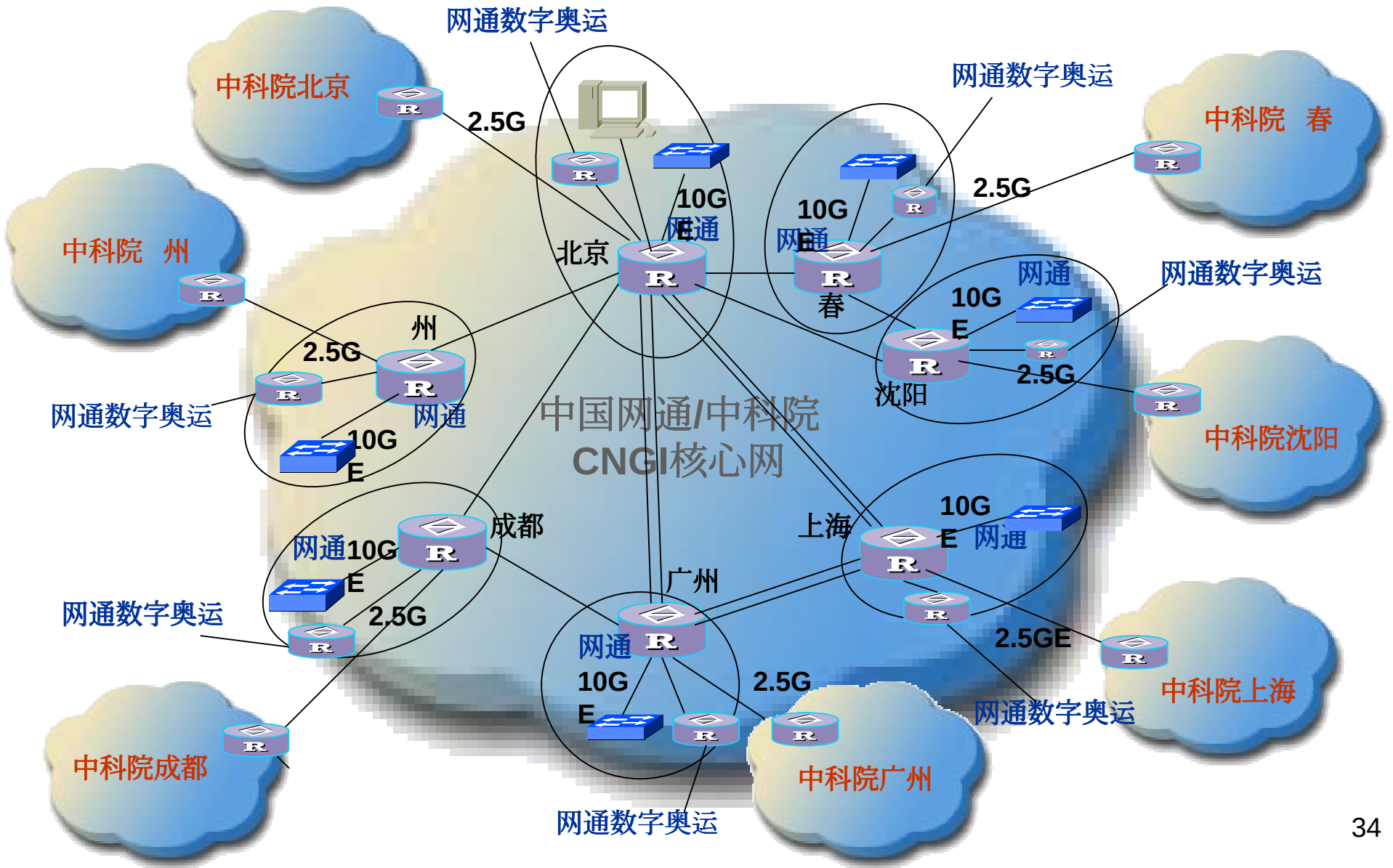
Joint CNGI Project of CNC and CAS

Advantages of close cooperation between CNC and CAS

- As a major telecom company, CNC is rich in resource of transmission capacity
- As an ISP, CNC runs three nationwide networks: China169, CNCnet and ChinaGBN
- As the first Internet provider in China, CAS has advanced network research experience
- CAS has finished its three years IPv6 project and accumulated relative experience
- CAS has most advanced network applications and urgent requirement for its scientific research

This is the first trial of the cooperation between telecom operator and scientific research organization on important project

CNC/CAS IPv6 Network Structure

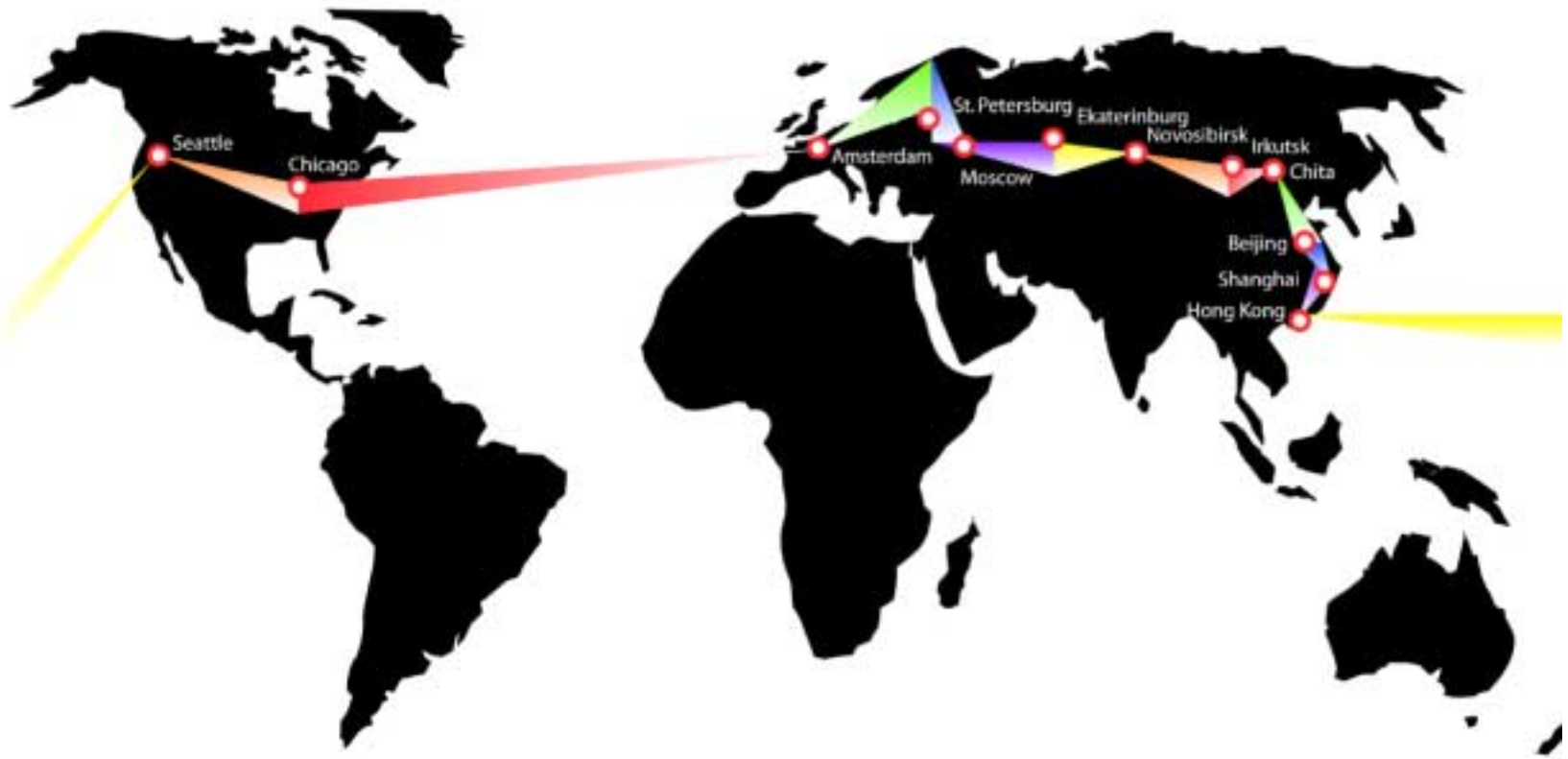


中国科学院
计算机网络信息中心
Computer Network Information Center,
Chinese Academy of Sciences

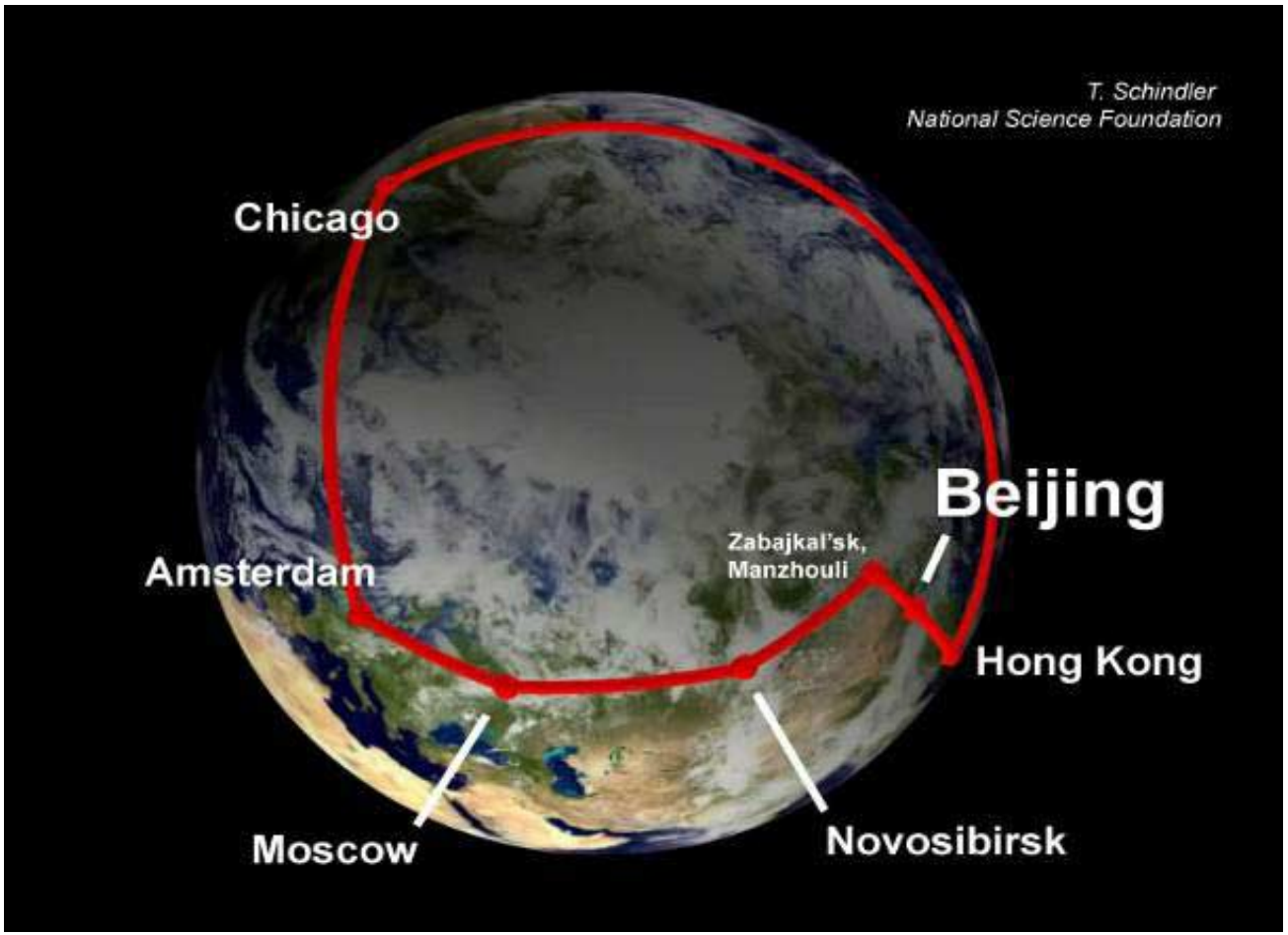
China-Russia-USA Joint Project GLORIAD

GLOBAL RING NETWORK FOR ADVANCED APPLICATIONS DEVELOPMENT

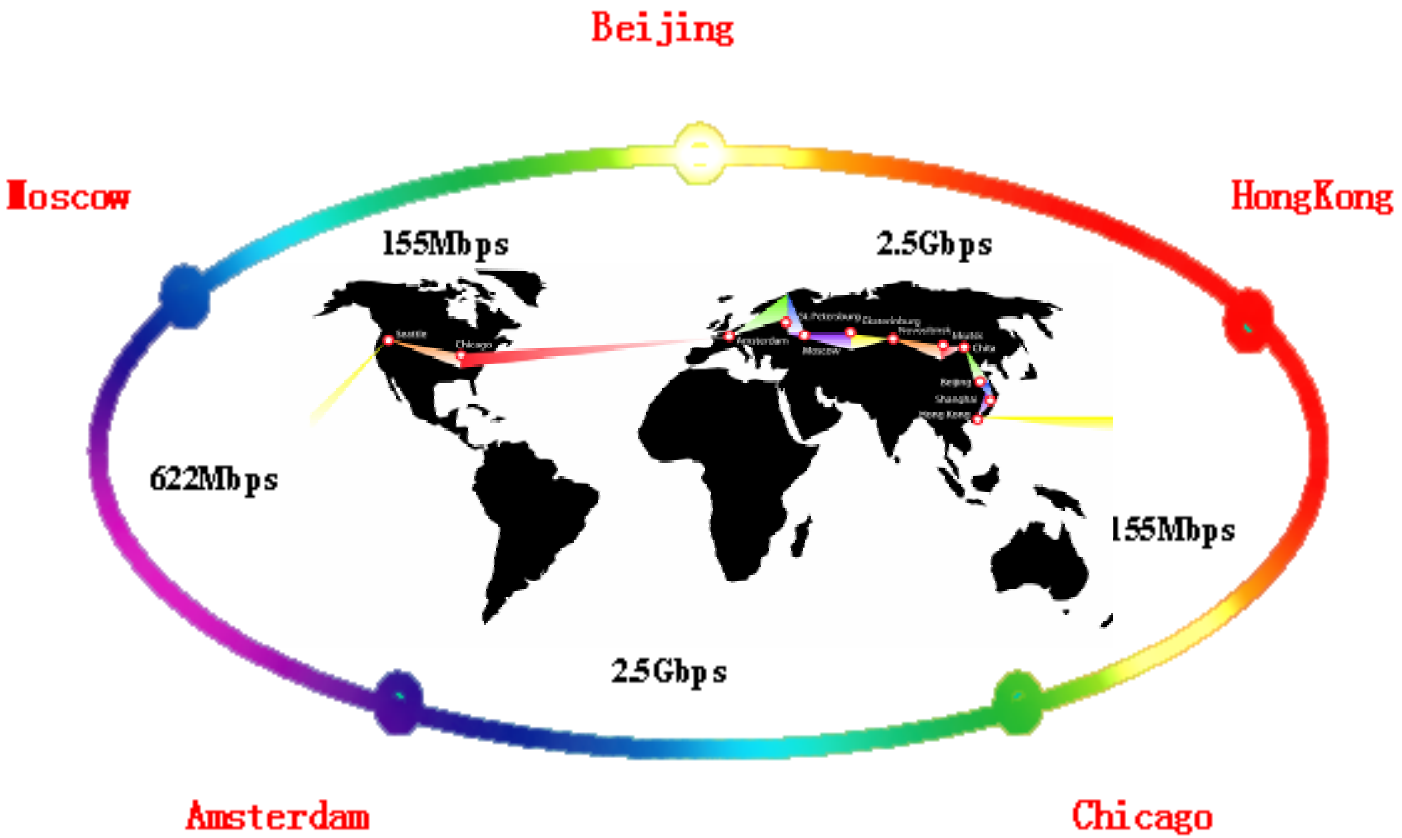
China-USA-Russia Science & Education Network



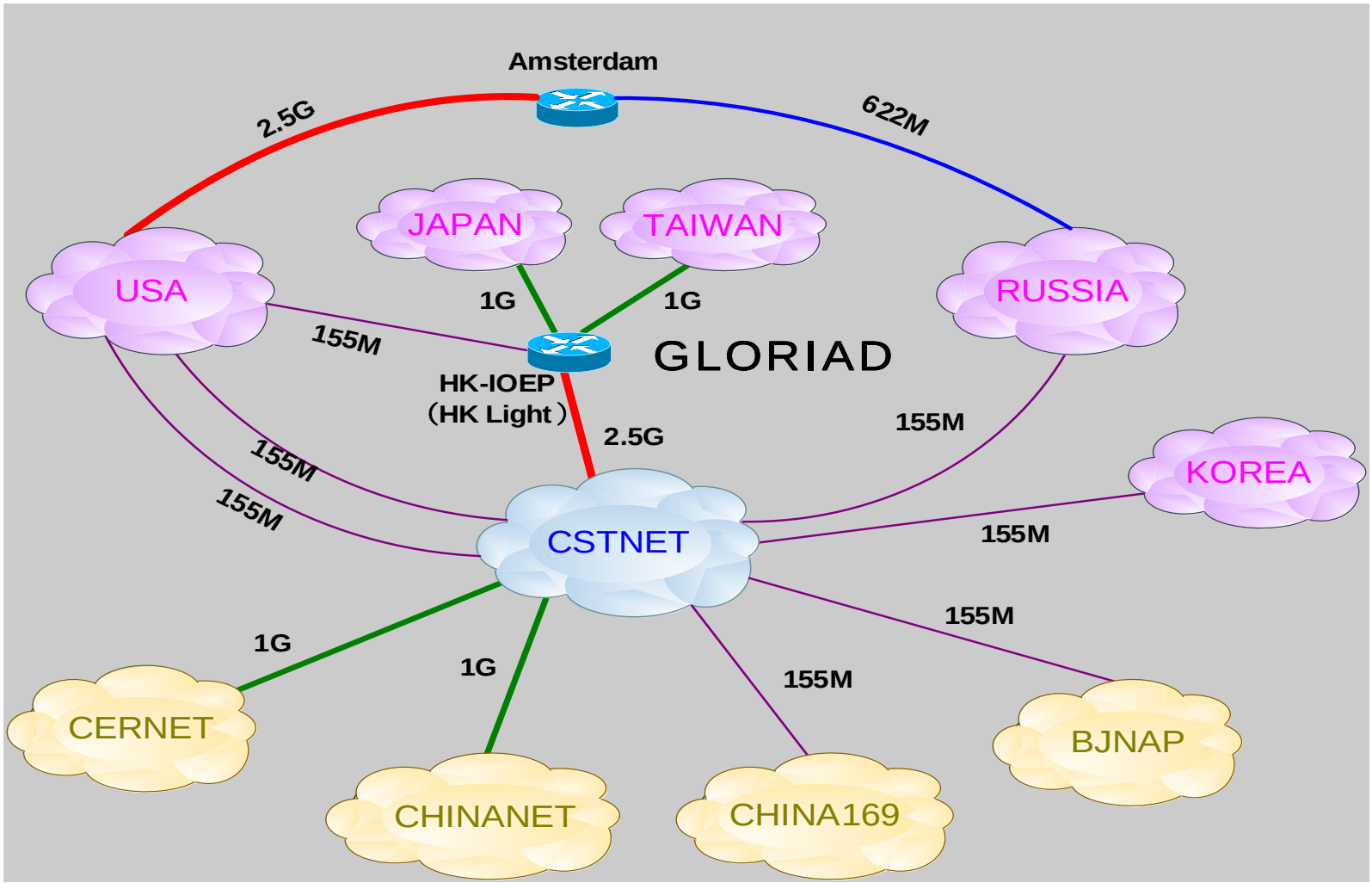
Bird View of GLORIAD



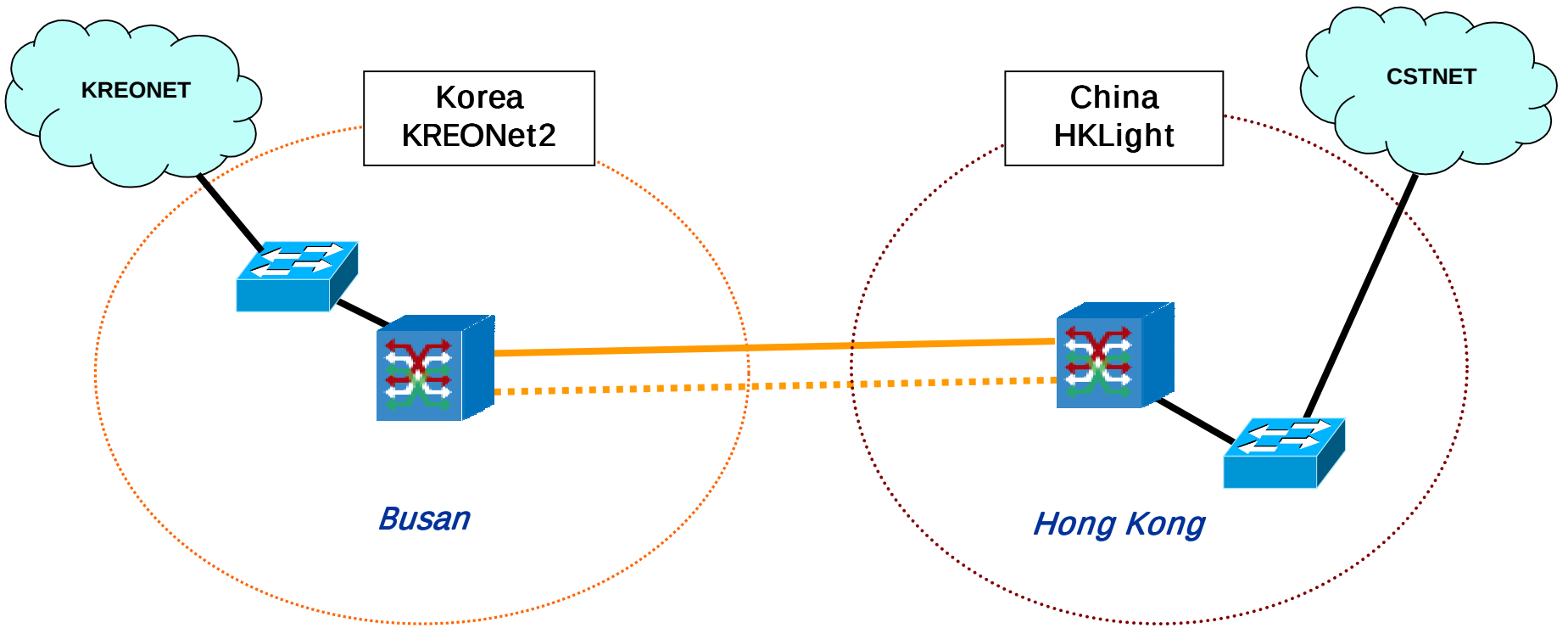
Current GLORIAD network speeds



HKLight current connectivity



HKLight-Korea Connection Plan



MSPP

10 GigE switch or switch router or router

10G primary (SONET/SDH)

10G backup (SONET/SDH)

10 GigE

Cooperation between GLORIAD and APAN

与日本APAN及美国Transpac会　2003年12月5日中国科学院院部

CAS IPv6 Applications

- CAS is working on IPv6 applications for:
  - grid computation
  - scientific data grid
  - high energy physics
  - virtual observatory
  - remote sensing
  - geoscience
  - web based public science education
  - e-science
  - CADAL
  - ......

Large Hadron Collider （大型 子 撞机）

能量: 14 TeV (子- 子)

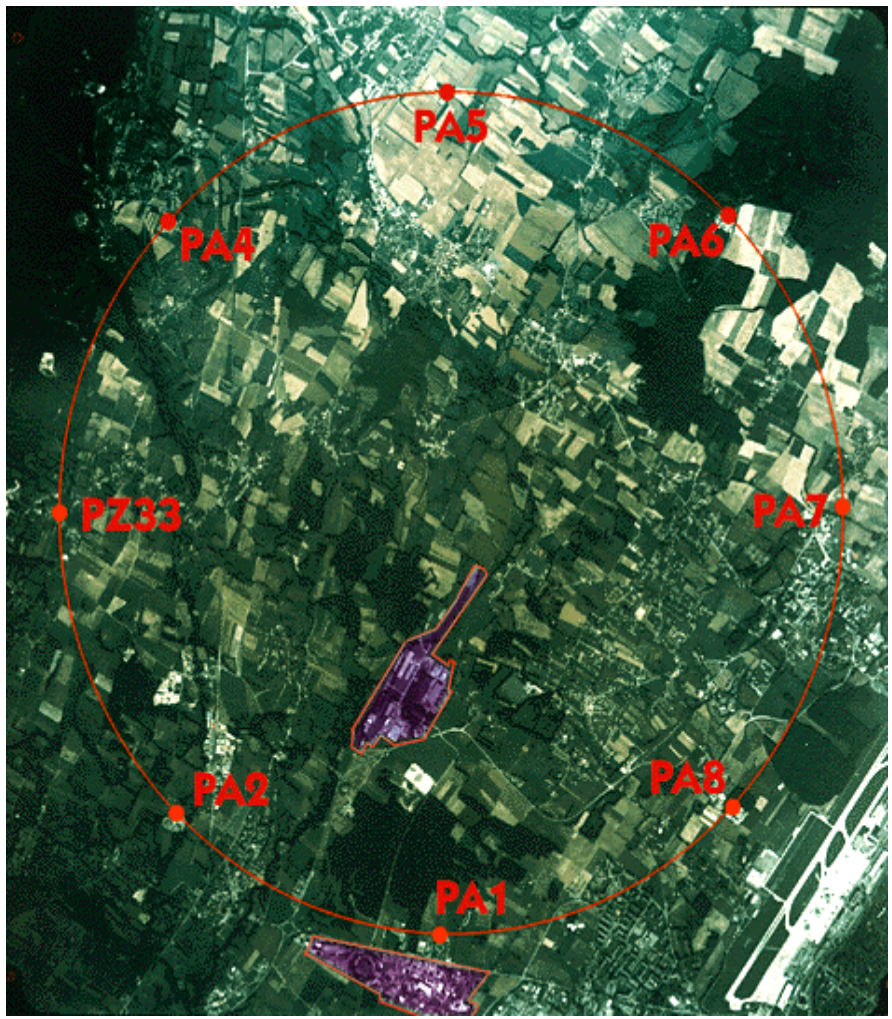
1250 TeV (核- 核)

亮度: $10^{34}\,cm^{-2}s^{-1}$ (子- 子)

$10^{27}\,cm^{-2}s^{-1}$ (核- 核)

周 : 26.6 km

主要 : 4个



LHC's Reqiuement of Computation Capability

Data storage –

raw data 0.1 – 1 GByte/sec

equivalent to 5-8 PetaBytes/year

required disk 10 PetaBytes

Processing capability –

200,000 fastest PC

Cosmic ray air-shower array detector

China-Japan Collaboration Yangbajing , Tibet 4300m a.s.l.

ARGO Experiment Hall: RPC carpet
IHEP-INFN collaboration, Yangbajing

一　数据

是供者

巡天
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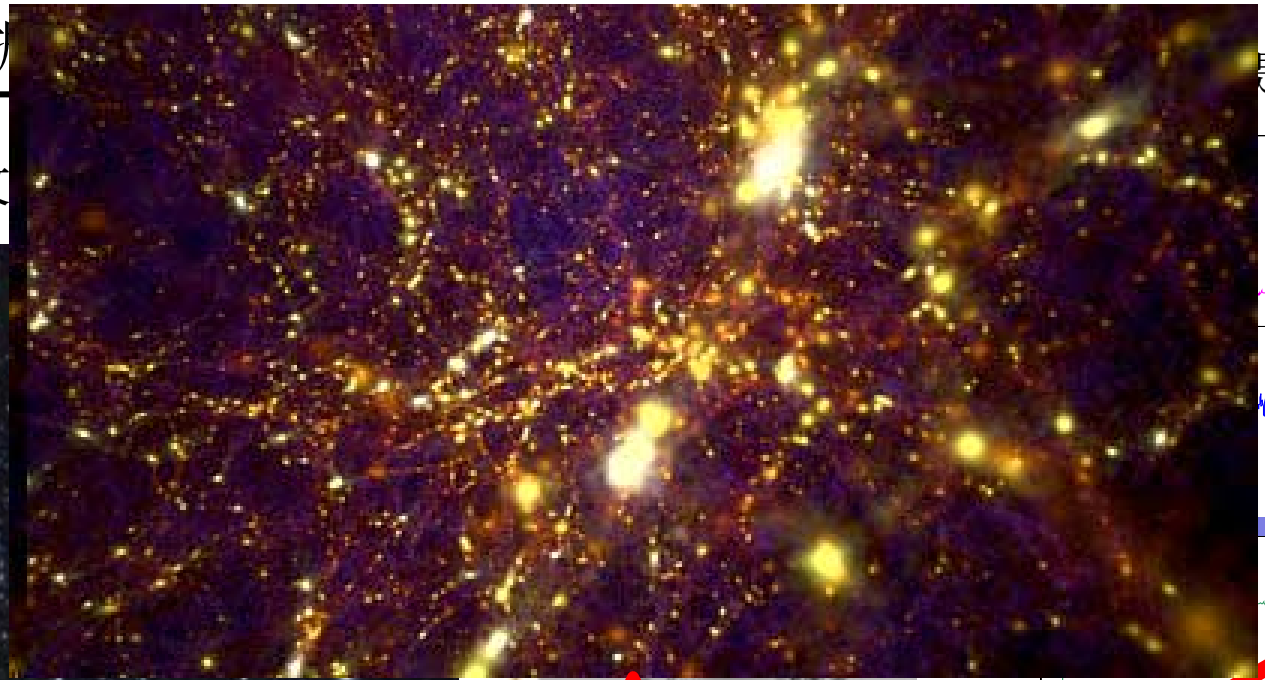
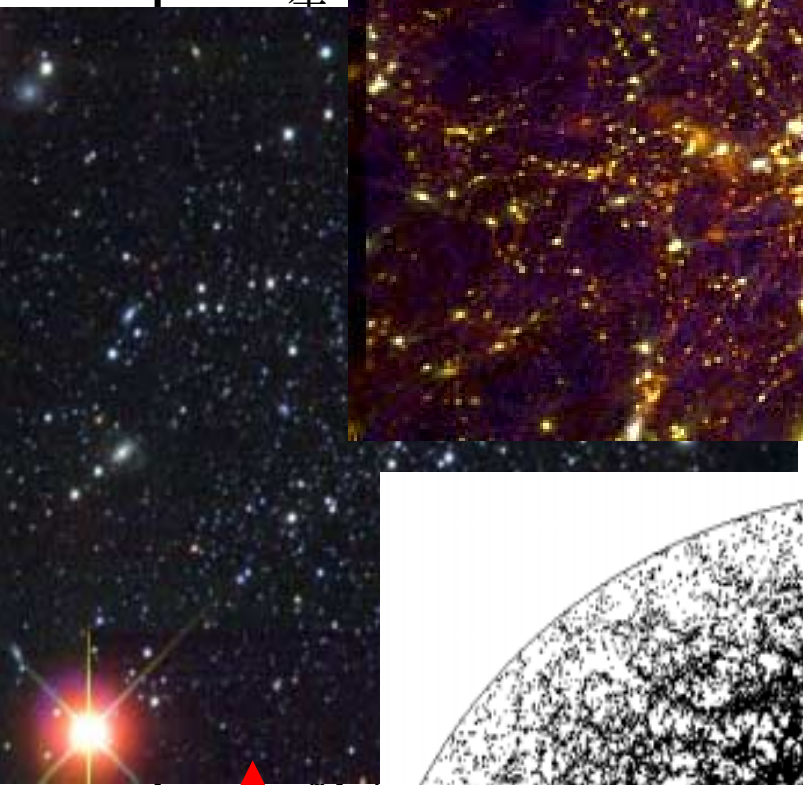
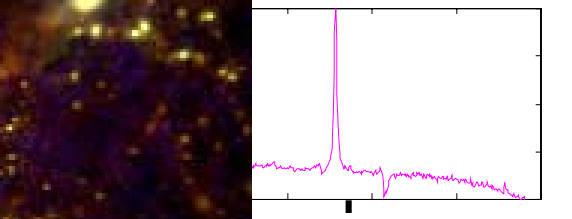
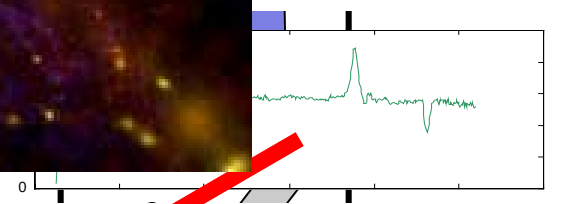
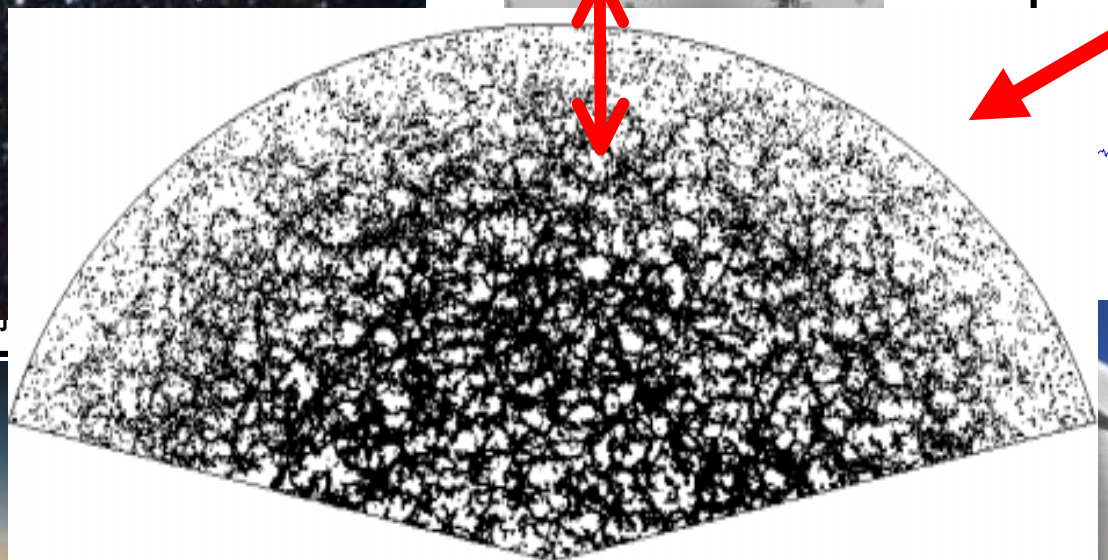
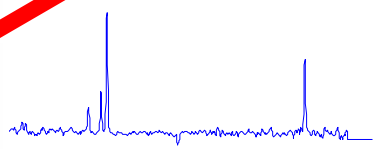


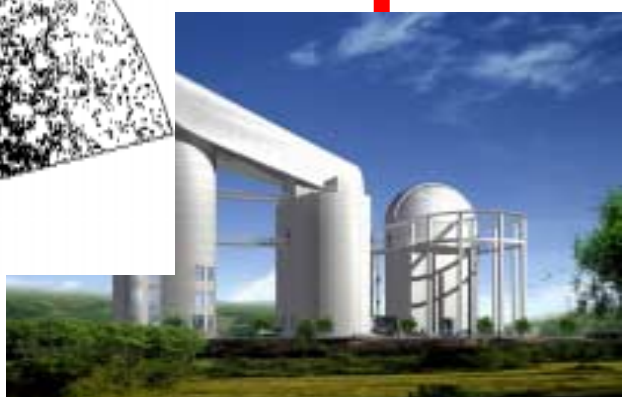












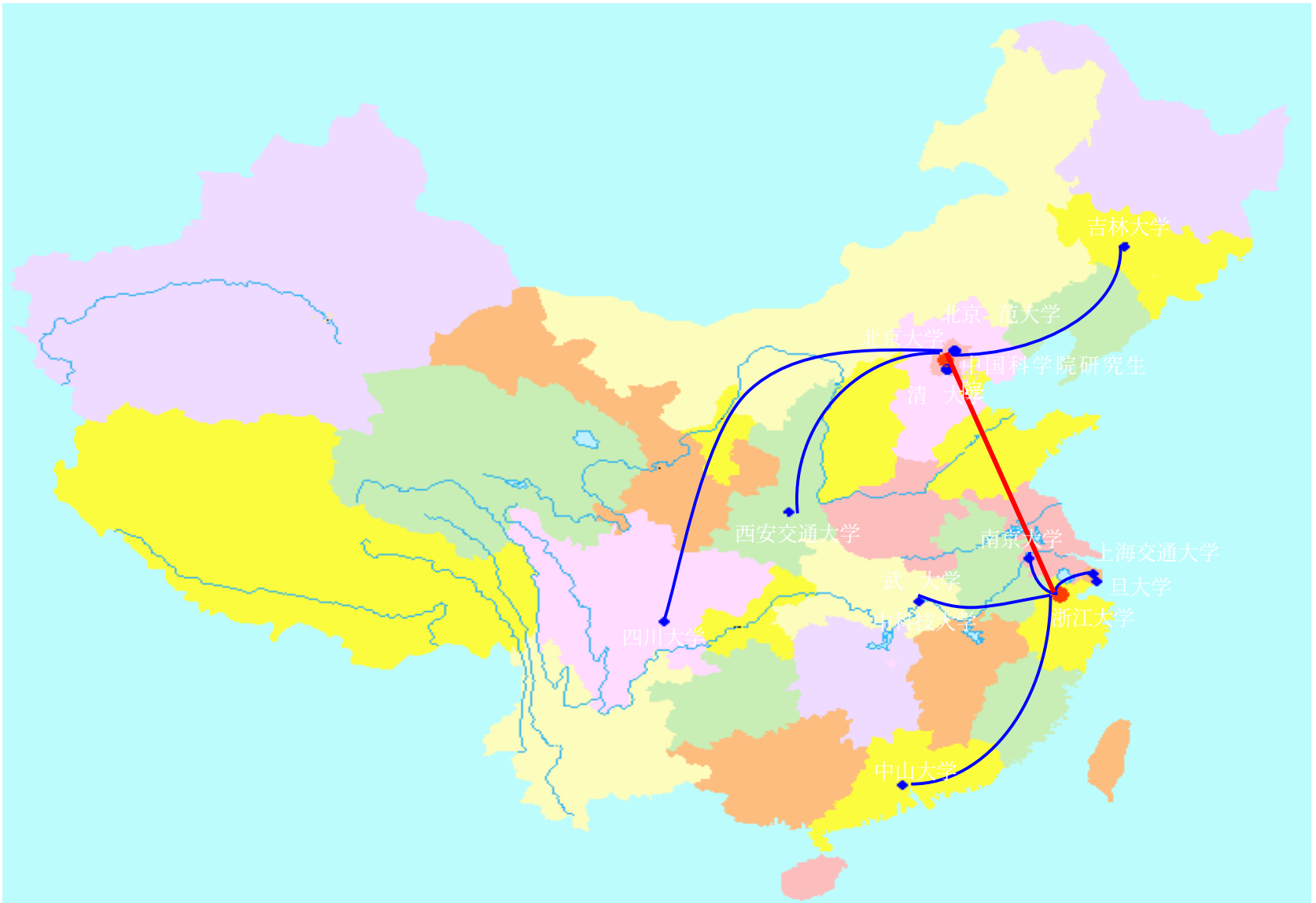
(美国)

(中国)

CADAL

1. China-US Million Book Digital Library Project
2. Graduate School, Chinese Academy of Science (GSCAS)
    1. one of leading sites
    2. north node
    3. partners: Peking University, Zhejiang University, …

The China-US Million Book Digital Library Project



CADAL - Data Volume

1. scanned images:
    1. 1 million books, 375 pages/book, 100+ KB/page → 40TB
    2. both original and processed images → 80TB
2. text:
    1. 1500 characters/page → 1TB
    2. count in index, → 2TB
3. multimedia:
    1. arts, audio/video, cultural heritage → 10TB
4. Total: ~100TB

- Universities working on
  - distance education
  - protein analysis
  - real time video applications
  - APAN
  - and so on
- Carriers working on commercial use

Conclusion

1, Killer application is the key factor in IPv6 deployment,

2, Dual stack is very important for transition from IPv4 to IPv6

3, Compared with early day's IPv4 network, IPv6 is more difficult to grow from its cradle

4, Most of the IPv6 activities in China are still concentrated on trial, research, showcases, experiments, and development. It is still a long way to go for actual use of the IPv6 network

5, IPv6 deployment and applications in China are for behind Japan, North America, and Europe

Thank you