

8th Global LambdaGrid Workshop

Optical Network Facilities for e-Science at CAS

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Deputy Secretary-General

Chinese Academy of Sciences (CAS)

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Outline

- **The CAS**
- **The Present of Cyber-
infrastructures/Optical networking
facilities**
- **The Future**
- **Conclusions**

CAS: History & Position

Founded on 1 Nov 1949

Highest academic institution in natural sciences in China

Most comprehensive R&D center in natural sciences and high-tech development

Highest national advisory body in S&T



1949



各地：除北京地区外，在上海、南京、合肥、长春、沈阳、武汉、广州、成都、昆明、西安、兰州、新疆设有分院12处。

NOW

Organizational Structure



中国科学院
CHINESE ACADEMY OF SCIENCES

President

Vice-presidents

Secretary General, Deputy Secretary General

**Presidium of
the Academic Divisions**

**Executive Committee of
the Presidium**

Research Institutions

Education Units

High-tech Enterprises

Supporting Units

Bureau of Basic Research

Bureau of High-tech Research and Development

*Bureau of Science and Technology
for Resources and Environment*

Bureau of Life Science and Bio-technology

Bureau of Domestic Cooperation

Bureau of General Affairs

Bureau of Personnel and Education

Bureau of Planning and Finance

Bureau of Planning and Strategy

Bureau of Supervision and Auditing

Bureau of Capital Construction

Bureau of Retirement Affairs

Bureau of Academic Divisions

**Division of
Mathematics & Physics**

Division of Chemistry

Division of Biology and Medicine

Division of Earth Science

**Division of
technological Sciences**

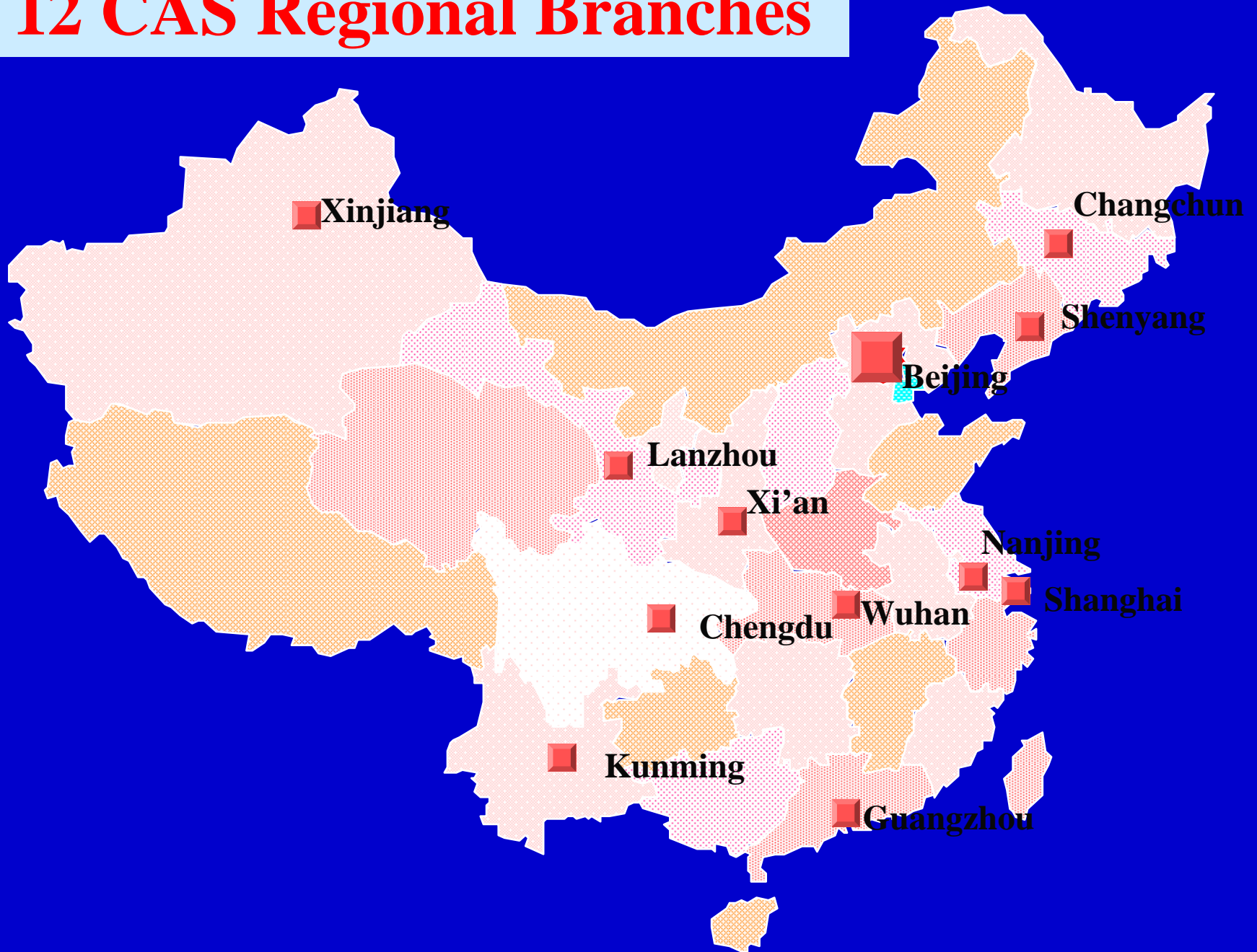
Division of Information Science



Facts & Figures

- **6 Academic Divisions**
- **95 research institutes**
- **75 national (state) laboratories**
- **110 field research stations**
- **435 spin-off companies (e.g., Lenovo)**
- **1 university+ 1 graduate school**
- **Total staff : 47,300**
- **PG students: 43,000**
- **12 regional admin branches**

12 CAS Regional Branches





CAS Position in China's S & T System

Play a leading role in -

- national knowledge innovation
- fostering outstanding talents
- R & D of advanced technologies
- national S & T consultation
- scientific knowledge dissemination

International Collaboration



中国科学院
CHINESE ACADEMY OF SCIENCES

On an equal basis and for mutual benefits

- **Cooperation between scientists**
- **Bilateral scientific agreements**
- **High-level bilateral workshops or N+N meetings**
- **Project-based partner groups**
- **Joint centers, labs, or institutes**
- **Partnership with industries**
- **From bilateral to multilateral cooperation**

Key CAS Cyber-Infrastructures

Other Infrastructures



e-CAS

Internet Based Science Popularization Platform

Information Dissimilation Platform

VRP (Virtual Research, or e-Science) Platform

e-Education and e-Training Platform

ARP (Academy Resource Planning) Platform

Info and Network Security

Rules and Regulations

Supporting and Service

CAS
Computer Network Information Center
(CNIC)

```
graph TD; A["CAS  
Computer Network Information Center  
(CNIC)"] --- B["e-Science Center"]; A --- C["Database Center"]; A --- D["Supercomputing Center"]; A --- E["Academy Resource Planning Center  
(ARP Center)"]; A --- F["CSTNet Operation Center"];
```

e-Science Center

Database Center

Supercomputing Center

Academy Resource Planning Center
(ARP Center)

CSTNet Operation Center



CSTNet



□ **CSTNet: China Science & Technology Network** (<http://www.cstnet.net.cn>)

□ **The first research network in China**

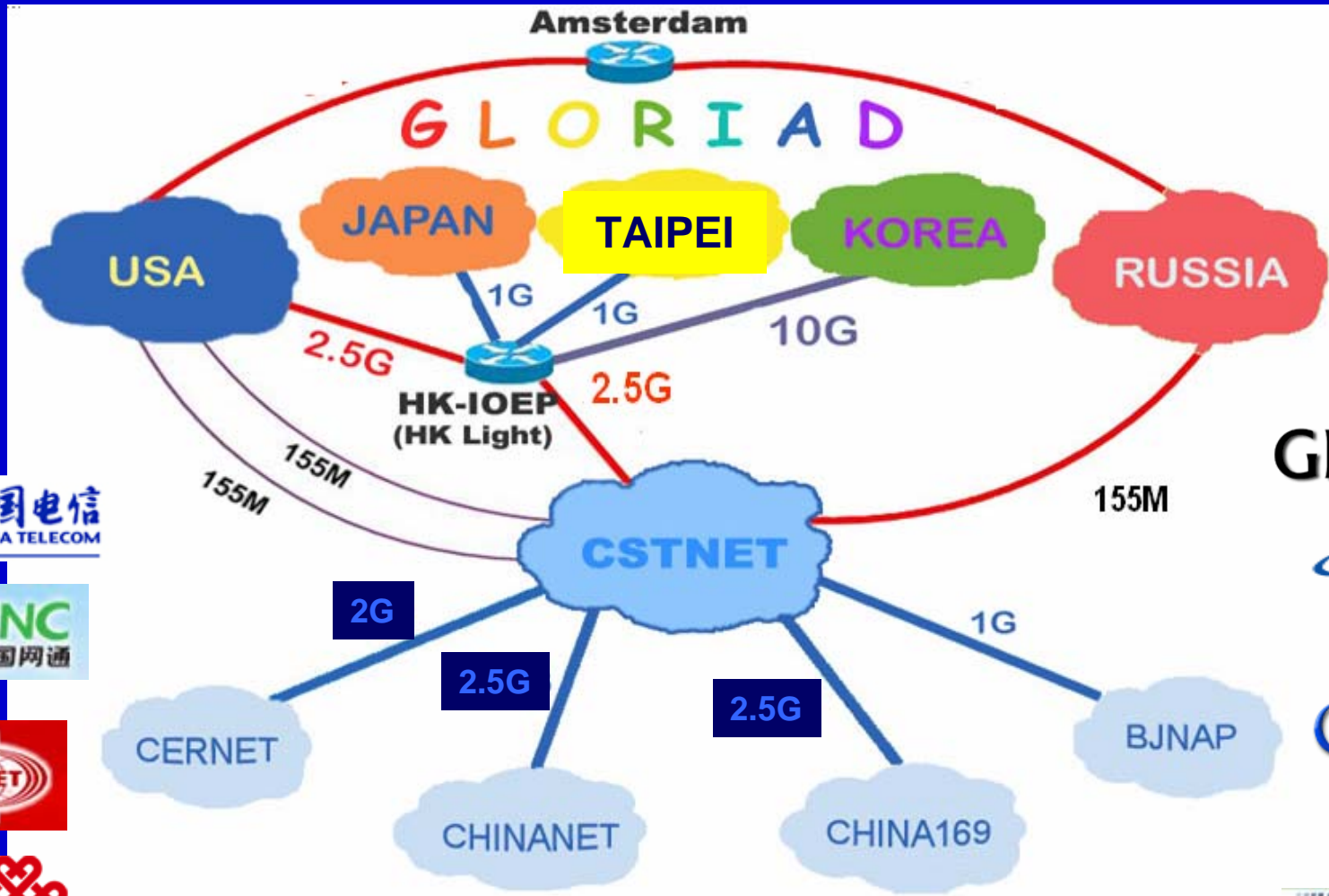
□ **The core network facility for the CAS**



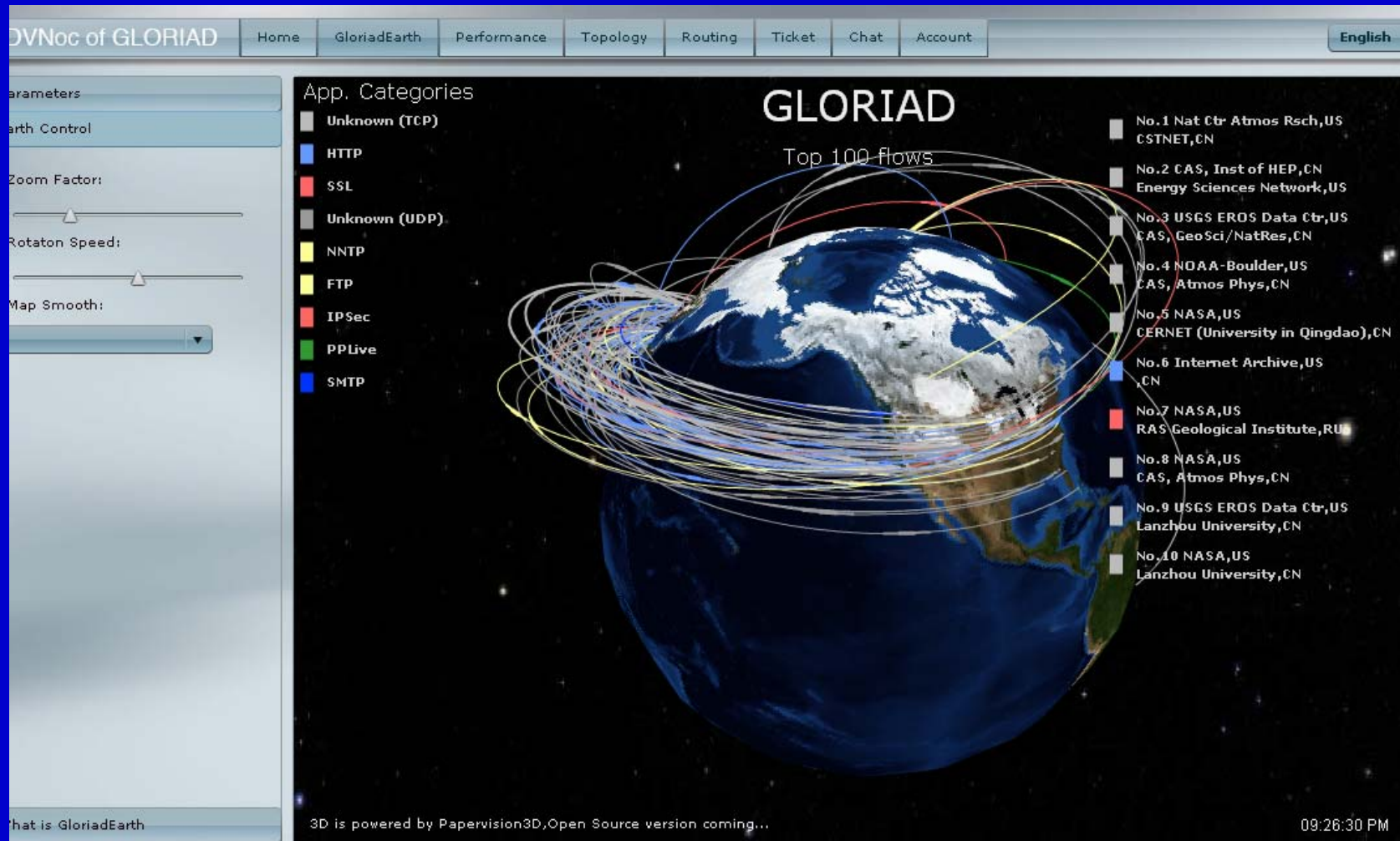
CSTNet Topology



CSTNet Connections



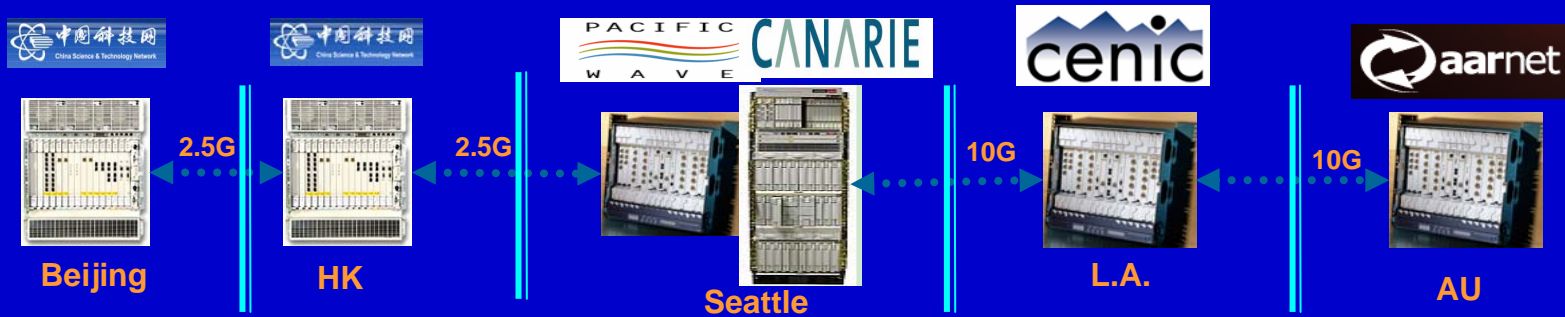
Gloriad DV-NOC



<http://dev.gloriad.org:8080/viz/dvnoc/dvnoc.html>

Light Paths for e-VLBI at CSTNet

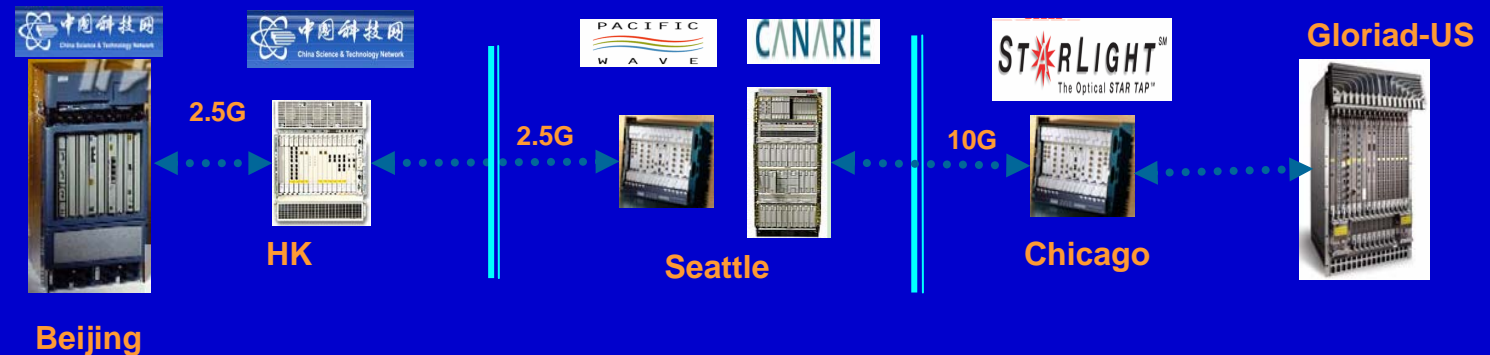
CN-AU eVLBI
Jun. 2008



CN-EU eVLBI
Aug. 2007



CN-US Gloriad
May 2006



e-VLBI Participants



Real-time e-VLBI data demo



24th Xi'An APAN meeting Aug 2007



Participants and Projects

The Pacific Wave Layer-2 facilities are being used by many networks to further research and educational goals and initiatives. For a list of Application Projects, see Application Projects.

New Pacific Wave Participants

- AARNET in Los Angeles (1 GIGe)
- UNINET in Los Angeles (1 GIGe)
- Google in Los Angeles, Sunnyvale and Seattle (1 GIGe in each location)
- Softbank Telecom (Japan Telecom) in Los Angeles and Sunnyvale (1 GIGe in each location)

For a complete listing of Pacific Wave Participants, see Current Participants.

Featured Project

Real-time e-VLBI data correlation

The e-VLBI community is using facilities of Pacific Wave and several different Pacific Wave participants to conduct real-time e-VLBI (electronic very long based interferometry) correlations from international telescopes. An example of this was the recent EXPreS project (Express Production Real-time e-VLBI Service) which conducted the first successful real-time correlation of e-VLBI data from Chinese and Australian telescopes, from Chinese and European telescopes, and from Australian and European telescopes. The observation was demonstrated before advanced networking experts at the 24th APAN (Asia-Pacific Advanced Network) Meeting in Xi'An, China.

For more information see [First e-VLBI data from China, Australia, China-Europe, Australia-Europe](#)

For archived featured projects, see Archives.

About

Participants and Projects

Application Projects

Current Participants

Partners

TransLight/Pacific Wave (NSF-IRNC)

About

Milestones and Achievements

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How to Connect

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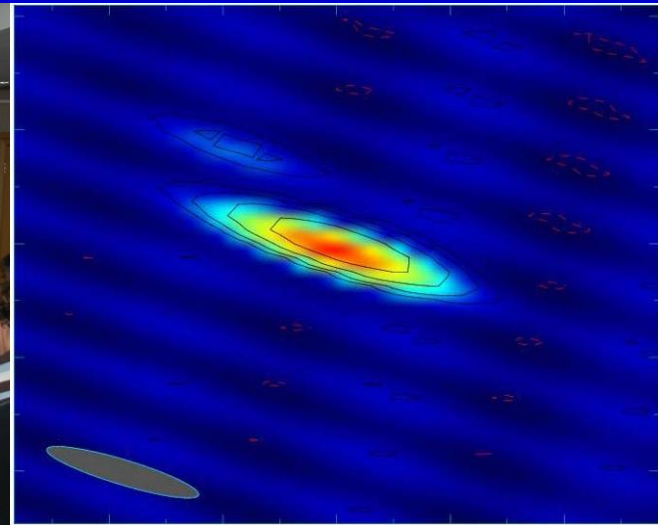
Events and Conferences

Presentations

Contact Us

AU light path application for e-VLBI

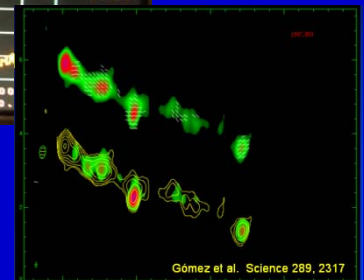
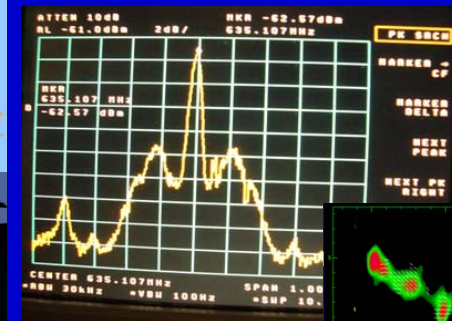
(Shanghai, June 2008)



Astronomy— Real-time VLBI



Real-time VLBI in the Chinese lunar "Chang E" project



Collaborative Research for HEP

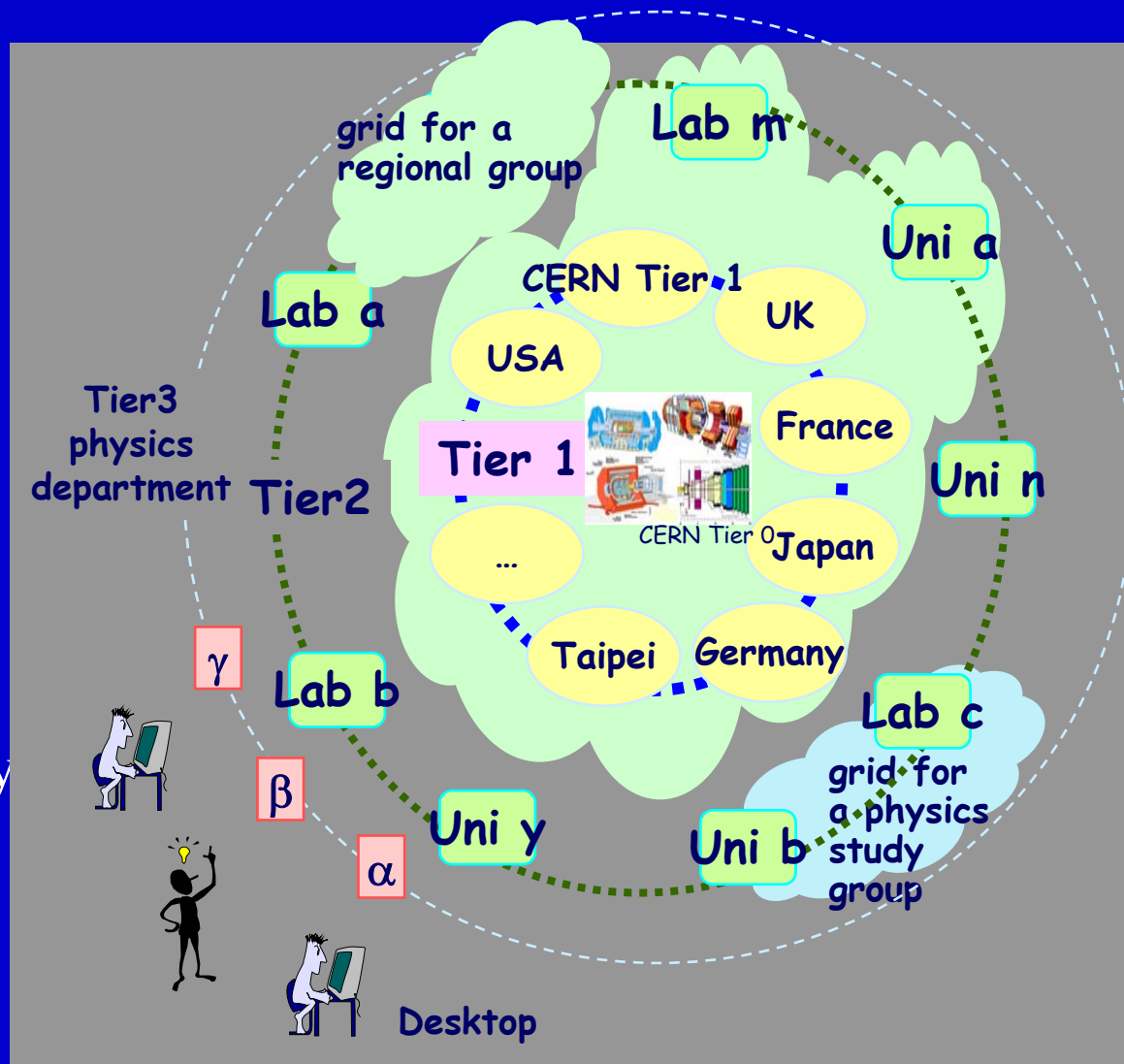
□ LHC – Institute of High Energy Physics joins CERN's Grid as Tier2

□ 20 Applications in 10 Areas

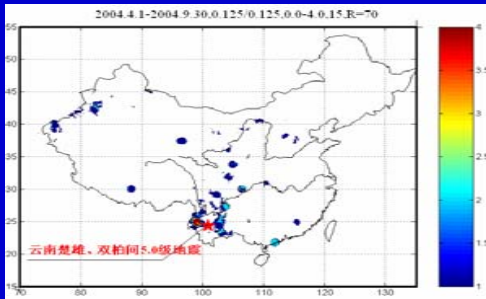
– BEPC-2 / BES-3

– YangBaJing Cosmic Ray Observatory

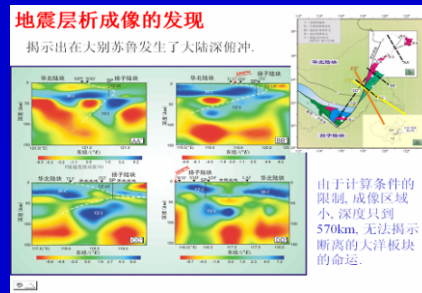
– ...



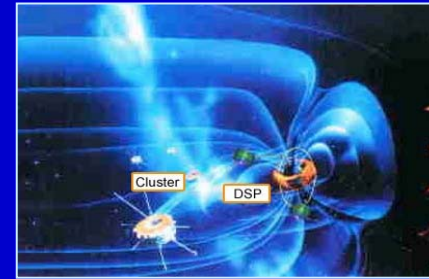
Some e-Science Applications



Earthquake prediction



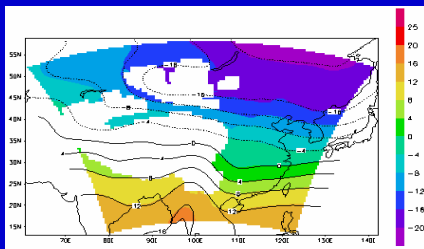
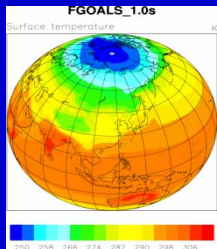
Earthquake Pattern Analysis



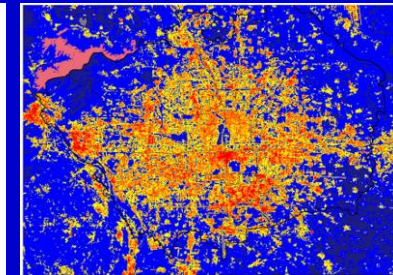
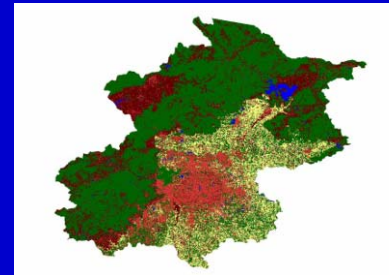
Disaster Atmosphere Prediction



VLBI Application



Global Climate Prediction



Beijing Ecology Pattern and Urban Planning



3D structure of Avian Influenza Virus

New Requirements and New Challenges

□ Supercomputing grid: >200Tflops

- Main Center (CNIC) : >130Tflop
- Sub-centers: 10-20Tflops
- Constructing a CAS grid through high speed network, as part of the national grid (CNGrid), as well as part of the international grid,

□ Data center: >6PB

- On-line services, mirroring, backup,
- Mass data migrating on the high speed network

- Large-scale scientific equipments:
Shanghai Light Source, LAMOST,
Tokamak device, ...**
- Need to expand connection with more
heterogeneous, professional and research
networks, i.e. Chinese medical and
health network, Chinese environmental
science network, ...**
- Networking of numerous field research
stations**
-**

Field Stations for Geo-science Domain of CAS Distributed in China (> 100)

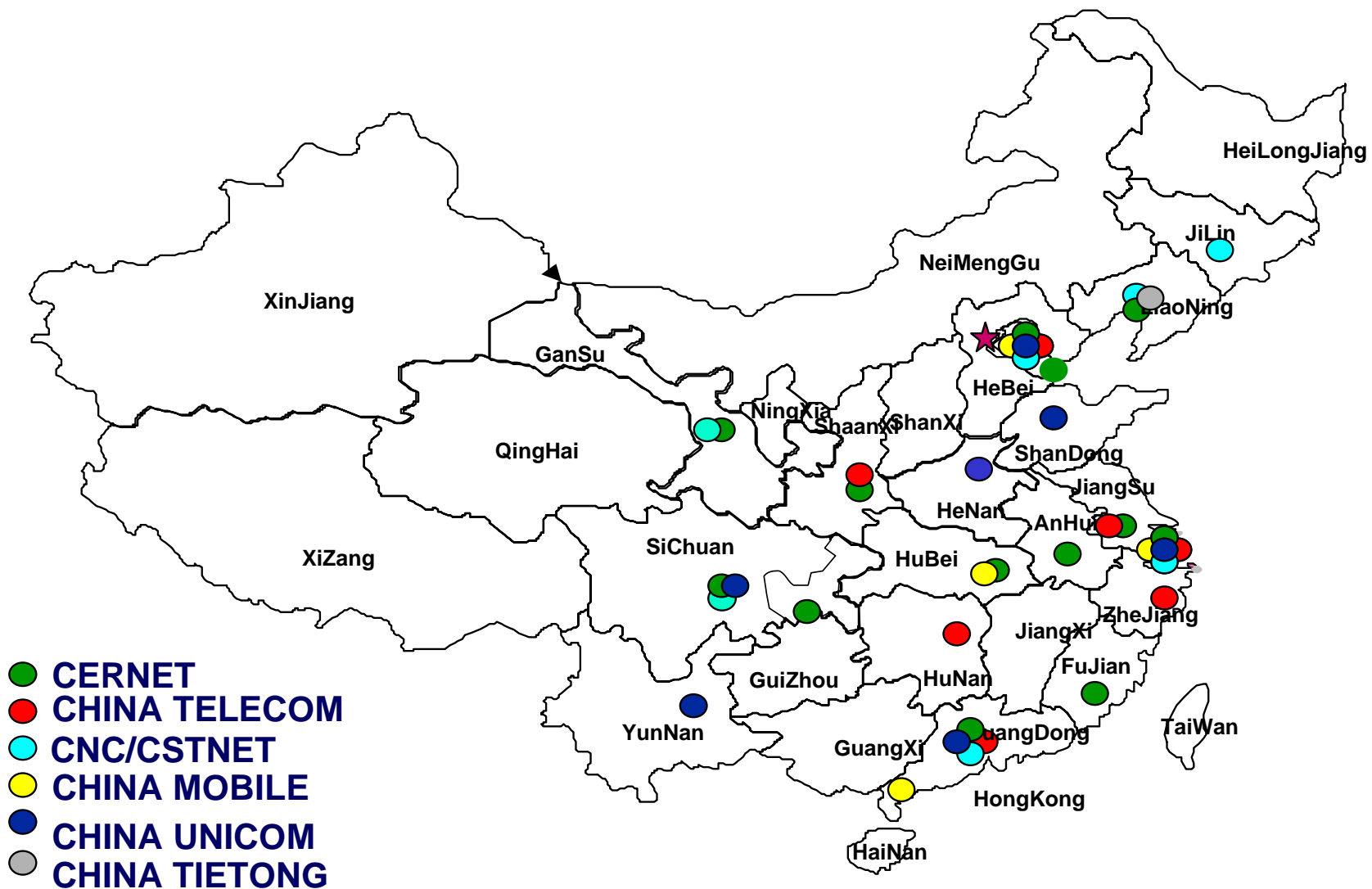
**All these call for
significantly enhanced
(optical) networking facilities**

- 大气观测站 (2)
- 地球物理站 (8)
- 特殊环境灾害站 (8)
- 海洋站

Multiple Light Paths for e-VLBI

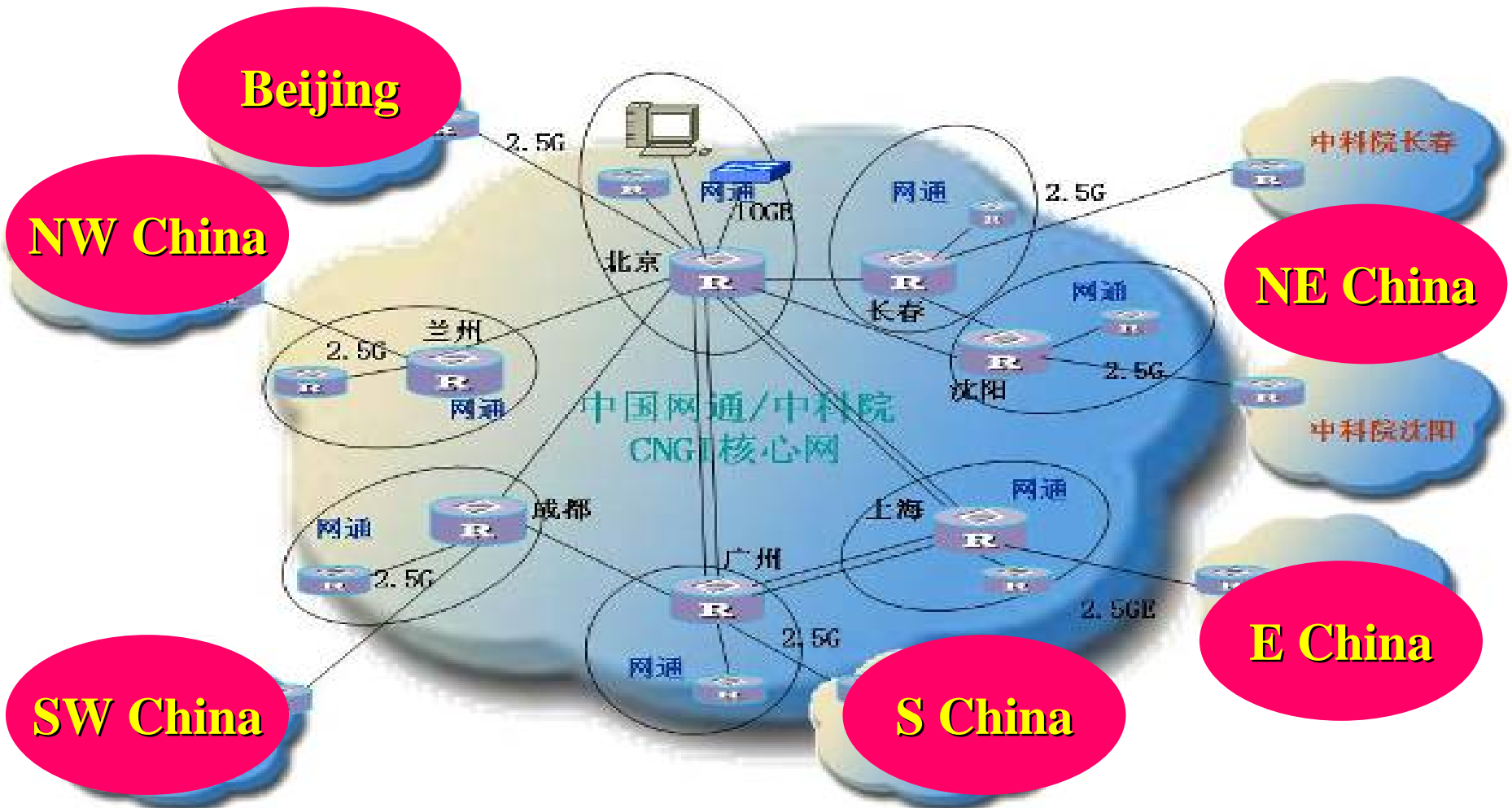


National Project - CNGI GigaPoPs

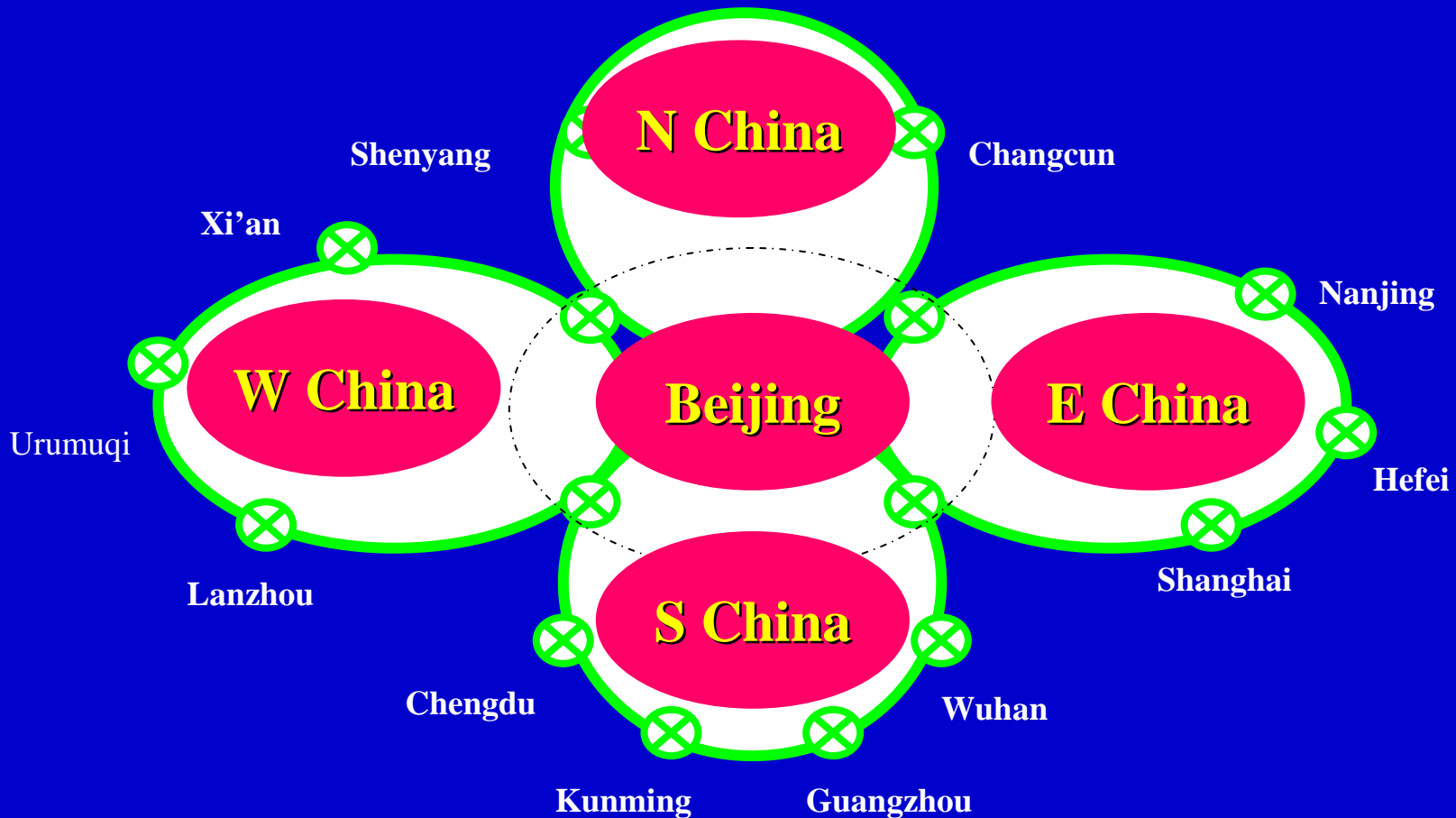


CNC/CSTNET CNGI Backbone

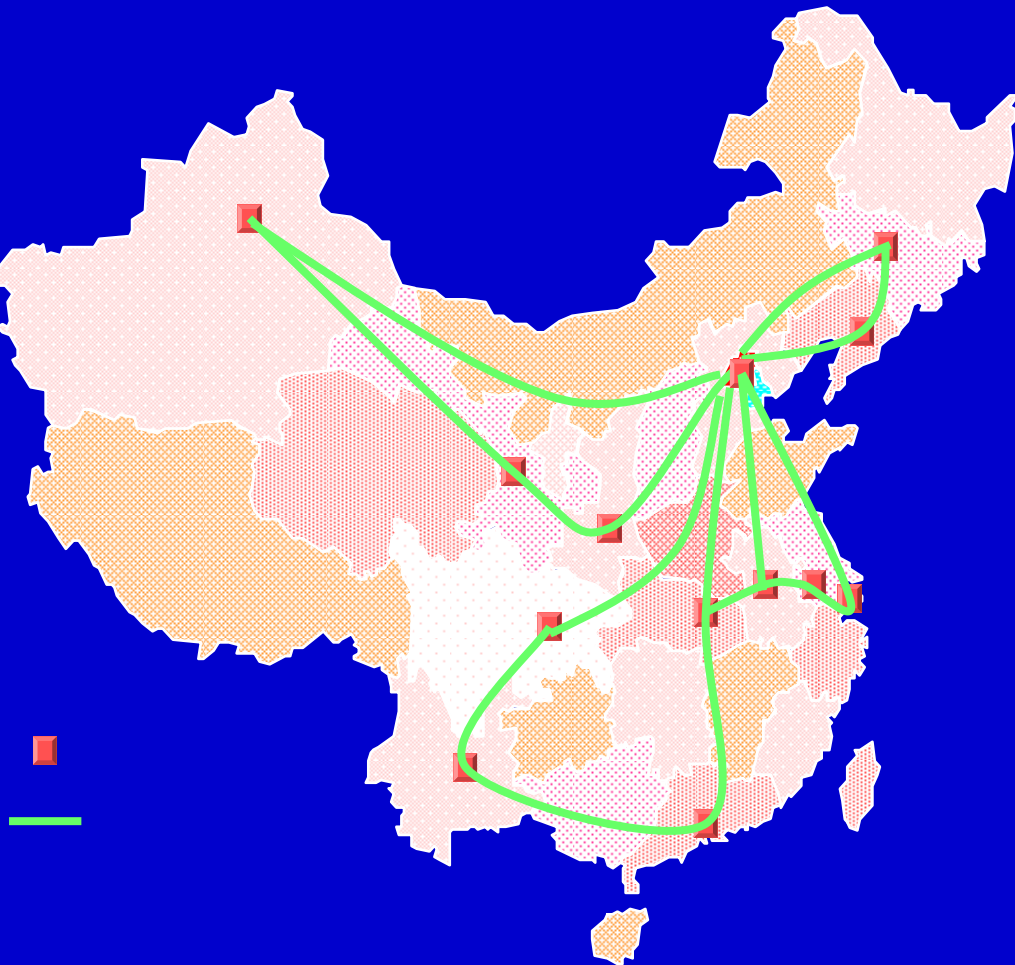
CNC/CAS CNGI Backbone



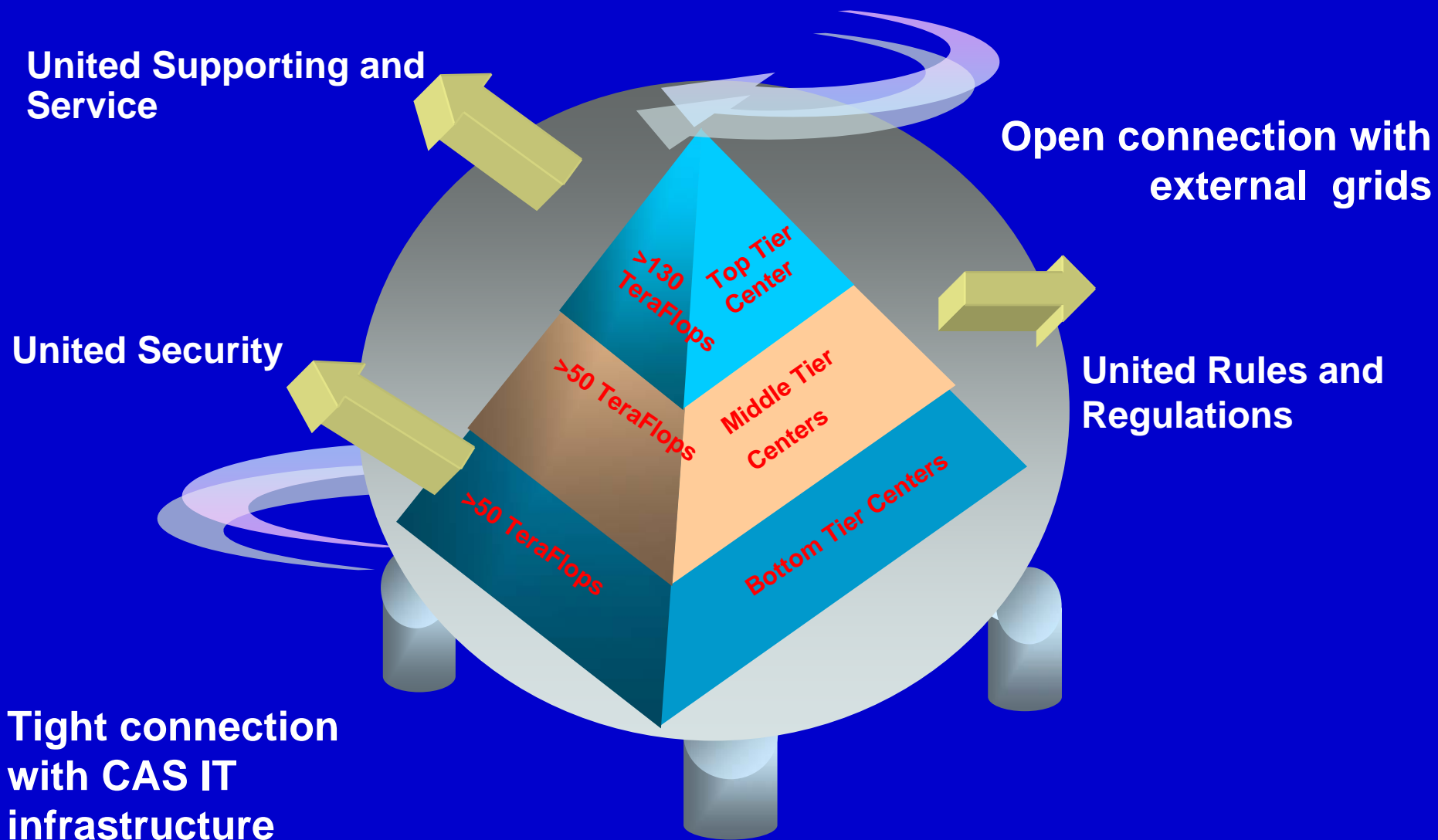
CSTNet Optical Rings



CSTNet Topology: Star + Rings



Chinese Scientific Computing Grid (CSCG)



Access CSCG



Windows / Linux Client

Computing

Data

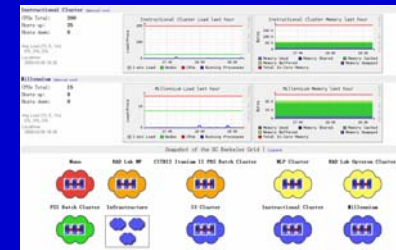
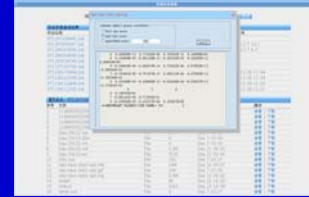
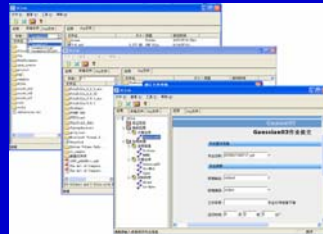
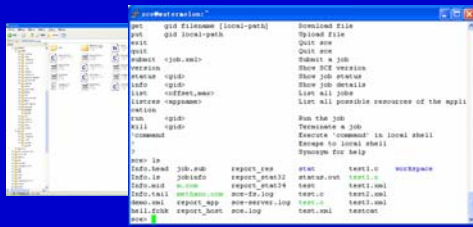
User

Administrator

Web Portal
Statistics

Computing
Application Bind

Monitoring
Bind
...



(Middleware of Grid System)



Top Tier



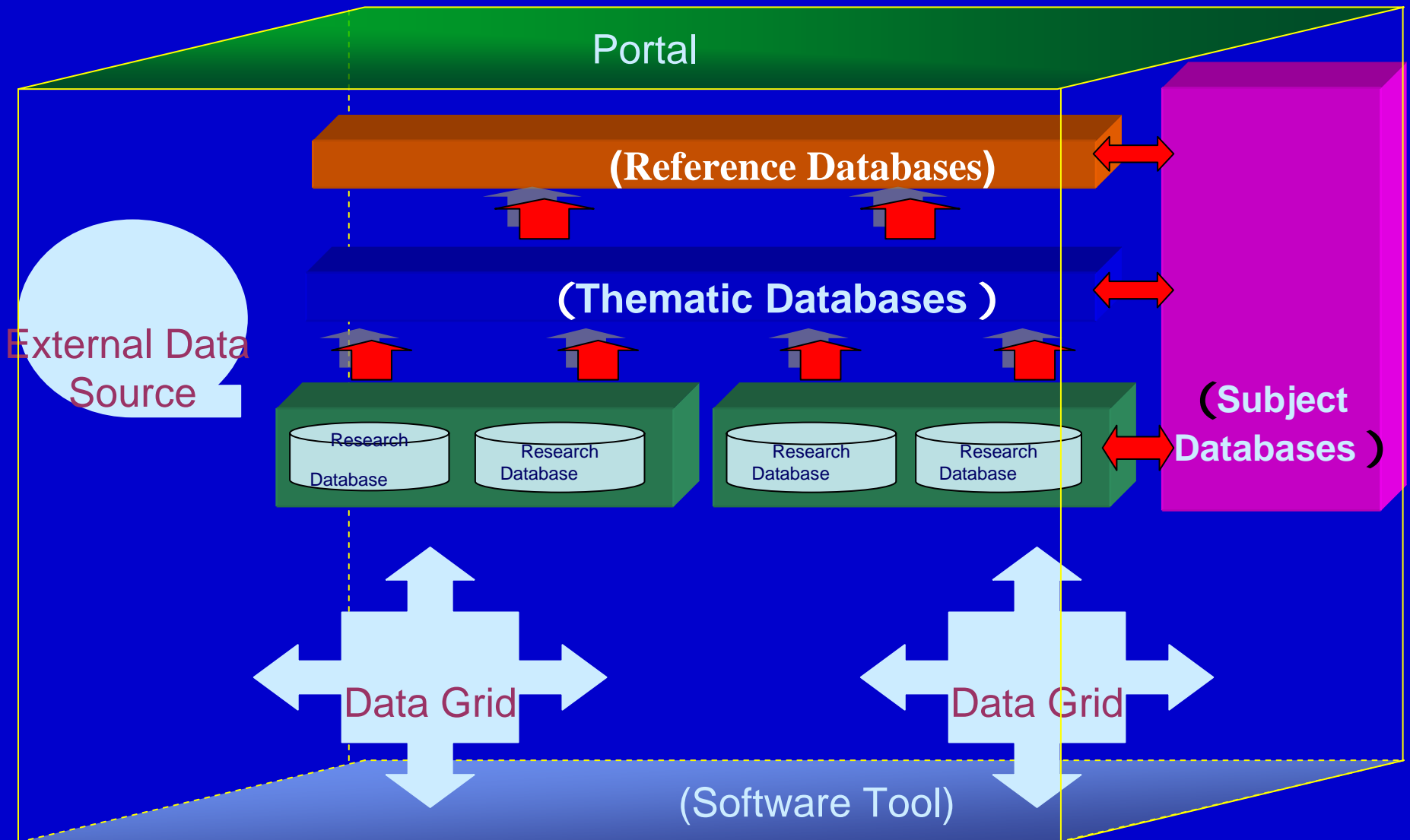
Middle Tier

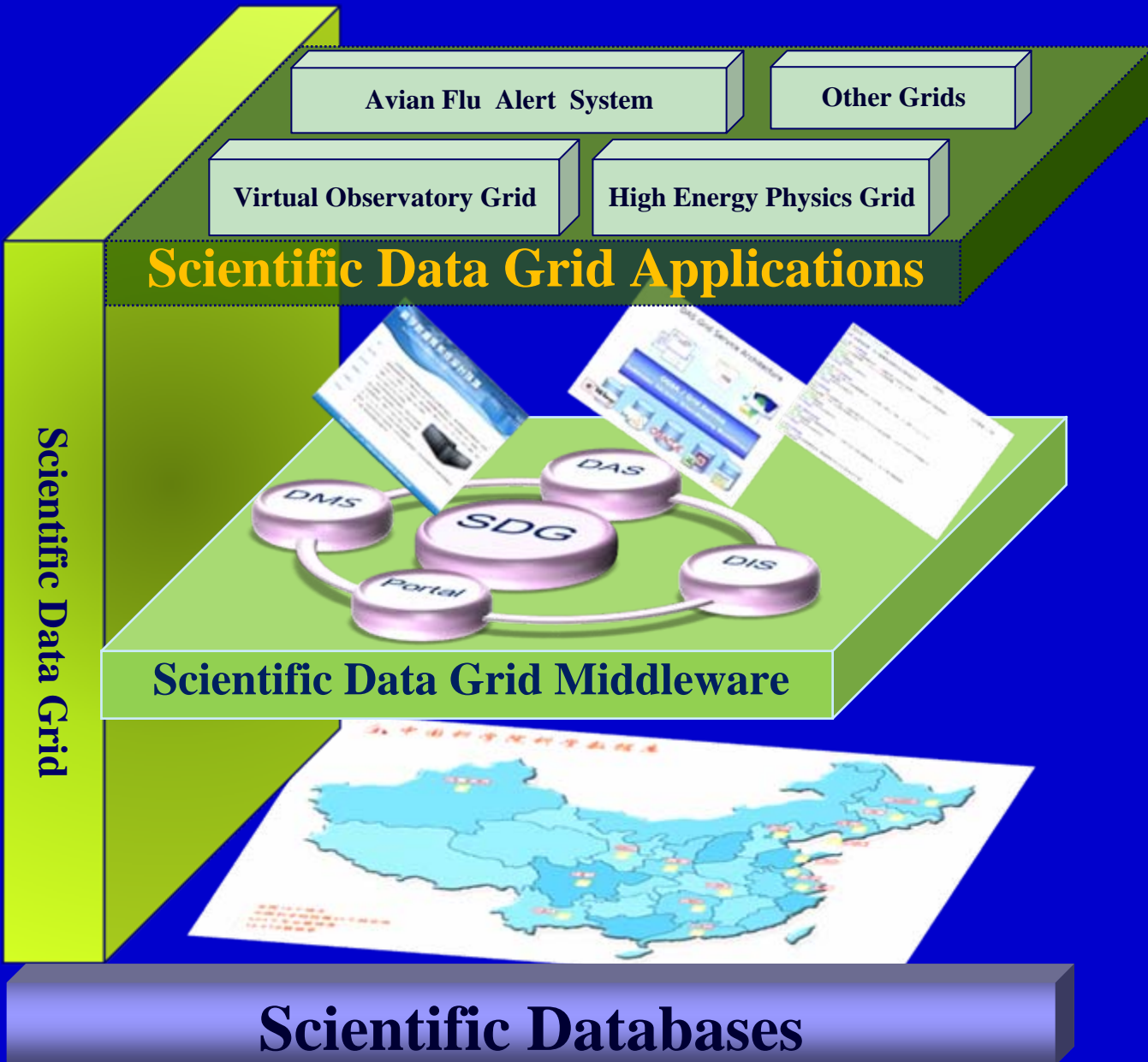


Bottom Tier

Integrated Management, Scheduling and Service

Access Scientific Databases





Conclusions

- ❑ High-end science calls for reliable and easily accessible cyber-infrastructures
- ❑ Network facilities are the infrastructure of the cyber-infrastructures
- ❑ Great efforts are being made in China to improve such facilities
- ❑ CSTNET (CAS) is spearheading such efforts
- ❑ International collaboration is a MUST in such efforts

Thanks



AARNET *Greg Wickham, Ivan Philips*



CANARIE *Eric Bernier Thomas Tam*



CENIC *Darrell Newcomb*



GLORIAD *Greg Cole*



Pacific Wave *Jacqueline Brown*



SURFnet *Kees Neggers, Erik-Jan Bos*

Wouter Huisman



StarLight *Joe J Mambretti, Linda Winkler, Alan Verlo*



Thank you

