



欧
中

HEP Grid Status in China

Rongsheng Xu
IHEP/China

ICFA DDW06, Cracow, Oct. 9-11th, 2006



Outline

- ▶ Review of IHEP Grid
- ▶ Computing requirements within next 5 years
- ▶ CA, LCG Deployment and Operation
- ▶ CMS/ATLAS/ARGO-YBJ experiments in China
- ▶ BES Grid Consideration
- ▶ China Grid projects
- ▶ Future Plans

Review of IHEP Grid

- ▶ China is one of the fastest growing economies in the world with a specific infrastructure for Science GRID, such as CNGrid, etc.
- ▶ July 2001, IHEP started studying on Grid
- ▶ Dec 2003, IHEP set up LCG test model
- ▶ Jun 2004, IHEP Grid project supported by China NFS (CrownGrid)
- ▶ Jan 2006, IHEP jointed EUChinaGRID project
- ▶ Feb 2006, IHEP signed MOU with CERN to be WLCG Tier2 site for CMS and Atlas
- ▶ Jun 2006, IHEP held EUChinaGRID 1st Project workshop



HEP experiments in China



Tibet – **ARGO-YBJ**
 Unique High Altitude
 Cosmic Ray Laboratory (4300 m)

Beijing - **IHEP**
 BEPC/BES
 Tao/Charm factory

Experiments' Data within 5 years

BES:

4960TB (tape lib. + Disk cache) for raw, rec., MC,
MC-rec., DST.

Atlas & CMS:

500TB (Disk cache) for Rec., MC, AOD, ESD, tag.

Argo:

240TB (Tape + dcache) for raw, MC., rec., ntpl.

DayaBay...

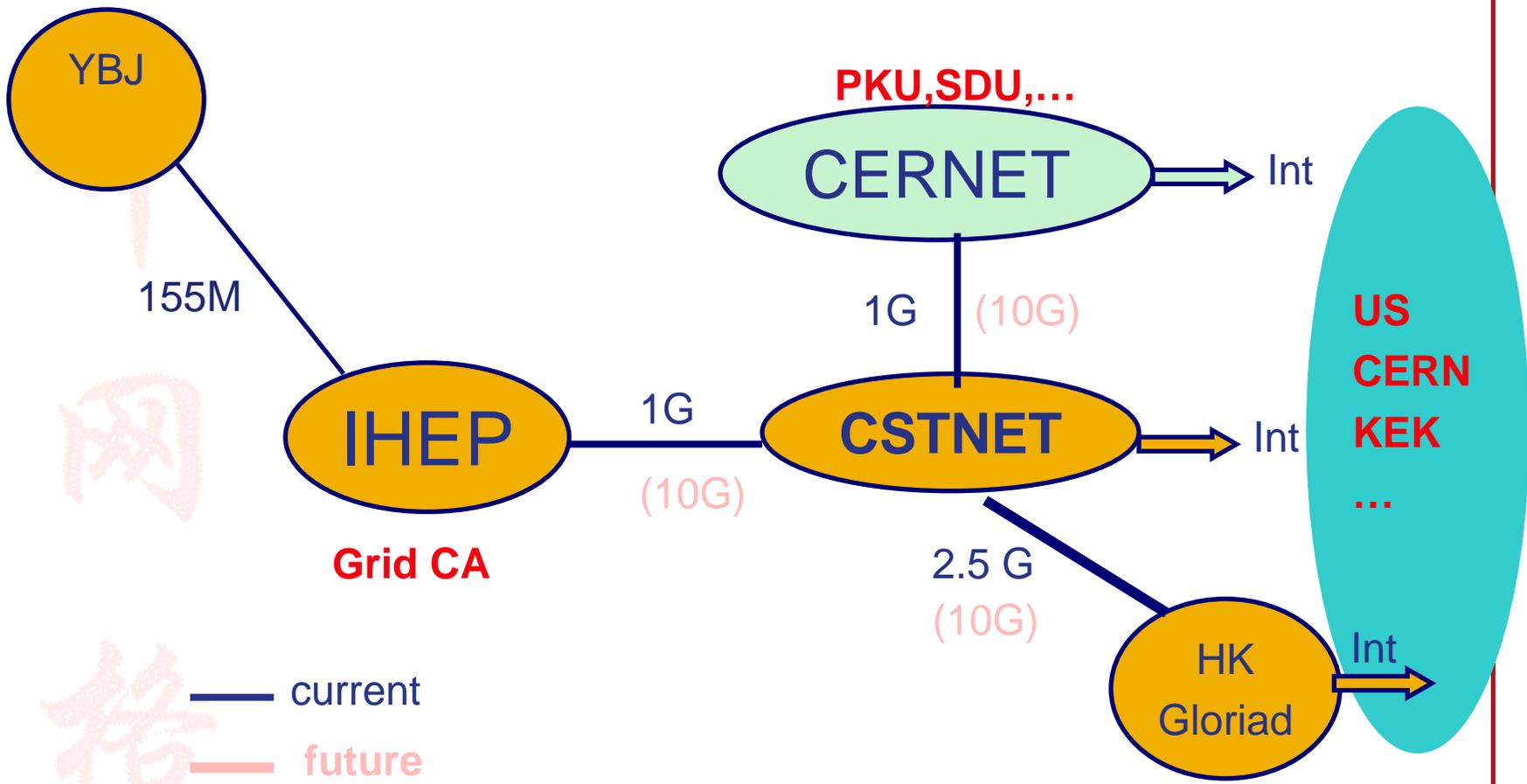
Computing requirement

- ▶ Data processing & re-processing and MC. Rec. analysis.
 - BES: **1504** KSI2K.
 - LHC Atlas & CMS: **1000** KSI2K respectively.
 - ARGO: **400** KSI2K.
- ▶ Total: 4000 KSI2K (4000Xeon 3.0 CPUs).

Network Infrastructure Requirement

- ▶ 2.5Gbps international link to CERN for Atlas & CMS /LHC transfer.
- ▶ 1 Gbps for BES collaboration among domestic universities and institutes.
- ▶ 155Mbps for ARGO experiment physics analysis between China and Italy.

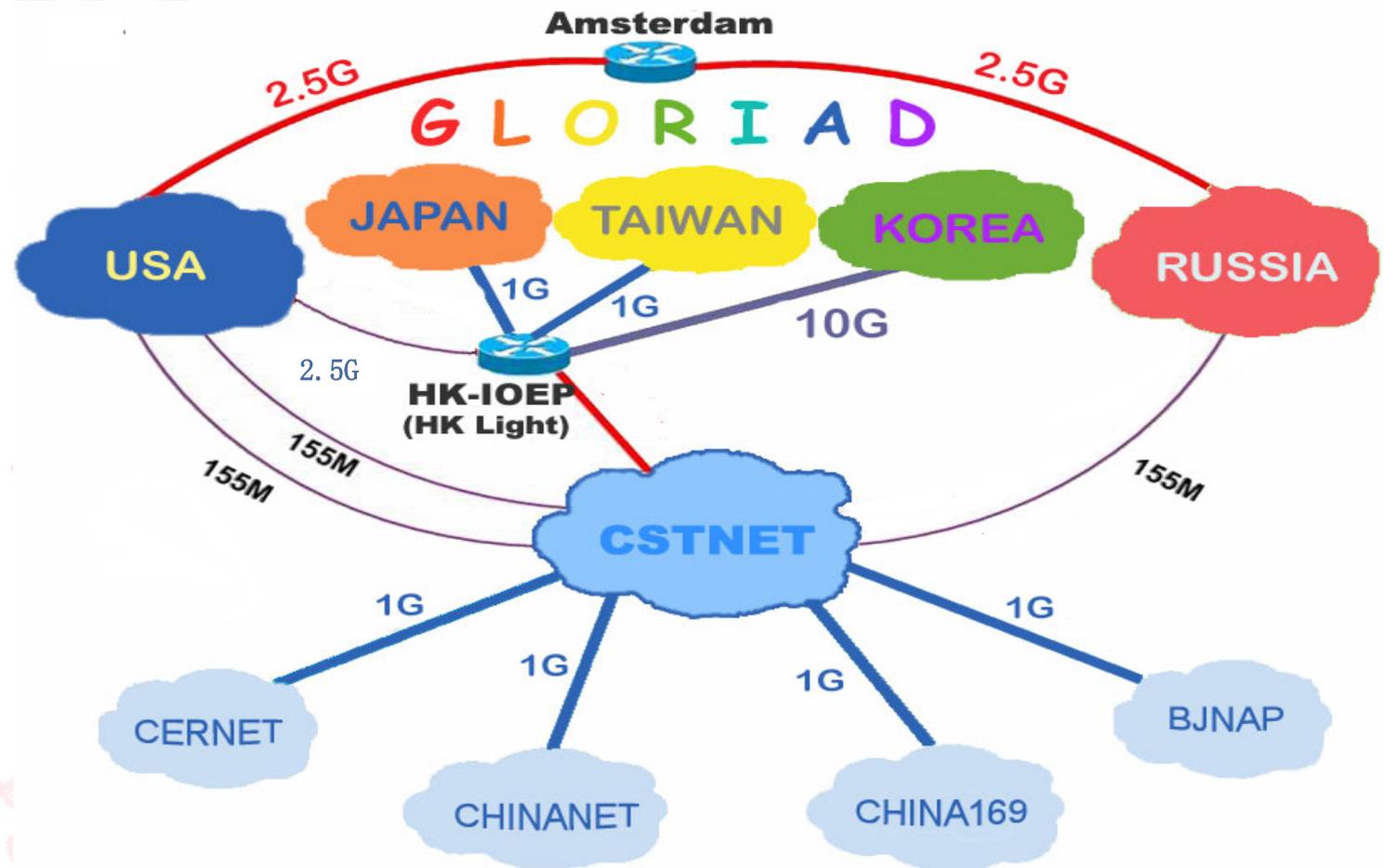
DIGITAL DIVIDE in China (2006)





China CSTNET

International and Domestic Connectivity



Data from cnic

CA and BES VOMS Operation

- ▶ **IHEPCA** is Unique CA recognized by EUGrid PMA and APGridPMA, covering HEP and Biomedical.
- ▶ Statistics:

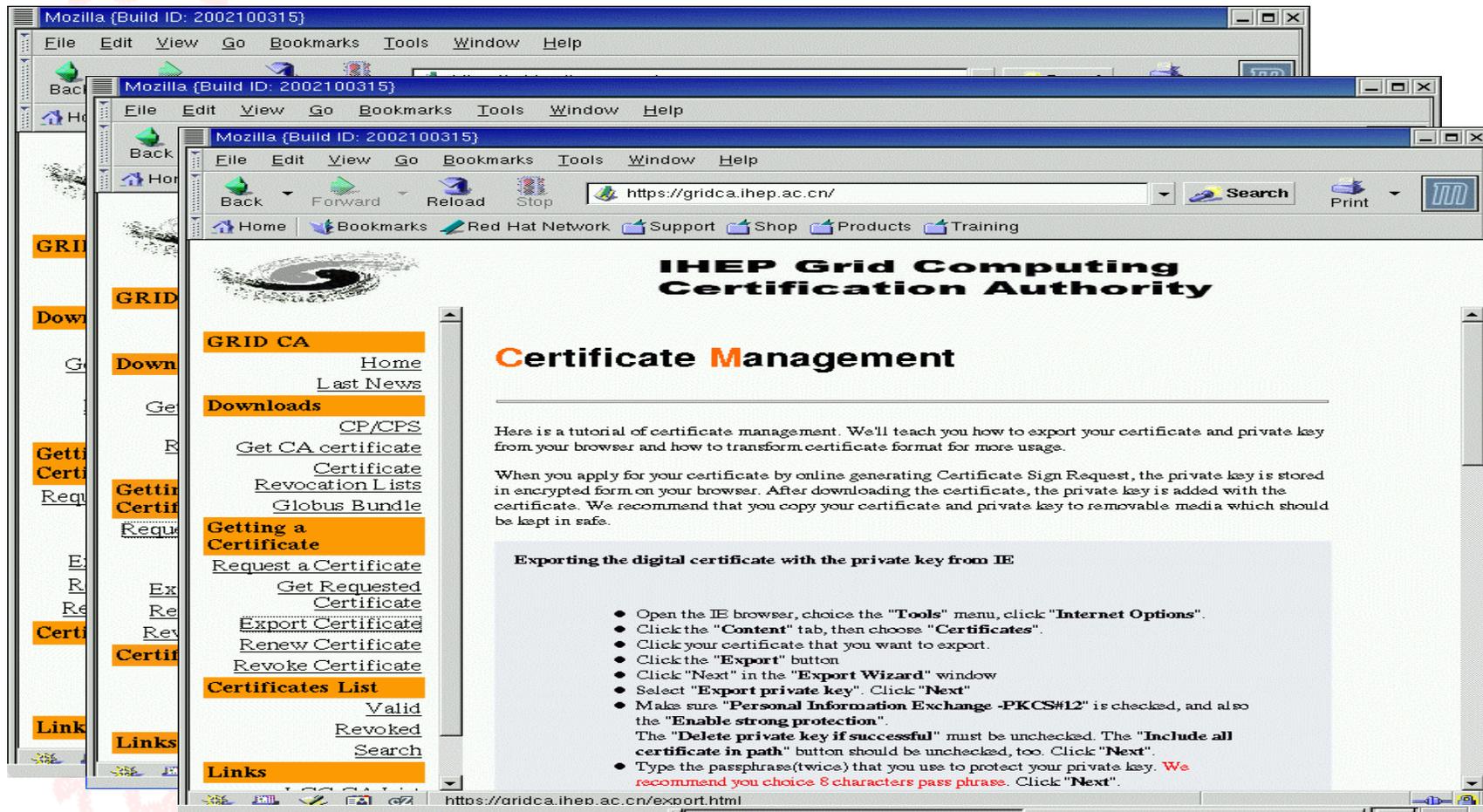
Number of issued certificates:

Types	User	Host	Server	Total
Valid	52	57	3	112
Revoked	25	10	3	38

Subscribers :

Org.	IHEP	PKU	SDU	KEK
number	25	2	1	1

Web-based CA User Interface



LCG Beijing Site Operation

- ▶ **UI** (User Interface): Glite-3.0.2
- ▶ **RB** (Resource Broker): Glite-3.0.2 (LCG RB)
- ▶ **MyProxy**: Glite-3.0.2
- ▶ **SE** (SRM/Dcache): Glite-3.0.2
- ▶ **CE** (OpenPBS->Torque) : Glite-3.0.2 (LCG-CE)
- ▶ **MON** (R-GMA) : Glite-3.0.2
- ▶ **BDII**: Glite3.0.2
- ▶ **WNs**: Glite-3.0.2
- ▶ **LFC**: LHC File Catalogue
- ▶ **CA**: IHEP CA
- ▶ **VOMS**: for BES/YBJ-ARGO

GILDA in IHEP (total 8 servers)

- ▶ **UI** (User Interface): Glite-3.0.2
- ▶ **RB** (Resource Broker): Glite-3.0.2 (LCG RB)
- ▶ **WMS/LB**
- ▶ **SE** (SRM/Dcache): Glite-3.0.2
- ▶ **CE** (OpenPBS->Torque) : Glite-3.0.2 (LCG-CE)
- ▶ **BDII**: Glite3.0.2
- ▶ **AMGA**
- ▶ **LFC**: LHC File Catalogue
- ▶ **Genius Portal**
- ▶ **FTS** etc.

Current Resources

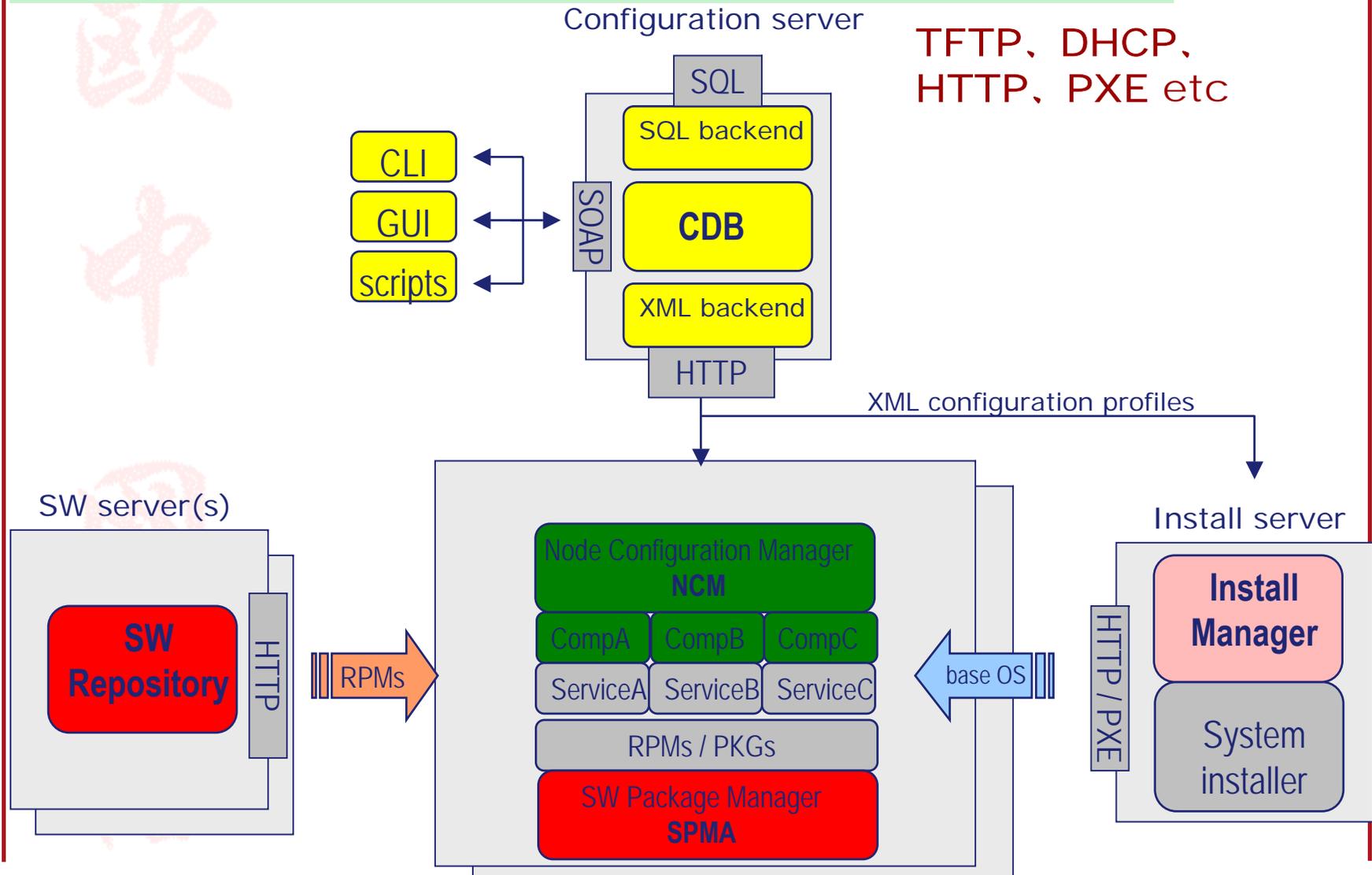
▶ Computing Resources

- 28 CPUs (Xeon 3.2GHz/2GB/73SCSI, IBM Blade Server)
- 10 CPUs (Xeon 3.0GHz/2GB/80GB Sata, 1U Rackmount).

▶ Storage resources

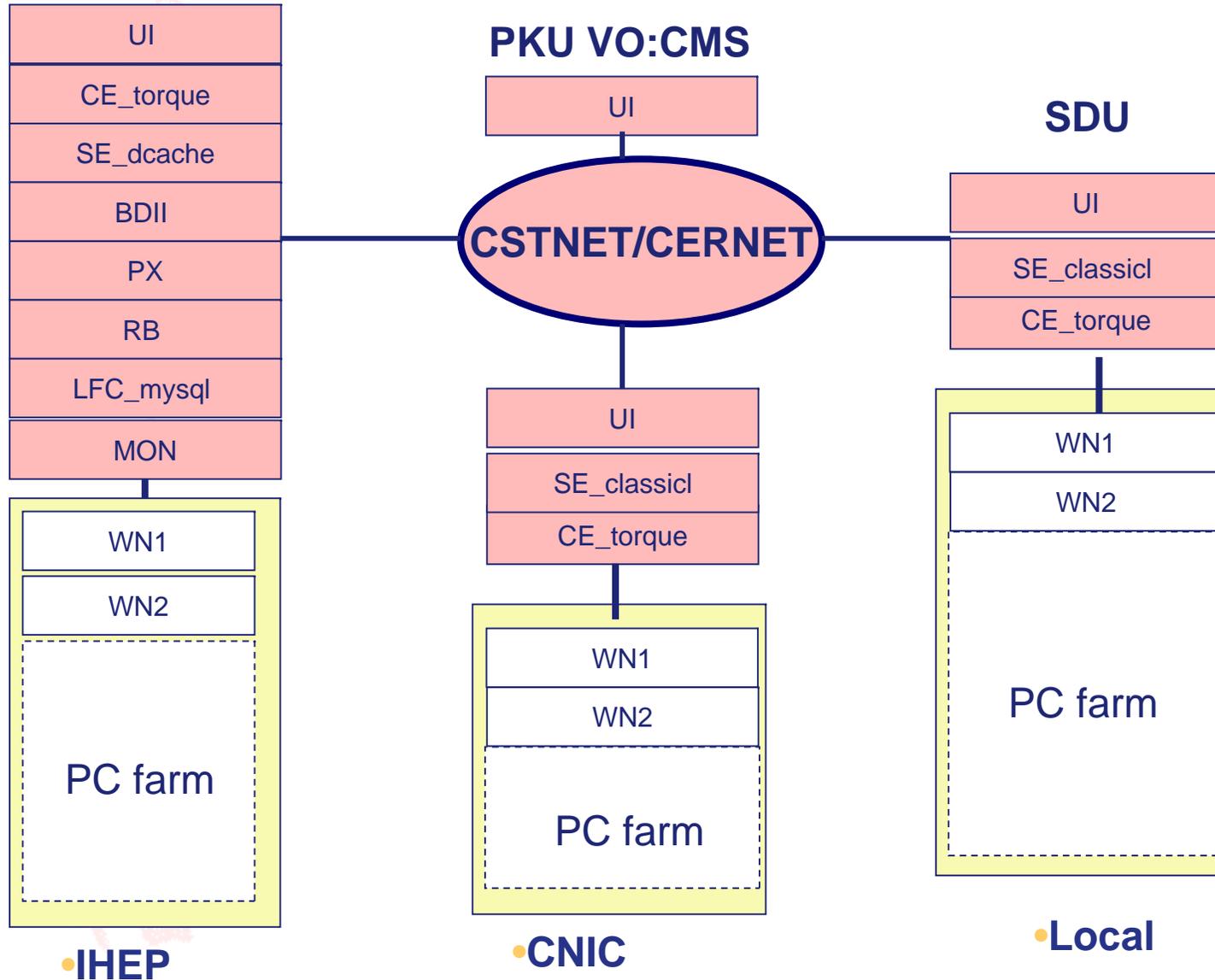
- CMS SE (Dcache/srm): 1.2TB(Scsi Raid5)
- Atlas SE (Dcache/srm): 1.2TB(Scsi Raid5)
- BES/ARGO...(Dcache/srm): 800GB(SATA)

Quattor ready for LCG installation automation



TFTP, DHCP, HTTP, PXE etc

LCG farm in China





欧

中

网

格

HEP International Collaborations for LCG CMS/Atlas, ARGO



ARGO – YBJ Laboratory

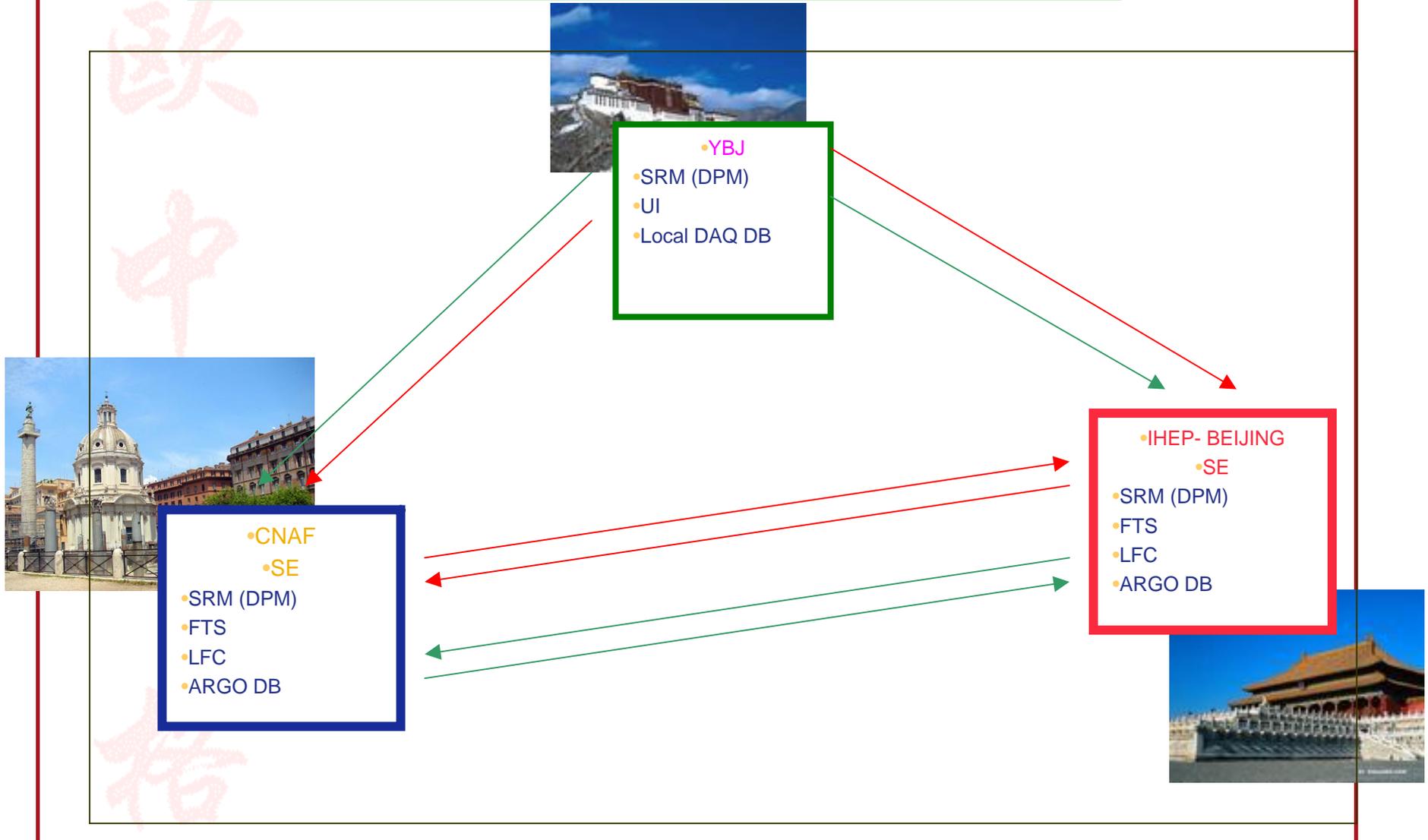


- The Experiment data rate to be transferred is **250 TB/Year** requiring a steady transfer rate of the order of 100 Mbps synchronizely to IHEP in Beijing and to Rome Univ. in Italy.
- **400 CPUs** to be processing the data.

ARGO Computing Model

- ▶ Symmetrical sites in IHEP and Roma Univ. respectively
- ▶ Data mirroring of raw, rec., ntpl. In both sites.
- ▶ Data replica synchronization.
- ▶ Computing resource sharing, storage resource double.

ARGO Grid Computing Model

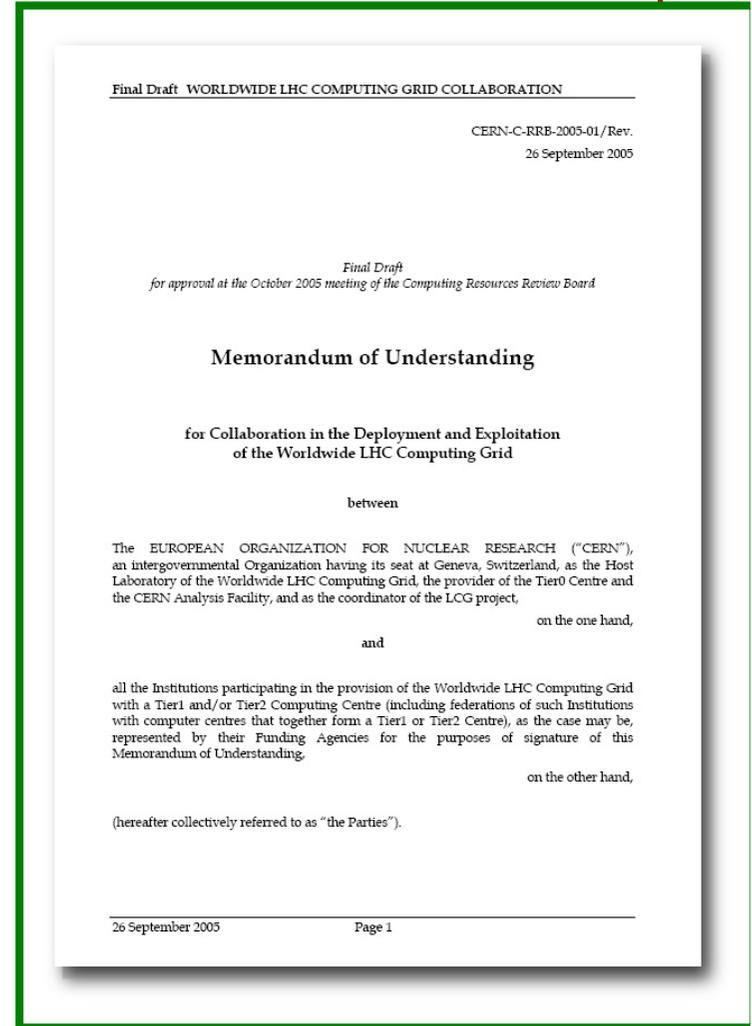




WLCG cooperation MOU

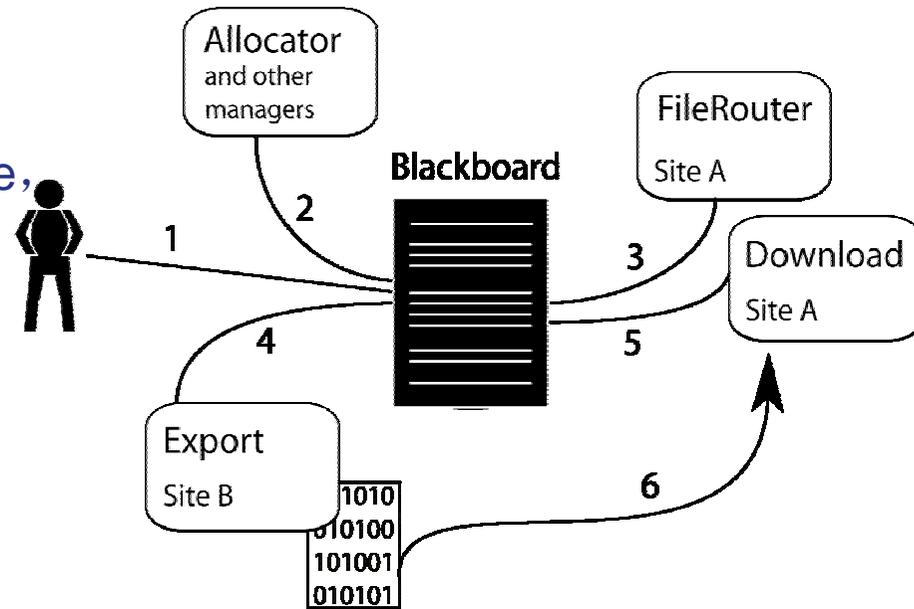
- ▶ Feb. 2006, IHEP and CERN signed cooperation MOU
- ▶ Set up **Tier-2** for the LHC CMS/Atlas exp. In IHEP Beijing China.

	Planned Resources				
	2006	2007	2008	2009	2010
CPU (kSI2K)	100	500	1000	1400	2000
Disk (TB)	20	50	200	400	600

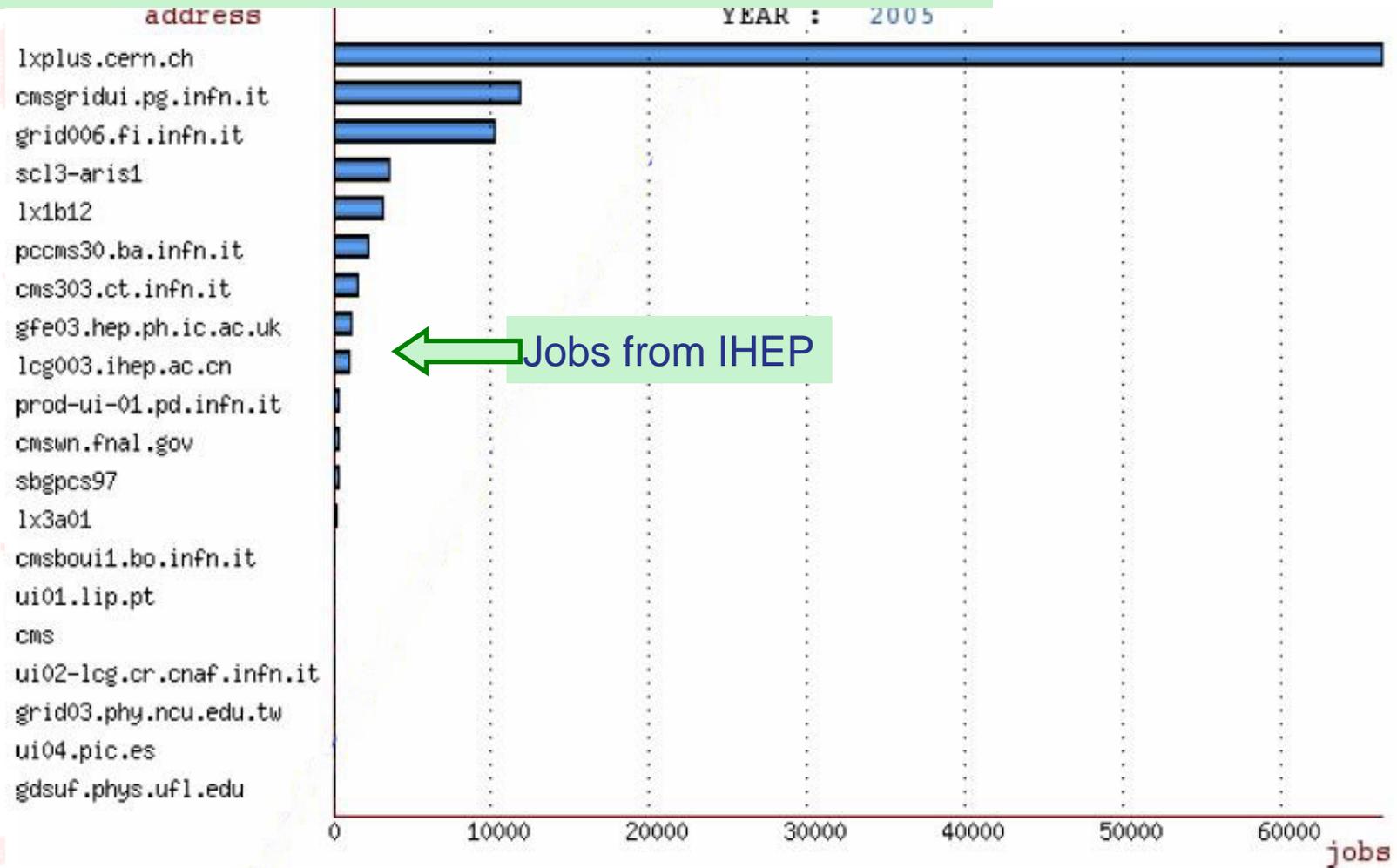


CMS PHeDex Data transfer

- ▶ Setup PHeDEX system on UI for Dataset transfer
- ▶ Agents: . FileDownload, FileVerify, FileDownloadDelete, InfoDropStatus and scripts.
- ▶ Successful test for dataset subscription, data transfer, error recovery, etc.
- ▶ Transfer speed is 200KB/s from IHEP—
T1_FNAL, T1_IN2P3, T1_CNAF



CMS Job Submission Statistics

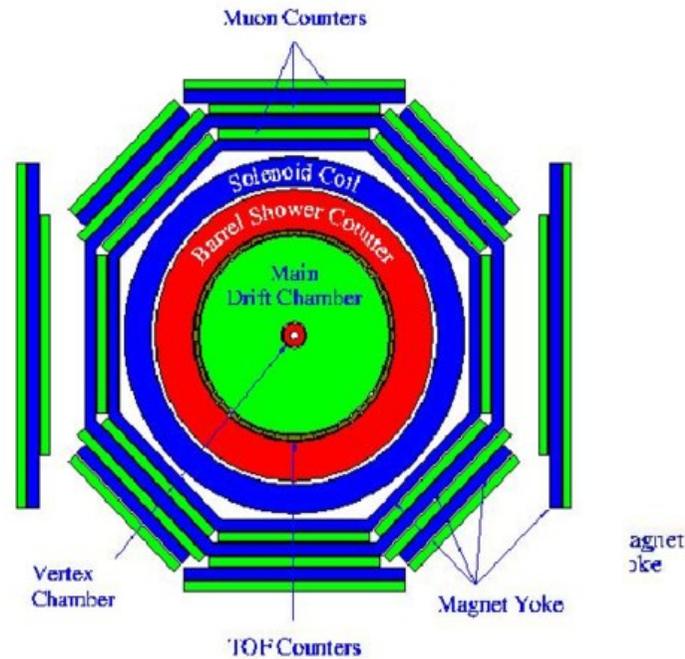


UI used from users to submit jobs using CRAB



欧
中
网
格

BES Application on LCG



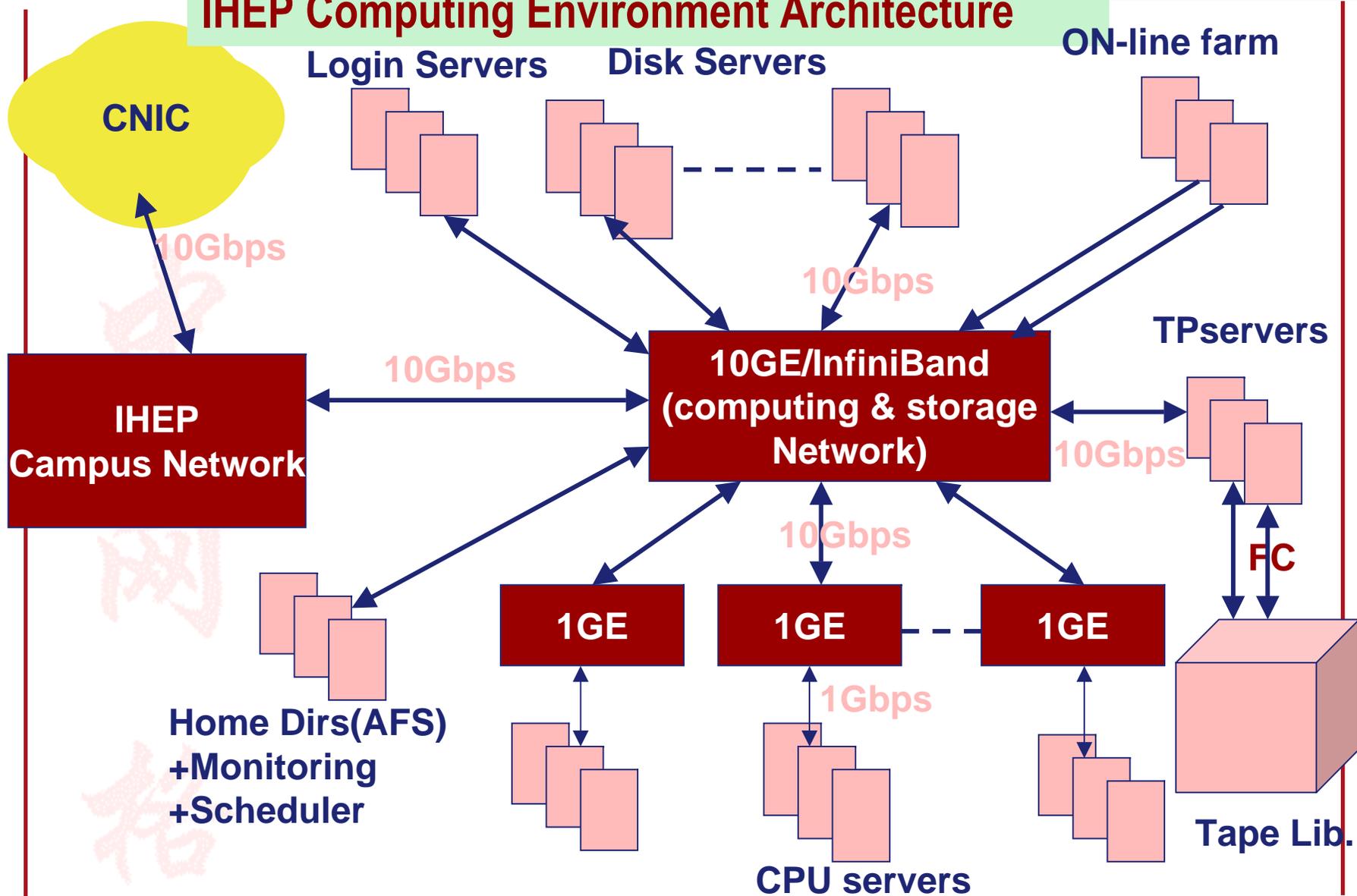
End view of the BES detector



BES Grid Consideration

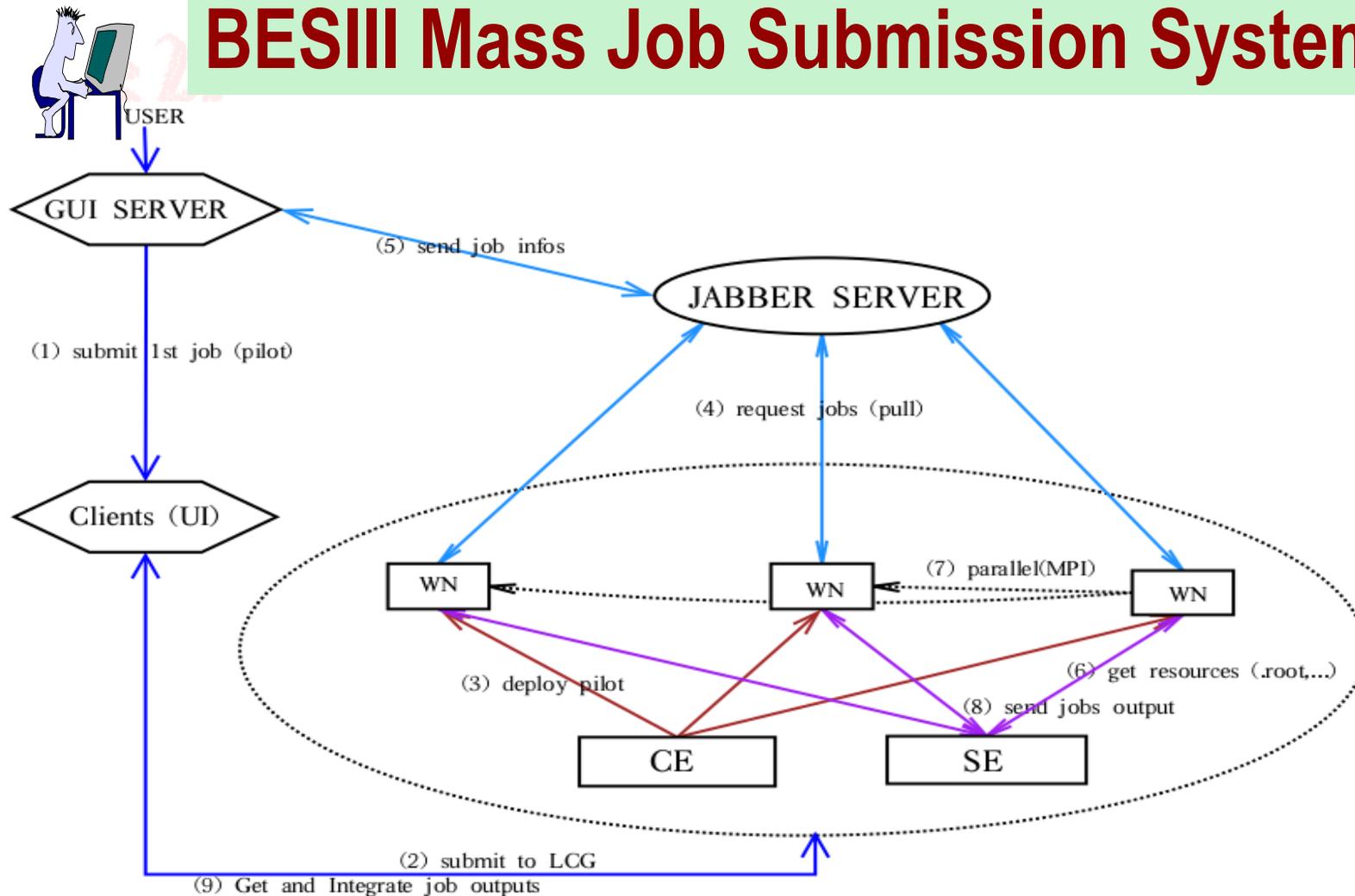
- ▶ Primary Site for mass analysis, reconstruction
- ▶ Secondary Sites for MC Simulation
- ▶ Data transfer from/to MC data or DST data
- ▶ Bookkeeping of raw, rec., DST
- ▶ Dataset location system
- ▶ Job monitoring
- ▶ Failed site blacklist phase-out
- ▶ Mass job submission

IHEP Computing Environment Architecture





BESIII Mass Job Submission System





China Four Grid projects



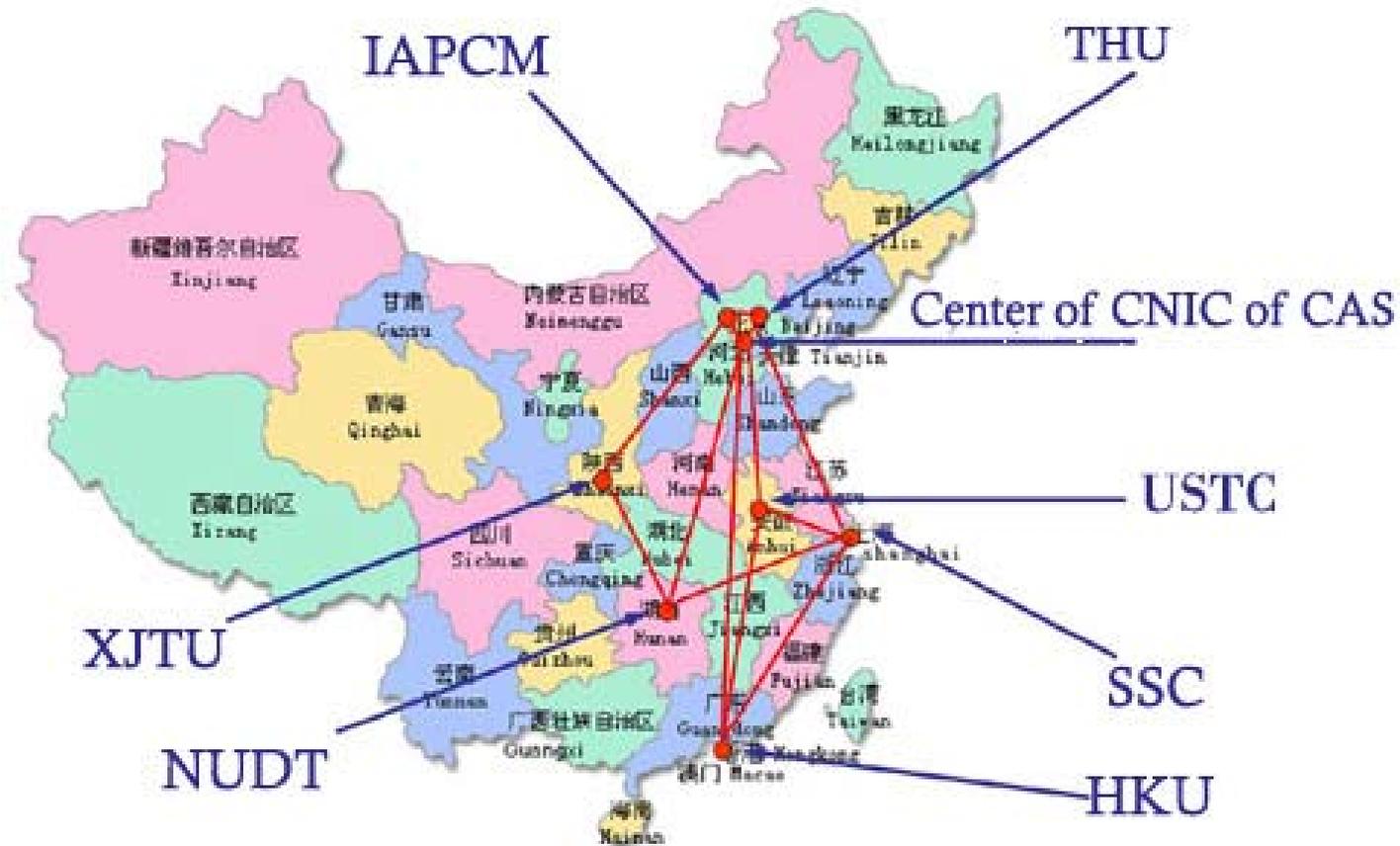
1. **CNGrid** (China National Grid), support by Ministry of Science and Technology
2. **CROWNGrid**, supported by CNFS
3. **ChinaGrid**, supported by the Ministry of Education
4. **SDGrid** (China Science Data Grid), supported by the Chinese Academy of Science

CNGrid– main nodes across country

1. CNNIC, CAS Network Center (Beijing)
2. Tsinghua University (Beijing)
3. Institute of Applied Physics and Computational Mathematics (Beijing)
4. Shanghai Supercomputer Center (Shanghai)
5. University of Science and Technology of China (Hefei, Anhui)
6. Xi'an Jiaotong University (Xi'an, Shaanxi)
7. NUDT (Changsha)
8. Hong Kong University (Hongkong)



Infrastructures: CNGrid



CNGrid Software Development

- ▶ **System Software**
 - Interfacing to heterogeneous systems
 - Resource management scheduling
- ▶ **Development Environment**
 - Portal based
- ▶ **User Environment**
 - Grid browser
 - GSML

CNGrid Applications so far

- ▶ **Geological Survey Grid; Digital Forest Grid**
- ▶ **Seismic Imaging Grid;**
- ▶ **Scientific Data Grid (astronomy);**
- ▶ **Bioinformatics Grid;**
- ▶ **New Drug Discovery Grid**
- ▶ **Traffic Information Grid**
- ▶ **Meteorological Application Grid**
- ▶ **Aviation Grid**
- ▶ **Simulation and Manufacturing Grid**

HEP Applications in CNGrid

- ▶ **The applications and testbeds developed over CNGrid currently are related to**
 1. Resource and Environment (GSG, DFG, SeisGrid)
 2. Research (SDG, BioGrid, DDG, ChinaGrid),
 3. Services (MSG, ITG),
 4. Manufacturing (AviGrid, SimGridResource)

- ▶ **The Chinese Grid-related research key players are**
 1. AVIC II (manufacturing of aero-products)
 2. China National Geologic Survey Bureau,
 3. Network & Information Center of CAS, etc.
 4. **IHEP of CAS** becomes important.



EUChinaGRID promoting HEP Grid

- ▶ Funded by European Union, EUChinaGRID Project officially started on last 1st January with the aim to interconnect the existing European and Chinese Grid Infrastructures and enable their interoperability, thus creating a network of collaboration between Europe and China around this emerging technology.
- ▶ On Nov 14th, 2005, Meeting held in Beijing to start.
- ▶ Director of CC/IHEP/Beijing, Dr Chen Gang as the vice project manager and chairman of Project Management Board of EUChinaGRID.

EUChinaGRID promoting HEP Grid

- ▶ On 12-14th June 2006 - The first EUChinaGRID Project Workshop was held in IHEP Beijing, it was a milestone for the EU-China cooperation on Grid, especially for the promotion of HEP as an important application in CNGrid.
- ▶ On 18th Sept. 2006 - The first EUChinaGRID Conference was held in University of Roma Tre jointly organized by INFN/University of Roma Tre and GARR.
- ▶ For more information see:
<http://www.euchinagrid.org> or
<http://www.euchinagrid.cn>.



Organizations in EUChinaGRID

▶ Currently, organizations involved in EUChinaGRID are the following (coordinated by INFN):

1. BUAA (Beijing University of Aeronautics and Astronautics) (China)
2. CNIC (China)
3. IHEP, Beijing (China)
4. Peking University, Beijing (China)
5. GRnet (Greece)
6. Consortium GARR (Italy)
7. INFN (Italy)
8. Jagiellonian University in Krakow (Poland)
9. CERN (Switzerland)

▶ The organizations involved in the Project as third parties are the following:

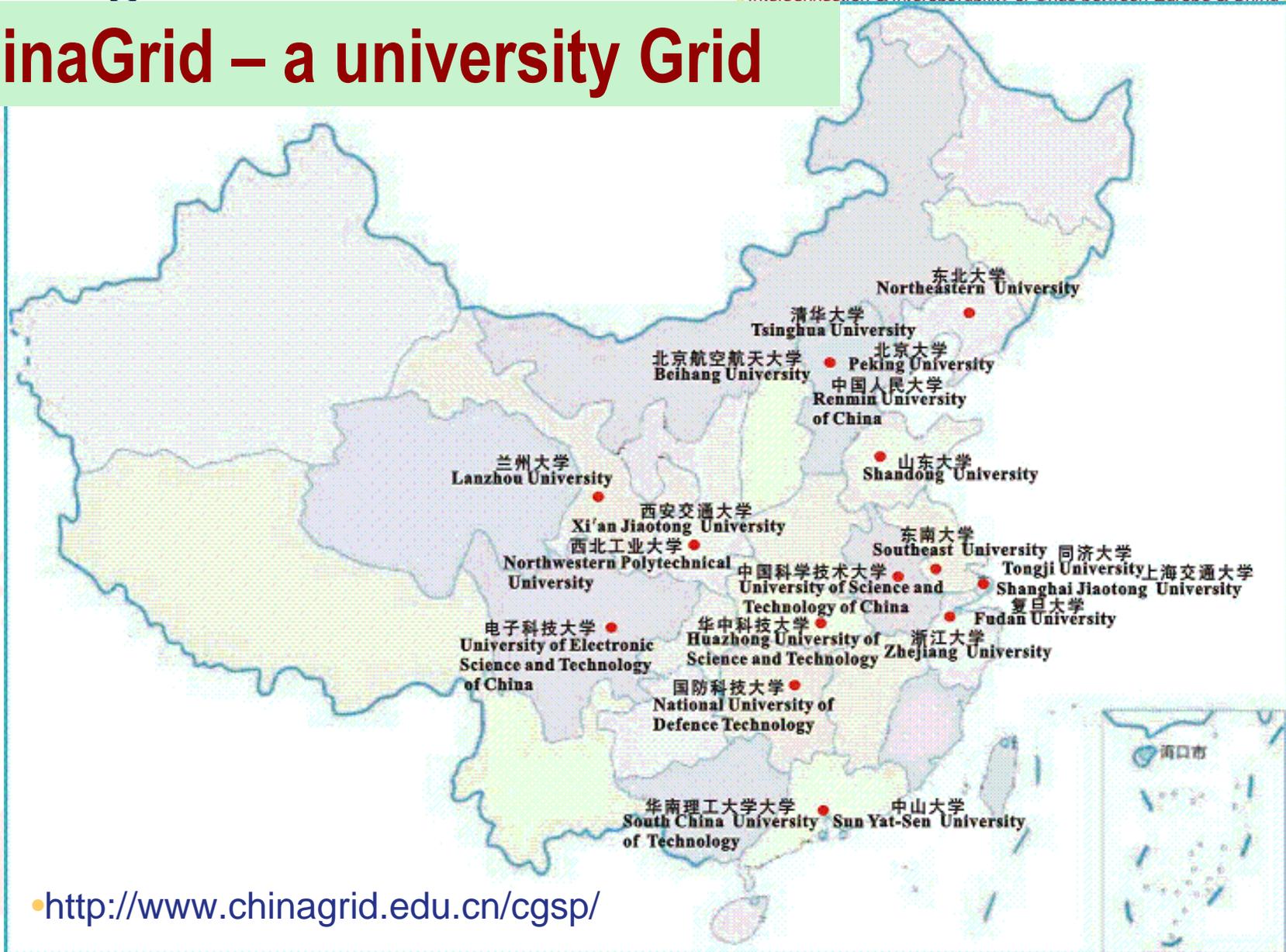
1. ASGC (Taiwan)
2. Department of Biology, Universityà di Roma3 (Italy)

CROWNGrid - a Research and Development Environment

- ▶ **CROWN (China Research and Development Environment over Wider-area Network)**
- ▶ **Started from 2002**
- ▶ **7 Universities and 5 Institutes involved, such as:**
 - BUAA (Beijing University of Aeronautics and Astronautics)**
 - Peking Univ.**
 - Tsinghua Univ.**
 - CNIC/ CAS**
 - IHEP/CAS, etc.**
- ▶ **Focus on Grid R&D, Testbed and its applications**
- ▶ **IHEP/PKU/SDU together will set up HEP Grid in China**



ChinaGrid – a university Grid



• <http://www.chinagrid.edu.cn/cgsp/>

ChinaGrid Software

▶ Middleware——**CGSP** (ChinaGrid Support Platform)

1. Provide a platform for grid construction from the top portal to the integration of bottom resources of grid. Not only does CGSP support the uniform management of heterogeneous resources, but it also supply the portal building, job defining, service packaging, and grid monitoring.
2. Support secondary development of grid service and improve the flexibility of the system. Parallel programming interface and its running environment supply the complicated application development based on deployed services in grid.
3. Follow **latest grid standard** and integrate existing advanced technology to avoid reduplicated works.
4. Provide an extensible and reconfigurable grid framework, in order to fit the purpose of ChinaGrid to cover top 100 universities of China in the near future, and satisfy the autonomy of each ChinaGrid application or unit.
5. Avoid unnecessary data delivery over grid. Data required by the computing job not stream with the job description file. It is delivered to the personal data space in data man

ChinaGrid applications so far

- Five aspects belong to ChinaGrid's main applications:
 1. *Bioinformatics grid*
 2. *Image processing grid*
 3. *Course on-line grid*
 4. *Computational fluid dynamic grid*
 5. *Large scale information processing grid*
- *17,000 users from more than 50 countries, 6,000 visiting per day, and >40GB download files.*

HEP as a potential collaboration

- ▶ **There are many research and application areas in common with potential for collaboration**
- ▶ **Link existing Chinese initiatives with corresponding activities in the EU**
- ▶ **Towards establishing a long-term co-operation framework**
- ▶ **More information can be seen at:**
<http://www.gridatasia.net>

ChinaGrid and China NGI

- ▶ CERNET2 - CNGI, 25 universities started working on it during 2004-2006 as the first step.
- ▶ Project finished in Sept 2006, the bandwidth of backbone is from 2.5G to 10G, which are connecting 25 core nodes in 20 cities around China.
- ▶ See <http://www.edu.cn/20060111/3170212.shtml>

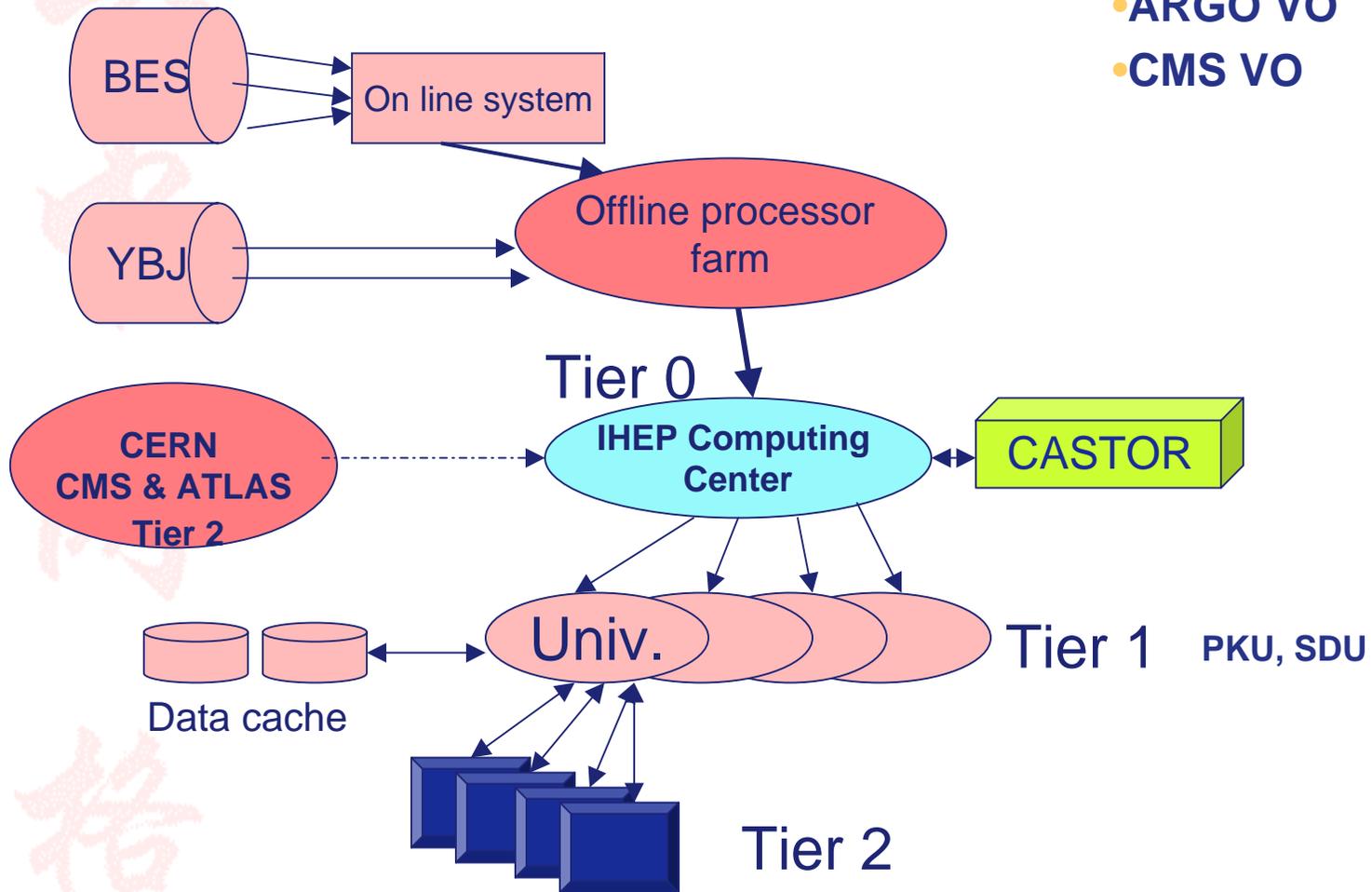


The next goal of ChinaGrid

- ▶ Key issues for the success of the project and, more generally, for a transparent and effective communication among the Chinese and European Grid facilities.
- ▶ As the different middleware solutions developed in the framework of both experiences .
- ▶ And the interoperability with the IPv6 protocol will be thoroughly under study.

Future HEP in China

- BES VO
- ARGO VO
- CMS VO



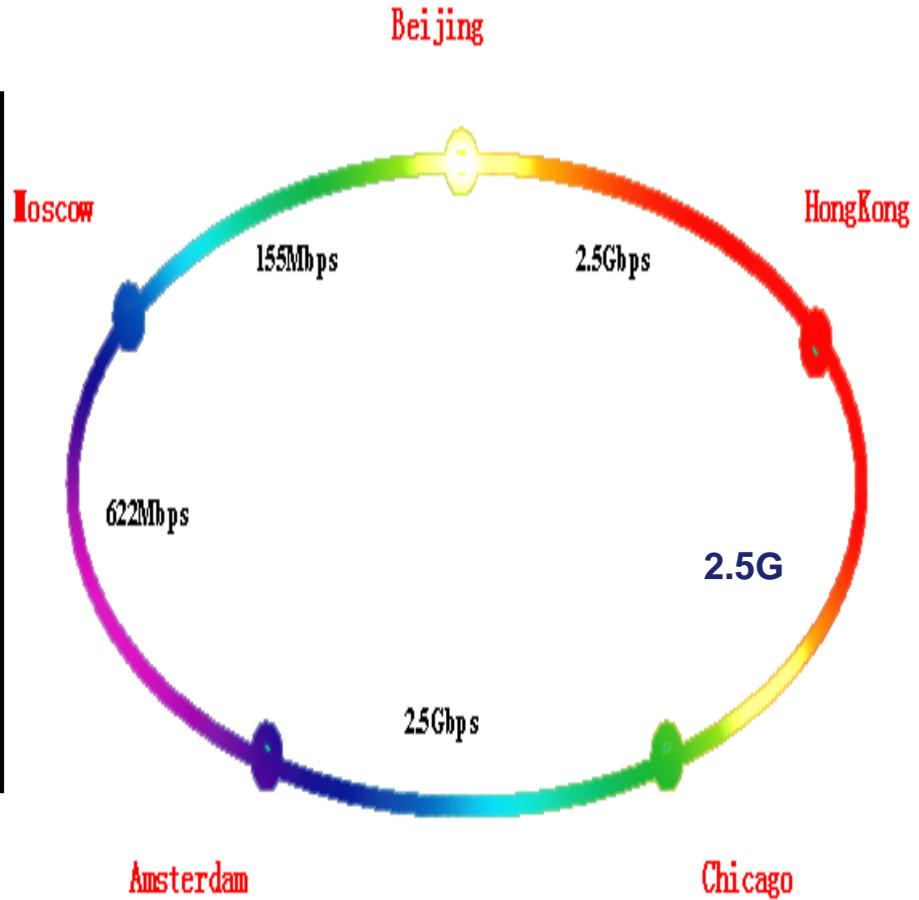
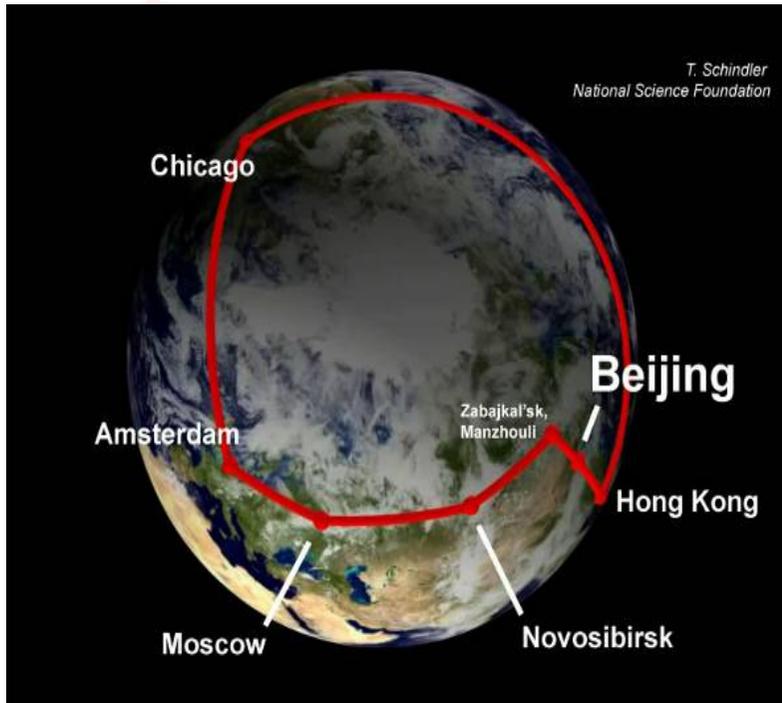
Current resource and Future plan

Supporting CMS, Atlas, BES, YBJ...

	Resource	Planned Resources				
	2005	2006	2007	2008	2009	2010
CPU (kSI2K)	200	600	1500	2000	3000	4000
Disk (TB)	3	100	200	600	1000	1400
Tape (TB)	14	500	1000	2000	3000	4400
Tape (MB/s)	15	80	160	200	260	300
WAN (Mb/s)	1000	1000	1000	10000	10000	10000



Current status of GLORIAD crossing China

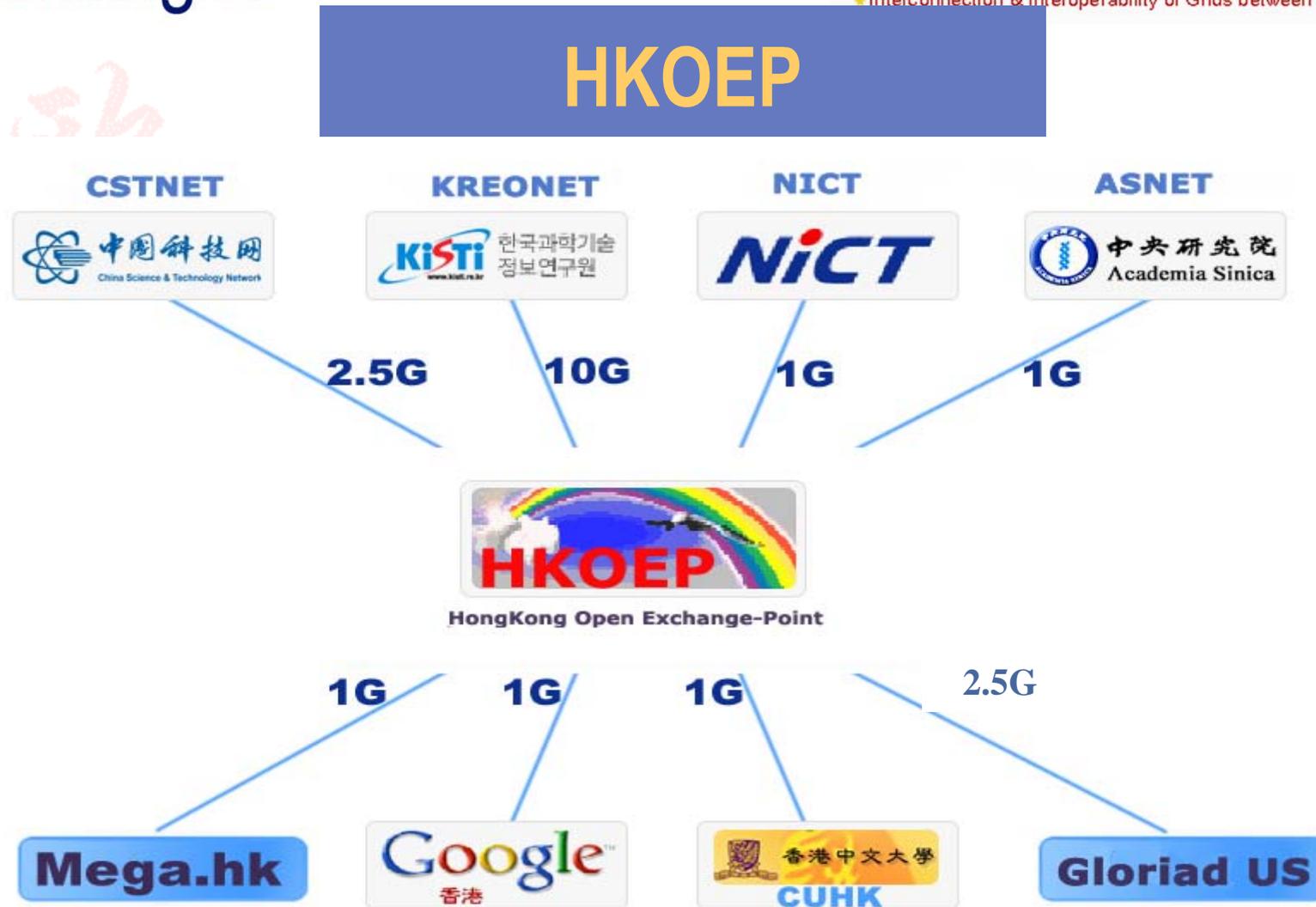


Data from cnic

Brief History of HKOEP (Hong Kong Open Exchange Point)

- ▶ Nov 23, 2004 Updated HK-Beijing to 2.5G
- ▶ Dec 26, 2004 Open 1G to Japan NICT
- ▶ Jan 12, 2005 Open 155M to Chicago
- ▶ Jan 26, 2005 Open 1G to Taiwan ASNet
- ▶ Apr 13, 2005 Open 1G to HK Google
- ▶ Apr 20, 2005 Open 1G to HK IX
- ▶ Apr 20, 2005 Open 1G to HK Mega
- ▶ Jul 30, 2005 Open 10G to Korean KREONET2
- ▶ Aug xx, 2005 Open 1G to HK CUHK
- ▶ Jun xx, 2006 Updated HK-USA to 2.5G

Data from cnic



Data from cnic



Plan of HKOEP

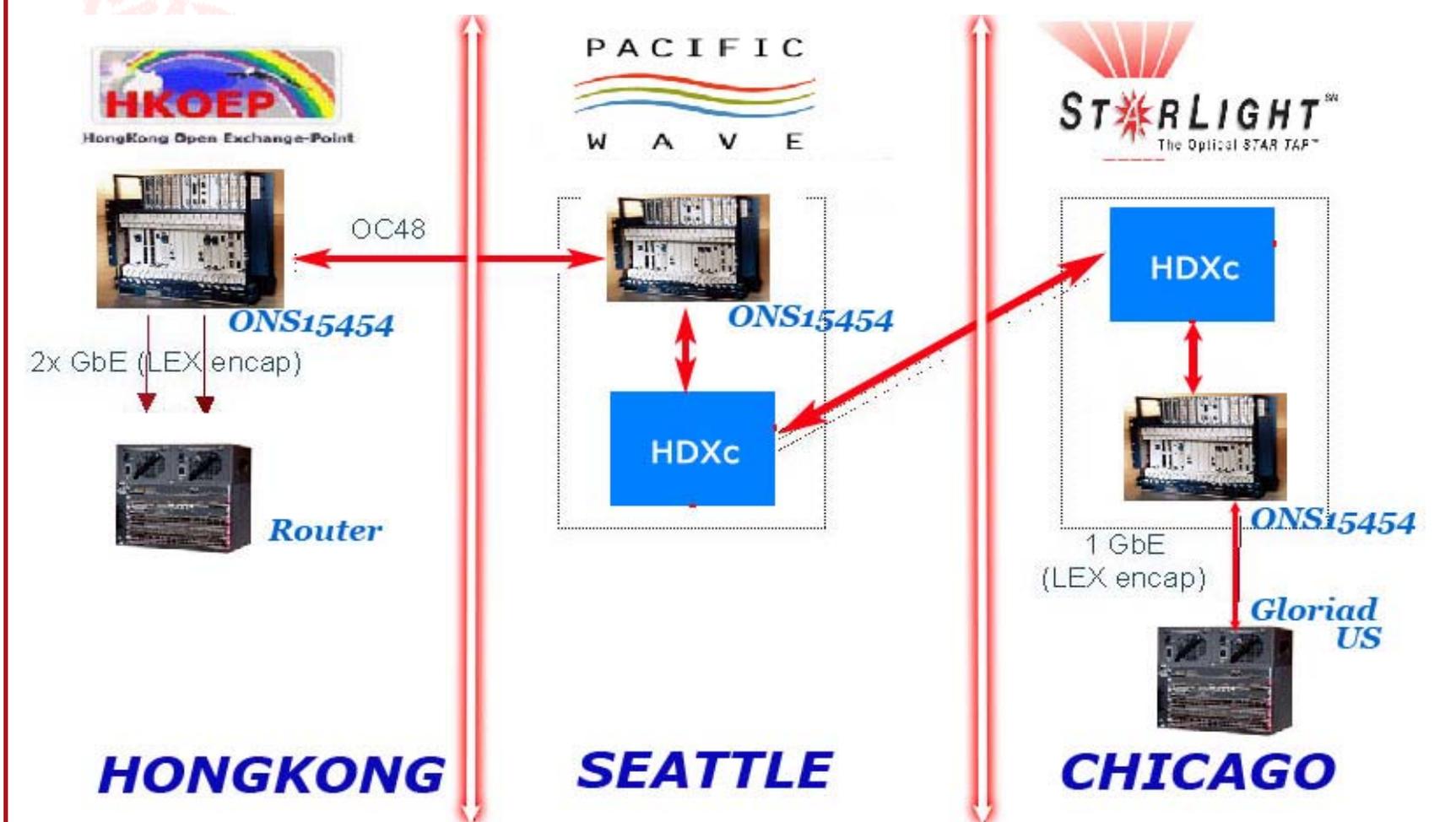


Data from cnic



欧

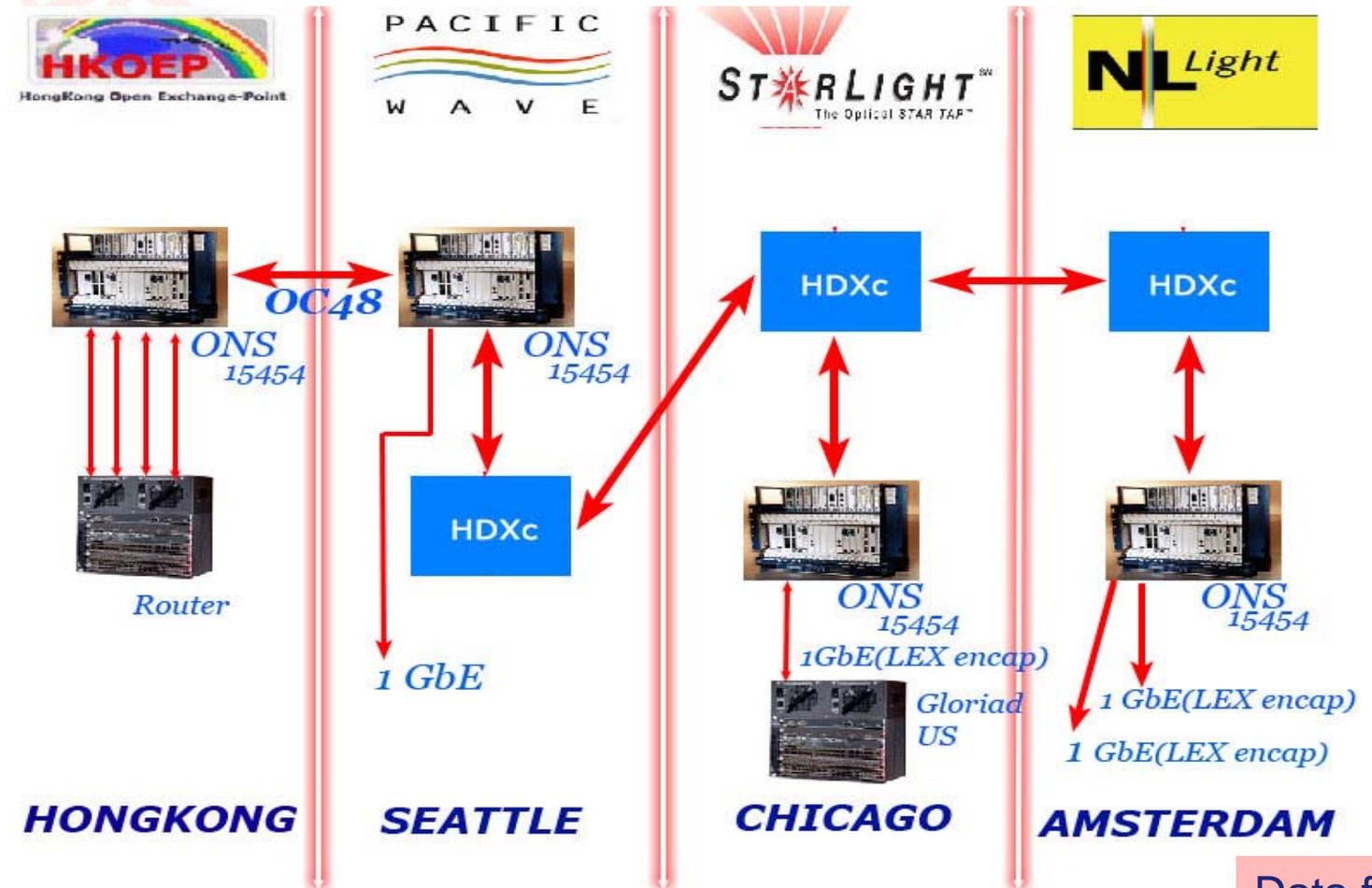
HK-US Connection



Data from cnic

HK-Europe connection

欧



Data from cnic

More International Bandwidth of China

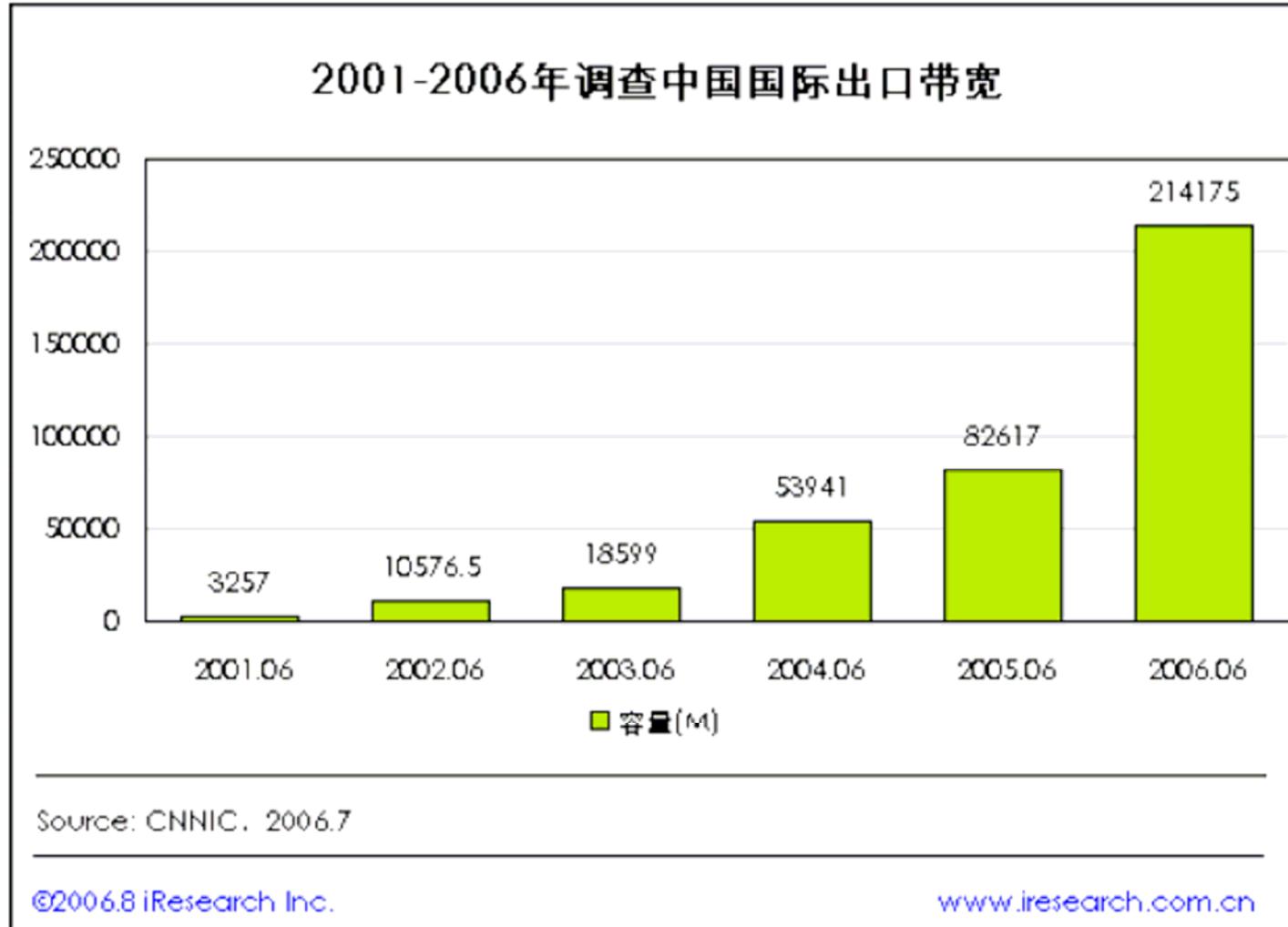
CNNIC Internet Industry
Research Report
200607

国际出口带宽总量为 214,175M，连接的国家有美国、俄罗斯、法国、英国、德国、日本、韩国、新加坡等。 (Total international bandwidth 214,175Mbps)

按运营商划分：9 NETs with international connection:

- 中国公用计算机互联网 (CHINANET) 122,587M
- 中国网络通信集团 (宽带中国 CHINA169 网) 60,888M
- 中国科技网 (CSTNET) 17,465M
- 中国教育和科研计算机网 (CERNET) 4,796M
- 中国移动互联网 (CMNET) 4,785M
- 中国联通互联网 (UNINET) 3,652M
- 中国国际经济贸易互联网 (CIETNET) 2M
- 中国长城互联网 (CGWNET) (建设中)
- 中国卫星集团互联网 (CSNET) (建设中)

2001-2006 China International Bandwidth





万里长城



Thank you very much!

Special thanks to:

CNIC

CNGrid

ChinaGrid

euchinagrid



FP6-2004-Infrastructures-6-SSA-026634



Information Society
and Media

欧
中
网
格