



Status of WLCG FCPPL project

- Status of Beijing site
- Activities over last year
- Ongoing work and prospects for next year

LANÇON Eric & CHEN Gang

Last year activities on one page

- ▶ Participation of Chinese & French colleagues to monthly ATLAS and technical computing French meetings + vidyo/Skype/...
 - Sharing of expertise and tools : grid middleware and experiment specific (**Xiaofei YAN (闫晓飞)**)
 - Network monitoring (**Fazhi QI/齐法制**)
- ▶ Workshop organised at Beijing IHEP (Sep. 2014) on BOINC & HPC for ATLAS simulation with participation from
 - ▶ BOINC developers
 - ▶ Largest Chinese HPC centres
 - ▶ Pilot project to use Chinese HPCs for ATLAS simulation
 - ▶ Ramping up of ATLAS@home project **Wenjing WU (伍文静)**
 - ▶ **Sha LI (李莎)** thesis started in July at LPSC (Grenoble) on cloud deployment

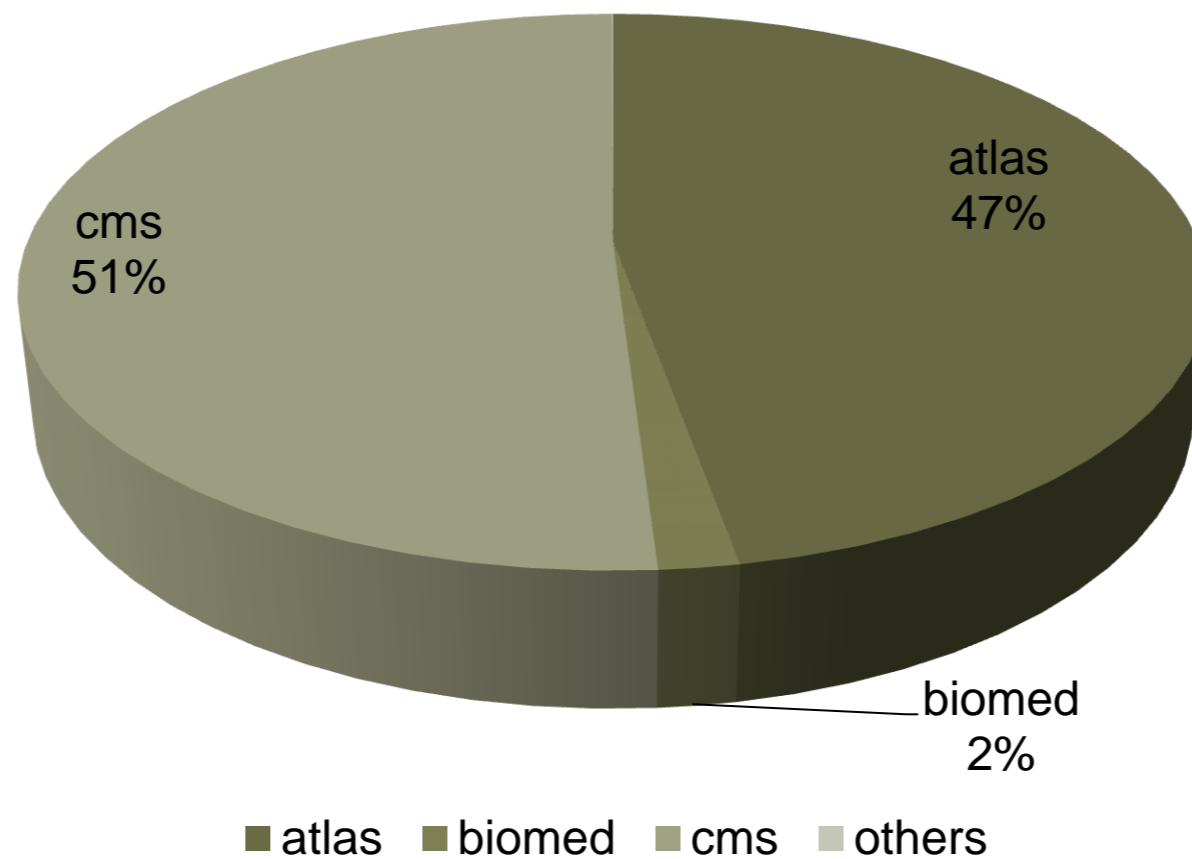
Beijing Tier-2 Infrastructure Update

- WLCG Tier-2 site @IHEP

- All grid services migrated to VM on new machines
- All storage servers replaced by new machines
- All disks replaced by 4TB*24 array.
 - Total disk capacity increased to 940TB
- All old work nodes (1088 cpu cores) will be replaced by the new ones

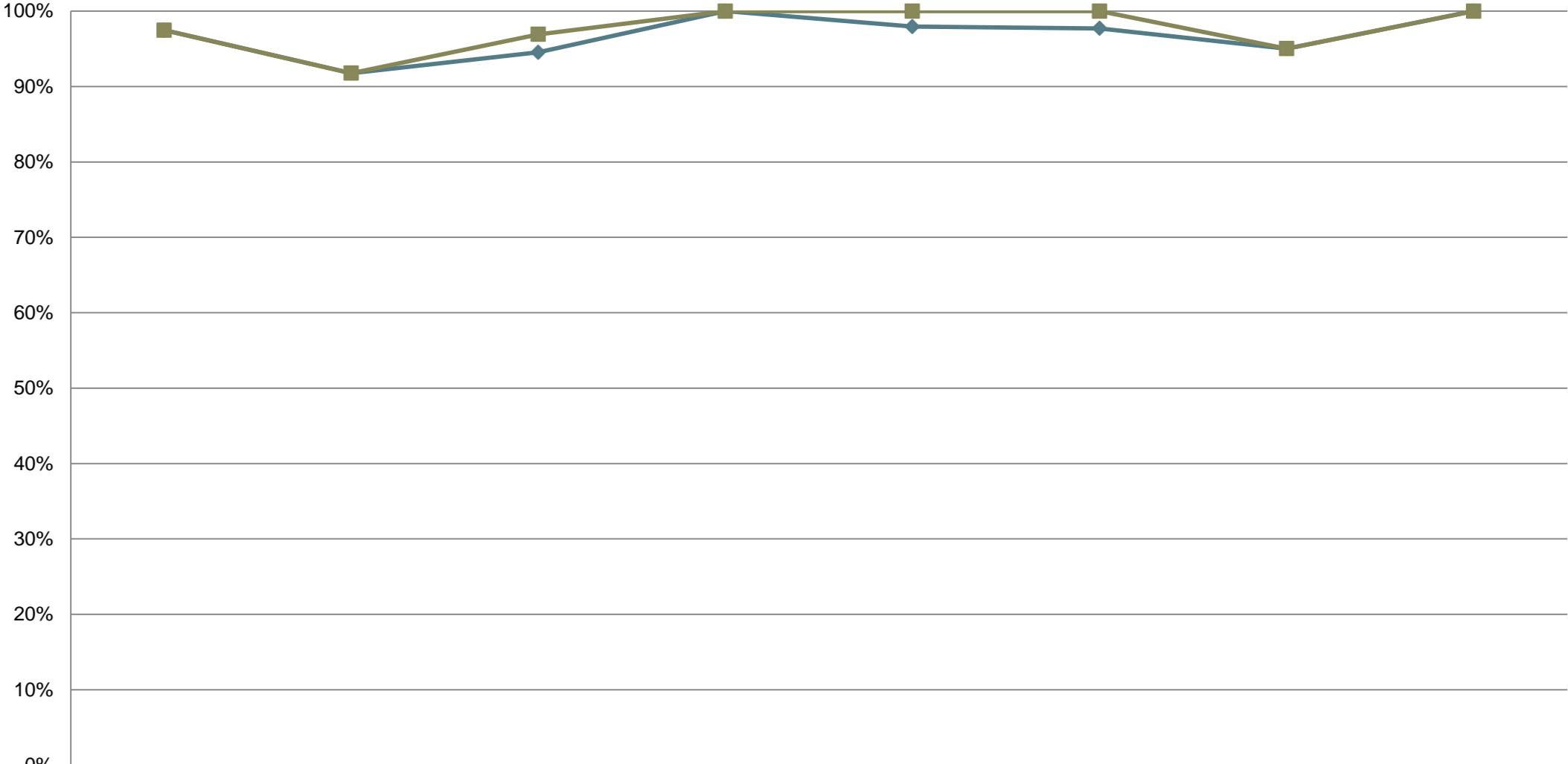
Applicaitons Supported

BEIJING-LCG2 Normalised CPU time (HEPSPEC06) Per VO



Reliability and Availability

Reliability And Availability



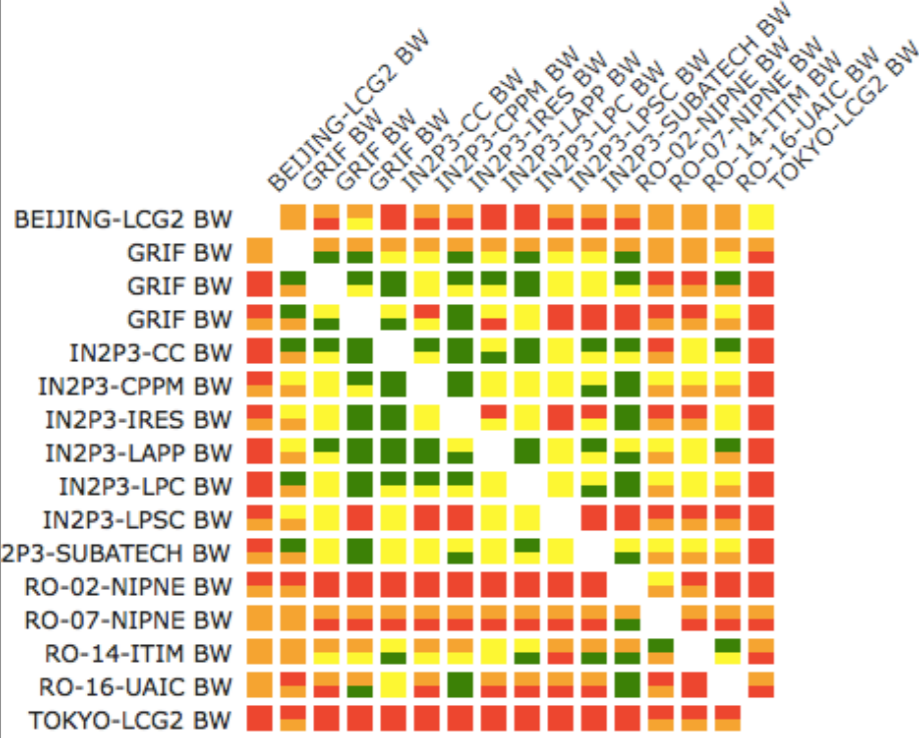
	08/14	09/14	10/14	11/14	12/14	01/15	02/15	03/15
◆ Availability	97.47%	91.77%	94.53%	100.00%	97.94%	97.71%	95.02%	100.00%
■ Reliability	97.47%	91.77%	96.91%	100.00%	100.00%	100.00%	95.02%	100.00%

Network Monitoring

FR Mesh Config Dashboard

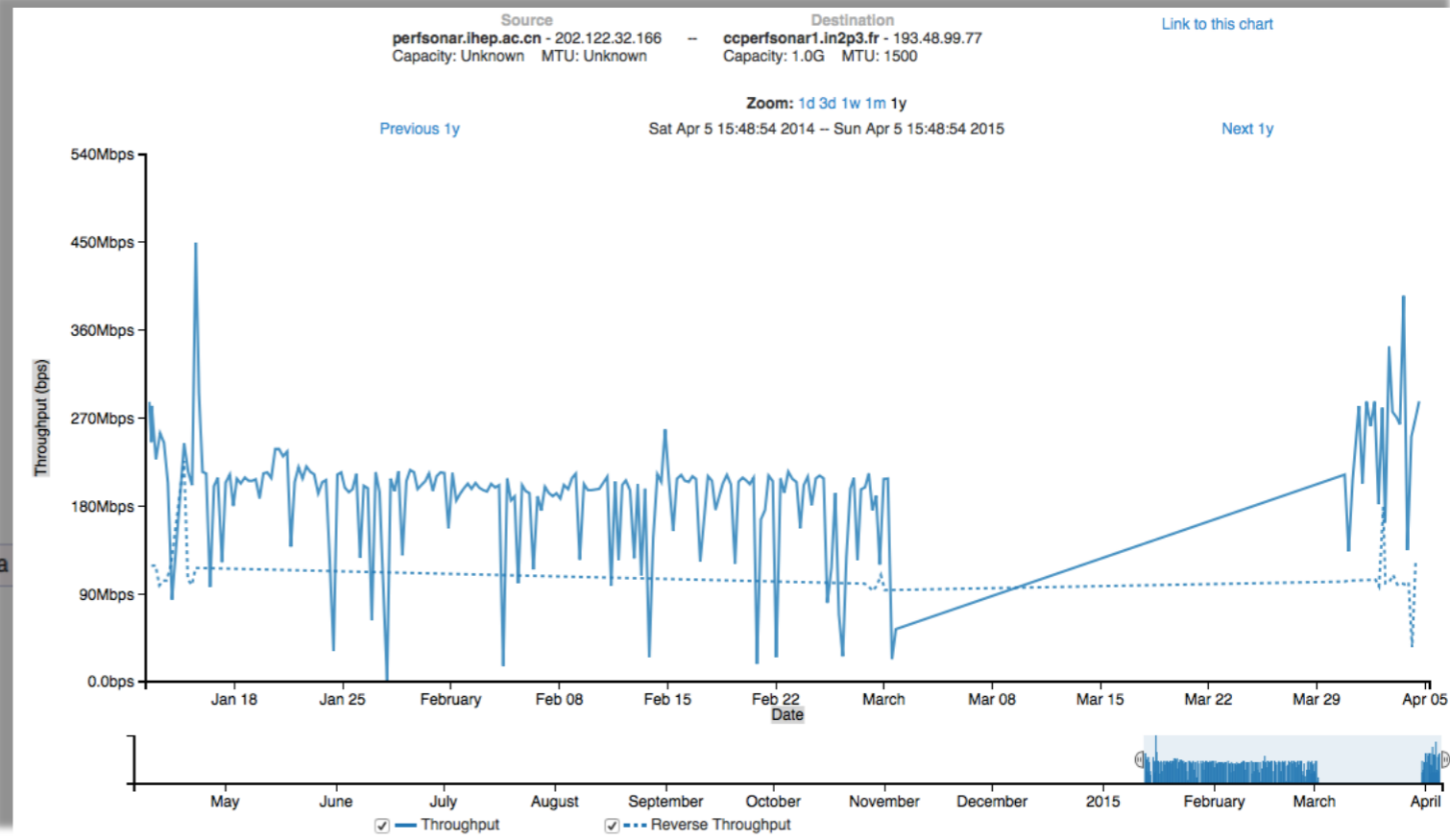
FR Mesh Config - FR Bandwidth Mesh Test

■ Throughput \geq 900Mbps
 ■ Throughput $<$ 900Mbps
 ■ Throughput \leq 500Mbps
 ■ Unable to retrieve data
 ■ Check has not yet run



FR Mesh Config - FR Latency Mesh Test

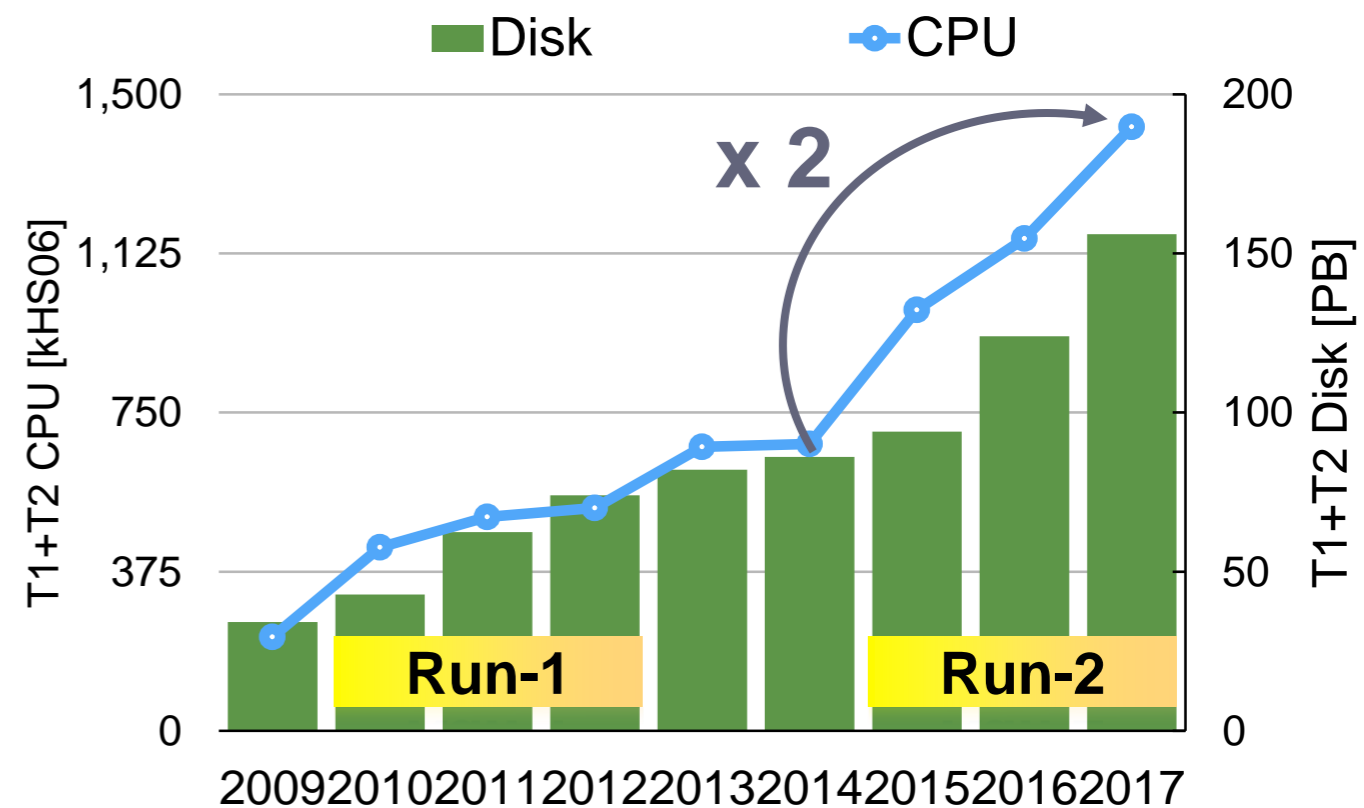
■ Loss rate is \leq 0
 ■ Loss rate is \geq 0
 ■ Loss rate is \geq 0.01
 ■ Unable to retrieve data



Seeking extra CPU resources

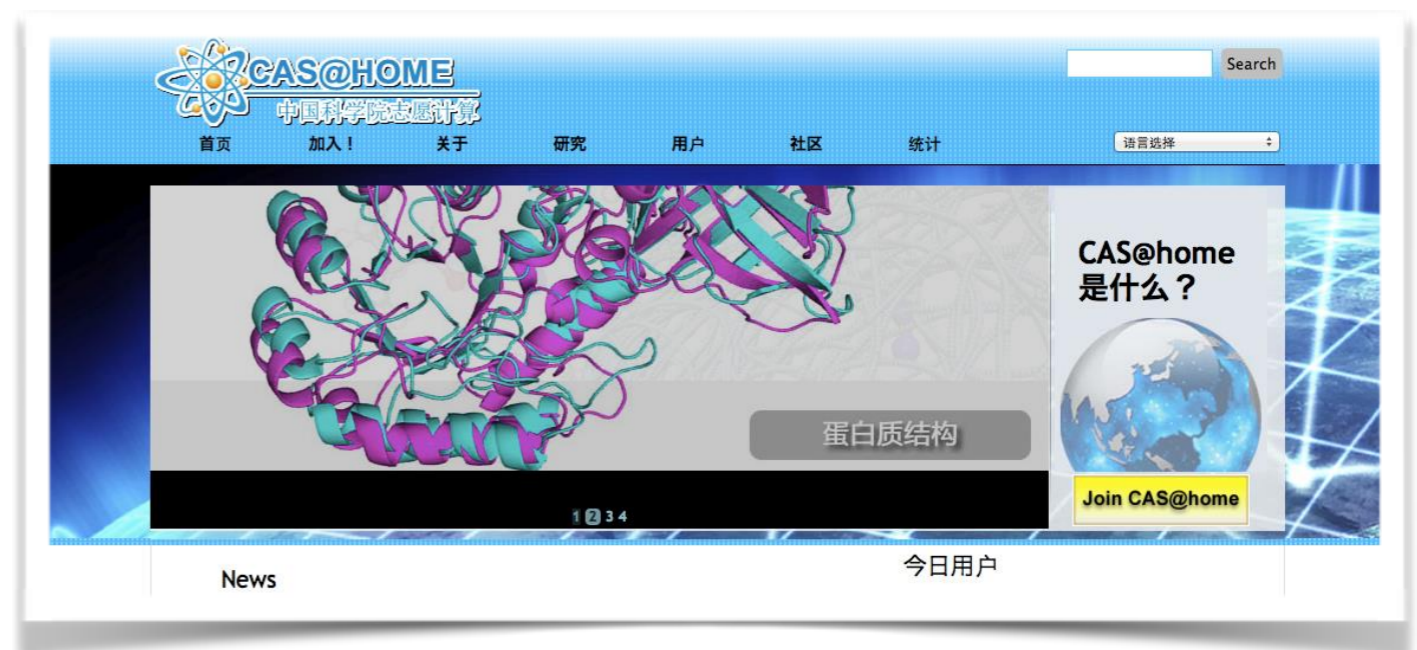
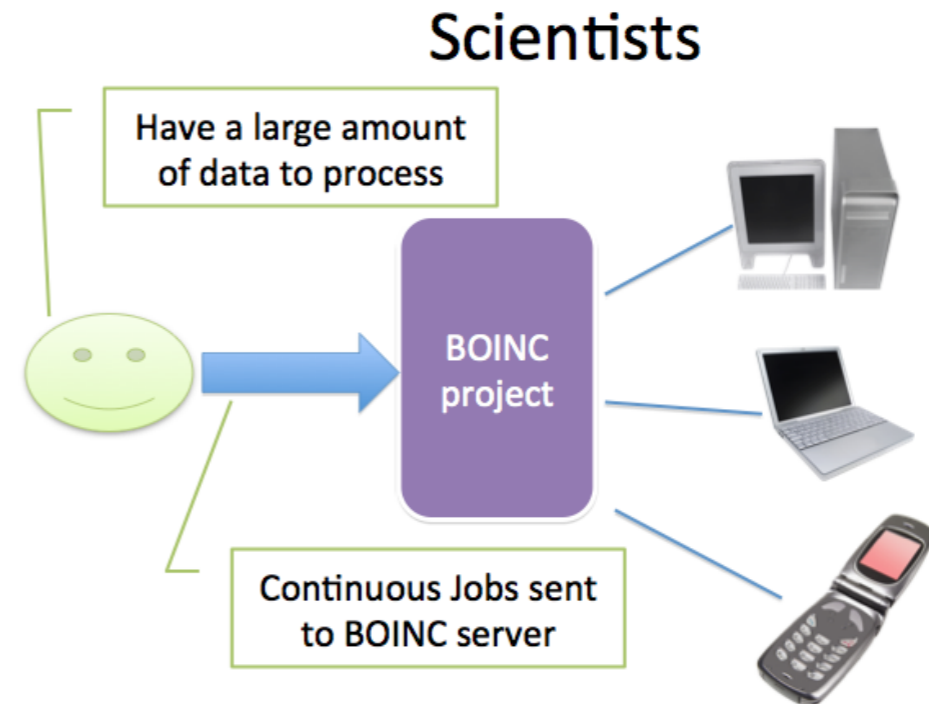
- ▶ LHC experiments need and use more CPU than pledged resources
- ▶ **LHC Run-2 : CPU needs x 2**
- ▶ Every possible options are investigated to get extra resources
 - Cloud computing
 - HPC (High Performance Computing) centres
 - Volunteer computing
- ▶ **Our collaboration is active in these 3 areas**

ATLAS resource needs at T1s & T2s



What is volunteer computing?

- ▶ Use of personal computer spare cycles (when computer sleeps) to run jobs for a community
- ▶ Initial project SETI (Search for Extra-Terrestrial Intelligence) launched in 1999
- ▶ Standard interfaces provided by BOINC project (Berkeley Open Infrastructure for Network Computing)
- ▶ Pioneer project in Asia : CAS@home



ARC-CE



▶ Grid interface to batch systems developed by Nordugrid

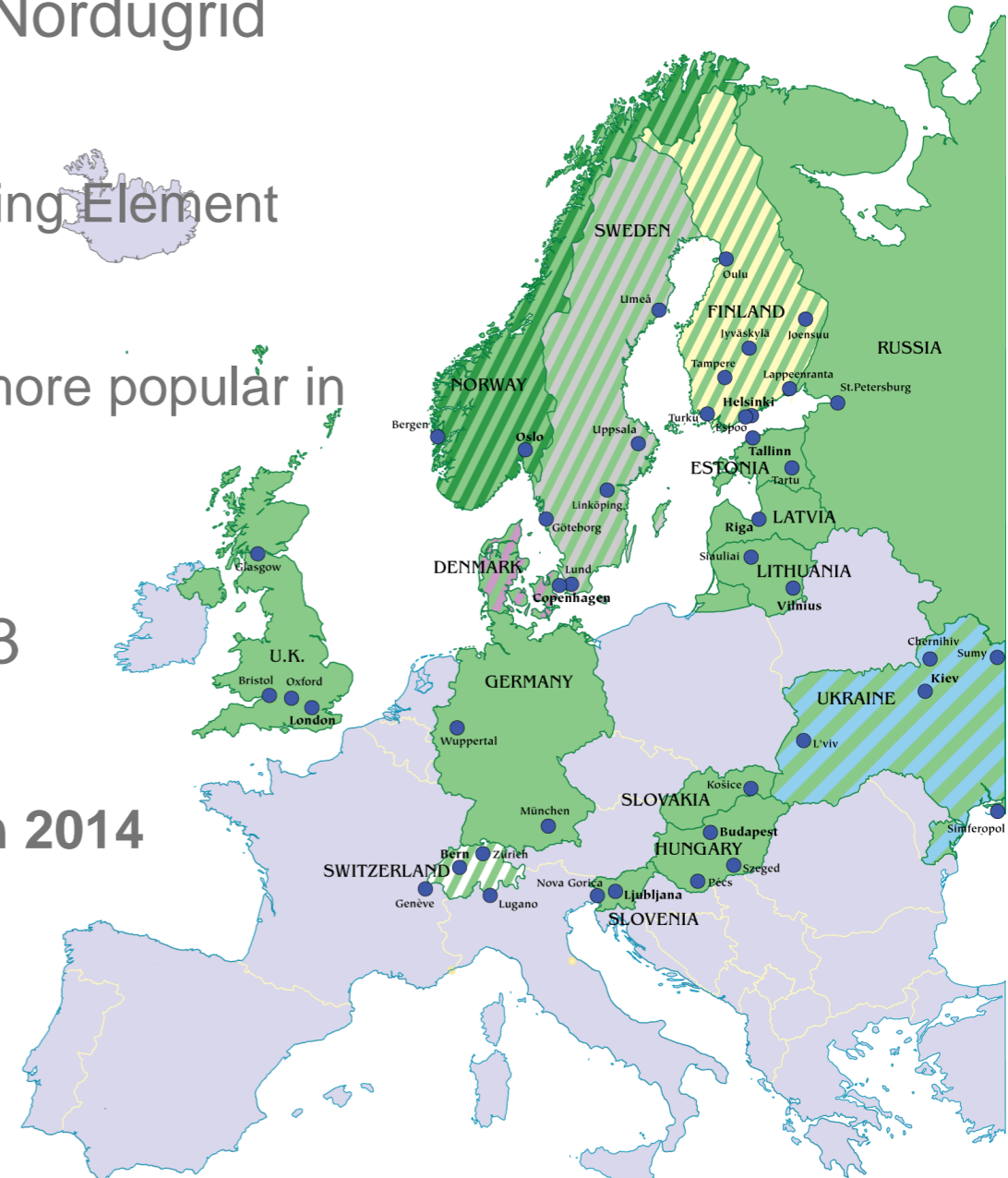
- ARC : Advance Resource Connector, CE : Computing Element

- Simpler than EGI equivalent, becoming more and more popular in Europe

▶ First installation in Asia at IHEP-Beijing in 2013

- Interface to BOINC developed by WU Wenjing in 2014

- 2015 : interface to HPCs in China



ATLAS@home and HPC related developments are based on ARC-CE

Harvest cheap CPU resources

Storage is where one wants to spend money



Easy setup of local cluster

No need of heavy grid middleware

Outreach

Make us know to society

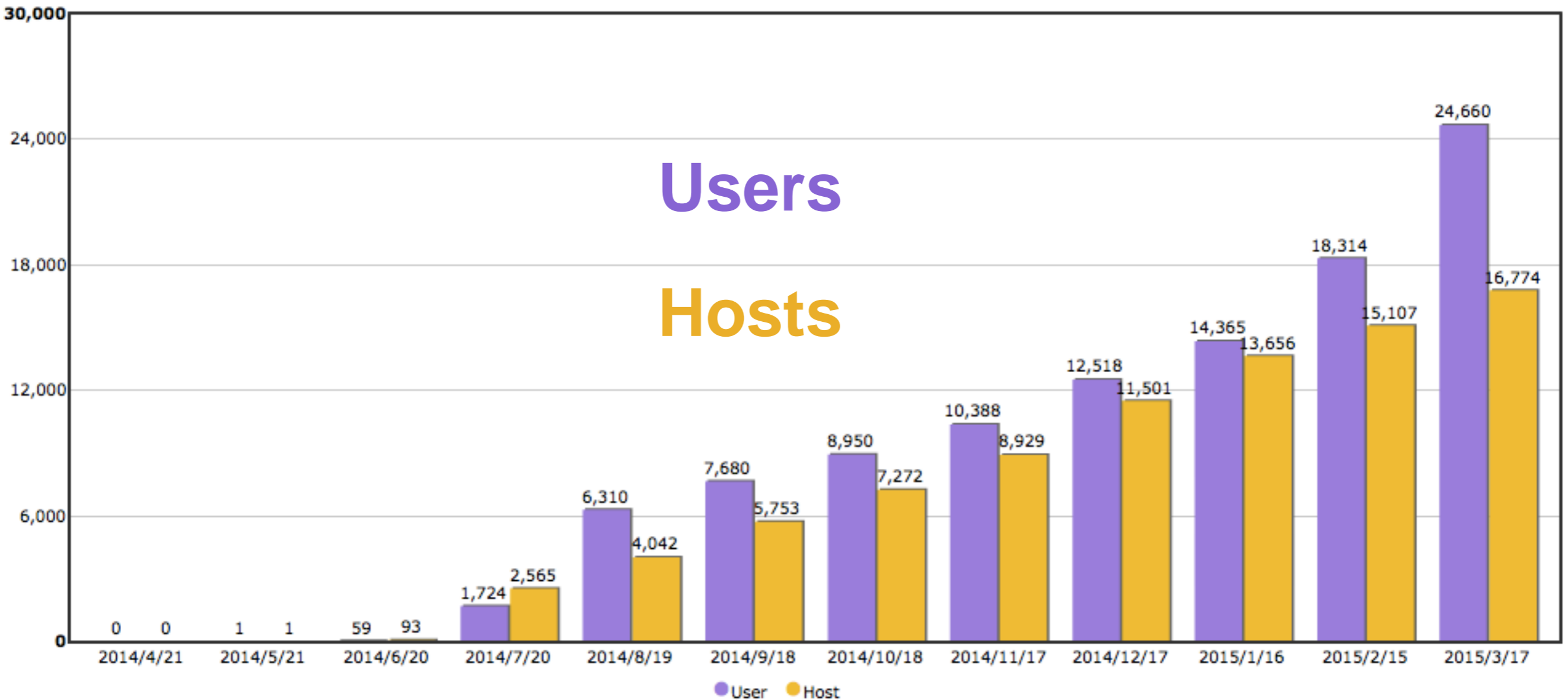
ATLAS@home since last year

- ARC-CE & BOINC server now hosted and managed by CERN-IT
- Continuous growth of number of volunteers (>25.000)
- Part of ATLAS outreach strategy
- Fully integrated in ATLAS production system
 - First and only LHC experiment !
- 5M of CPU hours delivered
 - Representing 1.5 to 4 M\$ on Amazon EC2 (depending on options)



Volunteer growth over ~one year

User&Host

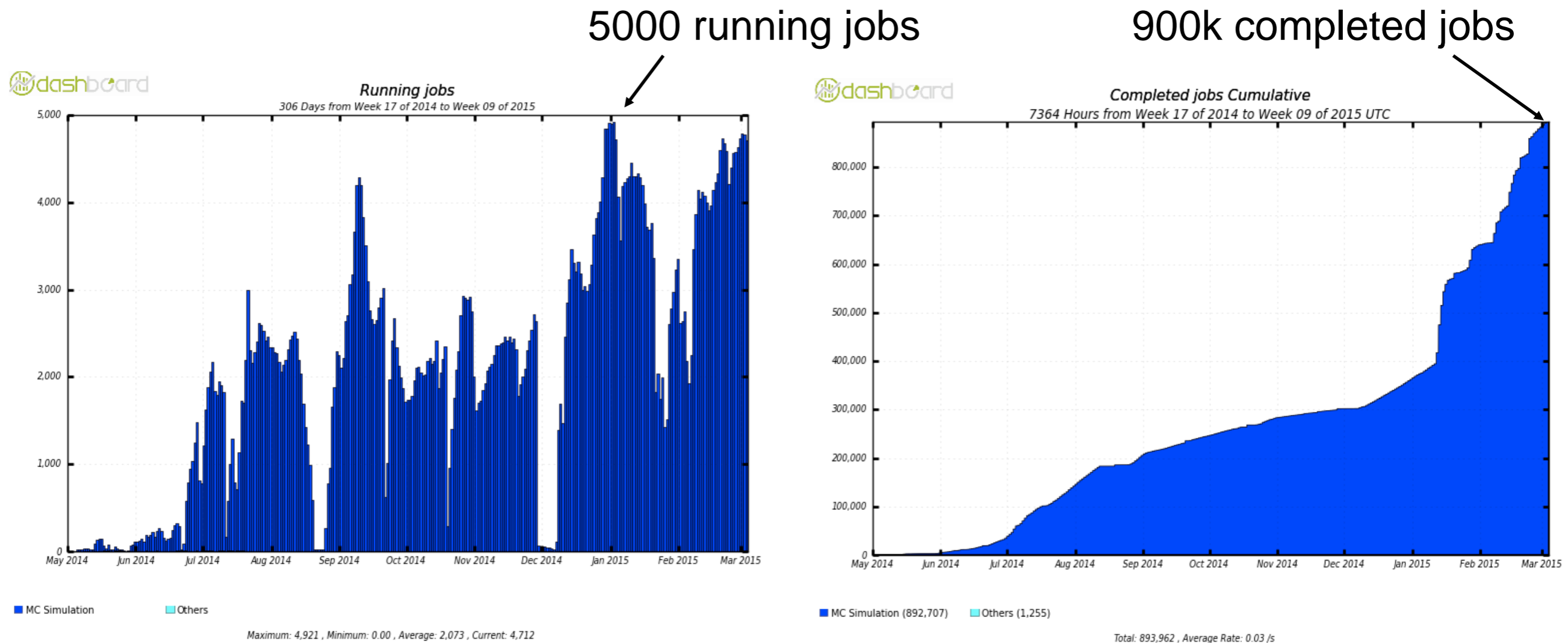


Currently 25k volunteers, 3.2k active

Einstein@Home: 300k volunteers, 47k active

Seti@Home: 5 million volunteers, 150k active

Job statistics since May 2014

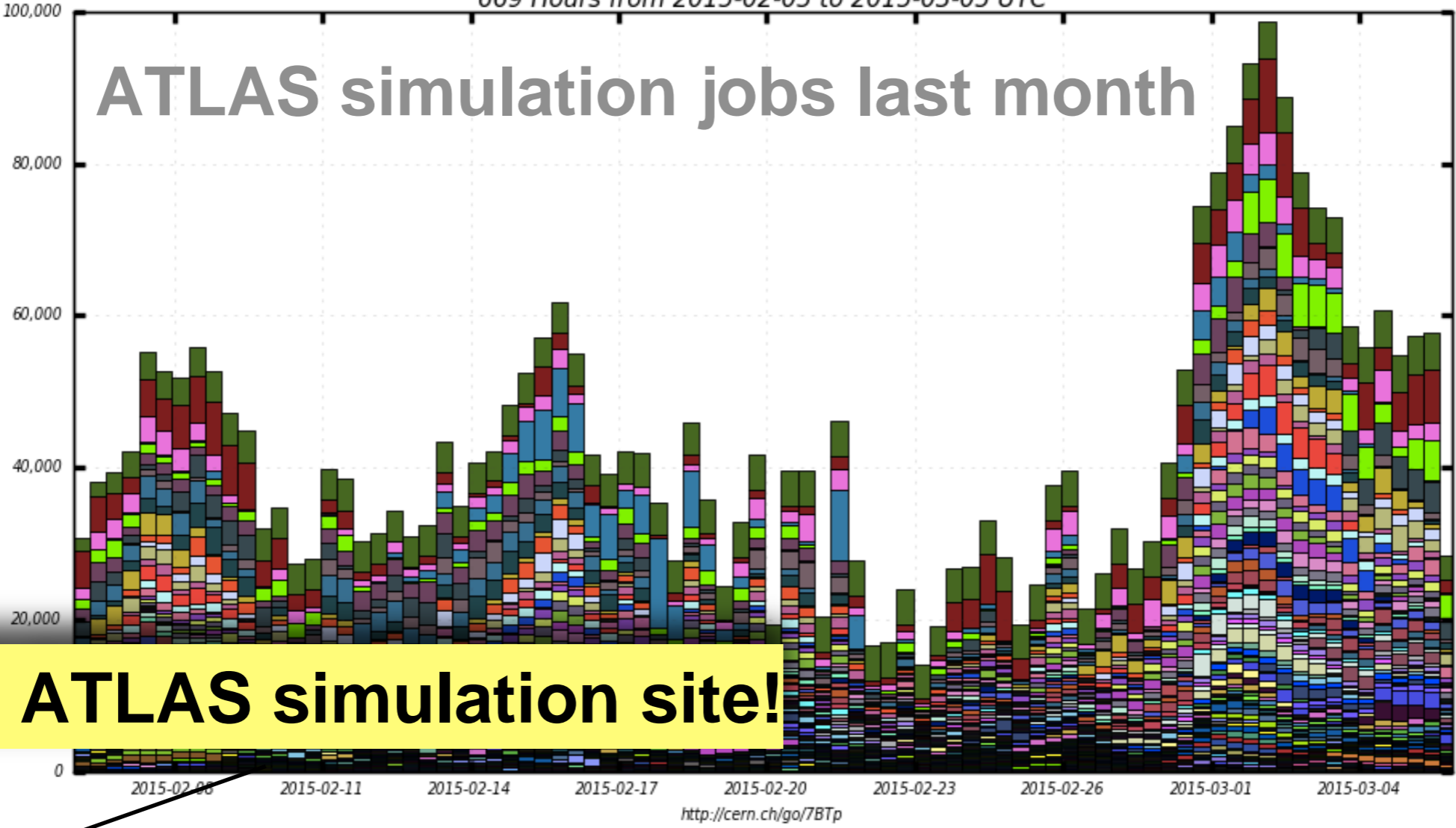


- Continuous 4000-5000 running jobs
- almost 900k completed jobs
- 5M CPU hours, 20M events
- 50% CPU efficiency
- Gaps are due to technical issues, not lack of volunteers

Scale of ATLAS@Home



Slots of Running Jobs
669 Hours from 2015-02-05 to 2015-03-05 UTC



Largest ATLAS simulation site!

- BOINC
- BNL-ATLAS
- RAL-LCG2
- UKI-LT2-BRUNEL
- CERN-PROD
- IN2P3-CC
- INFN-T1
- LRZ-LMU
- UKI-SCOTGRID-GLASGOW
- DESY-HH
- TRIUMF-LCG2
- INFN-NAPOLI-ATLAS
- UKI-SOUTHGRID-RALPP
- MWT2
- UKI-LT2-QMUL
- AGLT2
- INFN-MILANO-ATLASC
- FZK-LCG2
- UKI-NORTHGRID-MAN-HEP
- UKI-LT2-QMUL
- INFN-ROMA1
- UKI-NORTHGRID-LANCS-HEP
- WUPPERTALPROD
- SIGNET
- NDGF-T1
- SWT2 CPB
- UKI-SOUTHGRID-OX-HEP
- IFIC-LCG2
- BU ATLAS TIER2
- PIC
- PRAGUE LCG2
- UKI-LT2-RHUL
- CSCS-LCG2
- HU ATLAS TIER2
- WT2
- CYFRONET-LCG2
- JINR-LCG2
- TOKYO-LCG2
- IAAS
- UTA SWT2
- CERN-P1
- IN2P3-LPSC
- NIKHEF-ELPROD
- GRIF-IRFU
- IN2P3-CPPM
- ... plus 73 more

ATLAS@home references

- ▶ Numerous contributions to
 - ▶ ATLAS meetings,
 - ▶ Grid workshops,
 - ▶ BOINC workshop
- ▶ 2 contributions accepted at CHEP-2015 conference
- ▶ Visible on the Web


Ideas worth nurturing

A clean bill of health for CERN's medical applications office

LS1 Report: Handing in the ATLAS keys

CERN's role in medical applications

Microcosm 2015: showcasing real objects, real people and real discoveries

Transfer line tests take centre stage 

Brand new hall in the main building

Machine Learning wins the Higgs Challenge

ATLAS@Home looks for CERN volunteers

ATLAS@HOME LOOKS FOR CERN VOLUNTEERS

ATLAS@Home is a CERN volunteer computing project that runs simulated ATLAS events. As the project ramps up, the project team is looking for CERN volunteers to test the system before planning a bigger promotion for the public.



ATLAS@Home is a large-scale research project that runs ATLAS experiment simulation software inside virtual machines hosted by volunteer computers. "People from all over the world offer up their computers' idle time to run simulation programmes to help physicists extract information from the large amount of data



Now Playing HOW YOU CAN TAKE PART IN A SCIENTIFIC BREAKTHROUGH!

These computer programs allow you to get active and make a huge difference in the scientific community.

Tagged ATLAS@HOME, BOINC, CLOUD COMPUTING, DARK MATTER, DATA, DISTRIBUTED COMPUTING, FOLDING@HOME, PROTEIN FOLDING, SETI@HOME, SUPERCOMPUTER

ATLAS at HPC centres

- ▶ The jar on the right is full of rocks
- ▶ Nevertheless it is not full
- ▶ Often when supercomputers are “full”, there are empty nodes
- ▶ ATLAS program would benefit a lot by using those empty nodes



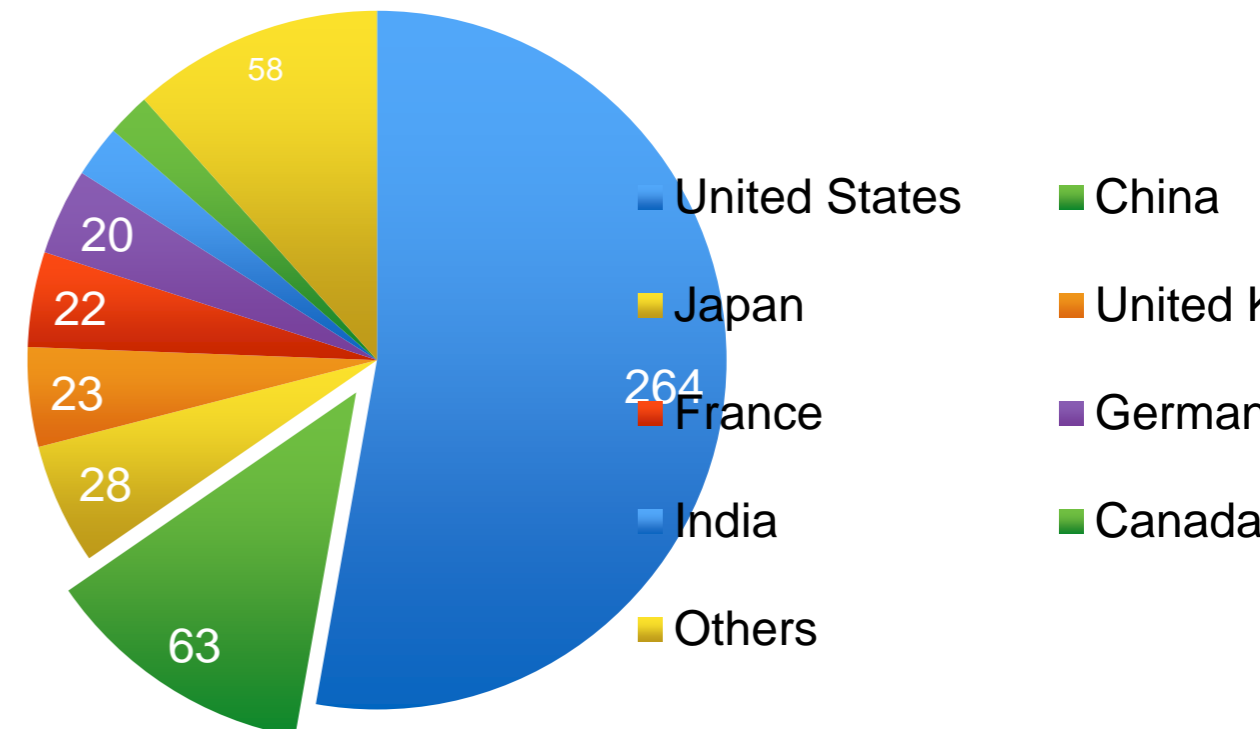
HPC (High-Performance Computing) resources

- ▶ Large investments in many countries : from Peta to Exa scales initiatives^[1]
- ▶ Latest competitive supercomputers are familiar Linux clusters
- ▶ **Large** number of spare CPU cycles are available at HPCs which are not used by 'standard' HPC applications
- ▶ **China** host some of the largest HPC facilities worldwide



SuperMUC a PRACE Tier-0 centre :
155,000 Sandy Bridge cores 2.8M HS06
WLCG 2013 T0/1/2 pledges ~2.0M HS06

Number of facilities in Top500 per country (2014)



HPCs in China for ATLAS simulation

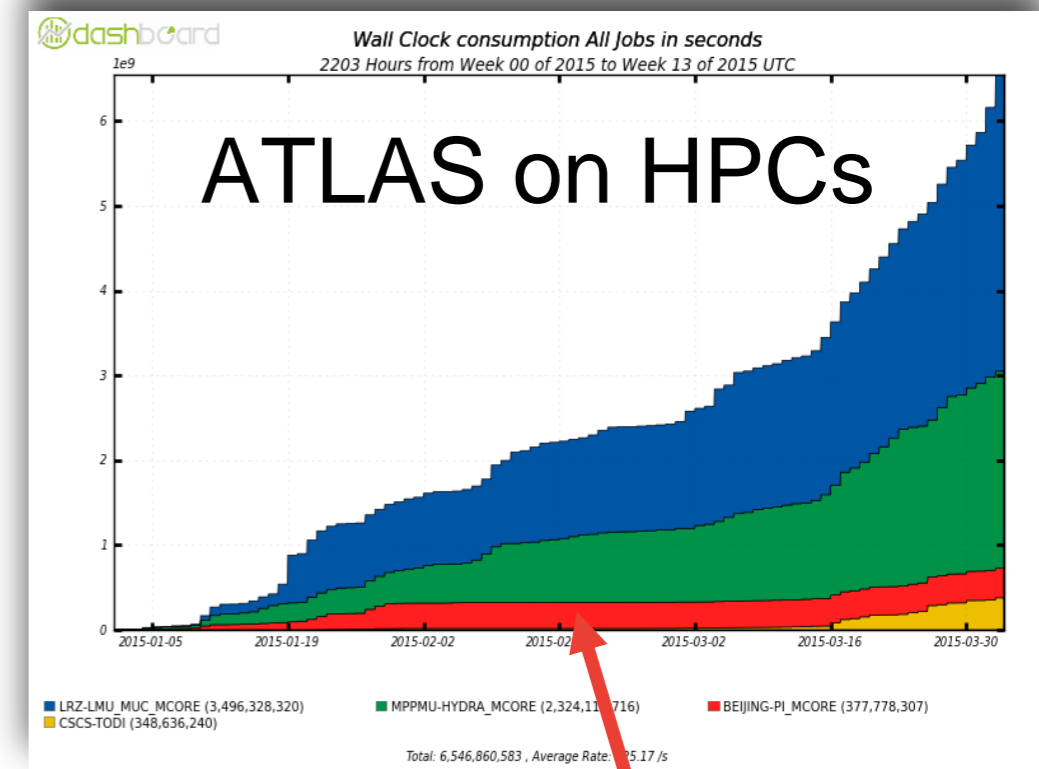
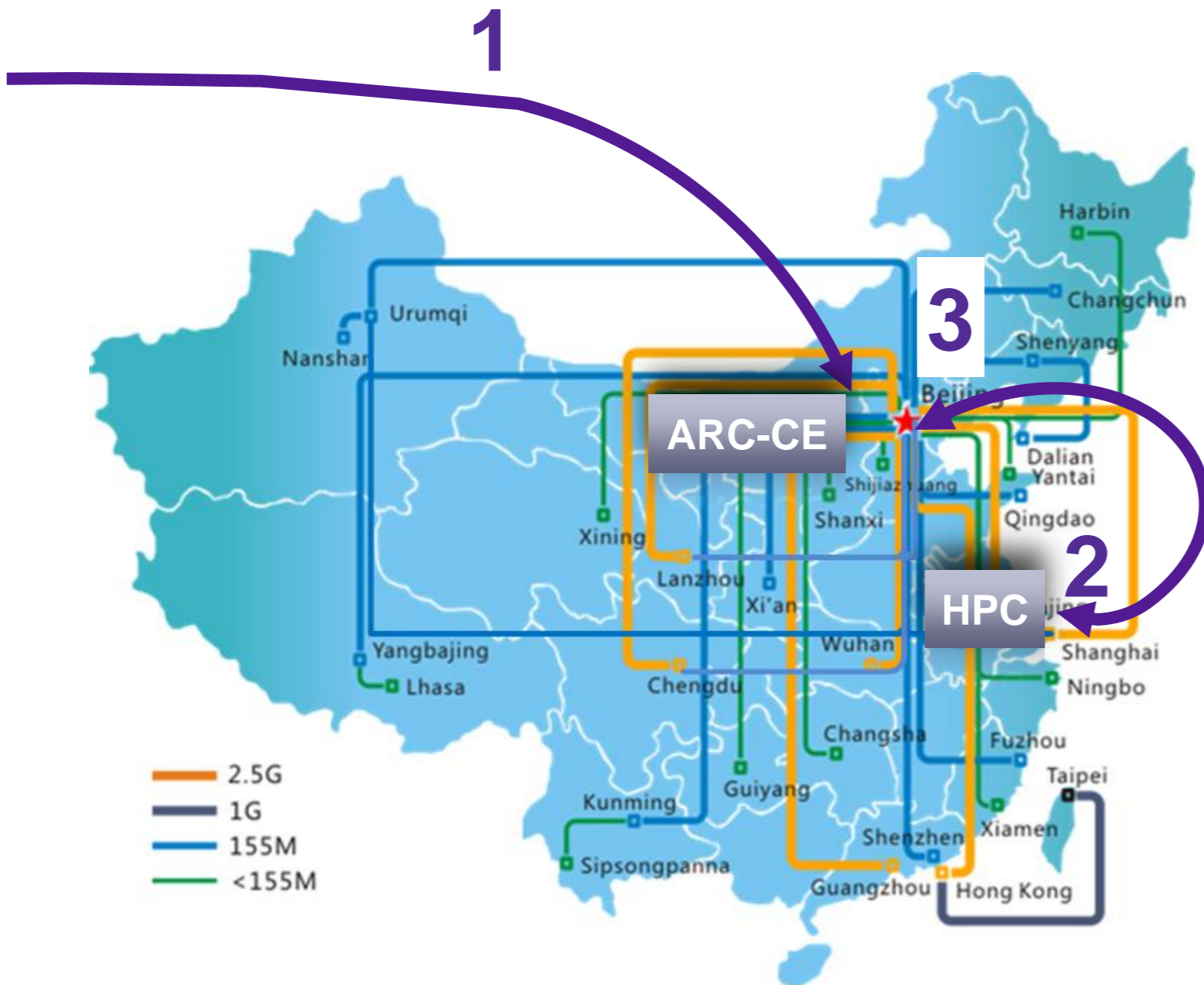
- ▶ Visit the new HPC called PI (JT) at Jia Tong University in Shanghai January 2015
- ▶ One ARC-CE installed at Beijing - IHEP to serve HPC in Shanghai as proof of concept
- ▶ Demonstrator fully operational in March 2015



上海交通大学
SHANGHAI JIAO TONG UNIVERSITY



1. Requests come from CERN to ARC-CE in IHEP
2. Jobs are submitted to HPC in Shanghai
3. Results stored on Grid storage at IHEP



Shanghai

Interface of HPCs from CAS

- Sep. 2014 visit to CAS HPC center at CNIC (Computer Network Information Center) to discuss use case and implementation
- HPC centres from CAS interconnected through ScGrid!
 - Unique in the world!
- Jan. 2015 workshop at CNIC to work on interface between ARC-CE and ScGrid



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

Supercomputing Center of Chinese Academy of Sciences

Scientific Computing Grid (ScGrid)

- ▣ Supercomputing Environment in CAS
- ▣ computing resources
 - 300T flops CPU
 - 3000T flops GPU
- ▣ 30+ Institutes from CAS
 - SCCAS: Head Center
 - 8 branch centers
 - 18 regional centers
 - 11 GPU clusters

北京总中心 在线用户: 37人 CPU利用率: 73.89%

★总中心 ◆分中心 ●所级中心 绿色 在线 灰色 不在线

新疆生态所 沈阳 大连 青岛 上海 福建物构所 昆明 深圳 合肥 武汉 山西煤化所 德州

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Interface to ScGrid

- ▶ Jan. 2015 visit to HPC centre in Huairou campus of CNIC (north of Beijing)
- ▶ Interface between ARC-CE and CsGrid almost finished
- ▶ Plan to submit ATLAS simulation on one HPC (ERA) in the next weeks
- ▶ Next steps :
 - Scalability tests
 - Use of ScGrid as a whole, not just one HPC



Supercomputing Center of Chinese Academy of Sciences

SCE - Middleware for Science Cloud

▣ Developed by SCCAS

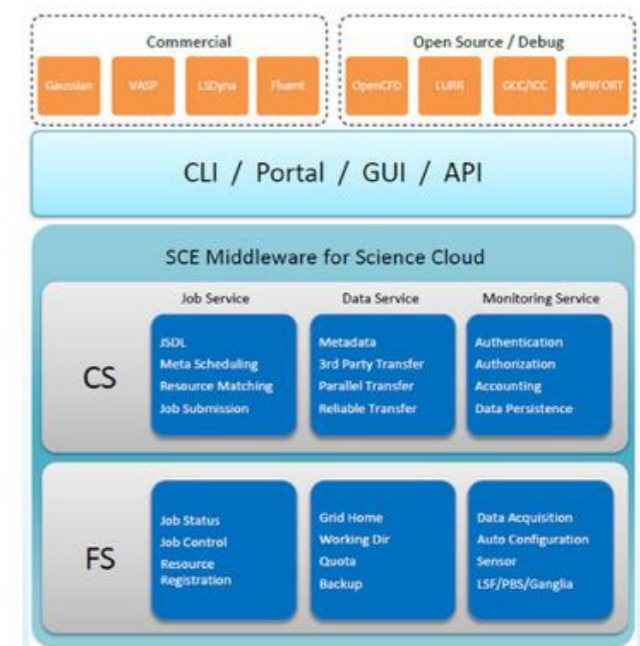
▣ SCE

- Scientific computing
- Lightweight
- Stable

▣ Diveristy

- CLI
- Portal
- GUI
- API

International Patent
(PCT/CN2011/071640)



Activities on cloud computing

- ▶ One CSC student LI Sha/李莎 arrived at LPSC (Grenoble) starting July-2014 to work on cloud computing with Catherine BISCARAT's team
- ▶ Interests in cloud computing :
 - Be part of the next big change in the computing landscape change
 - Investigate this new technology
 - Reduce the operational overhead
 - Flexibility (resource provisioning and sharing)
 - Being ready for potential resource provisioning opportunities

Activities on cloud computing - LI Sha's work

- ▶ Goal: getting a cloud infrastructure to serve ATLAS as well as other VOs efficiently and securely

- Regular exchanges/meetings with ATLAS and the French NGI Cloud operation team
- Integration of cloud infrastructures to LHC workflow

Cloud integrated to ATLAS production system and in test

- ▶ In practice :

- Identifying the most suitable cloud Middleware (various cloud technologies)
- Getting ATLAS jobs running on the LPSC cloud

[IN2P3-LPSC](#) ✓

[IN2P3-LPSC CLOUD](#)

(test) ✓

- ▶ LI Sha's work is crucial for the French LCG community

- her reports to the LCG-France coordinating team are highly appreciated

Summary & Outlook

- ▶ A very healthy collaboration !
- ▶ With visible contributions
- ▶ Prospects for the forthcoming year
 - ATLAS@home : Born in FCPPL, not yet at full scale, many optimisations to be done
 - HPC : from prototype to production
 - Cloud computing : optimisation for LHC usage
- ▶ Long term and substantial support needed
 - Collaboration need regular face to face meetings
 - Opportunities come from small talks and not through Skype/Video-conf.

Merci/谢谢

SPARES

ATLAS@home : How does it work for volunteers?

- ▶ Install BOINC client and VirtualBox
 - Linux, Mac and Windows supported
 - Currently 80% of hosts have Windows
- ▶ In BOINC client choose ATLAS@Home and create an account
- ▶ That's it!
- ▶ BOINC client can be configured to run whenever is convenient, e.g.:
 - After computer is idle for 5 mins
 - Only between 5pm and 8am

Basic ATLAS@Home Architecture

