

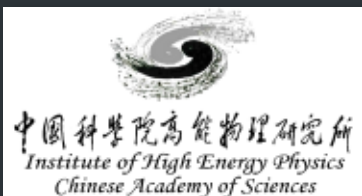
# Exploration of computing technologies project

Progress report

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*FCPPL Workshop  
Nanjing, March 29th, 2013*

- CC-IN2P3  $\leftrightarrow$  IHEP connectivity
- Cloud-based storage
- France-Asia virtual organization deployment
- Additional outcome
- Future activities

# CC-IN2P3 $\leftrightarrow$ IHEP connectivity

# CC-IN2P3 ↔ IHEP connectivity

- Reminder: observed asymmetrical low network throughput between CC-IN2P3 and IHEP, relative to the capacity of the link  
*transcontinental link between Beijing and London*  
*shared for all academic and research activities*  
*2.5 Gbps*
- Actions  
*extensive dedicated tests for measuring actual file transfer throughput*  
*deployment of permanent infrastructure for probing the link in both directions CC-IN2P3 ↔ IHEP*  
*from IHEP, also probing several other European sites of the LHC computing grid*  
*several software and hardware upgrades and reconfigurations of the local network of CC-IN2P3 and IHEP, devoting machines to specific tasks (e.g. measuring latency, throughput)*  
*analysis of file transfer rates collected by ATLAS and the WLCG dashboard*

# CC-IN2P3 ↔ IHEP connectivity (cont.)

- Results

*agreement between IHEP, CERNET and ORIENTplus network operations center: we can now collect data on the actual aggregated usage of the ORIENTplus link, as seen by the Chinese endpoint*

*ORIENTplus is busier in the direction London → Beijing, which may explain the lower throughput observed in that direction*

*CC-IN2P3 has now an additional 10Gbps link for carrying international traffic to GEANT*

*high variability in ATLAS file sizes means high variability in file transfer rates: rates for small files (10MB) are 10 times slower than rates of big files (1 GB+)*

*aggregating rates for files transferred simultaneously would be a better indicator than using average: however, lack of easily accessible data to compute this*

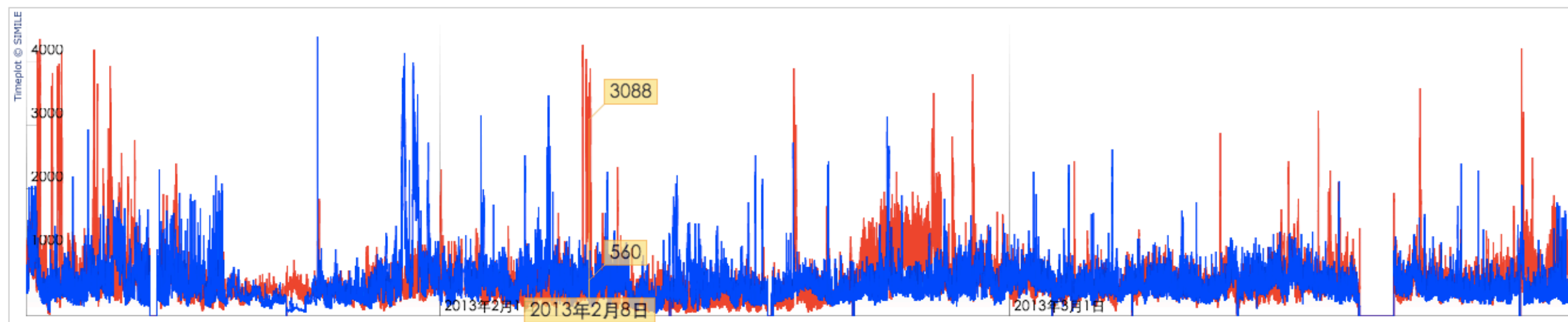
# CC-IN2P3 ↔ IHEP connectivity (cont.)



## Throughput Monitor for Orient+ (Beijing-London)

This is the Throughput Monitor for the Link between Beijing and London (Orient+). Thanks for the help from CERNET and Orient NOC, they gave IHEP the privilege to read the Router (CNGI-6IX) interface information. We are reading the router interface information every 2 minutes.

London -> Beijing vs. Beijing -> London



The blue line is the throughput from Beijing to London.  
The red line is the throughput from London to Beijing.

# CC-IN2P3 ↔ IHEP connectivity (cont.)

- Results (cont.)

*no intrinsic limitation on the network link between CC-IN2P3 and IHEP*

*early January 2013, ORIENTplus bandwidth doubled to reach 5 Gbps — tests performed showed it is possible to use 4.4 Gbps for transferring data from IHEP to Europe*

- What is next

*system for collecting and analyzing detailed data on the usage of IHEP international network links is under development (ZENG Shan)*

*preliminary results presented at Hepix Fall 2012 [\*]*

*planned evaluation of ZNeTS for deployment at IHEP: this tool is developed by IN2P3 Grenoble (LPSC) and in production at all IN2P3 sites*

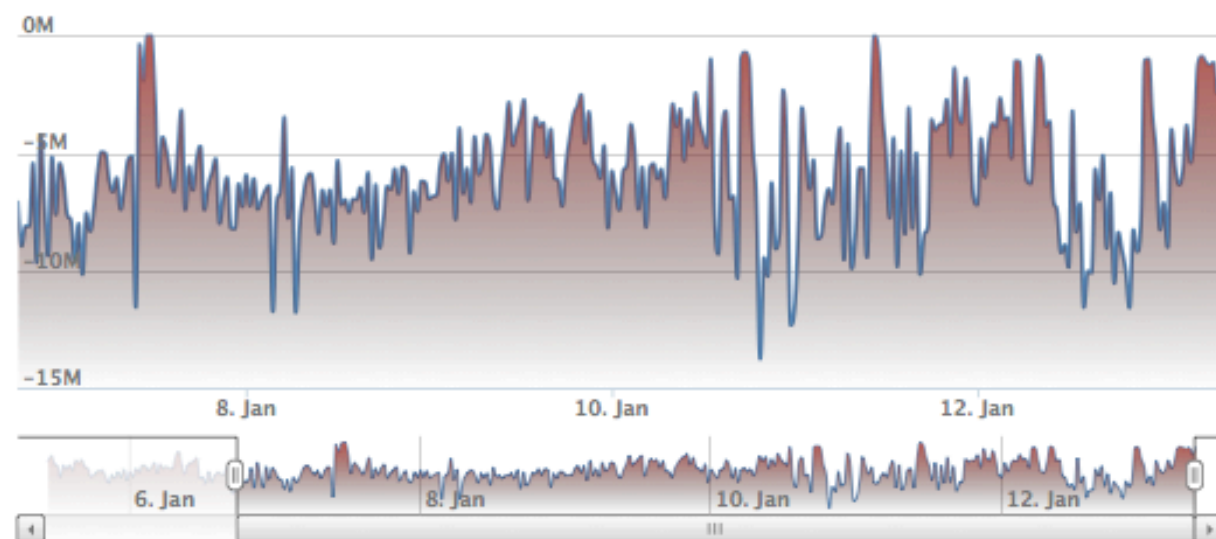
[\*] <http://indico.cern.ch/getFile.py/access?contribId=6&sessionId=2&resId=1&materialId=slides&confId=199025>



# CC-IN2P3 ↔ IHEP connectivity (cont.)

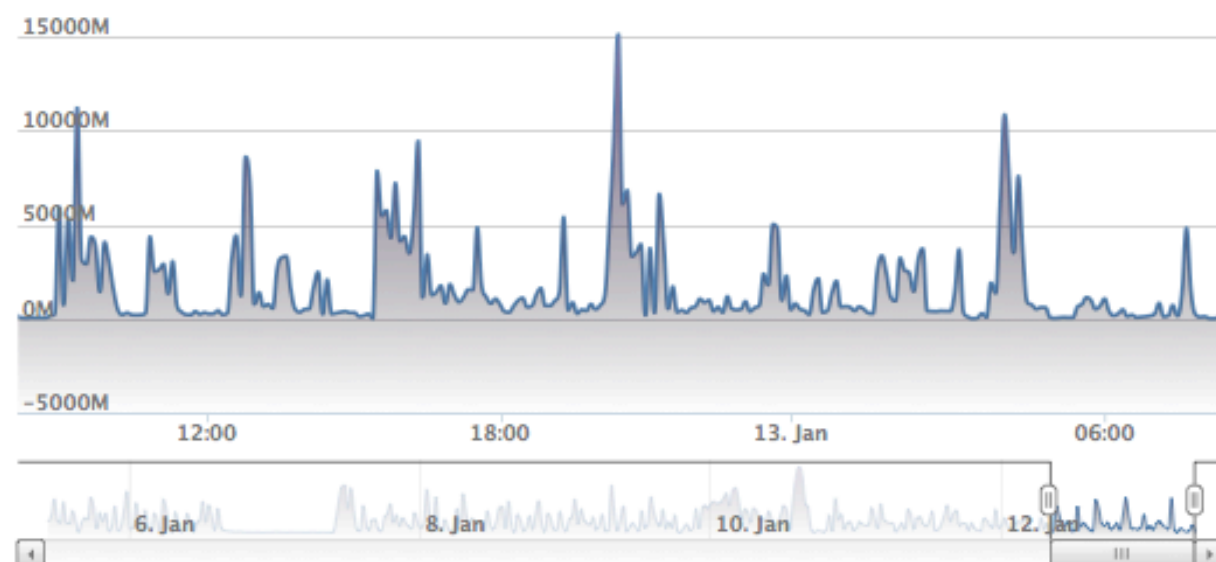
DYBTraffic count by minute

Zoom 1h 1D 1m All



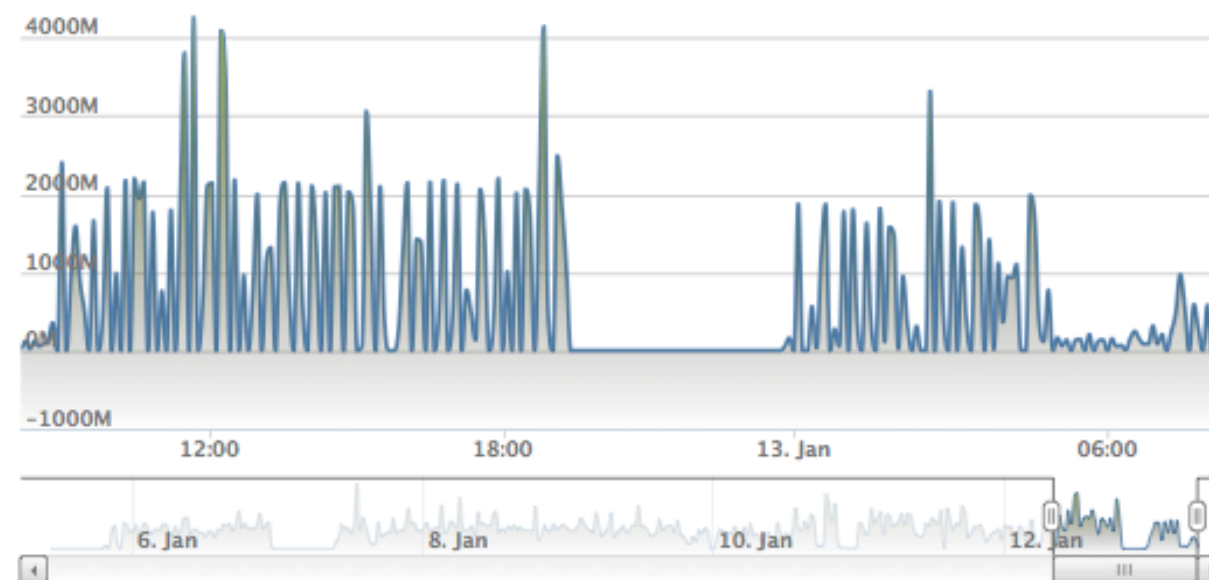
CMSTraffic count by minute

Zoom 1h 1D 1m All



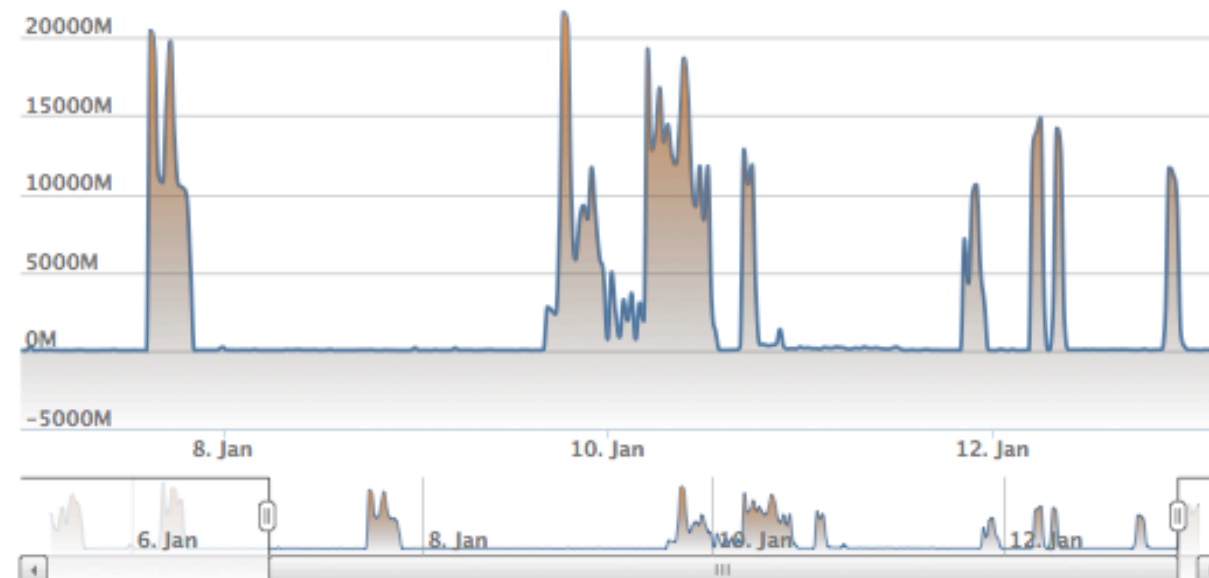
YBJTraffic count by minute

Zoom 1h 1D 1m All



ATLASTraffic count by minute

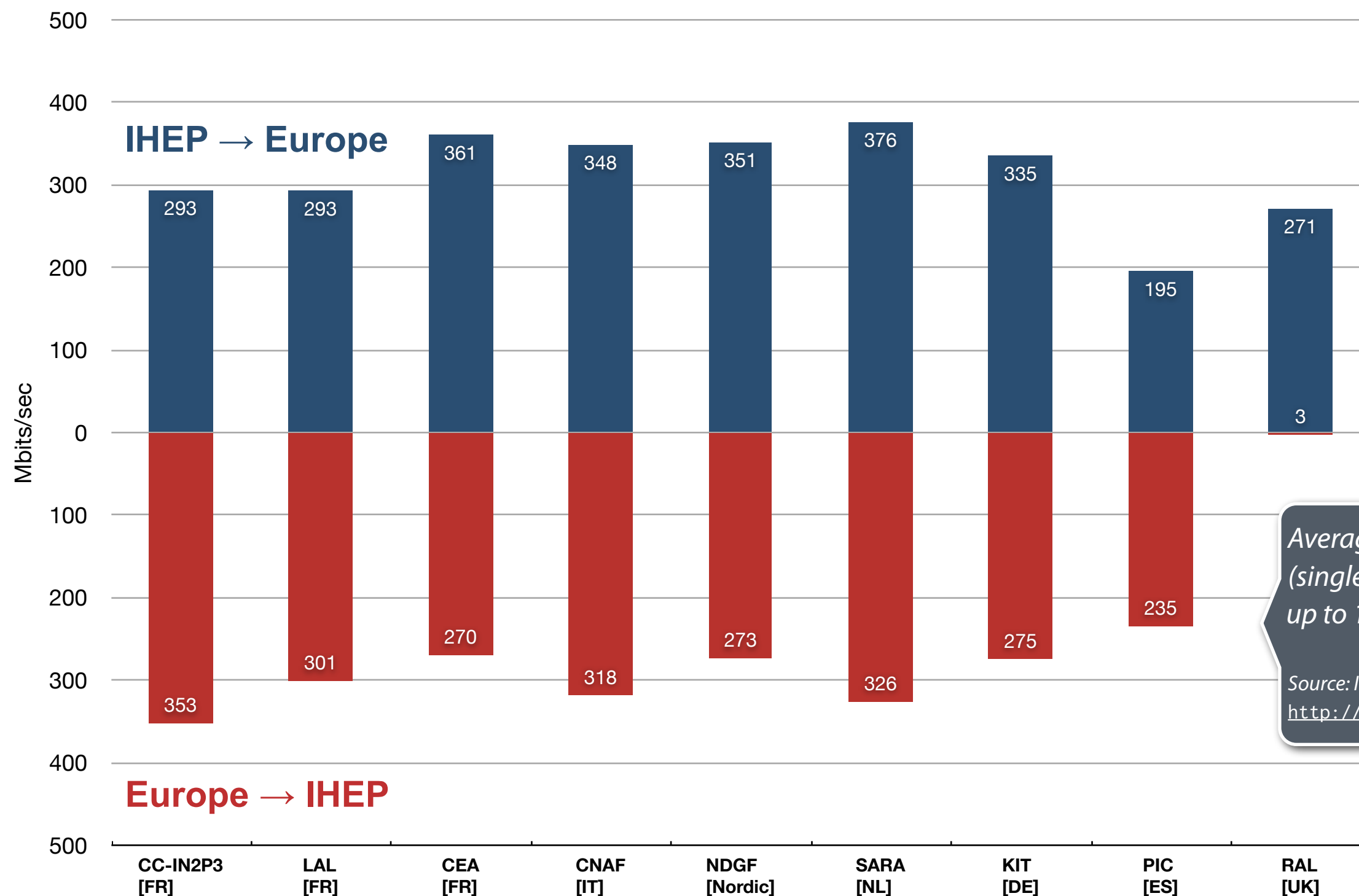
Zoom 1h 1D 1m All





# CC-IN2P3 ↔ IHEP connectivity (cont.)

## IHEP — Measured Network Throughput



Average network throughput  
(single stream) over 1 month,  
up to 11/03/2013

Source: IHEP's Perfsonar  
<http://perfsonar.ihep.ac.cn>

# Exploration of cloud-based storage

# Exploration of cloud-based storage

- Can we use standard protocols used by commercial cloud storage services for our research needs?

- Use cases

*file repository for individual users*

*file repository for experimental data*

- Recent work

*intensive tests performed with Huawei's pre-production S3 appliance,  
lent to IHEP during 6 months*

*similar machine being evaluated at CERN's Openlab*

# Exploration of cloud-based storage (cont.)

- Results

*improved support of S3 protocol in ROOT framework*

*experiments can efficiently read remote files using the S3 protocol without downloading the whole file*

*no experiment-specific software needs to be modified*

```
TFile* f = TFile::Open("s3://uds.ihep.ac.cn/myBucket/myDataFile.root")
```

*features: partial reads, vector read (provided the S3 server supports it), web proxy handling, HTTP and HTTPS*

*works with Amazon, Google, Huawei, ...*

*integrated in current production version [ROOT v5.34/05]*

*experiments can make an opportunistic usage of cloud storage providers*

# Exploration of cloud-based storage (cont.)

- File repository for individuals

*experimental configuration deployed*

*successfully showed it is viable to use this technology for providing additional storage capacity to individuals*

*several GUI-based tools available, free and commercial*

*currently working on improving the CLI tools*

- File repository for experimental data

*performance tests comparing usage of sample ATLAS files using local file system, cluster file system and S3-based file server*

# Exploration of cloud-based storage (cont.)

- Detailed results

*presented last week at ISGC 2013 in Taipei*

<http://indico3.twgrid.org/indico/contributionDisplay.py?contribId=164&confId=370>

# France-Asia virtual organization



# France-Asia VO deployment

- IHEP now operational, supporting users of this VO

*sites: IHEP(China), KEK (Japan), Kisti (Korea) and CC-IN2P3 (France)*

*outcome of the visit to IHEP by Ghita RAHAL and Yonny CARDENAS in April 2012*

- DIRAC instance operated by CC-IN2P3 configured to be used by France-Asia VO

*members can leverage DIRAC's user friendlier tools to exploit the power of the grid infrastructure*

*very important for small experiments to get started quickly on the grid*

- TREND experiment

*currently adapting its simulation software tools to migrate from a centralized computing environment (CC-IN2P3) to a grid-based environment*

*goal: perform a large scale simulation using sites supporting France-Asia VO*

*already able to submit jobs through CC-IN2P3 using grid interfaces*

*next step: make its software tools site-independent*

# Noteworthy



# Noteworthy

- Hepix Fall 2012 organized and hosted by IHEP computing centre



<http://indico.ihep.ac.cn/conferenceDisplay.py?confId=2664>

# Future work

# Planned activities for 2013-2014

- A proposal for pursuing the ongoing work submitted to this year's FCPPL call

- Intended work

*extend DIRAC to cover additional use cases and explore alternative implementations of some of its components*

*make DIRAC able to exploit volunteer computing platforms, such as IHEP's campus desktop grid*

*explore unstructured data stores for storing and exploiting DIRAC usage data*

*establish a pilot of a distributed heterogeneous computing environment for scientific experiments, based on DIRAC, operated by IHEP*

*see Andrei's presentation next*

- Partners

*IHEP computing centre, CC-IN2P3, CPPM*



- From spring 2013 KAN WenXiao, a computing science PhD student, will spend 12 months working in the DIRAC team at CPPM (Marseille)

*funding: China Scholarship Council*

# Questions & Comments