ALICE Wuhan Site Report

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Current Status of Wuhan Site

The network is under development: plan A or B

Nuclear Science Computing Center (**NSC³**) at CCNU

ALICE Wuhan Site at CCNU
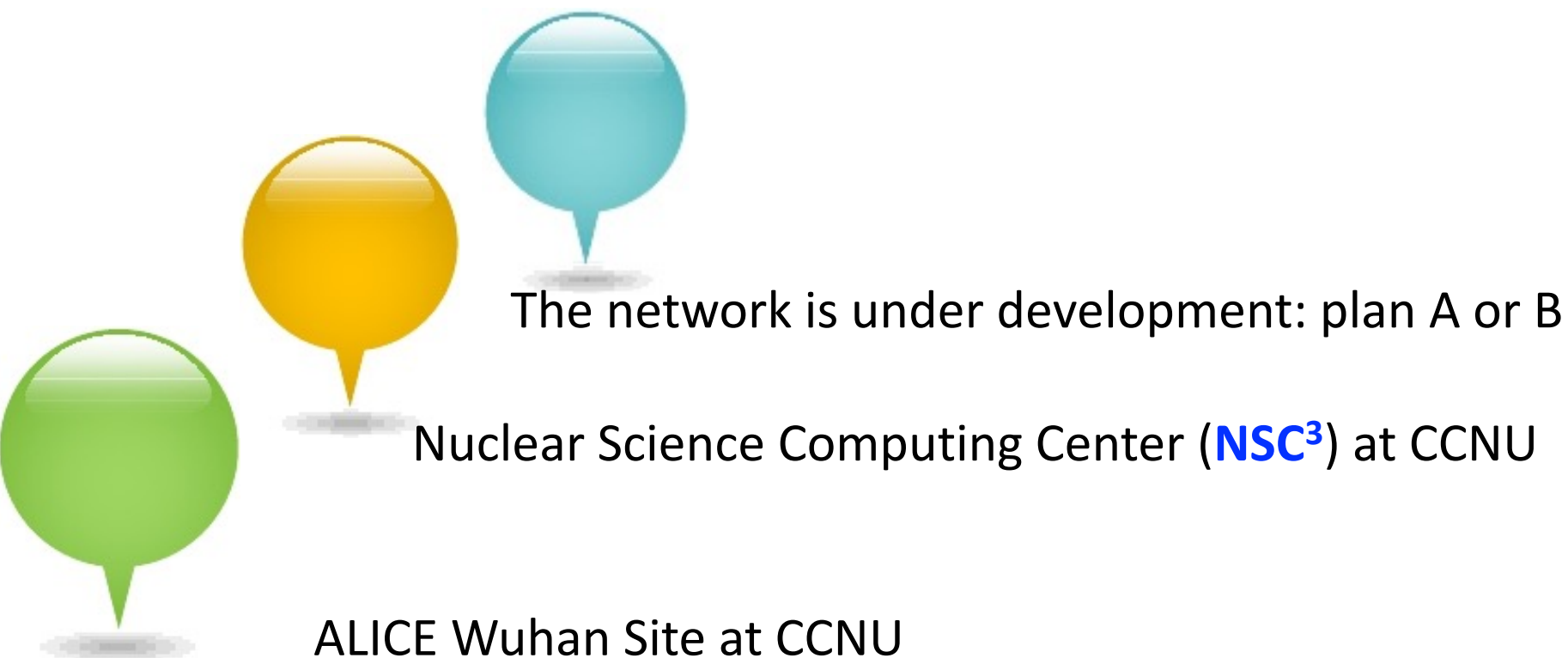
A map view of ALICE computing sites

Previously available resources

■ "Old" computers reported 2018

- ■ VOBOX: 8 cores,

  16GB RAM, 120GB disk

- ■ CREAM-CE: 8 cores,

  16GB RAM, 120GB disk

- ■ WNs: each WN has 24 cores, 50GB RAM, 280GBdisk.

  Total 240 cores

  (CPU purchased by 2015)

- ■ SE: ThinkServer RD530, 80TB

地图　　卫星图像

Wuhan (151 currently active jobs / max 151)

| 1 hour | 1 day | 1 week | 1 month | 1 year |

Active jobs

150 125 100 75 50 25 0

6　7　8　9　10　11　12

Sep 2018

▲ Wuhan

Wuhan

Google　　Imagery ©2018 TerraMetrics　使用条款
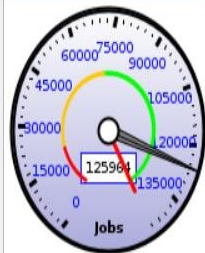
○ Running jobs　○ Running jobs but no ML info　○ Site service problem(s) prevents job
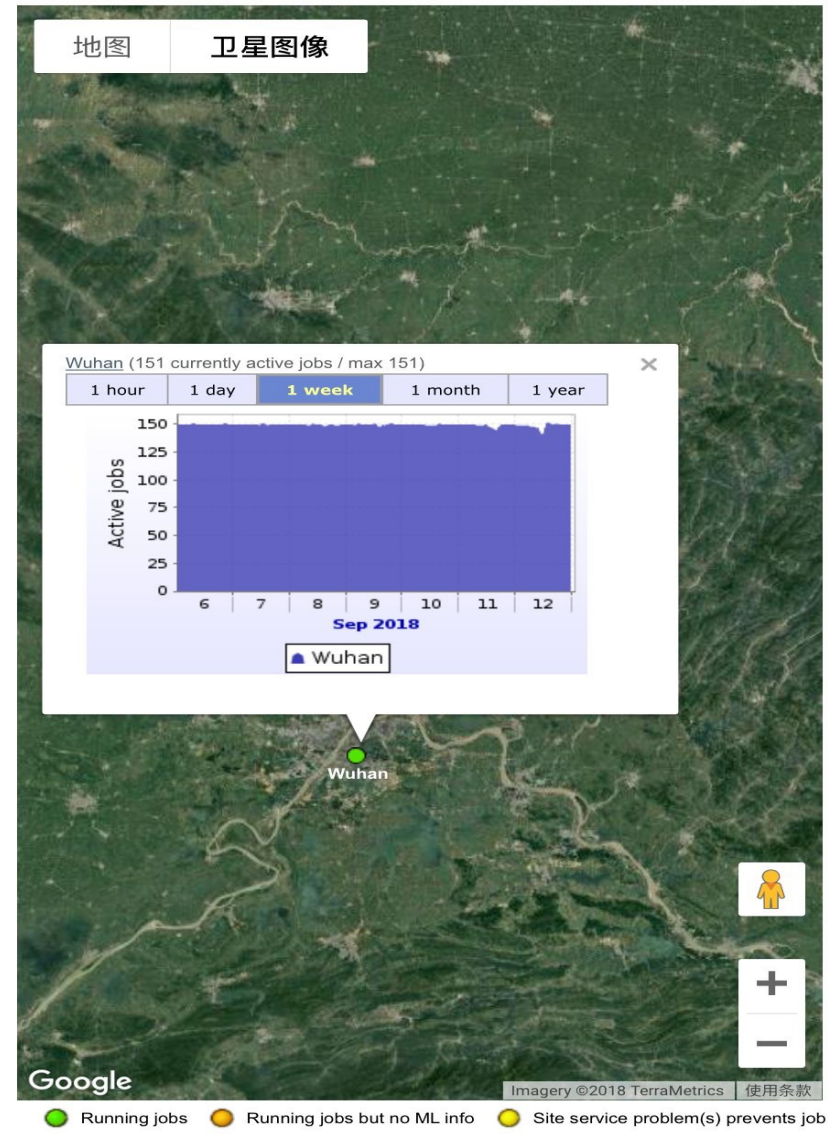
- In brief, the existing computers are too old

- And has been limited storage space

- plus, the network needs improvement in both bandwidth and latency

  - according to previous discussion, latency is probably more urgent for user experience

- Overall, the jobs activity is far from optimistic
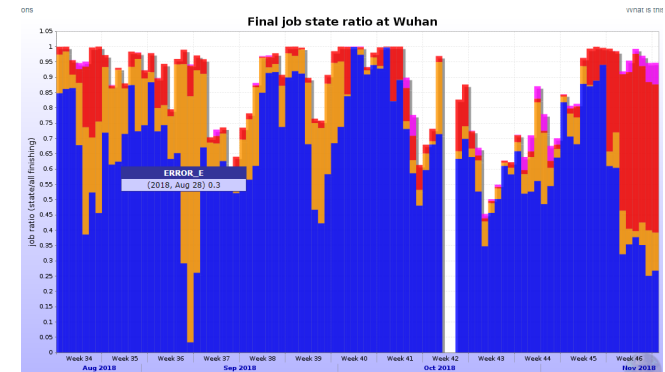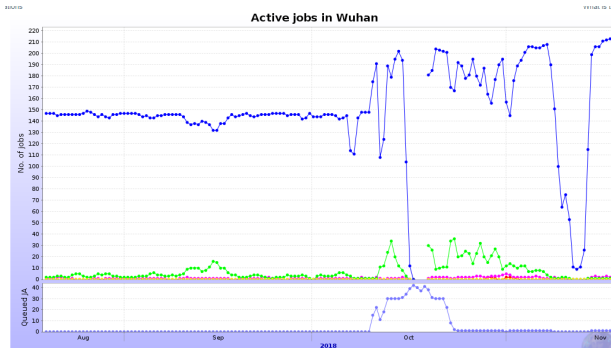
- Improvement of Tier 2 network depends on the university

- However, the connection of campus network to "the Internet" is limited, and relies on unexpected resources, i.e. treaty with neighboring universities and bargain with major ISPs
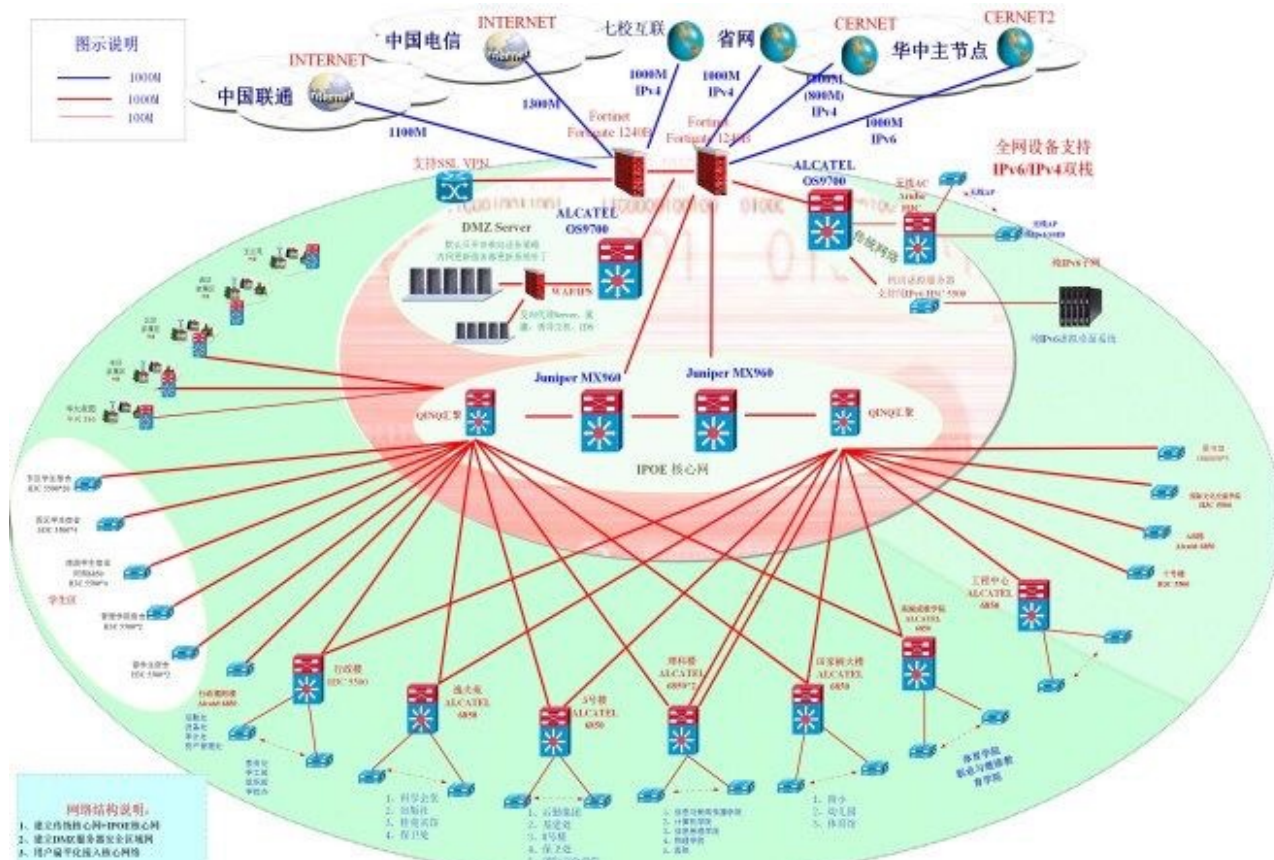
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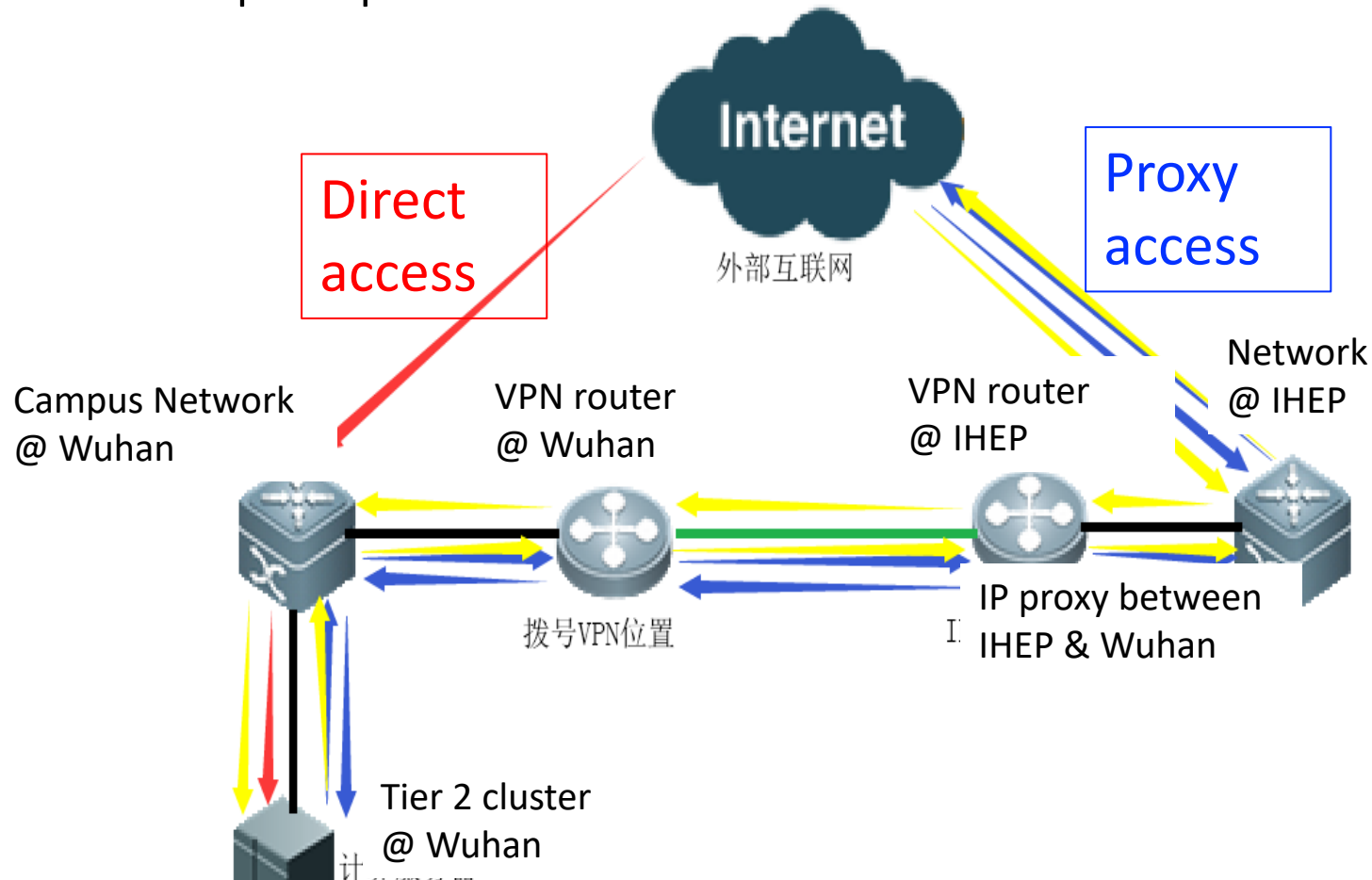
Alternative News Chart Map

‹Wuhan›

IN from

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			05 Jun				

Out to

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Direct connection to IHEP?

- VPN construction between CCNU and
Institute of High Energy Physics Chinese Academy of Science

- Also coupled with new computer purchase
(in next slides)

Direct access

Proxy access

Internet

外部互联网

Network @ IHEP

Campus Network @ Wuhan

VPN router @ Wuhan

VPN router @ IHEP

拨号VPN位置

IP proxy between IHEP & Wuhan

Tier 2 cluster @ Wuhan

计算服务器

However…
Existing computing
resources not sufficient
for all research purposes:

- LQCD: QCD phase structure, Transport coefficients…
- Hydro simulations
- STAR/ALICE/LHCb data analyses

Batch 1 (2008) 10servers, 10 * 2 Intel Xeron E5-2620 (2.0GHz, 6 core)CPU, 48GB RAM
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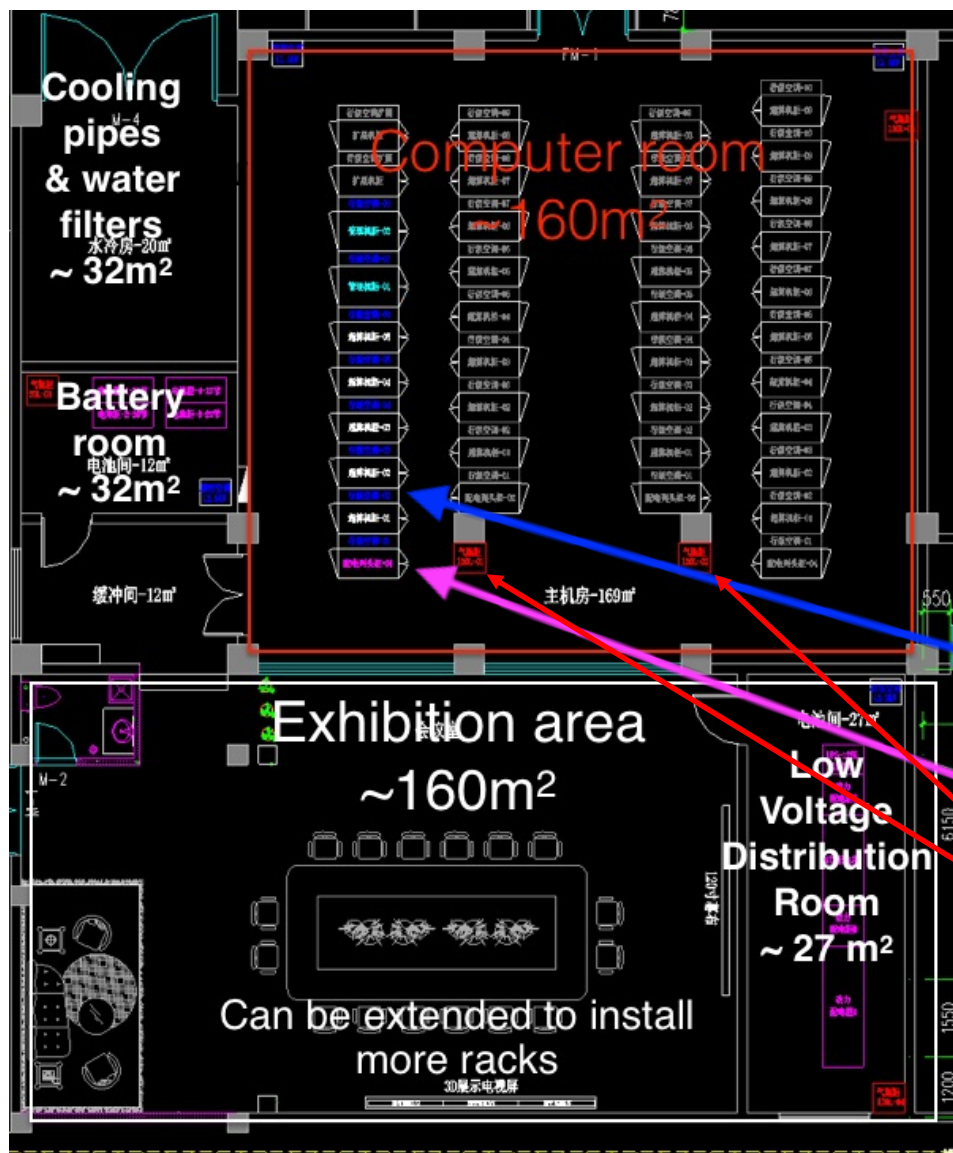Batch 3 (2012) 55servers, 42 * 2 Intel Xeron E5-2620 (2.0GHz 6 cores)CPU, 48GB RAM;
13 * 2 Intel Xeron E5410 (2.33GHz, 4 core)CPU, 16GB RAM
Batch 4 (2014) 12 servers, 12 *2 Intel Xeron E5-2640 (2.50GHz 6 cores)CPU, 48GB RAM

First open in June 2018
18 computing nodes (144 V100 GPUs)
Peak performance 1 PFlops/s, 1 PB storage

➢ Lattice QCD (hep-lat)
➢ HIC (nucl-th,hep-ph)
➢ Detector simulation (nucl-exp)
➢ Experimental Data analyses (nucl-exp)
➢ ……

High Performance, Low Power Consumption

Nvidia Tesla V100

NuclearScience
Computing Center at CCNU

✓ Total area ~ 360 m²
  Computer room ~ 160 m²

✓ Capacity of 36 Racks
  7 racks installed at June 2018
  9 racks installed at October 2019
  20 racks installed at October 2022
  (not yet fully equipped with computers)

Liquid Cooling Package

Electricity rack

Originally designed for theorists, the computers were balanced between CPU and GPU:

In one GPU node:
8 Volta 100 GPU cards
2 skylake-SP (12 cores)
256 GB DDR memory
2 HBA cards

GPU node interconnected
via EDR Infiniband

In total: 18 GPU nodes,
144 GPUs
432 (288 for computing) CPU cores
500 + 500 TB storage

- Budget cut in computing happened at Wuhan in the last few years
- Fortunately, a new three-year computing budget for the Department of Physics was approved by the university at August 2022
- It includes a 10-million Yuan (~1.3 million US dollars) package, but that package is for everything: computers, network hardware, ISP, etc.
- And it is for everybody in the department, so a balance between different users is necessary

- An agreement for the year 2022, about 3-million Yuan budget has been reached this month:
- It focus on CPU purchase by the strong support of HEP experimentalists, which fits the need of ALICE Tier 2 (and possible LHCb Tier2 at Wuhan)

- **Computing nodes**

26 computing servers, each with 2 Xeon CPUs, each CPU >= 32 cores, each core with 6GB RAM (by average)
each server with two 200GB IB card for network

- **Managing nodes**

2 gateway machines

- **Network**

1 IB switch with 5 800G modules and 20 200G modules
1 10-Giga Management switch with 48 10G SFP+fiber and 6 40G QSFP+fiber

- **Software**

Job submission and usage statistics (for billing)

But please keep in mind:
these are <u>for share</u> (e.g. no storage purchase in plan)
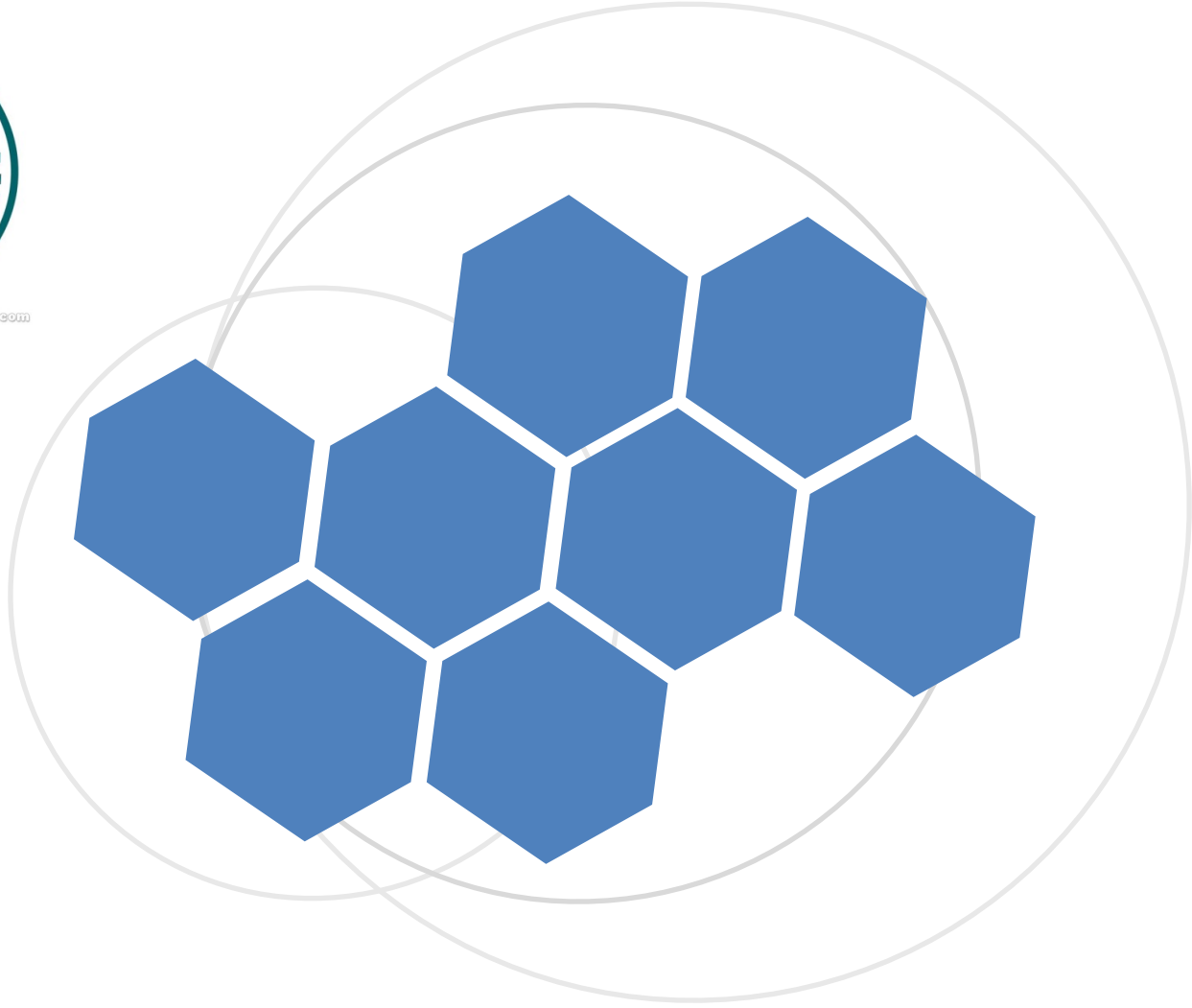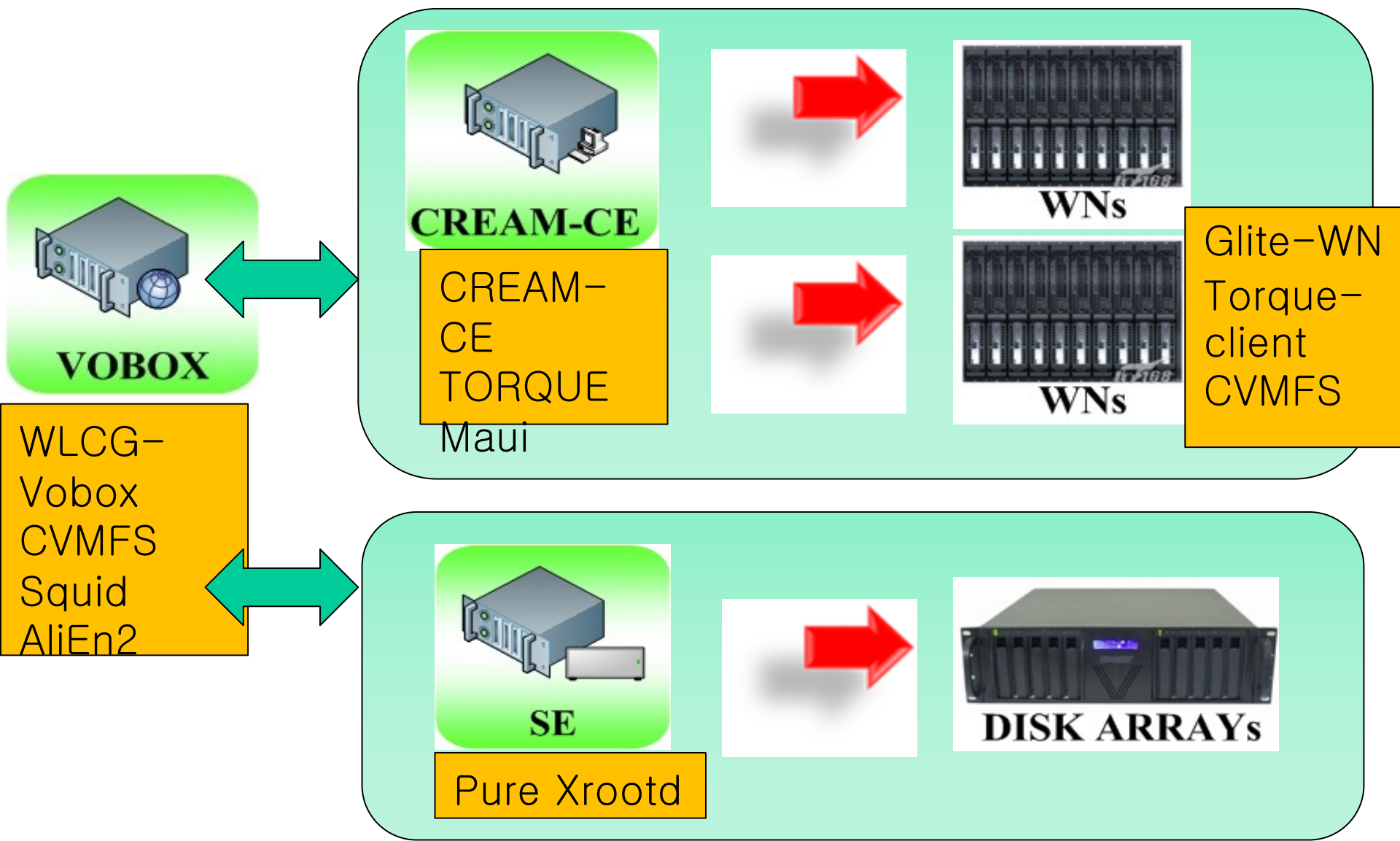and not designed for <u>off-campus usage</u> (e.g. network)

Future Plan

- Computer Grids joint management with IHEP

- Not only renting network from IHEP to Wuhan, but possible shift of (partial) newly purchased computers to IHEP site

- But that decision can't be made by ALICE group at Wuhan: Moving properties worth one million US dollars off-campus needs approvement of university management

- On the other hand, ALICE group at Fudan university (Shanghai) has proposed to share the budget of ALICE Tier 2, including storage and other accessories

- The expected (much) improved performance at IHEP than Wuhan site will be a good reason for Fudan university to shift their hard drives to IHEP
  - while Wuhan network can hardly be better than Shanghai

Backup

VOBOX

CREAM-CE

WNs

WNs

SE

DISK ARRAYs

CREAM-CE
TORQUE
Maui

Glite-WN
Torque-client
CVMFS

WLCG-Vobox
CVMFS
Squid
AliEn2

Pure Xrootd

Machine status

Select site: Wuhan ▼ »

MonALISA information	Version: 13.11.04 (JDK 1.8.0_92) Running on: 172.16.30.1 Administrator: Jianlin Zhu <Jianlin.Zhu@cern.ch>	**Service health** NTP: SYNC, offset: 0.009s

Services status
AliEn: v2-19.395

ClusterMonitor: **OK**
PackMan: n/a
CE: **OK**
CE info: At the moment we are busy (we ...
Max running jobs:
Max queued jobs:

Proxies status AliEn proxy: **OK** (1 day, 23:27)
Delegated proxy: **OK** (1 day, 23:59)
Proxy server: **OK** (95 days, 08:41)
Proxy of the machine: **OK** (20:30)

Current jobs status

Assigned: 0
Running: **216**
Saving: 0

Accounting
(last 24h)

Success jobs: **150** (profile)
Error jobs: **486** + **10** expired
kSI2k units: **670** / pledged

Site averages
(last 24h)

Active nodes: 10
Average kSI2k/core: 2.872

Storages status

| Name	Status	Size	Used	Free	Usage	No of files	Type	ADD test
ALICE::Wuhan::SE		-	-	-	-	-		

VoBox health

CPUs: 8x 1596MHz
Mem usage: 10.57% of 15.56 GB
Processes: 266
Sockets: 57 TCP / 26 UDP
Uptime: 29 days, 15:29

CPU usage
(last 1h avg)

Load: *0.076*
User: 0.526%
System: 0.14%
IOWait: 0.067%
Idle: 99.26%

Int: 0%
Soft int: 0.003%
Nice: 0%
Steal: 0%

AliEn LDAP var	VoBox path	Size	Used	Free	Use%
TMP	/home/sgmali01/ALICE/tmp	70.65 GB	4.574 GB	62.49 GB	7%
LOG	/home/sgmali01/ALICE/alien-logs	70.65 GB	4.574 GB	62.49 GB	7%
CACHE	/home/sgmali01/ALICE/cache	70.65 GB	4.574 GB	62.49 GB	7%

Active jobs in Wuhan
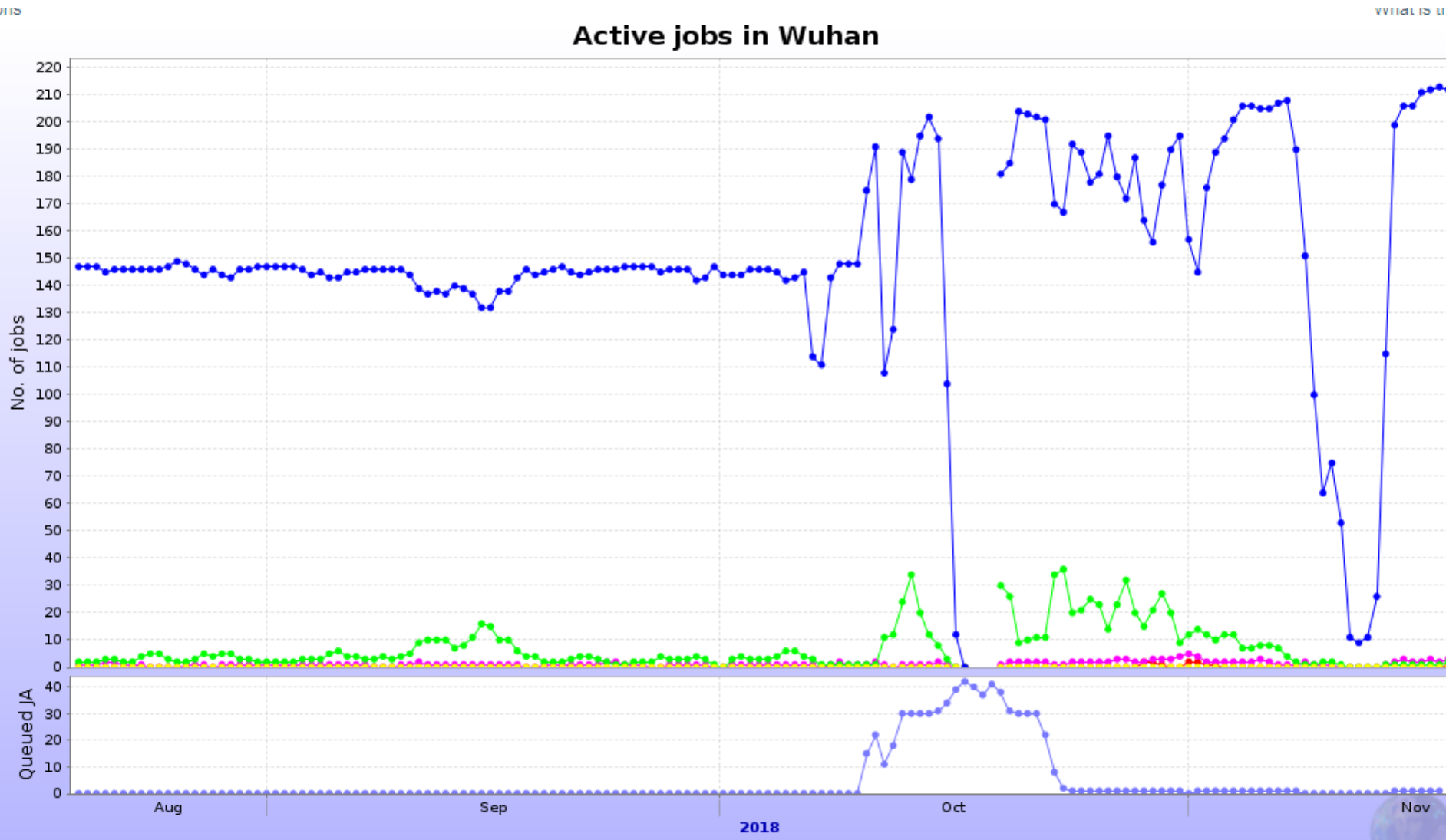
Final job state ratio at Wuhan
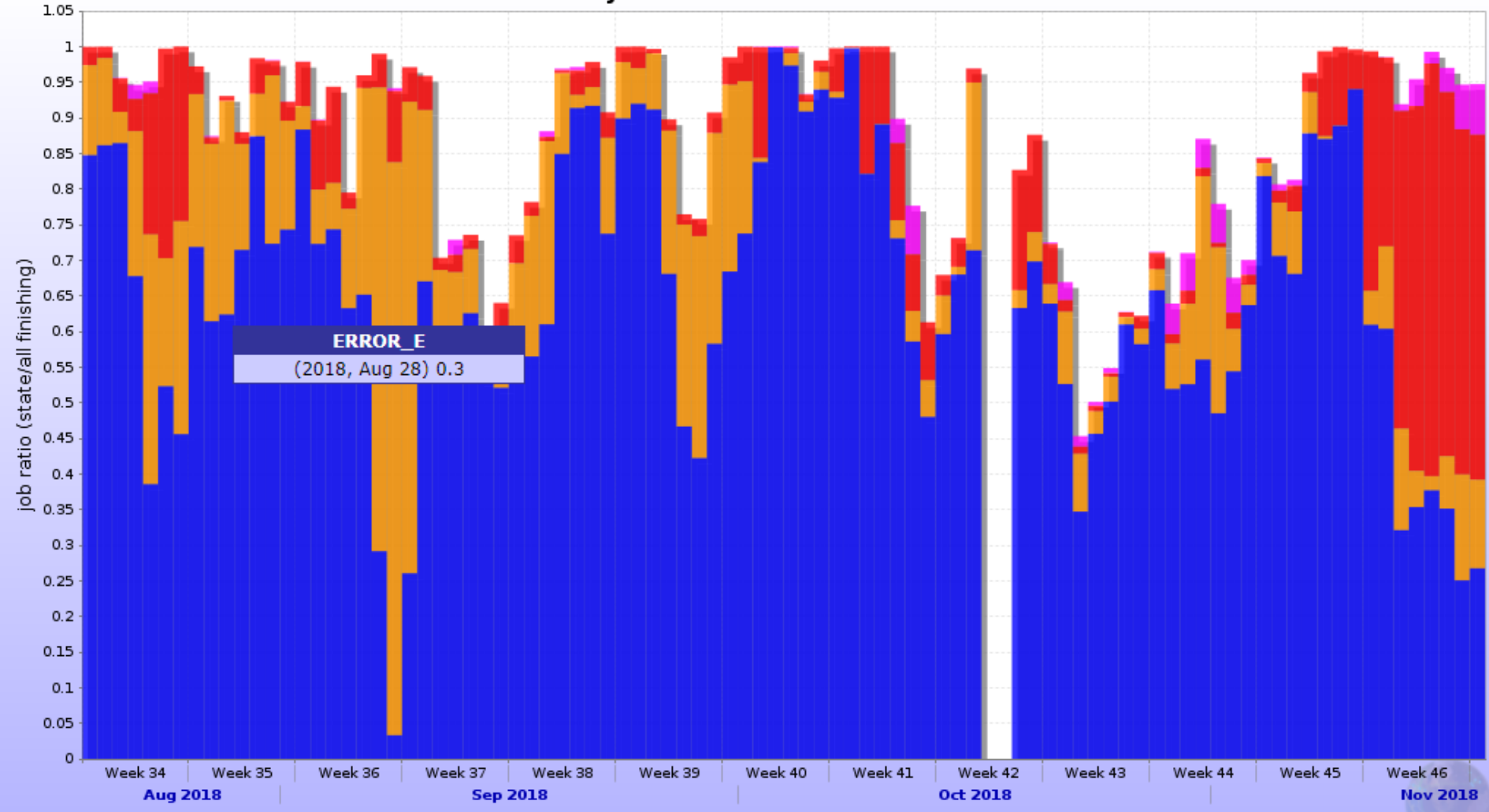
Location of NSC³
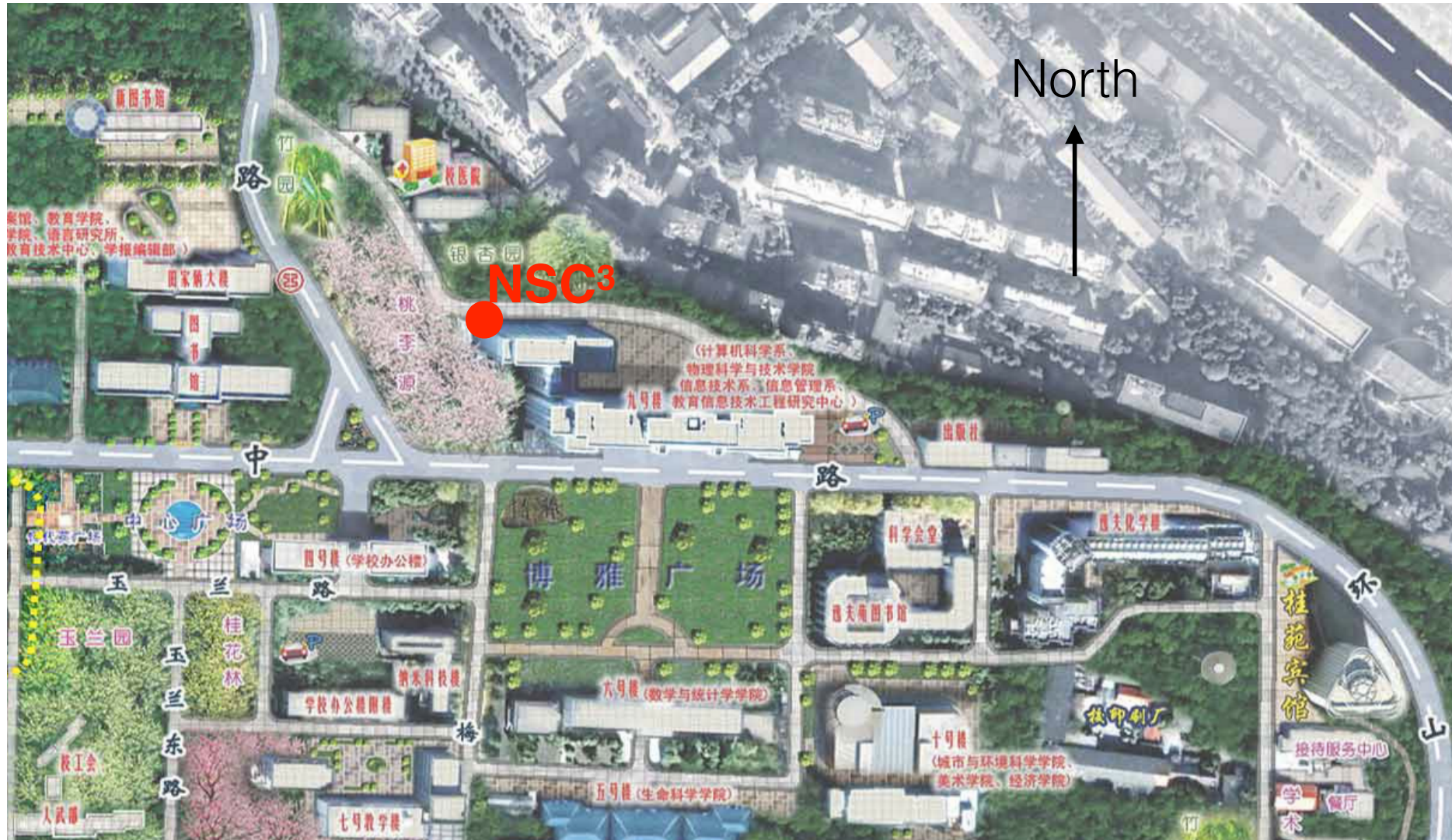
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Institute of High Energy
Physics Chinese Academy of
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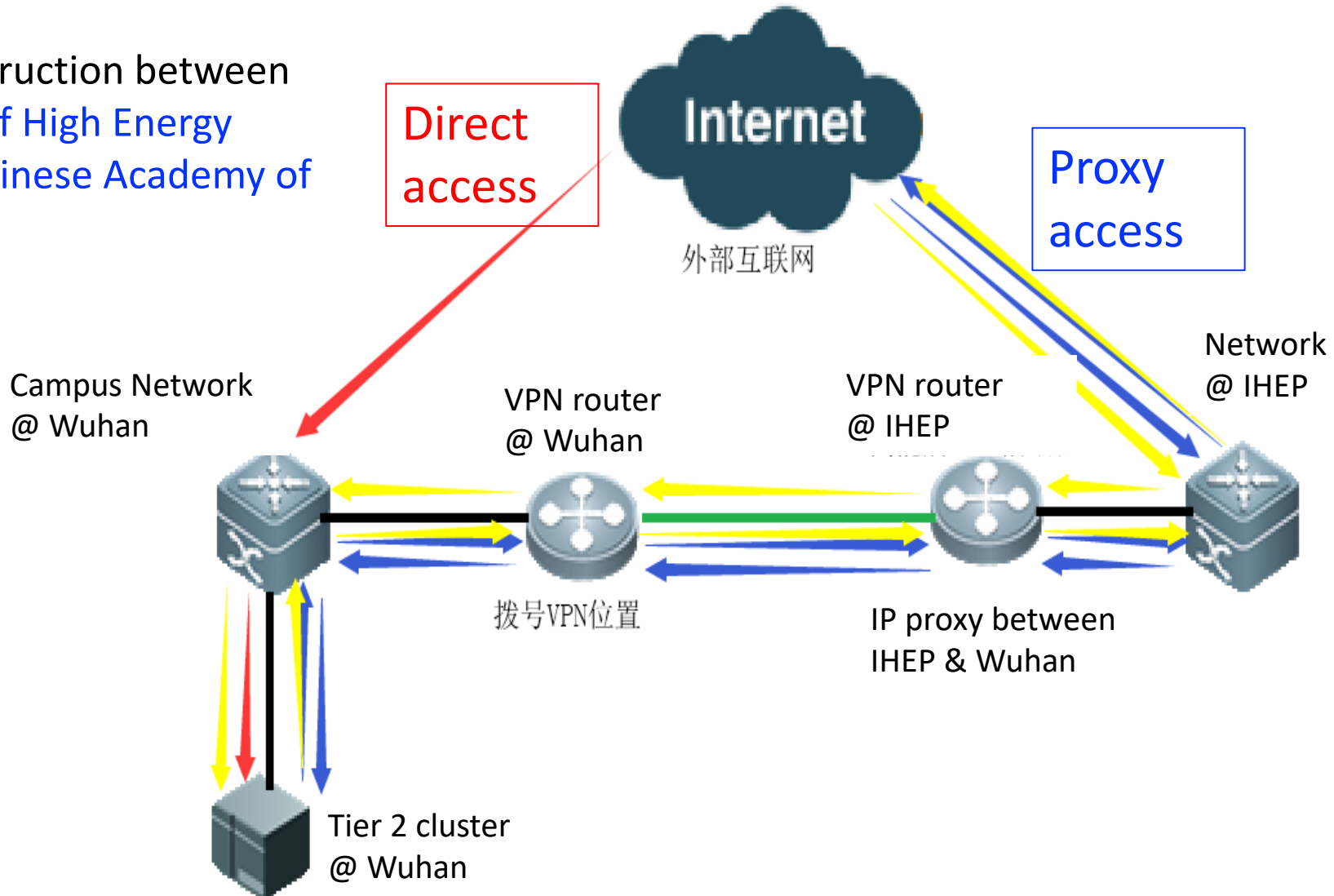
Big space to improve

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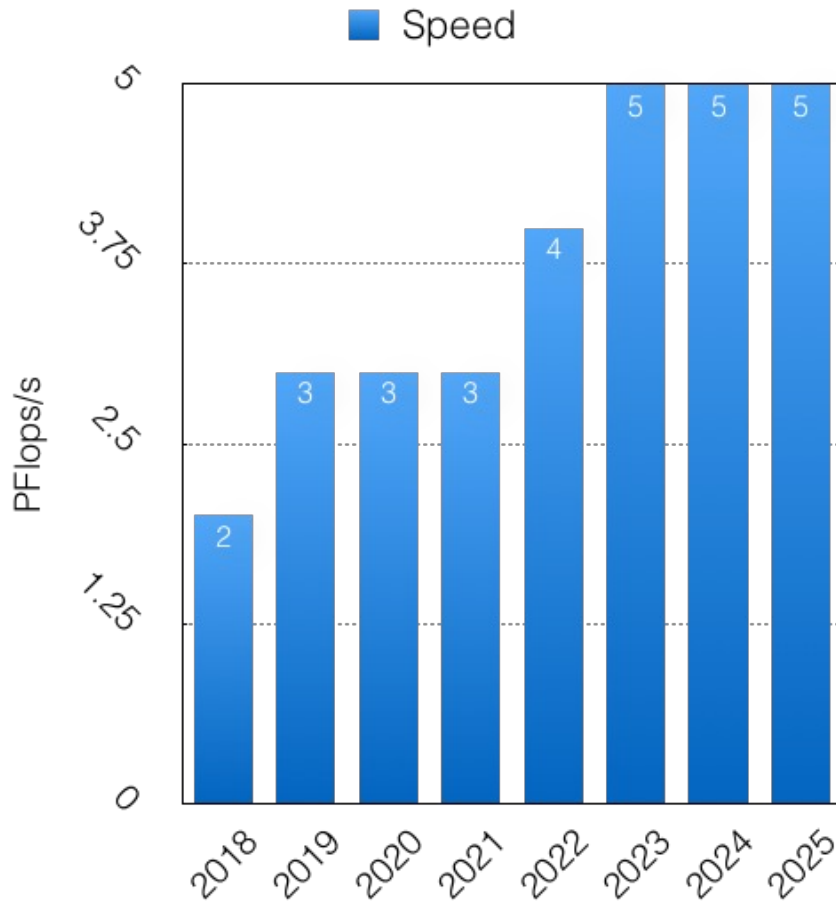- LQCD: QCD phase structure, Transport coefficients…
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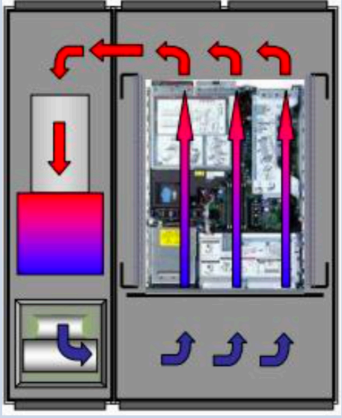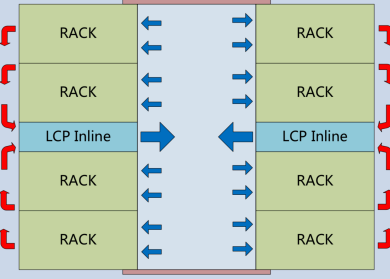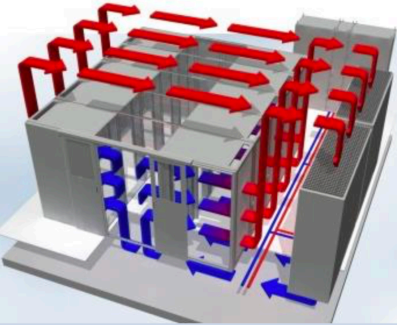13 * 2 Intel Xeron E5410 (2.33GHz, 4 core)CPU, 16GB RAM
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- Programs to be determined by a committee

- Domestic and international collaborations are welcome

Cooling strategies

Strategies of cooling	Cool each rack	Cool each two rows of racks	Cool the room
Layout			
Cooling target	IT devices within a rack	IT devices with 1 or 2 rows of racks	whole computer room
Blow distance	0.1~0.8m	1.2~3m	3~15m
Cooling efficiency	High	Medium	Low
Application	High Performance, Green computing	Cloud computing, mixed	Traditional computing room

Temperature distribution in a typical year of Wuhan
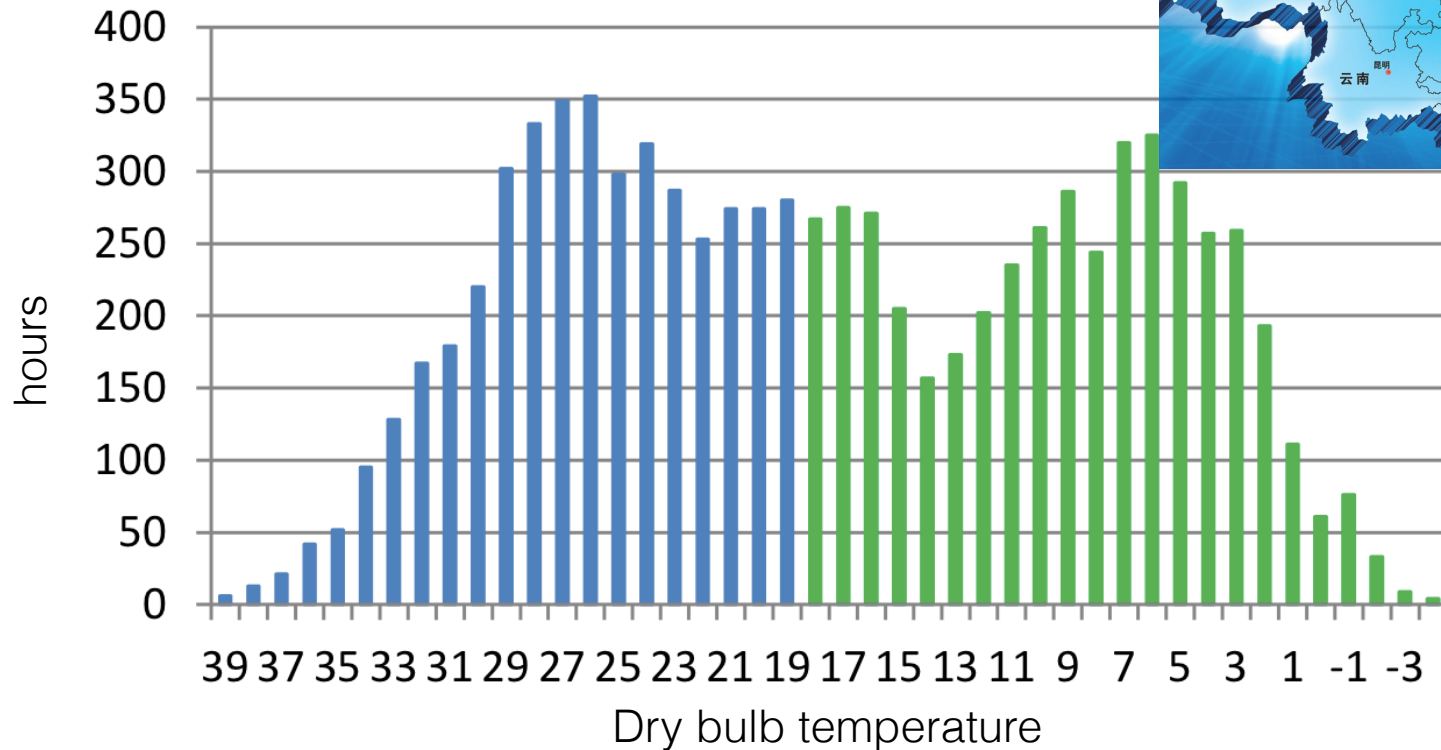
There are 4516 hours yearly in Wuhan that T < 18°C

51% of the year free cooling is available

Water Cooling