ASIAN FORUM FOR ACCELERATORS AND DETECTORS (AFAD 2015)

Summary Report of WG6 Networking and Computing

Eric Yen

(Academia Sinica Grid Computing Centre)

and the WG6 Coordinators

WG6: 11 Presentations/4 Sessions

Balance of Requirements and Resources

	Experiments					Networking
	LHC/WLCG (200-4000 MB/s)	AMS/ WLCG	BELLE II/DIRAC (1800 MB/s)	BEPC/BES (3PB/5yr)	Neutrino (Daya Bay) (200TB/yr)	
AU	ATLAS		X			AARNet
CN	ALICE, ATLAS, CMS, LHCb	7	X	X	X	CERNET, CNGI-CERNET2
IN	CMS, ALICE		BELLE II, ILC	X		NKN, TEIN
JP	ATLAS, ALICE		X	X		SINET
KR	ALICE (T1), CMS	2	X			KREONET, Gloriad
TH	CMS/WLCG			X		UniNet
TW	ATLAS (T1), CMS	4	4		1	ASGCNet, TWAREN

Belle II Collaboration

23 countries/region
99 institutes
621 colleagues

as of Nov 28, 2014

c.f.
ATLAS, 38 countries, 177 institutes, ~3000 members
CMS : 42 countries, 182 institutes, 4300 members
ALICE : 36 countries, 131 institutes, 1200 members
LHCb : 16 countries, 67 institues, 1060 members

Asia : ~45%
- Japan : 141
- Korea : 36
- Taiwan : 26
- India : 26
- China : 19
- Australia : 21

N. America : ~16%
- US : 72
- Canada : 17
- Mexico : 8

Europe : ~39%
- Germany : 88
- Italy : 61
- Russia : 38
- Slovenia : 17
- Austria : 14
- Poland : 11
- Czech rep. : 7

others : < 5 colleagues / country

New Experiments

CEPC, 2028

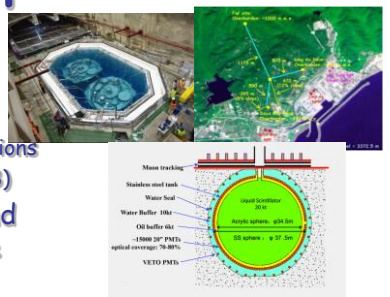
CEPC (Future Project)

- Next Generation Accelerator in China, Circular Electron Positron Collider, Higgs/Z Factory
- CEPC basic parameters:
  - Beam energy ~120 GeV.
  - Synchrotron radiation power ~50 MW.
  - 50/70 km in circumference.
- CEPC timetable
  - Pre-study, R&D and preparation work
    - pre-study: 2013-15
    - R&D: 2016-2020
    - Engineering Design: 2015-2020
  - Construction: 2021-2027
  - Data taking: 2028-2035

JUNO, 2019
2PB/yr

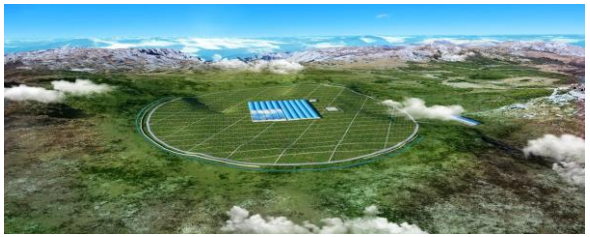
Neutrino Experiments

- Daya Bay Reactor Neutrino Experiment
  - To measure the mixing angle θ_{13}
  - 300 collaborators from 38 institutions
  - Produces ~200TB/Year (2011-2018)
- JUNO - Jiangmen Underground Neutrino Observatory (Future Project)
  - Start to build in 2014, operational in 2019
  - 20 kt LS detector
  - 2-3% energy resolution
  - Rich physics opportunities
  - Estimated to produce **2PB data/year** for 10 years



LHAASO (Future Project)

- Large High Altitude Air Shower Observatory, located on the border of Sichuan and Yunnan Province
- multipurpose project with a complex detector array for high energy gamma ray and cosmic ray detection
- Expected to be operational in 2019
- **~1.2PB** data/year * 10 Years
- On-site storage and computing resources. Data will be filtered and compressed before transferring back to IHEP



LHAASO, 2019
1.2PB/yr

Source: Prof. Wu, IHEP

Considerations for Belle II Comp.

Why do we use GRID ?

- 50 times more data than the Belle's data (1999-2010)

  → O(50) times more computing resources

- Required resources are too large to be obtained by one center (=KEK)
- Data easily available to all the international collaborators
- Have to enable all Belle II member institutes to contribute

  Responsibility-sharing is reasonable as well as detectors

  (The fractions of resources will be determined by a MoU.)

  → Distributed computing system based on grid services (e.g. EMI)

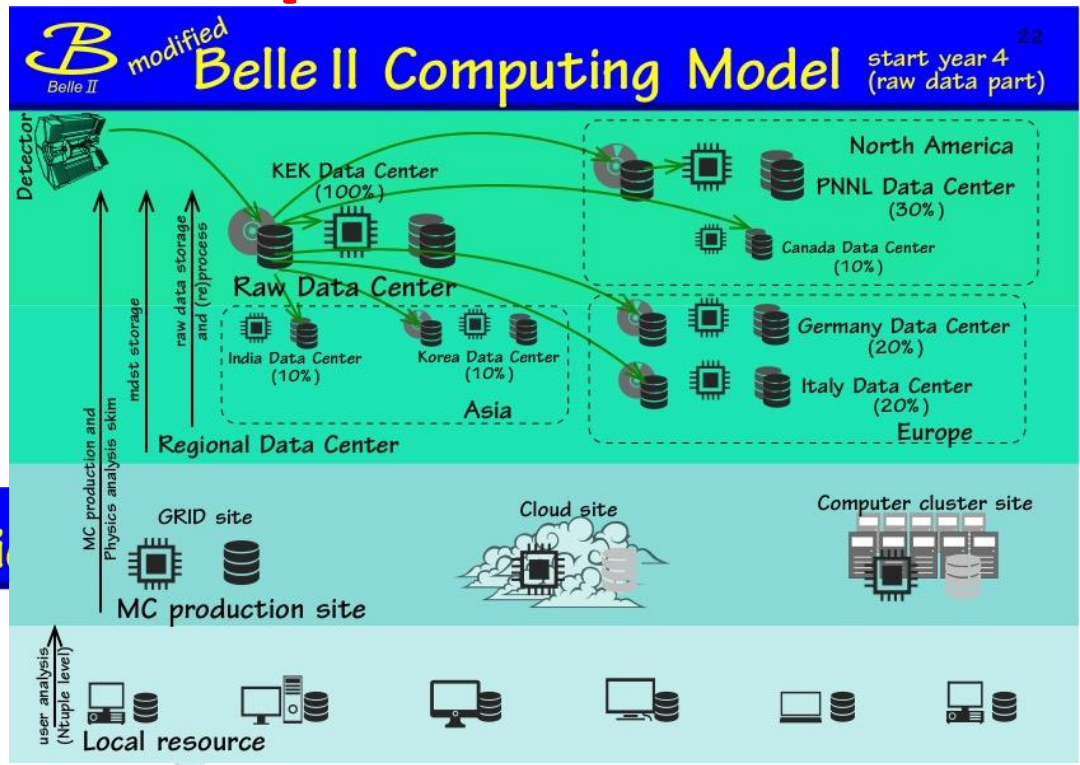
  → Can benefit from existing LCG infrastructure

  → Profit from experience of LHC experiments and their well-established and matured solutions

→ We decided to adopt GRID computing

LCG : LHC Computing Grid

Computing Model is the best Description of Requirements



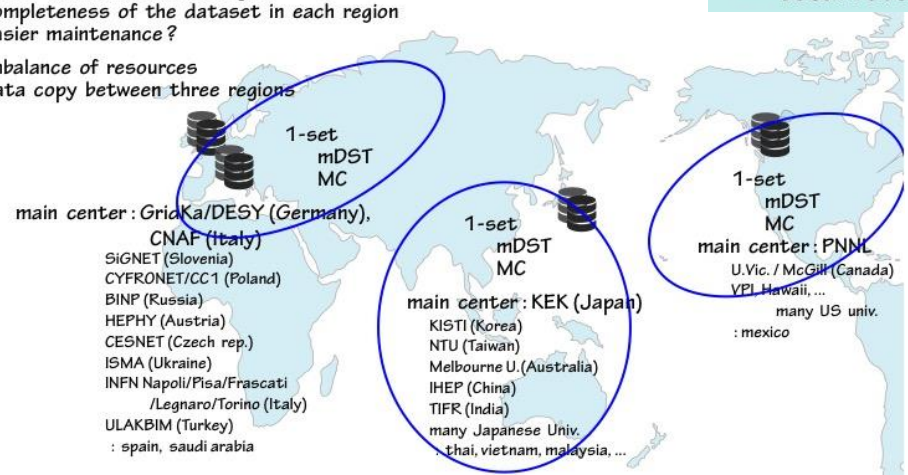
mDST/MC Data Distributi

mDST (data) is copied in Asia, Europe, and USA

For the MC data seems to be natural to be the similar structure

- better network ? in each region
- completeness of the dataset in each region
- easier maintenance ?

unbalance of resources
data copy between three regions



Source: Prof. Hara, KEK

Experiences

- Scientific requirements (well-defined computing model) are driving the evolution of research infrastructure
  - Distributed infrastructure is the norm
  - Grid + Cloud + local cluster: WLCG/EGI, DIRAC, Direct Submission
  - Academic resources + Commercial Cloud Resources (AWS)
- International Collaboration has to be strengthening for larger science and wider disciplines
  - Sharing of distributed infrastructure, trust framework and resources
  - Sharing of tools, technology and even application framework
  - Challenges often are the gaps between user communities and resource providers

Regional Networking Matrix

	AU	CN	HK	IN	JP	KR	SG	TW
AU			2.5G				2.5G (+2.5G)	
CN			2x2.5G, 2.5G					2x1G
HK	2.5G	2x2.5G, 2.5G		2.5G	10G + 2.5G	10G	10G	2.5G+10G
IN			2.5G				2.5G	
JP			12.5G				10G	2.5G
KR			10G					
SG	2.5G (+2.5G)		10G	2.5G	10G			
TW		1G: CERNET, 1G CSTNET	2.5G+10G		2.5G			

Connectivity between Asia and Other Region

	US	Europe
AU	2x40 (2x100G in 2016)	
CN	10G (I2-CERNET2)	10G (Geant)
HK		
IN		2.5G to ES; 10G to Geant
JP	3x10G to LA, NY, WA; 100G (2016)	3x10G to Geant
KR	10G	10G
SG		
TW	2x10G to Chicago + 5x2.5G	2x10G to AMX and CERN

Future Perspectives

- Reliable and Fast Data Delivery and Archive
- Software Define Network development is the trend: virtual network and intelligent services
- How to collaborate to meet the requirements
  - E.g., with regional NRENs: APAN
  - Regional Coordination framework: experiment, AFAD, ISGC, etc.
  - Partner institutes have to negotiate with NREN and local service providers
  - Sharing the knowledge/tools/infrastructure/technology of other experiments really helps (e.g., the networking and Grid technology)