Summary of WG6: Network & Computing

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List of talks

- Fanzhi Qi Networking and Computing Status of IHEP
- Eric Yen Research Infrastructure Development in Academia Sinica, Taiwan
- Martin Sevior Status of Computing for Australian Accelerator based physics
- Tomoe Kishimoto Tokyo Tier2 status
- Tomoaki Nakamura Upgrade of KEK Central Computer System and Grid service
- Andrey Sukharev Computing & Software for the Super-Charm-Tau factory detector project
- Buseung Cho The current status and plan of HEP network in Korea
- Kihyeon Cho The evolving computing architecture for HEP researches in Korea

IHEP Networking and Computing

- Data challenge: BES III 10 Pb, DYB 2Pb, LHAASO 6Pb/year for 20 years, JUNO 2PB/year for 10 years, HEPS > 200 Pb/year from 2024
- Networking: 20 Gb/s IHEP-EU, 20 Gb/s IHEP-USA, ~17 PB/year data exchange
- CPU: 50K cores @ IHEP + new computing center in CSNS 30K cores

- We are facing the huge data challenges, especially for the photon science experiments
- Computing & storage resources increased according to the requirements from experiments, distributed/remote sites are important
- More and more network bandwidth is needed for data movements and jobs schedule

Distributed Cloud Research Infrastructure Development & Applications in Academia Sinica, Taiwan

- WLCG Tier-1: 20K CPU cores, 800K CUDA cores, 20Pb storage, 20Gb/s to CERN
- ASGC is supporting multiple O(PB) scale research applications by the common distributed cloud research infrastructure based on WLCG technologies

- The scale, functionality and technology of RI would be advanced along with the extension of scientic applications, based on user community requirements mainly
- The RI is also supporting regional collaborations and extending e-Science for the masses
- System efficiency based on intelligent monitoring and control is also our strategic focus
- Open source, data sharing, reproducibility and open application are included in roadmap

HEP Computing in Australia

- Tier-2, Tier-3 for ATLAS and Belle II, up to 10K cores
- Cloud jobs for Belle II: pilots are sent from KEK DIRAC to Victoria, Canada, which launches jobs in Clouds around the world
- Network: 100Gb/s links inside Australia, 1Tb/s link to Sinagpore and Japan
- Using GPU for machine learning: developing algorithms for cluster identification in an upgraded calorimeter for LHCb
- Migration to University-based general purpose IT solutions
- Extensive use of Cloud resources
- Move of tailor-made HEP software to mainstream solutions
- CVMFS is a core enabling technology

ICEPP, University of Tokyo Tier-2

- Main projects: ATLAS, MEG, ILC
- Features: hardware is leased and replaced every 3 year, uniform architecture
- 10K CPU cores, 15PB storage, 40Gb/s network
- Testing ARM by A64FX by Fujitsu, still in stage of recompilation of software
- Developing ML software to for log analysis
- ICEPP regional analysis center is in operation stable: 5% of ATLAS all Tier-2 sites
- Several R&Ds are ongoing: Oakbridge-CX to process ATLAS production jobs,

  ML is promising approach to automate data center operation

KEK central computing system

- Launched in September 2020. Supporting KEK research projects: Belle2, J-PARC, ILC, etc. Mainly using for data analysis but also IT infrastructure including Grid-CA, email, Mailing list, Web, Indico, Wiki, Online storage, etc
- Rental system, replacing hardware every 4-5 years
- 15K CPU cores, 17PB GPFS + 8.5 PB HSM cachem 100 PB tapes
- Network: 100 Gb/s links to EU, USA and Singapore
- IPv6 advertisement for LHCONE will be available at the next Summer.
- Computing requirements from the next generation experiments hosted by and related to KEK are becoming high
- Several projects have interests in going to utilize the Grid infrastructure: J-PARC (muon g-2), T2K / Hyper Kamiokande, LightBIRD, other small experiments

HEP Computing & Network in Korea

- Supporting experiments: CMS/Alice, Belle2, CEPC, FCC, ShiP, KNRC, KNO, etc
- 100Gb/s links to Hong Kong, Seattle, Chicago, 20-300Gb/s inside Korea
- KISTI: 5K CPU cores, 13PB storage, Alice Tier-1, CMS Tier-2, Belle2, LIGO, RENO
- KISTI-5 supercomputer: 8K CPU nodes, 132 GPU nodes, 20PB storage, Xeon Phi

- New physics beyond Standard Model needs machine learning and evolving computing architecture
- HEP computing merges from Grid Farm to evolving computing architecture
- KISTI-5 will play an important role to study HEP in Korea besides Grid farms

Computing for Super c-τ factory

- Super charm-tau factory is a major BINP project at nearest future
- Current stage for detector is R&D: fast/full MC simulation, reconstruction& analysis software
- BINP computing resources are sufficient: 2K CPU cores, 0.5PB storage (CEPH), VM servers, 10Gb/s connection to local resource in Novosibirsk, 2 Gb/s to Moscow (KIAE) and LHCone
- Providing: login servers, batch system, storage area, gitlab server, wiki & web servers, mail list, etc
- Software for the project improves continuously, new experimental groups are joining the activity
- Aurora framework: based on Gaudi, conventional and recently emerged HEP software tools: ROOT, Geant4, DD4Hep, other experiments software (Belle II, ILC, FCCSW), build & configuration system inspired by ATLAS Athena, lcgcmake.
- Event generators, fast simulation, developing full simulation, digitization & reconstruction
- Adopting Belle2 analysis software
- The Aurora framework v.1.0.0 has just been released, featuring all components required at the present stage of the Super charm-tau detector project

Summary

- New experiments will produce ~1 Exb data per year. Need to improve storage, network, CPU. Do not store raw data ?
- Using machine learning to reduce required CPU time → moving to alternative architecture: ARM, GPU, FPGA ?
- Reducing operation cost → general solutions, CVMFS, Cloud technology
- CentOS8 is dead. Further Linux distributive ?
- Super c-t factory is next BINP fagship project. Included to EU particle physics strategy update, LoI for Snowmass 2021. International collaboration, supported by Horizon 2020 and CREMLIN+. Current computing infrastructure is adequate for detector project developing. Aurora framework developed to support detector R&D.