Pacific Northwest
NATIONAL LABORATORY
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Track 9 Summary

A personal view

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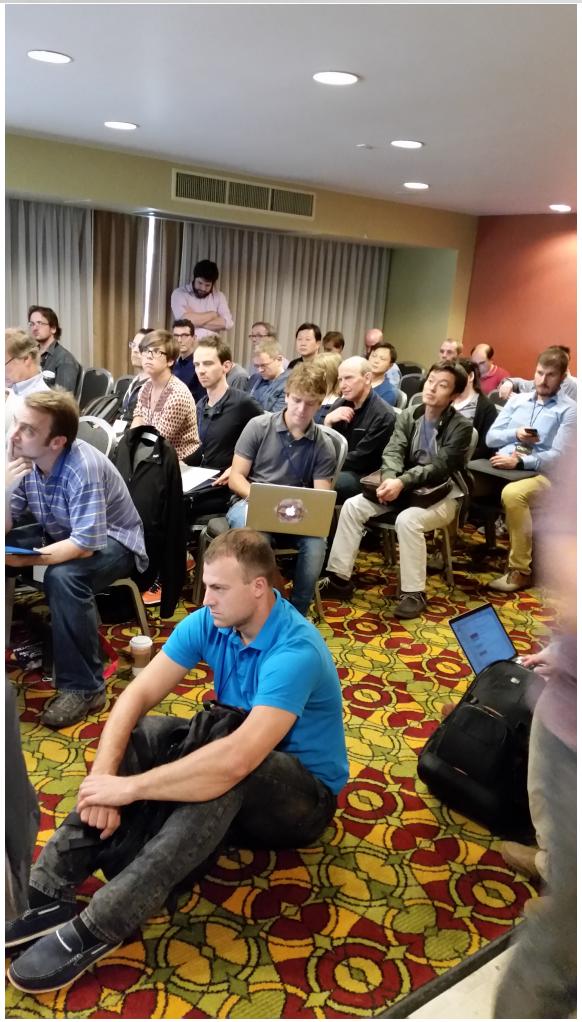
U.S. DEPARTMENT OF ENERGY

First things first

- Helping to organize the CHEP2016 parallel sessions was a very pleasant experience (after all)
- A big thank you to
  - amazing co-chairs: Oxana Smirnova and Takanori Hara
  - a hard-working team of track conveners
    (unfortunately, today is not your last working day)
  - terrific Conference Chairs that really put a lot of thought into coming up with a program, and their hearts into organizing this conference
  - the Local Organizers and the “microphone runners”
- Trying to compile 587 abstracts into a coherent (and balanced) program is not going to leave everybody happy.
  Thank you for attending and being part of the community, even if you **only** have a poster.
- Many things worked well
- Some didn’t

Like trying to predict attendance



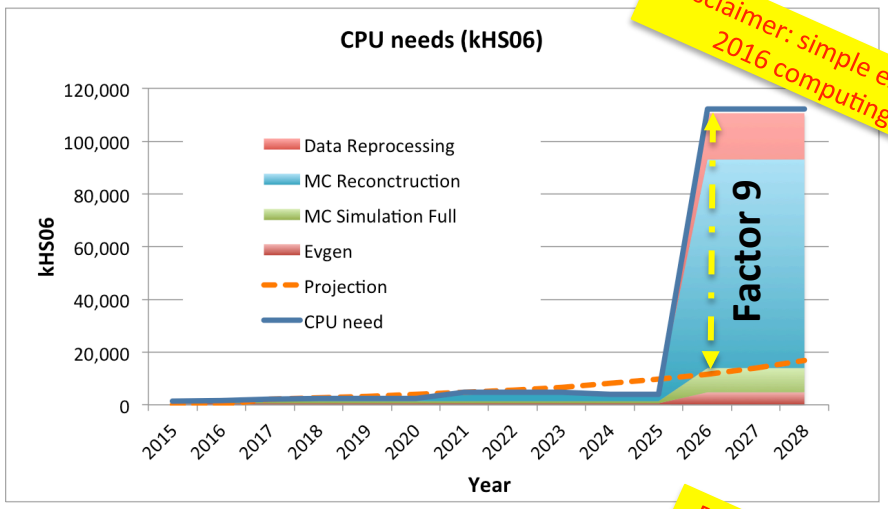
Track 9: Future Directions

- Computing at future experiments

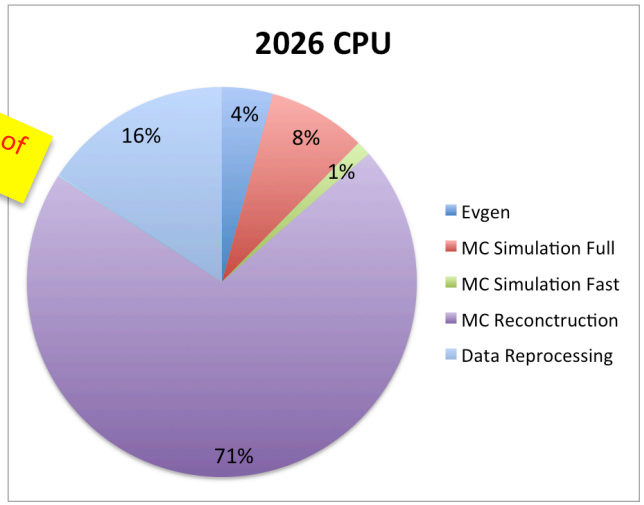
- Simone Campana: 90 - The ATLAS computing challenge for HL-LHC
- Stefan Roiser et al.: 250 - The LHCb software and computing upgrade for Run3: opportunities and challenges
- Takanori Hara et al.: 345 - Highlights of the Belle II Computing
- Volker Friese: 410 - The high-rate data challenge: computing for the CBM experiment
- Markus Diefenthaler: 610 - Computing at the Electron-Ion Collider
- Dorian Kcira: 79 - SDN-NGenIA A Software Defined Next Generation integrated Architecture for HEP and Data Intensive Science

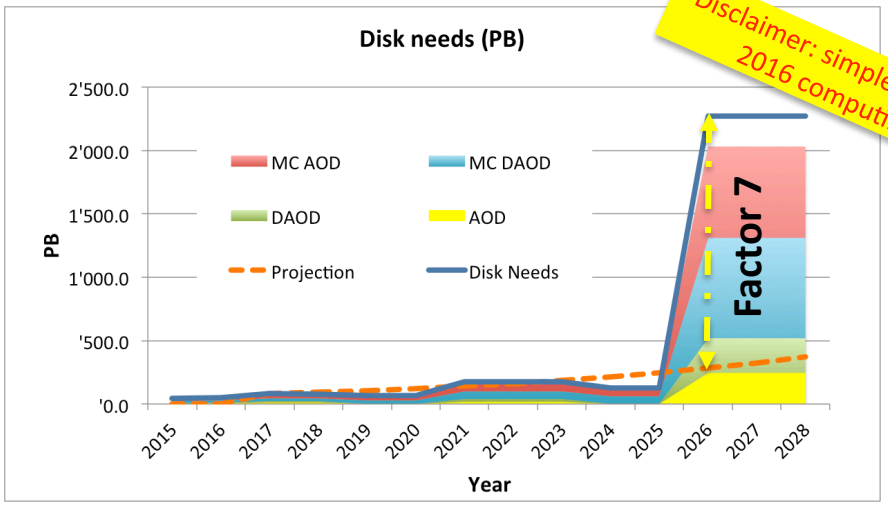
Highlights

HL-LHC baseline resource needs



Disclaimer: simple extrapolation of 2016 computing model !





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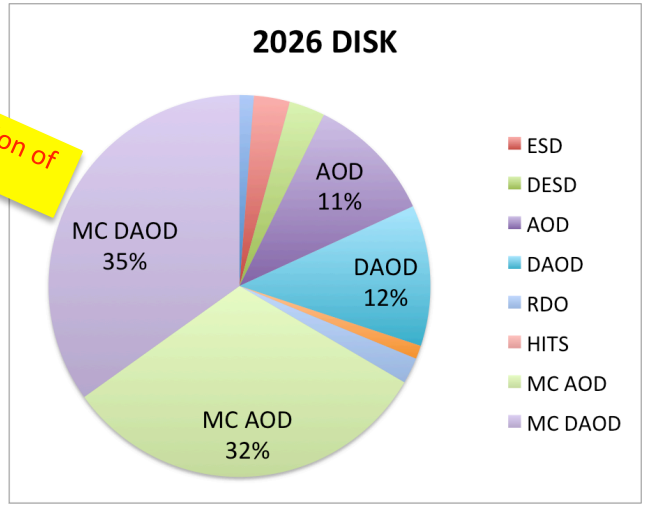
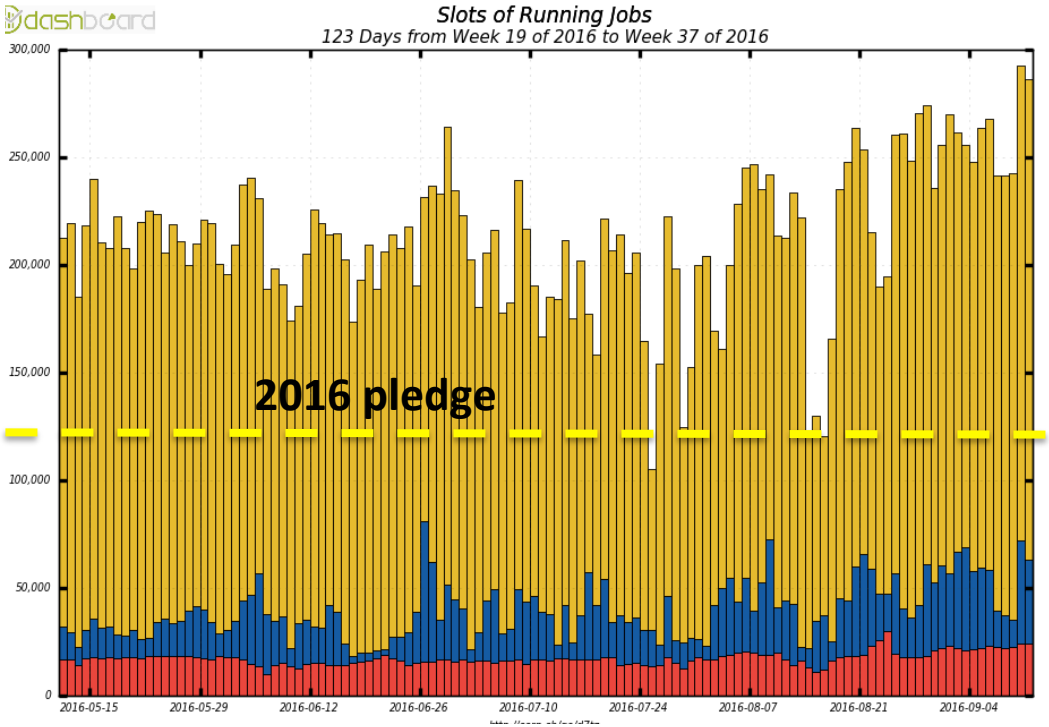
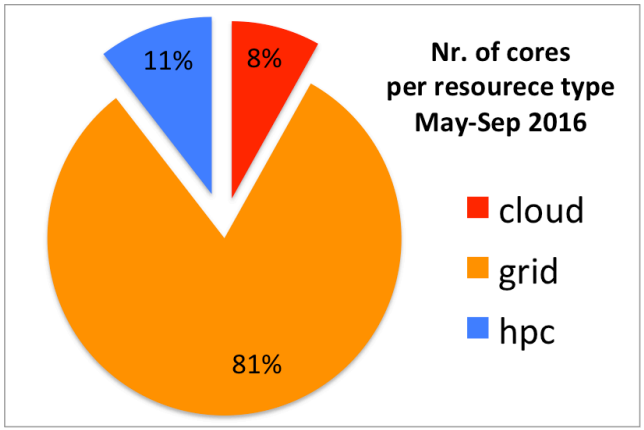
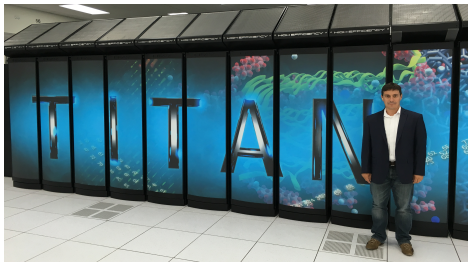


Heterogeneous Resources





Integration of non Grid resources in ATLAS is a big investment with the potential of a big return



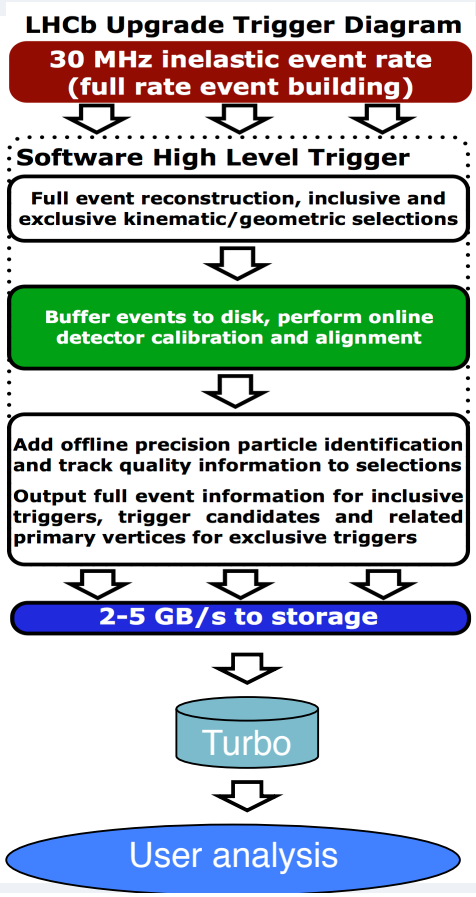
Challenges: resource provisioning, non standard architecture, GPU processing capacity, memory

Highlights: LHCb

Software and computing in the LHCb Upgrade era

G. Raven, Track 1, Monday

- The concepts deployed for Run2 will be further exploited for the Run3 Upgrade
  - HLT split into two parts
  - Turbo stream
    - final reconstructed physics objects in MDST format
    - RAW information not kept on offline storage
- 30 MHz events triggered in software
  - Strain on CPU efficiency of the trigger software
  - Trigger only signal events, 100% retention
    - event selection becomes classification
    - offline storage costs driven by HLT output rate
- HLT output rate O(GB/s), all Turbo
  - Smaller event size, more events, format in a range between MDST and DST
  - Very little offline data processing
- Signal proportional to MC needed
  - Work for simulation explodes



Highlights: Belle II

Highlights of the Belle II Computing

Takanori Hara (KEK), Hideki Miyake (KEK), Ikuo Ueda (KEK IPNS), Kiyoshi Hayasaka (Nigata Univ.), Yuji Kato (Nagoya Univ.), Silvio Pardi (INFN, Napoli)
Martin Sevior (University of Melbourne), Fabrizio Bianchi (Universita degli Studi di Torino), Vikas Bansal (PNNL), Malachi Schram (PNNL)

- SuperKEKB accelerator :
  LER/HER beam circulation was successfully done as scheduled

Belle II detector :
Right now, CDC(Central Drift Chamber is being installed

- Main Computer @ KEK was entirely replaced in August 2016
  → Belle II distributed computing core services are being reconfigured (almost done)
  → the next large-scale MC production is scheduled from this November
- SINET5 improved the connection of Japan-USA, Japan-Europe
- KEK LHCONE connection is now fully configured
  Network @ other sites will contribute to the performance improvement
  (INFN-Napoli, PNNL, etc.)
  → next data transfer challenge is scheduled to complete the performance test

Highlights: CBM

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Computing Challenges for CBM

- Huge interaction and data rates necessitate real-time event reconstruction and data selection
  - Reduce about 1 TB/s to several GB/s in real time in software
- Basis of the data model is a time slice containing many events
  - No events from hardware trigger; have to be found in software
- Fast 4-D reconstruction algorithms under developments
  - Many achievements, but still some way to go
- Quest for a common online and offline software framework
  - Concurrency needed
  - Common data model allowing time-based and event-based analysis without change of code
  - Make use of the extension of the current FairRoot to FairMQ

Highlights: EIC

- **Electron-Ion Collider** (EIC): next-generation U.S. facility to study quarks and gluons in strongly interacting matter
- **NP experiments**: driven by precision to access the **multi-dimensional** and **multi-channel** problem space
- **EIC computing**: think about the **next generation(s) of analysis environments** that will **maximize** the **science output**
- **EIC computing consortium**:
  - interfaces and integration
  - planning for the future with future compatibility
  - organizational efforts with an emphasis on communication

Highlights: SDN-NGenIA

SDN in SDN-NGenIA and SENSE

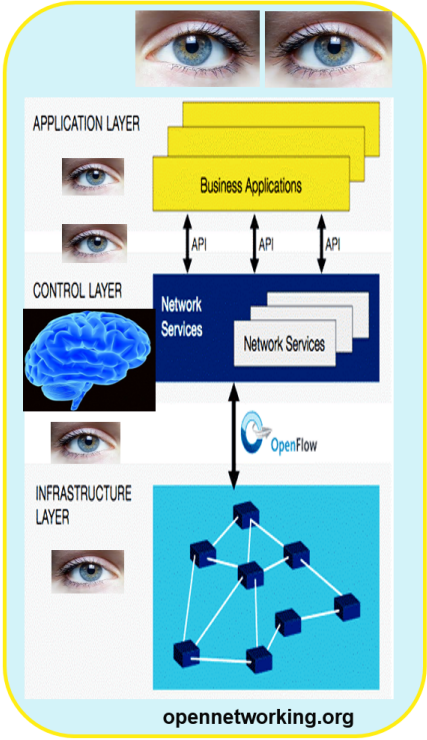
Building on Caltech/ESnet/FNAL Experience

Vision: **Distributed environments where resources can be deployed flexibly to meet the demands**

SDN is a natural path to this vision: separating the functions that control the flow of network traffic, from the switching infrastructure that forwards the traffic itself through open deeply programmable controllers.

With many benefits:

- **Replacing stovepiped vendor HW/SW solutions by open platform-independent software services**
- **Virtualizing services and networks, lowering cost and energy, with greater simplicity**
- **Enabling new methods and architectures**
- **A major direction of Research networks + Industry**
- **Still emerging and maturing**



A system with built in intelligence

Requires excellent monitoring at all levels

Individual Contributions

- HL-LHC
  - Grid utilization: factor 2 over pledge: Can't count on it, but has been quite reliable
  - Storage and CPU requirements remain … interesting problems
- LHCb:
  - Distinction between online/offline
- Belle II
  - Networking
- CBM
  - Event complexity
- EIC
  - User analysis / time to publication

Common Themes?

Common themes: Matrix

	Clouds	Data (rates, complexity)	Online vs. Offline	Networks	People
HL-LHC	✔	✔			
LHCb		✔	✔		
Belle II		✔		✔	
CBM		✔	✔		
EIC		✔			✔
SDN-NGenIA		✔		✔	

While many problems are common, different experiments have a different focus. It is always a wise choice to talk to people who spend a lot of time thinking about the problem you are trying to solve.