Workshop Concluding Remarks

2nd AACL Workshop on DAQ@LHC
Chateau de Bossey
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Beat Jost / Cern
Run-2 Systems

- All experiments have invested a lot of effort to prepare for Run2
- Alice, Atlas and CMS have installed new hardware
  - Basically because of obsolescence of Run1 hardware (death of PCI-X)
  - New PCs
  - Improved performance
  - CMS completely new event-builder and readout network!!

- LHCb did mainly software architecture changes in the HLT to maximize the quality of the physics data
  - Split HLT and quasi-online alignment and calibration

- All upgrades and changes seem to run nicely
Timescales for LHCb and Alice are completely different from Atlas and CMS

- Alice and LHCb will go through major upgrades during LS2 (2019/20)
- Atlas and CMS will do their major upgrades mainly in-line with HL-LHC (LS3 2025/26 or so...)

All upgrades aim at a significant increase in performance

- LHCb will fulfil the physicists dream of trigger-free readout
  - 40 MHz DAQ, all selection in software
  - DAQ system handling ~5 TByte/s
  - Massive need for processing power to reduce event rate from 40 MHz to ~50 kHz
- Alice will implement a continuous readout of the TPC
  - Loss of correlation between bunch crossing and event data
  - ~50 bunch crossings accumulated during the TPC drift time
  - Has to be re-established in software after reconstruction of TPC data
  - Heavy use of hardware accelerator (FPGA, GPU)

Concluding Remarks, DAQ@LHC Workshop
Run-3 Systems and Upgrades (II)

- Atlas Run 3 system upgrades dictated by detector upgrades (LAr Calo) which necessitates an upgraded (local) DAQ system
  ➢ CMS has no major plans for Run 3
- Atlas and CMS will have to cope with the challenges imposed by HL-LHC
  ➢ Surely LS3 is far away and no concrete plans are yet made
  ➢ Some ideas are around and it’s nice to brainstorm
  ➢ Surely HL-LHC will have a major impact especially on the processing requirements and data rates of the experiments
Hardware Trends (in industry)

- Presentations from Intel...
  - Intel OmniPath an interesting development, especially if it comes directly out of the CPU
    - Killer for Infiniband
  - Intel integration of FPGAs into CPU chips might be interesting for certain applications
    - Question is cost and impact on CPU performance (loss of cores, interference of memory accesses)
  - Otherwise not a lot of information from Intel besides reduction of feature size
    - Unclear what the additional gates are used for...

- ...and Seagate (very nice presentation)...
  - Disk capacity expected to increase at least until 2025 (120 TB per drive)
  - Many technical challenges

- ... and Arista
  - Main message... Moore’s law still and also holds for networking
  - Deep buffering is not dead (yet)

- And Tapes will still be around for a long time
  - 140 TB tape cartridge in the lab...
Hardware Trends (in experiments)

- Strong trend towards PC-based components (PCI-Express cards)
  - LHCb/Alice Tell40
  - Felix in ATLAS
- xTCA is popular in CMS, but future (especially $\mu$TCA) is not clear
- There is (maybe) also a trend towards common solutions for common problems.
  - Alice/Atlas new RORC
  - Tell40 (Alice and LHCb)
    - We would prob. have used Felix, had we known about it and if it had implemented some features we need
    - Actually fully commercial boards are (almost) usable
  - I still hope that Atlas and CMS could, for post LS3 era, agree on a common readout board.
Hardware Accelerators

- Very fashionable
- Likely to have its applications, but
  - Is not the panacea for everything
  - Very limited problem space

- Usual problem is
  - Data transfers to/from accelerator
  - Synchronisation between host/accelerator

- Do not forget to improve performance of CPU code
  - Benefits both online and offline immediately
    - There will (most probably) no accelerators on the grid/cloud...
Finally

- Many thanks to David who was the (slave)driver and main organisational wizard to make this happen
  > Thanks to Pierre for hosting the meetings for the organisers (including coffee and tea)
- Last, but not least, special thanks to Petya for the nitty-gritty organisation and setting up the agenda etc...
- I look forward to another workshop sometime
  > BUT I do hope I will not have to give the final remarks!

Thank you for attending!