Using ARM processors in LHCb

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LHCb applications on the ARM platform

- LHCb is interested in using ARM resources as long as they become available
  - More work per watt
  - More work per buck

- The pilot work started back in 2013
  - CHEP 2013: M.Clemencic et al, Measurements of the LHCb software stack on the ARM architecture
  - LHCb applications stack ported
  - Tests on ARM Cortex-A9 CPU, 4 cores, ≈ 1.1 GHz, 4GB RAM
  - Single core performance about a factor 5 to 7 slower compared to x86 processor of the time
  - Power consumption promissing
  - Interesting but premature at that time

LHCb applications on the ARM platform

- November 2023: LHCb software compilation for ARM
  - Detailed instruction for compilation on ARM are documented :
    - https://codimd.web.cern.ch/s/G2qnvDjev#
- The LHCb simulation (Gauss) now builds and runs successfully on ARM (*A.Valassi*)
  - LHCb simulation is ~90% of the CPU needs
- The Gauss releases are now available on CVMFS
  - Dev area
  - Nightly builds
  - Functional tests
  - Configuration identical to x86

Validation of the LHCb simulation

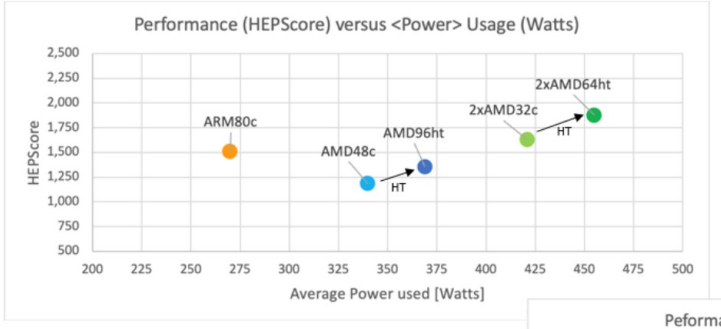
- The functional tests are OK
  - LHCb performance & regression test suite (LHCbPR)
- The bit-to-bit comparison with the x86 results are not possible
- There is a need to validate statistically
  - 3-4 representative channels
  - ~50K events per channel
- The validation is being prepared now
  - The plan is to accomplish it in Q1’24
- Priority work but not the highest

Benchmarking application on ARM

- The LHCb container lhcb-sim-run3 is prepared
  - The container is suitable for the HEPScore23 evaluation
    - Pending the LHCb Simulation validation
- The DB12 benchmarking on the ARM is in progress
  - DIRAC benchmark used in the LHCb production workflows

Using ARM resources

- LHCb is offered resources for doing the physics validation work
  - Glasgow T2
  - CNAF/CINECA
- These are not pledged resources
  - But may be soon ?



HEPScore suite now established (previously we used the individual workloads).

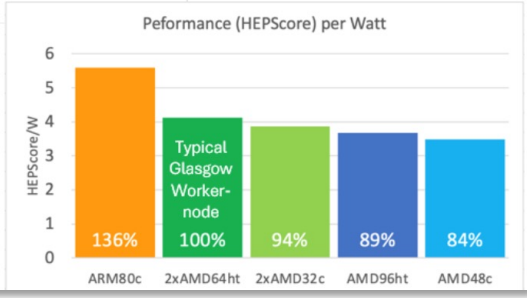
Compared:

- 80-core Altra (ARM80c)
- 48-core (96 HTs) AMD EPYC 7003 (AMD96ht and AMD48c)

Comparable cost in Aug22

- 2x32-core (128 HTs) AMD EPYC 7513 (2xAMD64ht and 2xAMD32c)

Typical Glasgow worker-node



Using ARM resources

- LbPlatformUtils needs to be properly extended to support ARM
  - determines **tags** for matching of LHCb jobs
  - identifies the platform of the node where it ran
  - handles compatibilities
  - finds out the possibility to use containers
  - recognizes the processor instructions set available

Conclusions

- The LHCb simulation, Gauss, is ported to the ARM platform
- The physics validation is being prepared
- ARM resources are available
  - Not pledged
  - The production procedures (DIRAC) are to be adapted
- Benchmarking of LHCb application on ARM is in progress