

Investigations of Future Computing Platforms for High Energy Physics

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Around the year 2000, the convergence on Linux and commodity x86_64 processors provided a homogeneous scientific computing platform which enabled the construction of the Worldwide LHC Computing Grid (WLCG) for LHC data processing. In the last decade the size and density of computing infrastructure has grown significantly. Consequently, power availability and dissipation have become important limiting factors for modern data centres. The on-chip power density limitations, which have brought us into the multicore era, are driving the computing market towards a greater variety of solutions. This, in turn, necessitates a broader look at the future computing infrastructure.

Given the planned High Luminosity LHC and detector upgrades, changes are required to the computing models and infrastructure to enable data processing at increased rates through the early 2030s. Understanding how to maximize throughput for minimum initial cost and power consumption will be a critical aspect for computing in HEP in the coming years.

We present results from our work to compare performance and energy efficiency for different general purpose architectures, such as traditional x86_64 processors, ARMv8, PowerPC 64-bit, as well as specialized parallel architectures, including Xeon Phi and GPUs. In our tests we use a variety of HEP-related benchmarks, including HEP-SPEC 2006, GEANT4 ParFullCMS and the realistic production codes from the LHC experiments. Finally we conclude on the suitability of the architectures under test for the future computing needs of HEP data centres.

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Processor architectures

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