

Linux Kernel and HPC

(High Performance Computing)



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High Performance Computing (HPC)

HPC advancements in computer industry is equivalent to

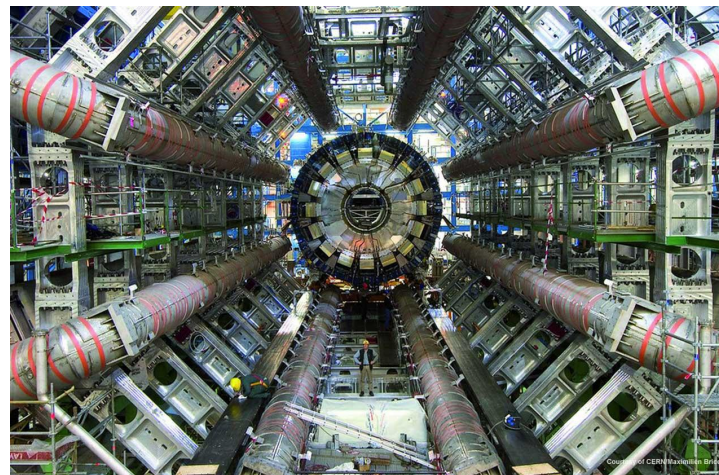
Formula-1 advancements in the racing world

- is not bound by choices, but it is bound by challenges in technological innovation, achieving cutting-edge performance, being in line with Moore's Law !

HPC Applications

to solve large problems in science and engineering ...

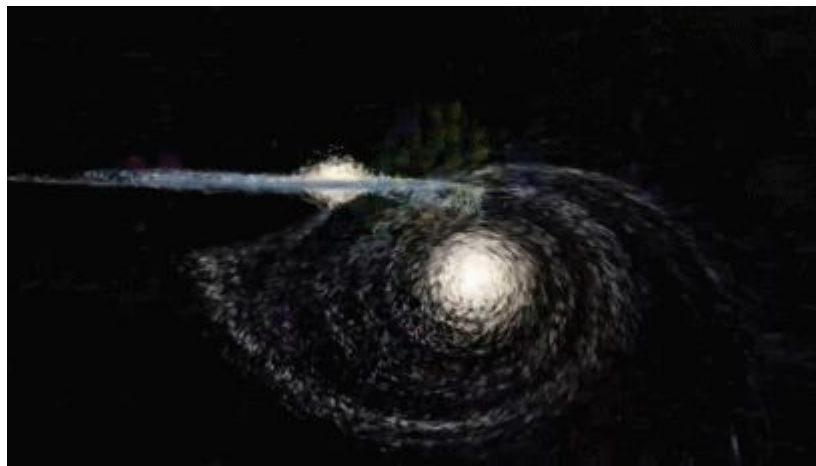
such as data-crunching applications in Large Hadron Collider (LHC) at CERN



HPC Applications

to simulate galactic collisions in space ...

data-crunching
applications in super-
computers



HPC Applications

in SDN applications ...



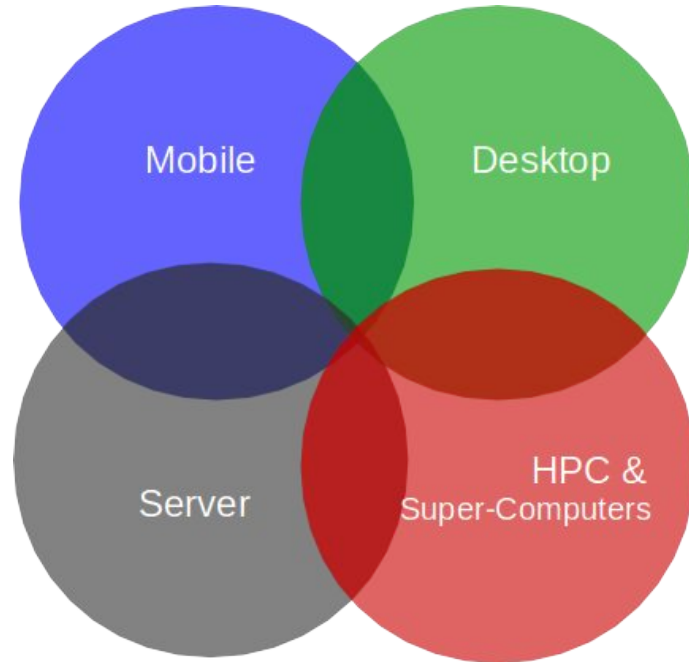
HPC Challenges (in terms of Hardware)

- CPU technology being limited by physics for over a decade
- Data Transportation and Networking (Memory<>CPU Bus, Networking technologies)
- being in pace with Moore's Law
- **adding more cores to CPU is not a solution. We need more powerful per-core CPU performance !**

HPC Promising Technologies (in terms of Hardware)

- optical computing (photonic computer)
- optical bus system for board-to-board and CPU<>Memory Interconnect
- Hardware offload

Boundaries of Computing Platform



Server vs High-end Desktop Computing Platform

in other words ...



HPC Challenges (in terms of Software i.e Linux)

- **Truth is:** Linux Kernel **unless customized** it is neither suited completely for desktop, embedded applications, nor HPC !
- sometimes excessive choices and generalization of kernel code/modules makes it difficult to customize for HPC

Recent advancements of Linux Kernel ... for example

- **Kernel 3.18 transmission queue batching**
 - allows to achieve 10 Gbit/s full TX wirespeed smallest packet size on a single CPU core
 - less CPU overhead
- **Kernel 4.1 Decade old x86 assembly code cleanup**
 - over 100 separate cleanups, restructuring changes, speedups and fixes in the x86 system call of a decade old spaghetti asm code

GPU offload in Linux Kernel

- GPU offload as a mainstream option to enhance performance of CPU and VMs in HPC ... is in agenda

Thank you!

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