CPU Performance Study for HEP Workloads with Respect to the Number of Single-core Slots

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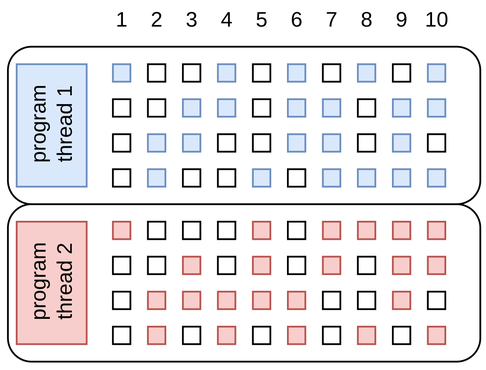
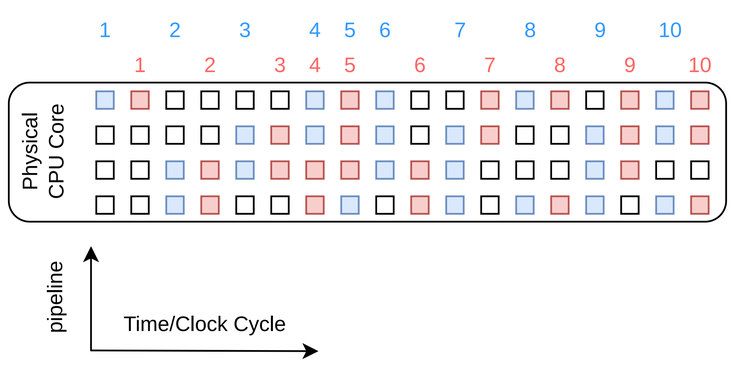
Simultaneous Multithreading

- **S**imultaneous **M**ulti**t**hreading (SMT) is a CPU feature to improve the CPU efficiency via the pipeline and other doubled components
- SMT allows two threads to access one physical CPU core
  $\Rightarrow$ two threads/logical cores per physical cores
- SMT double number of logical cores but does not double the CPU performance





SMT in Grid and Batch System

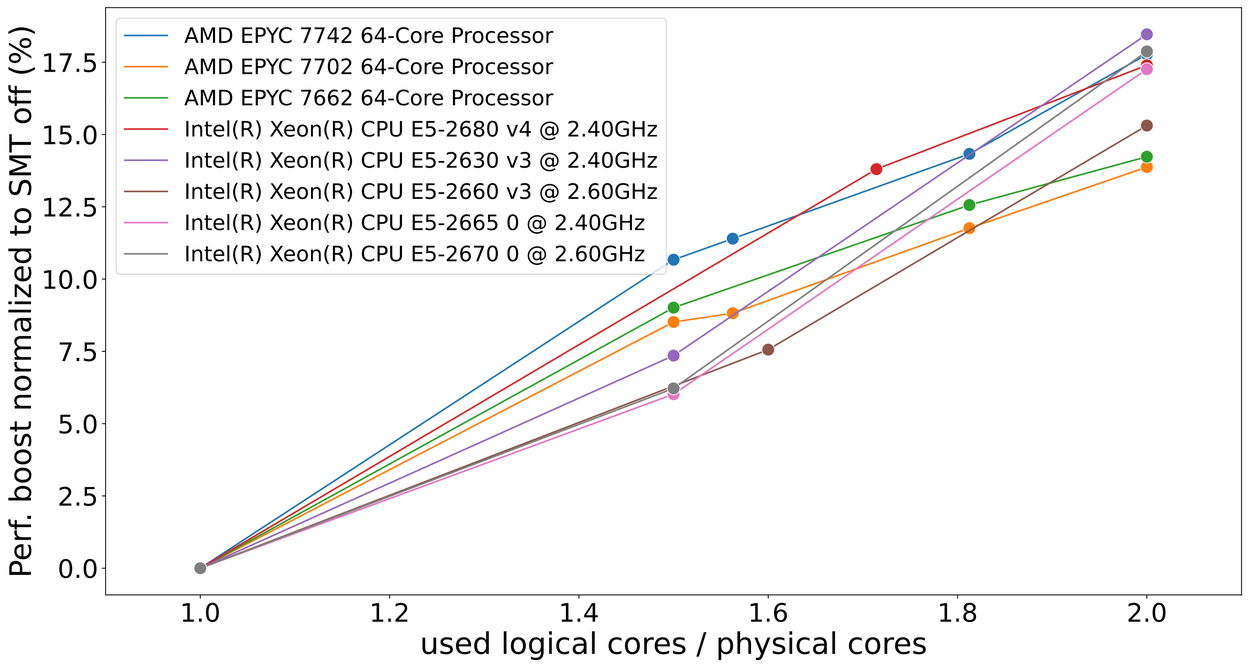
- experiment software can utilize several logical cores
- job are accounted in units of single-core slots (one logical core is utilized)
- **V**irtual **O**rganisations request single-core slots or eight-/multi-core slots
- wide spread in requested memory per core (2 GB $<$ 4 GB / logical core [1])

Benchmark Procedure

- HEPScore23 (HS23) benchmark successor of HEPSpec06 benchmark, see talk: 'HEPscore: a new benchmark for WLCG compute resource'
- disabled or enabled SMT on kernel level
- number of used cores (multiple of four) set via benchmark copies

Results and Conclusion

CPU Model in Dual Socket-System (higher $\rightarrow$ newer)	SMT off (HS23)	SMT on (HS23)	increase (%)
AMD EPYC 7742 64-Core Processor	2499.8	2944.0	17.77
AMD EPYC 7702 64-Core Processor	2228.0	2537.1	13.87
AMD EPYC 7662 64-Core Processor	2182.6	2493.3	14.23
Intel(R) Xeon(R) CPU E5-2680 v4 @ 2.40GHz	525.9	617.3	17.39
Intel(R) Xeon(R) CPU E5-2630 v3 @ 2.40GHz	246.8	292.3	18.46
Intel(R) Xeon(R) CPU E5-2660 v3 @ 2.60GHz	339.9	391.9	15.31
Intel(R) Xeon(R) CPU E5-2665 0 @ 2.40GHz	189.0	221.7	17.26
Intel(R) Xeon(R) CPU E5-2670 0 @ 2.60GHz	202.6	238.8	17.87



Possible Setups

disable SMT/only physical cores
+ no additional memory and disk necessary
- lower CPU performance than with enabled SMT

enabled SMT/all logical cores
+ higher CPU utilization due to SMT
- additional costs for memory and disk for additional logical cores

enable SMT/not all logical cores
+ profit from SMT and free resources for e.g. monitoring, configuration management
- additional memory and disk necessary

$\Rightarrow$ GridKa setup
- enable SMT to profit from performance boost
- reserve logical CPU cores for monitoring (packetbeat, telegraf, ...) and configuration management puppet

[1] EGI VO Id Card: https://operations-portal.egi.eu/vo/view/voname/[atlas,alice,cms,lhcb,icecube]

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