

CPU Benchmarking at GridKa (Update 04/2012)

HEPiX Spring 2012, Prague

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New Generations of Processors

■ AMD:

- Available: Q4/2011
- Interlagos ("Bulldozer" microarchitecture)
- Core multithreading:
 - 2 chips per module
 - Common L2 cache + FPU
- Up to 16 cores per chip
- Up to 2.6 GHz (+ ~30% turbo frequency)

■ Intel:

- Available: Q1/2012
- Sandy Bridge
- Up to 8 cores (16 hyperthreaded cores) per chip
- Up to 3.1 GHz (+ ~30...40% turbo frequency)
- Very surprising pricing ...

Benchmarking of New Processors

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- Test machines at GridKa:
 - AMD "Bulldozer":
 - DELL C6145
 - 2 system trays / 2U
 - Opteron 6276 (16-core, 2.3 GHz)
 - 4 sockets → 64 cores per box
 - 128 GB RAM
 - 8x500 GB hard disks
 - Thanks to DELL for providing the system!
 - Intel "Sandy Bridge":
 - Intel S2600JF
 - 4 system trays / 2U
 - Xeon E5-2670 (8-core, 2.6 GHz)
 - 2 sockets → 16 cores (32 hyperthreaded cores) per box
 - 32 GB RAM
 - 2x500 GB hard disks

What is HS06?

- Official benchmark to be used at HEP sites
- Benchmark set: CPP benchmarks of SPEC CPU2006
 - Meets the ratio of floating-point operations in real HEP applications
- System under test runs the same operating system than the production environment used
 - RHEL/SL/SLC 5 (not SL 6 so far!)
 - In this talk some results of machines running SL 6 will be presented. Note that these results are for HEPiX internal discussions and not to be used e.g. in procurements!
- Compiler flags are chosen by users and are mandatory for benchmarking:
 - -O2 -pthread -fPIC -m32
 - Other optimizing flags are not permitted!
- One benchmark copy per logical processor seen by the operating system

What is HS06?

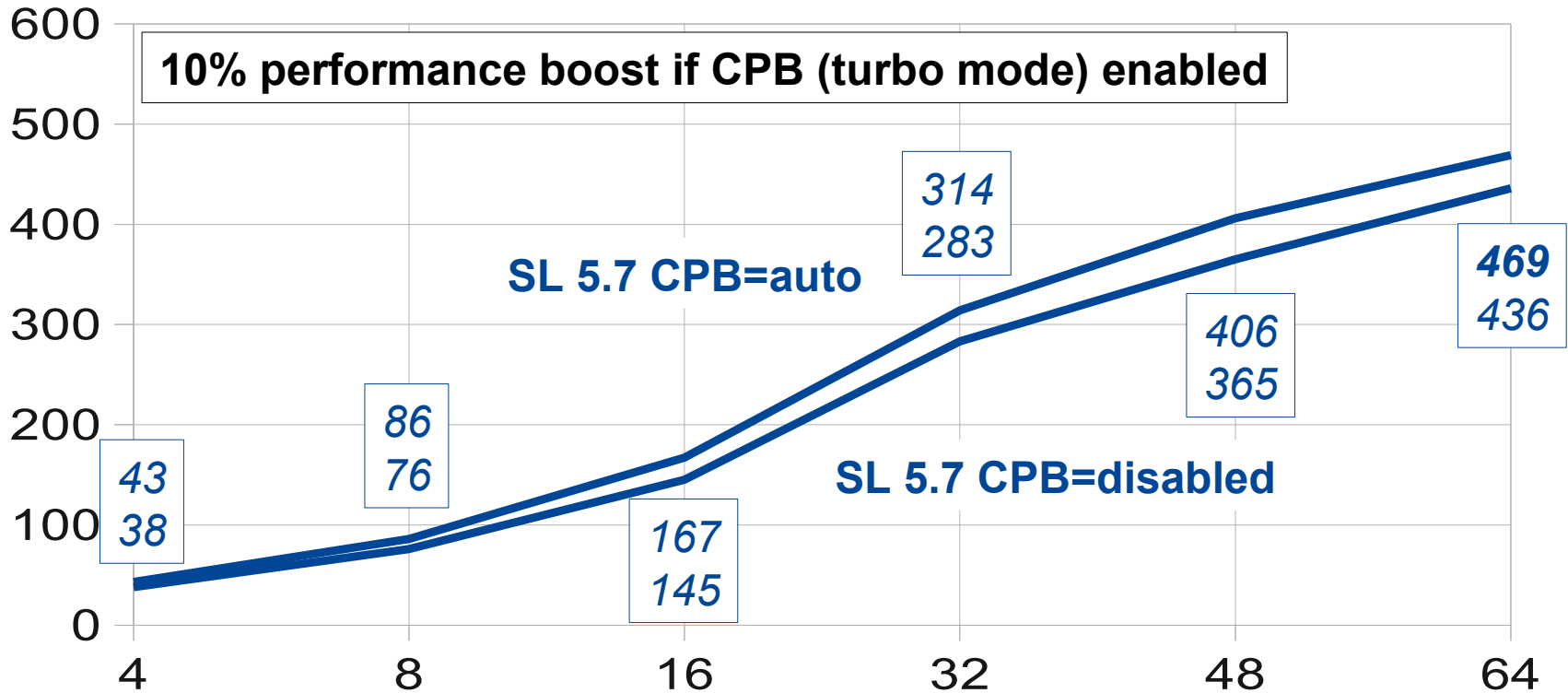
- Homepage:

<http://hepix.caspur.it/benchmarks>

Performance Scores (AMD Bulldozer)

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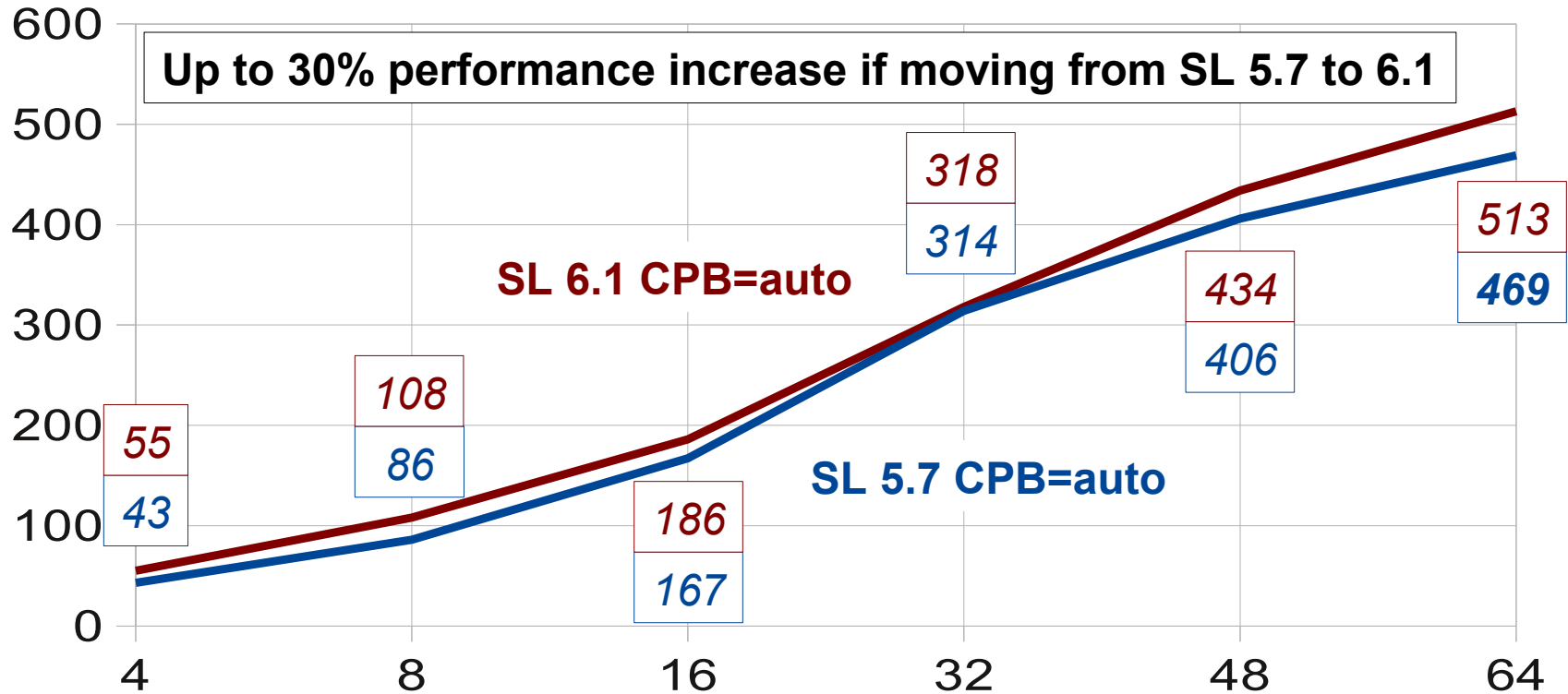
Performance (HS06) of 4-way AMD 6276 (Bulldozer 2.3 ... 3.1 GHz, 16-core)



Hardware platform: DELL C6145 | OS: SL 5.7 | Compiler: default | Copies: 4 ... 64

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Performance (HS06) of 4-way AMD 6276 (Bulldozer 2.3 ... 3.1 GHz, 16-core)

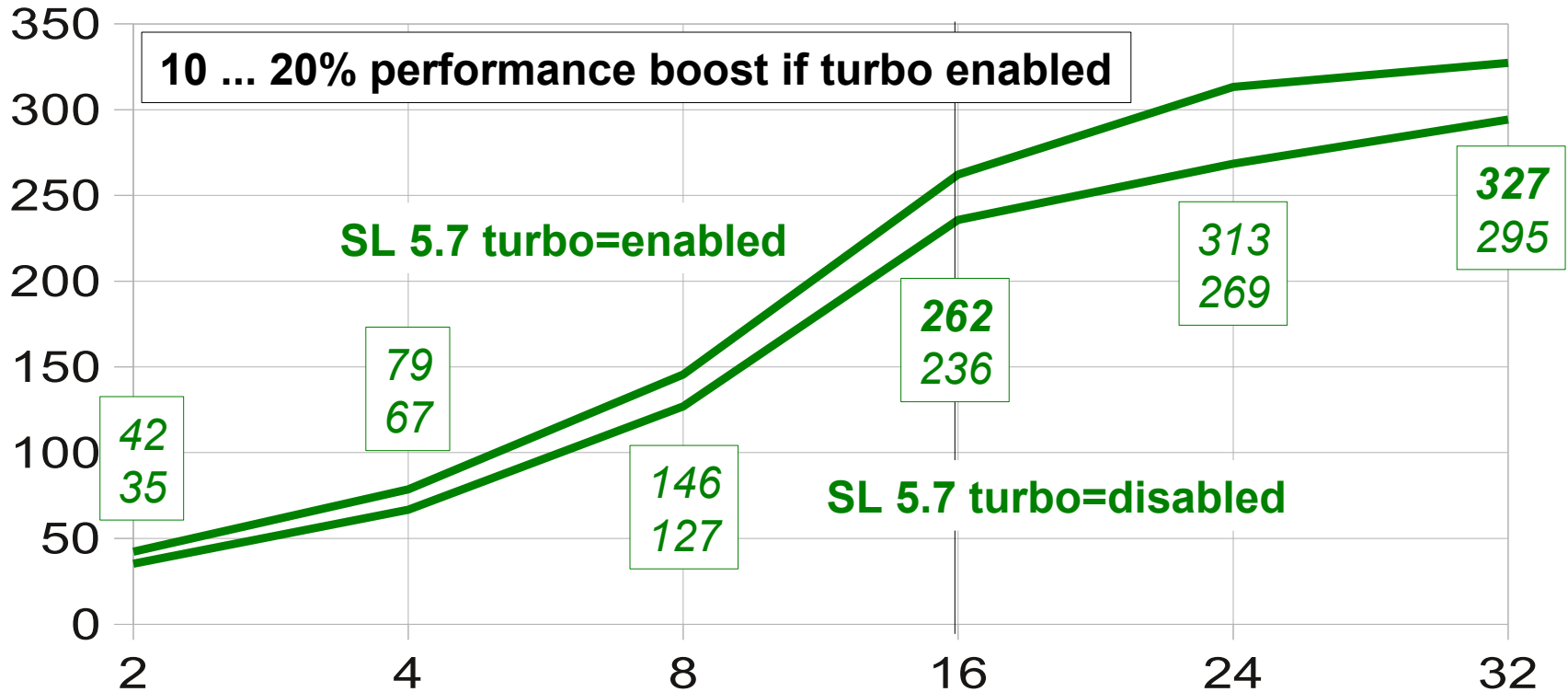


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Performance Scores (Intel Sandy Bridge)

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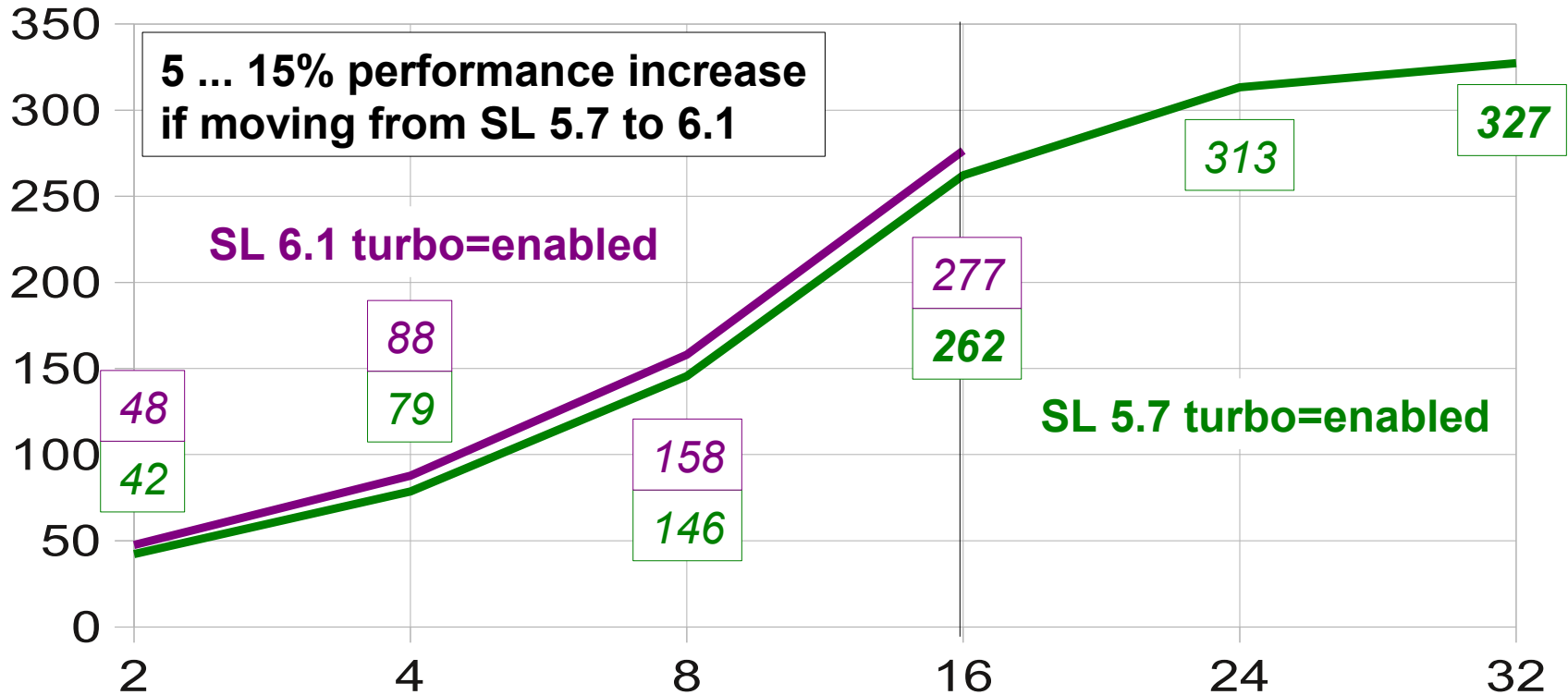
Performance (HS06) of 2-way Intel E5-2670 (Sandy Br., 2.6 ... 3.3 GHz, 8-core)



Hardware platform: Intel S2600JF | OS: SL 5.7 | Compiler: default | Copies: 2 ... 32

Performance Scores (Intel Sandy Bridge)

Performance (HS06) of 2-way Intel E5-2670 (Sandy Br., 2.6 ... 3.3 GHz, 8-core)

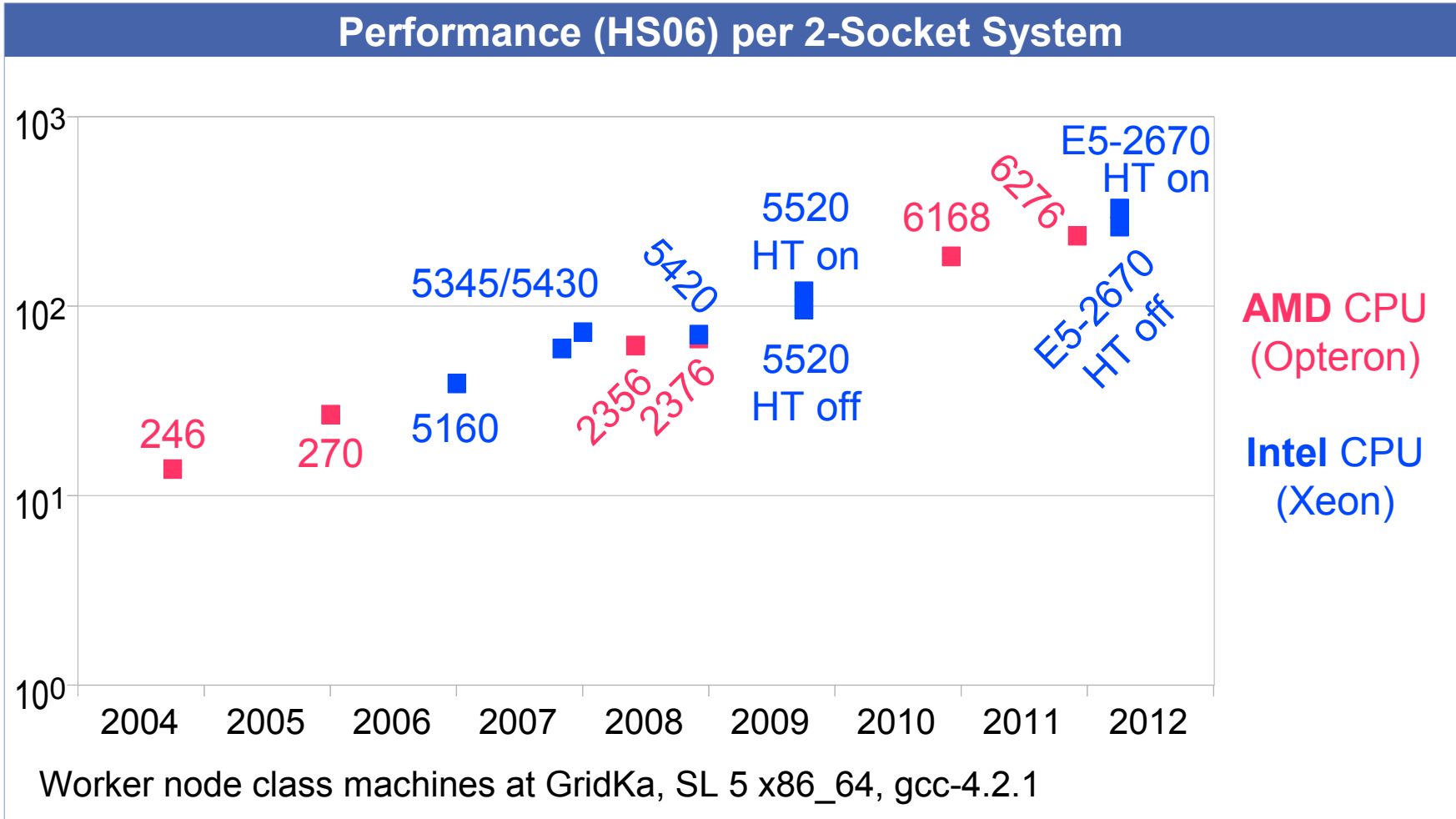


Hardware platform: Intel S2600JF | OS: SL 5.7 / 6.1 | Compiler: def. | Copies: 2 ... 32

Performance per Box

- Performance of worker node class machines at GridKa 2004-2012

Performance per Box

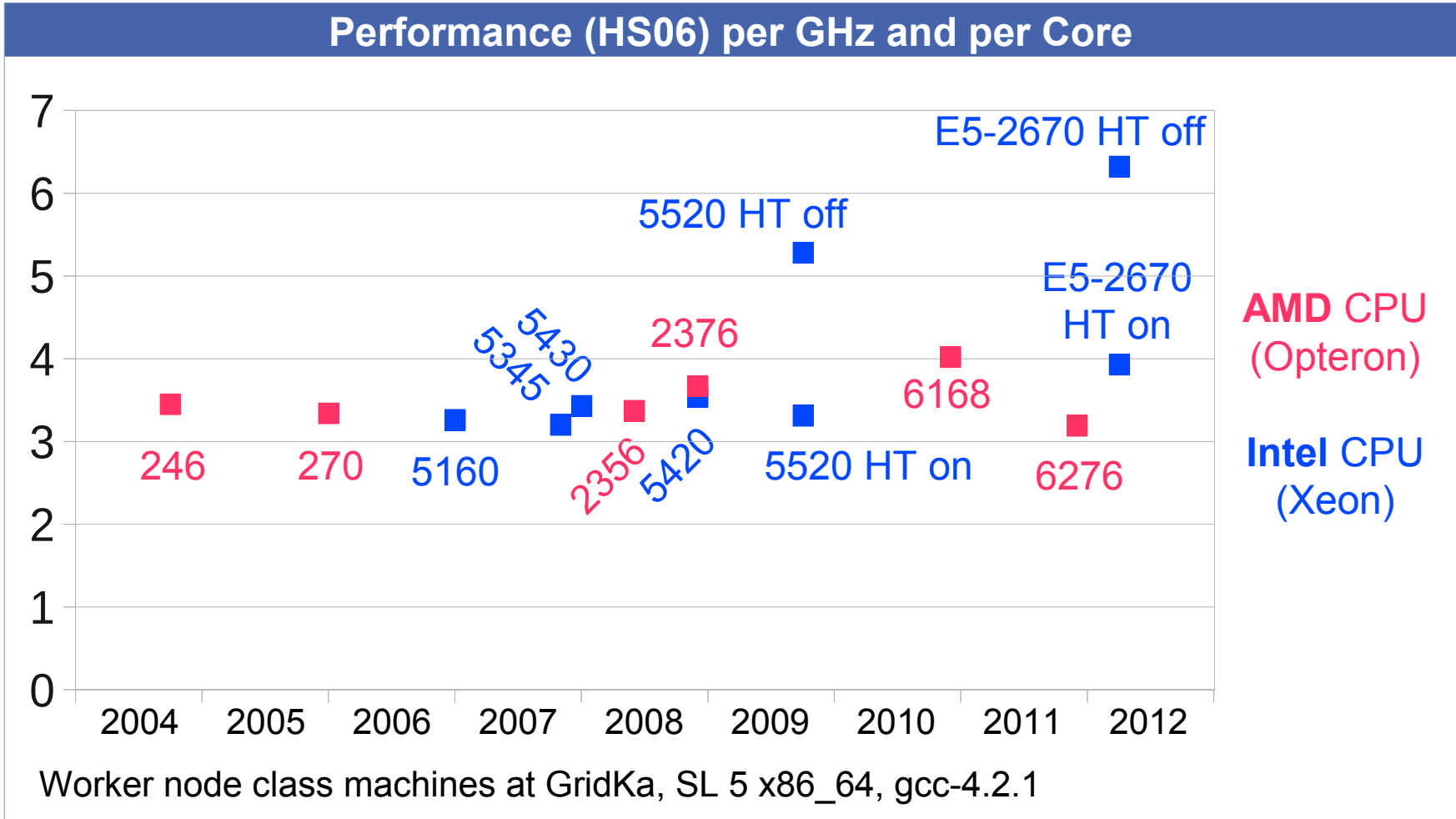


Performance per CPU Core

- Not only the performance per box is important, but also the performance per job slot
 - Costs of RAM + local disks increase with number of job slots (see VO ID cards)
 - Batch licenses are charged per core, not per CPU or per box
- Compare performance of cores per clock cycle
 - In general, it's a bad idea to use clock speed as a performance indicator :-(
 - In 2004, the performance of an AMD Opteron 246 (2.0 GHz) based cluster node was much better than an 3.06 GHz Intel Xeon machine *
 - Nevertheless, recent series of worker node class machines at GridKa feature a more balanced ratio of performance and clock speed (per core)

* <http://hepix.caspar.it/processors/spec-cpu2000.html>

Performance per CPU Core

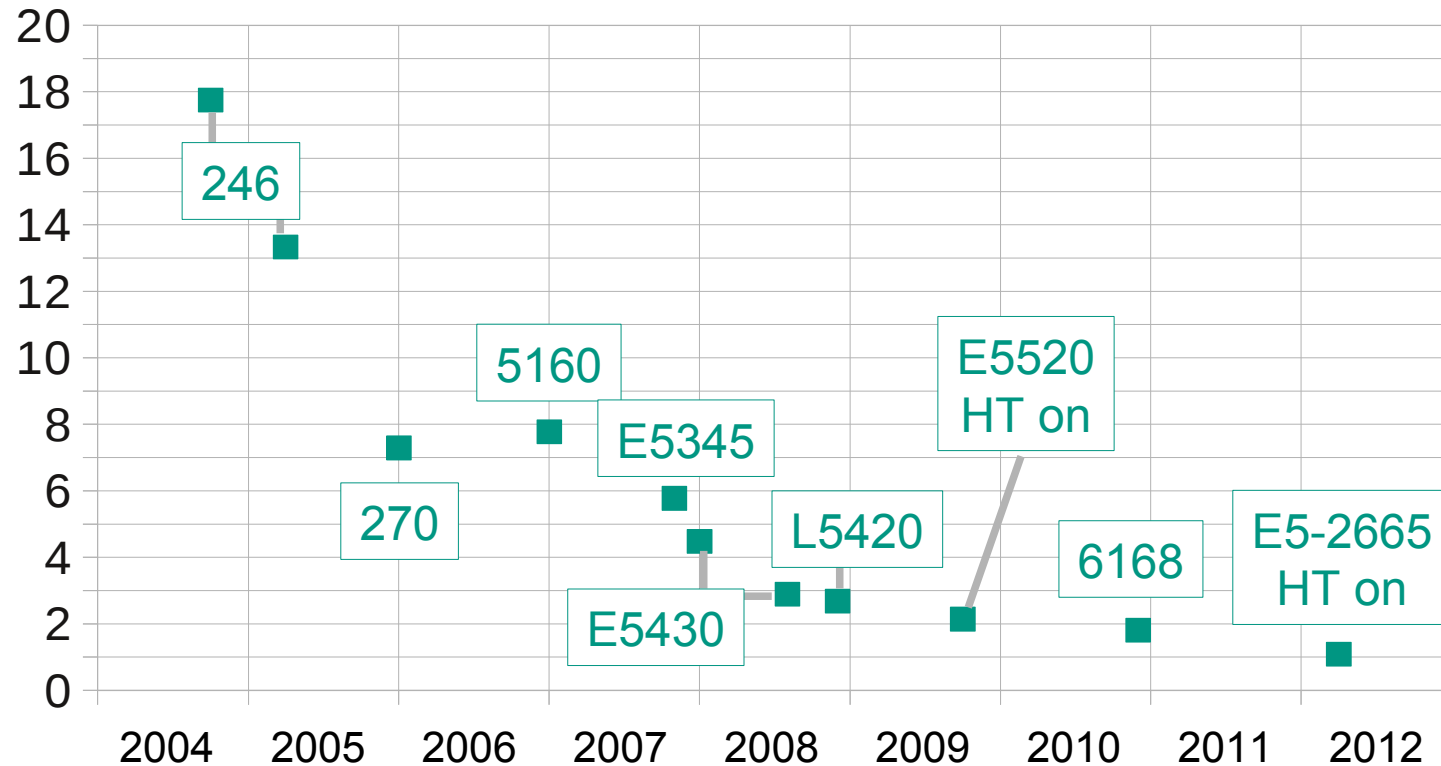


Power Efficiency

- How much electric power is consumed for providing 1 HS06?

Power Efficiency

Power Usage (W) per Performance Score (HS06)



Worker node class machines at GridKa, SL 5 x86_64

Conclusions

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- New generations of processors on the market
- Better performance *per chip* (i.e. per box) than before
- Performance *per core*
 - AMD (Bulldozer):
as before (coming with more cores to provide increased chip performance)
 - Intel (Sandy Bridge):
improved performance per core
- Surprising pricing of new Sandy Bridge chips
- Improved power efficiency (~ 1 W per HS06)
- Benchmarks demonstrate performance boost when migrating from SL 5 to SL 6

Questions, Comments?