TECHNISCHE UNIVERSITÄT DRESDEN

Zentrum für Informationsdienste und Hochleistungsrechnen

Linux Performance Practical

Processor Architecture Point-of-View

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ZIH
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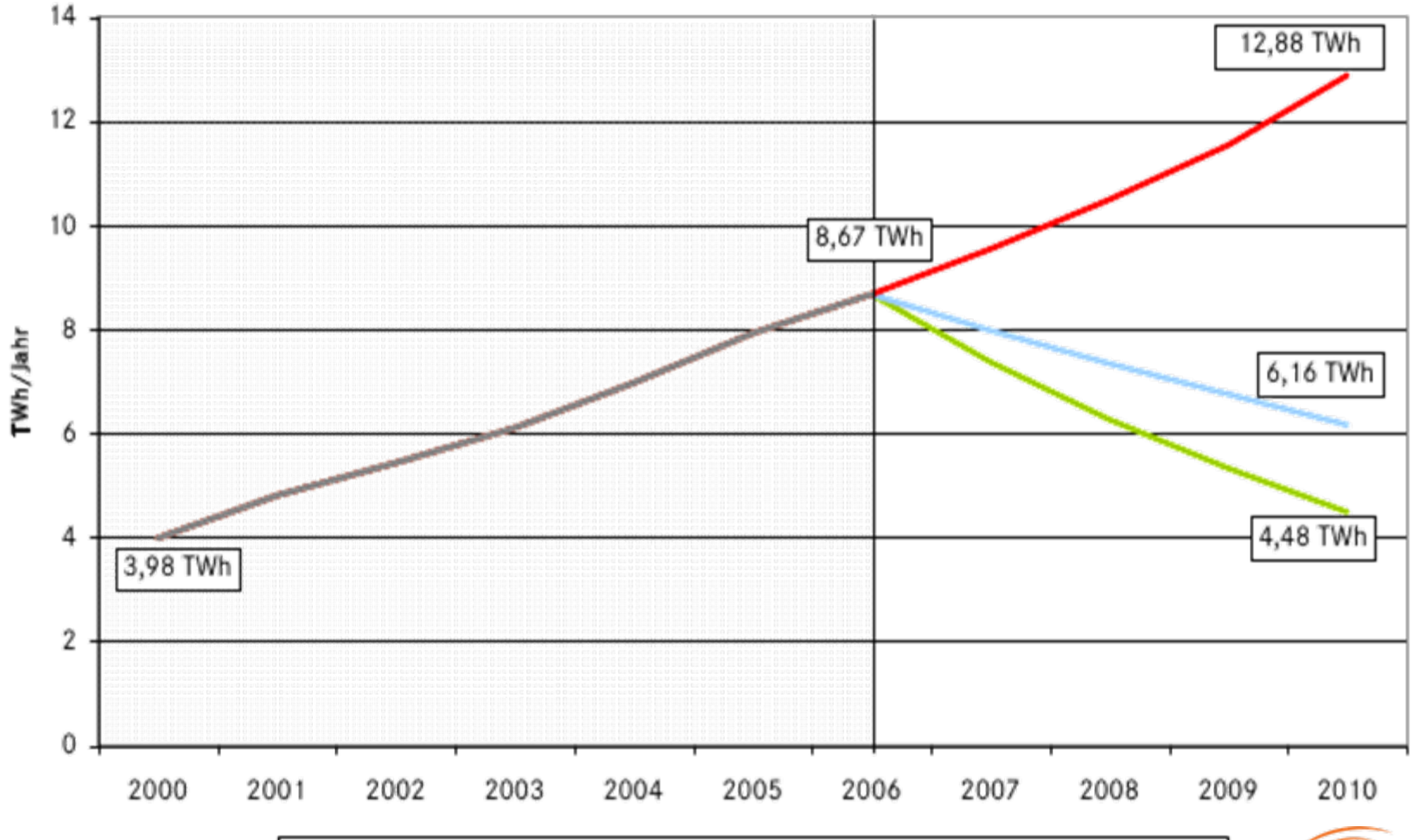
Motivation

- ZIH Bedarf für HPC + Zentrale Dienste
  Elektroenergie: ≤ 0,8 MW
  Kühlung („CO_2-neutral“) ≤ 1,0 MW
- CO_2-Emissionen von ICT (*information and communication technology*) (Quelle: Gartner, 2007)
  - 2% der weltweiten CO_2-Emissionen
    ~ weltweiter Luftverkehr
  - 23% davon entfallen auf Rechenzentren (40% PC)
  - Ohne Gegenmaßnahmen: Anstieg bis 2020 um 60%
- Steigende Energiepreise
- Energieversorgung der Rechenzentren (hohe „Leistungsdichte“ der Server)

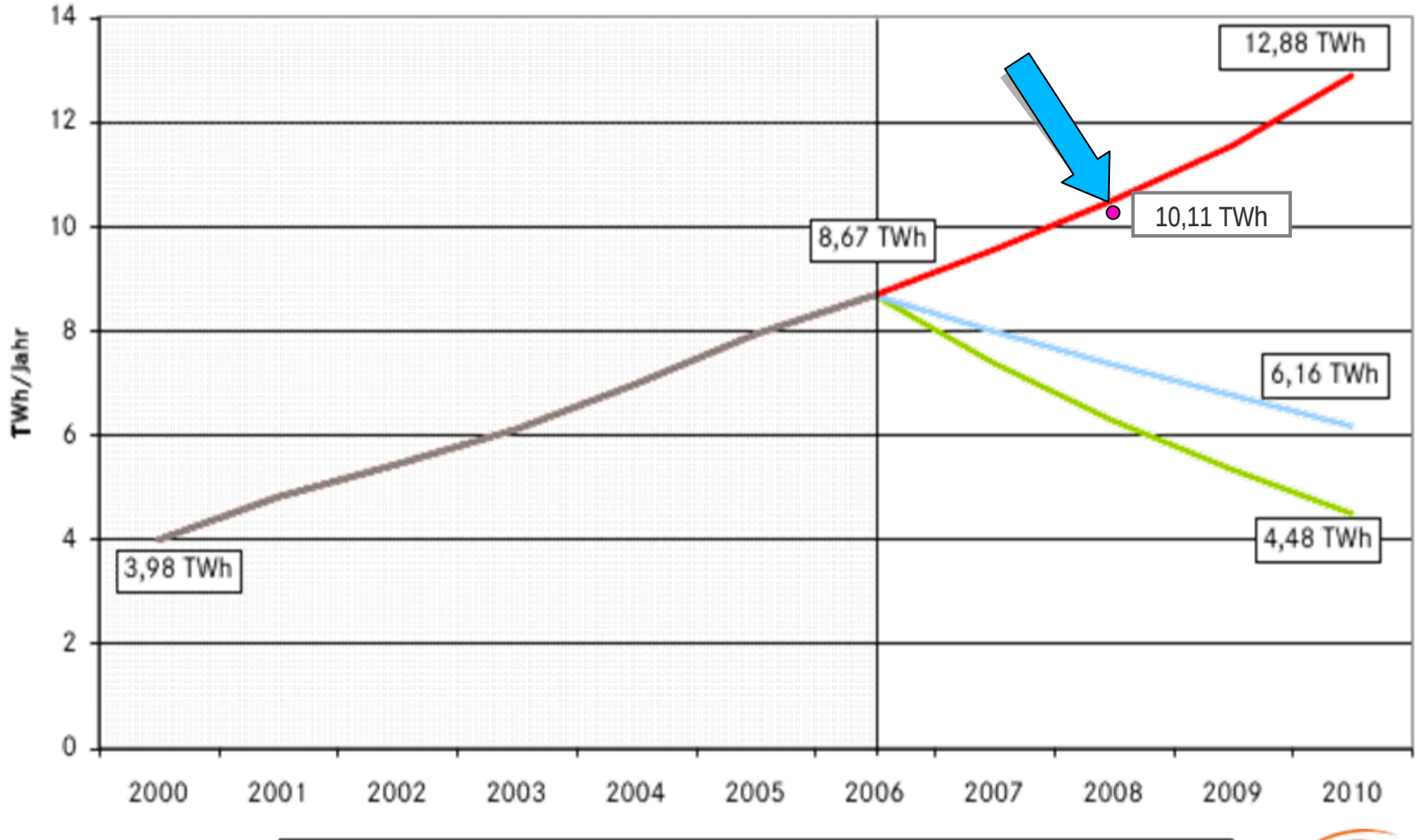
Energieverbrauch Rechenzentren

Server und Rechenzentren in Deutschland (Quelle: Borderstep 2007)



Energieverbrauch Rechenzentren

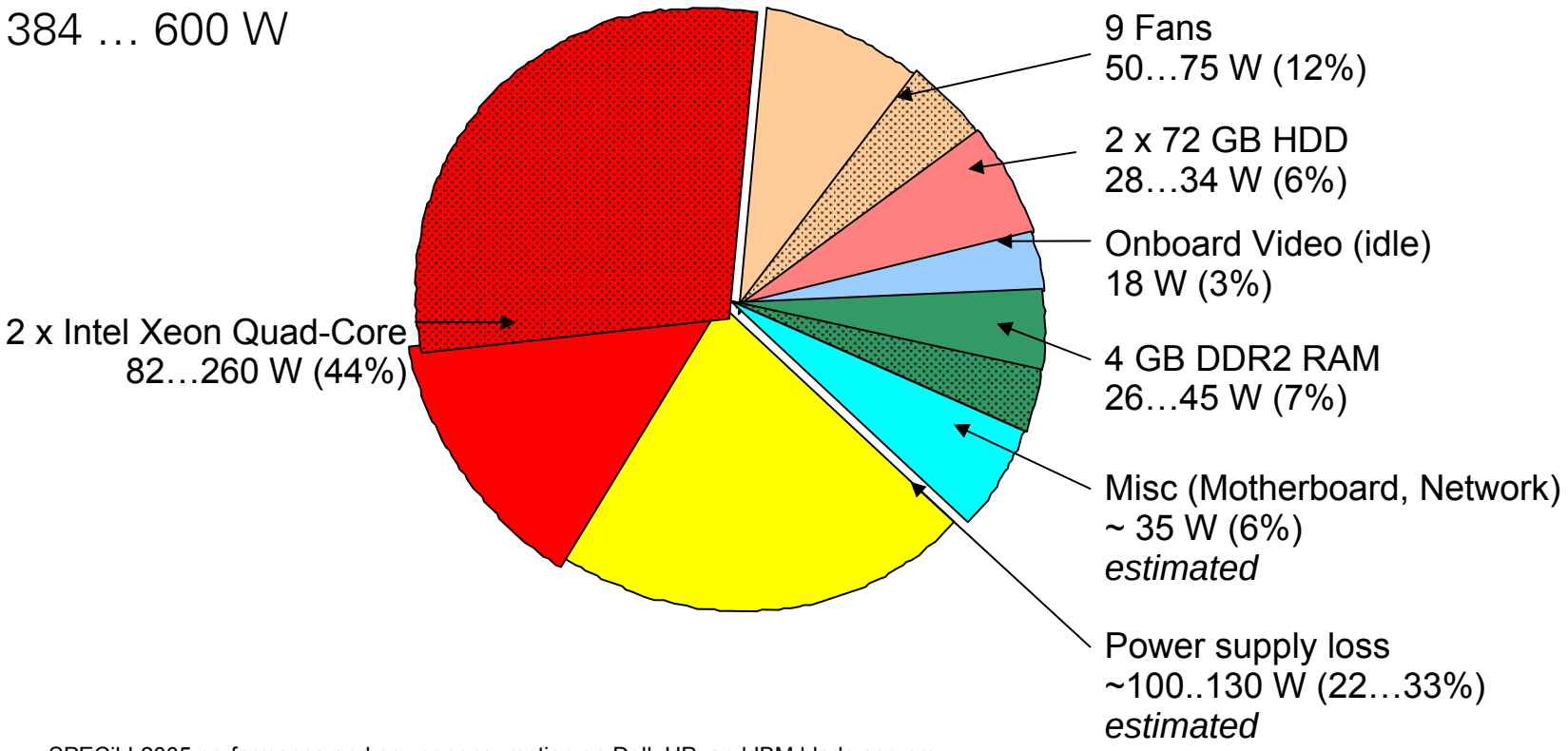
Server und Rechenzentren in Deutschland (Quelle: Borderstep 2008)



Server-Komponenten

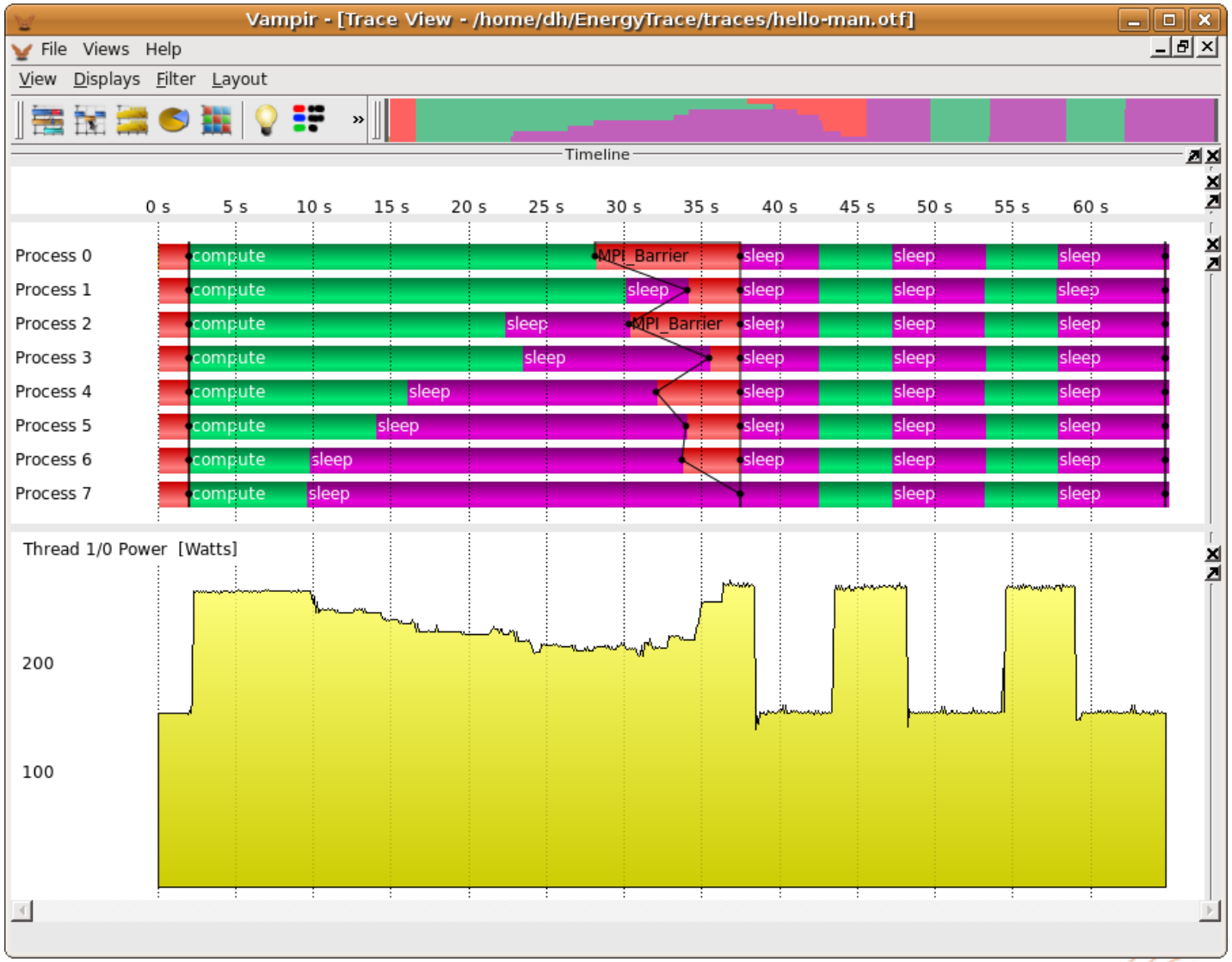
Dell PowerEdge 600 (12 / 2007)

Total: 384 … 600 W

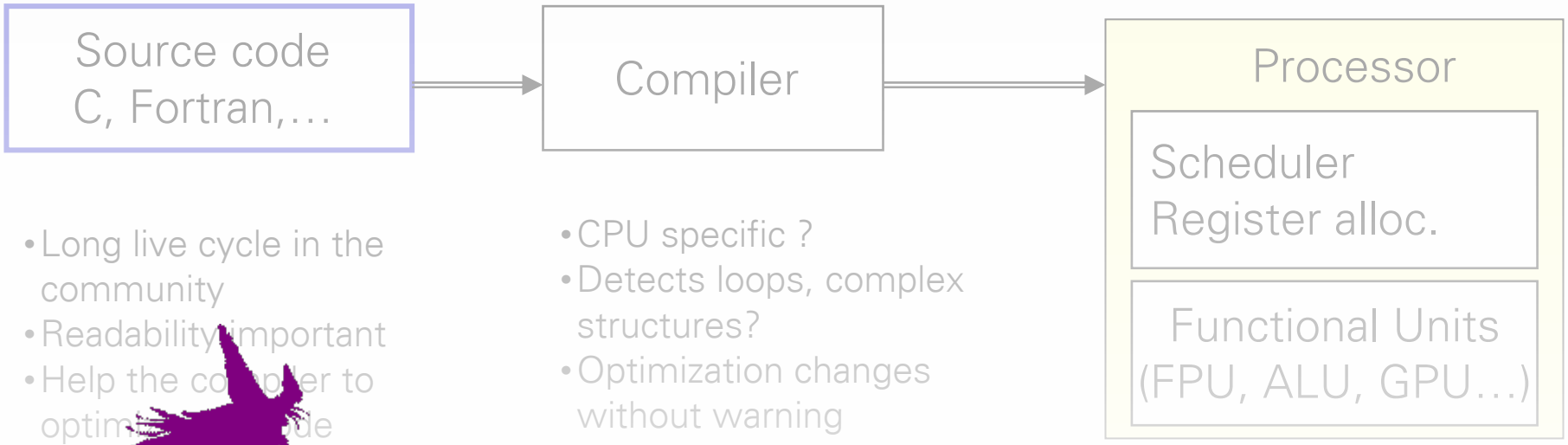


- SPECjbb2005 performance and power consumption on Dell, HP, and IBM blade servers
  http://www.dell.com/downloads/global/products/pedge/en/pe_blades_specjbb2005.pdf
- Profiling Energy Usage for Efficient Consumption
  http://www.rdacorp.com/PDF/Profiling Energy Usage for Efficient Consumption.pdf
- Samsung DDR2 Memory Specifications
  http://www.samsung.com/global/system/business/semiconductor/product/2008/9/22/417026ds_ddr2_512mb_e-die_based_fbdimm_rev151.pdf

Energieverbrauch im Zeitverlauf



This course



We cannot make you fly -

but we show you how to use a broom.

Agenda

1. Overview over the x86 processor architecture
2. Localization of performance problems - gprof
3. Identification of performance problems – PAPI

4. Callgrind – analysis of memory accesses
5. Compiler Flags
6. Heat conduction example

All slides: http://wwwpub.zih.tu-dresden.de/~mlieber/practical_performance/