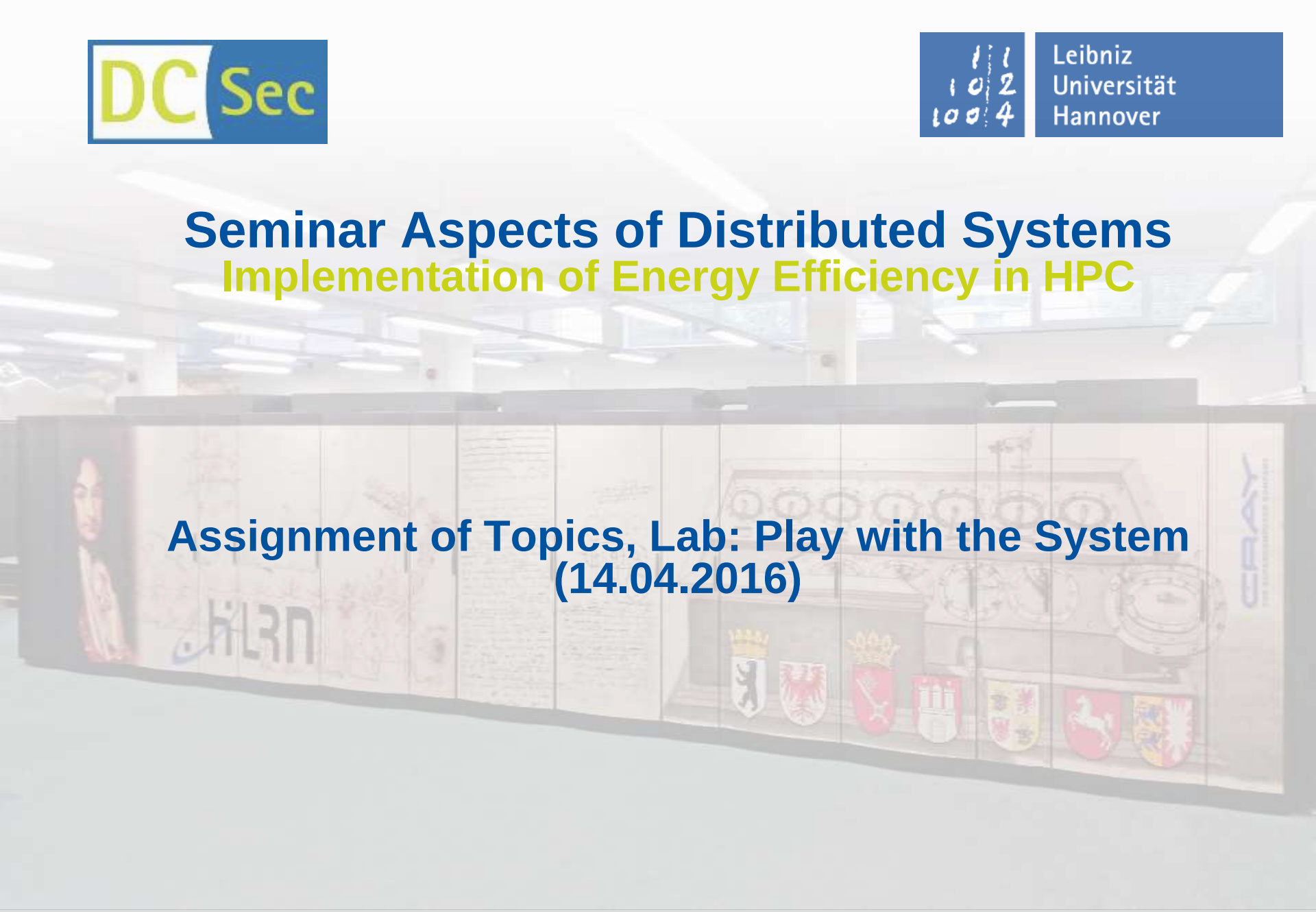
Seminar Aspects of Distributed Systems

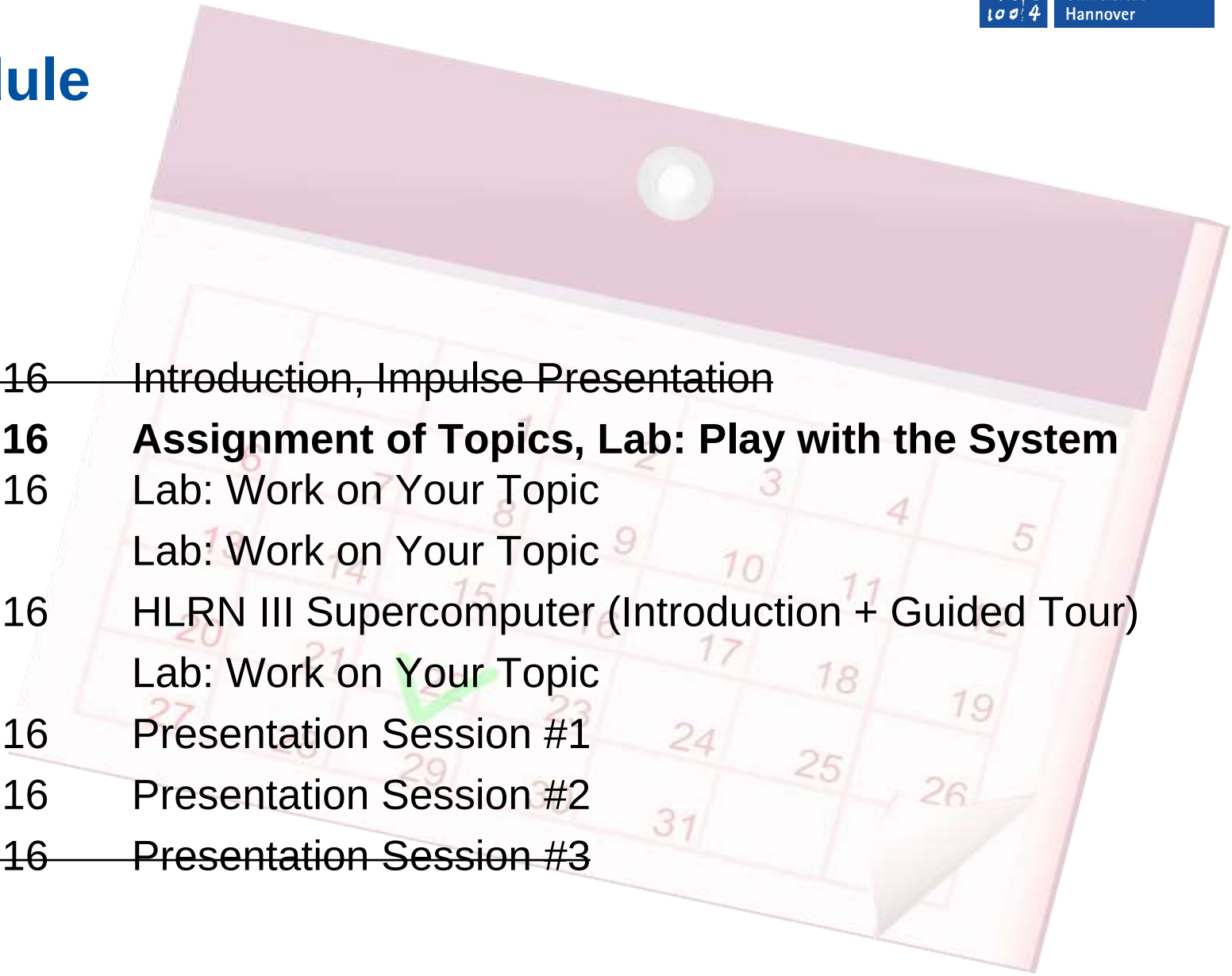
Implementation of Energy Efficiency in HPC



Assignment of Topics, Lab: Play with the System (14.04.2016)

Prof. Dr.-Ing. Gabriele von Voigt, Fabian Pflug, Hinrich Tobaben

Schedule



- ~~07.04.16 Introduction, Impulse Presentation~~
- **14.04.16 Assignment of Topics, Lab: Play with the System**
- 21.04.16 Lab: Work on Your Topic
- … Lab: Work on Your Topic
- 26.05.16 HLRN III Supercomputer (Introduction + Guided Tour)
- … Lab: Work on Your Topic
- 30.06.16 Presentation Session #1
- 07.07.16 Presentation Session #2
- ~~14.07.16 Presentation Session #3~~

Documents via STUD.IP

- Tab Wiki
  - References to some paper, slides and links
- Tab Dateien->Allgemeiner Dateiordner
  - Präsentation XX.XX.2016
- Registration will be closed
  - Upload of more Paper

Definition of the Tasks
Assignment of Topics

- Each task consist of 2 benchmarks
  - 1 kernel benchmark
  - 1 pseudo application

#	Student	Kernel	Pseudo App
3	Hermann Kroll	IS (Integer Sort, random memory access)	BT (Block Tri-diagonal solver)
2	Jakob Riga	EP (Embarrassingly Parallel)	SP (Scalar Penta-diagonal solver)
5	Zijian Zhang	CG (Conjugate Gradient, irregular memory access and communication)	LU (Lower-Upper Gauss-Seidel solver)
1	Albert Koch	MG (Multi-Grid on a sequence of meshes, long- and short-distance communication, memory intensive)	BT-MZ (uneven-size zones within a problem class, increased number of zones as problem class grows)
4	Somer Kelef	FT (discrete 3D fast Fourier Transform, all-to-all communication)	SP-MZ (even-size zones within a problem class, increased number of zones as problem class grows)

assigned odroid# (1 for odroid1, 2 for odroid2, …)

Presentation Schedule 30.06.16 & 07.07.16

Student	Date
Hermann Kroll	30.06.16
Jakob Riga	30.06.16
Zijian Zhang	07.07.16
Albert Koch	07.07.16
Somer Kelef	30.06.16

Access Information

Hostname	IP	MAC-Adresse
odroid1.dcsec.uni-hannover.de	130.75.7.31	00:1e:06:61:7a:39
odroid2.dcsec.uni-hannover.de	130.75.7.32	00:1e:06:61:7a:3a
odroid3.dcsec.uni-hannover.de	130.75.7.33	00:1e:06:61:7a:3b
odroid4.dcsec.uni-hannover.de	130.75.7.34	00:1e:06:61:7a:3c
odroid5.dcsec.uni-hannover.de	130.75.7.35	00:1e:06:61:7a:3d
odroid6.dcsec.uni-hannover.de	130.75.7.36	00:1e:06:61:7a:3e

Account	Local Directory (no Backup will be done)	Shared NFS Directory (daily Backup)
user1 (odroid1)	/home/user1	/space/user1
user2 (odroid2)	/home/user2	/space/user2
user3 (odroid3)	/home/user3	/space/user3
user4 (odroid4)	/home/user4	/space/user4
user5 (odroid5)	/home/user5	/space/user5
user6 (odroid6)	/home/user6	/space/user6
user7 (any odroid)	/home/user7	/space/user7
root (only sudo)	/root	-

Utilities 1/2

/usr/local/bin/smartpower

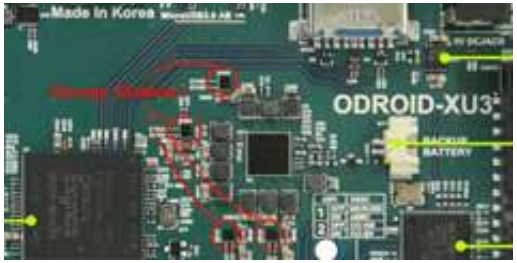
Usage: ./smartpower [options]

Options:

-h, --help	print this message
-p, --power	toggle power supply on/off
-r, --record	toggle power consumption recording
-v, --verbose	print hidraw details
-c, --csv	produce csv output (default raw)
-w --wait	waiting time in seconds between two samples (default 1)
-s, --samples <n>	take n samples and exit
-t, --title	print title before the output
-d, --dev <dev>	path to hidraw device node

- Source: /space/tobaben/tools/smartpower-dcsec
- SetUID root (chmod u+s)

Utilities 2/2



/usr/local/bin/read-xu3-sensors

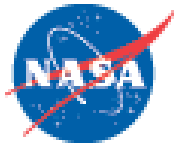
Usage: ./read-xu3-sensors [options]

Options:

-h, --help	print this message
-c, --csv	produce csv output (default raw)
-w, --wait	waiting time in seconds between two samples (default 1)
-t, --titleprint	title before the output

- Will read the XU3 sensors and write the data to stdout
- Source: /space/tobaben/tools/read-xu3-sensors
- SetUID root (chmod u+s)

Sample Programs



/space/tobaben/LAB/NAS

- NPB3.0.tar.gz
  - Contains the Java versions
- NPB3.3.1.tar.gz
  - Contains the OpenMP and MPI versions
- NPB3.3.1-MZ.tar.gz (Multi-Zone)
  - Contains the OpenMP and MPI versions

Hints

- Definition of Compiler and Flags for the Makefiles
  - Sample Files in /space/tobaben/LAB/NAS
    - OMP/make.def for OpenMP
    - MPI/make.def for MPI
    - MPI-MZ/make.def for MPI (Multi-Zone)
    - JAVA/make.def
    - JAVA/testAllS.sh (Example)
- Just for OpenMP
  - export OMP_NUM_THREADS=<number_of_threads>
  - Cheat Sheets
    - C/C++ http://openmp.org/mp-documents/OpenMP-4.0-C.pdf
    - Fortran http://openmp.org/mp-documents/OpenMP-4.0-Fortran.pdf

Task: Become familiar with the Lab Environment

- Use the Smart Power Device
  - http://odroid.com/dokuwiki/doku.php?id=en:odroidsmartpower
- Work with the Tools for Power Measurement
- Measurement of
  - Boot process
  - Idle system
  - System under full load
- Sample program: compute Pi
  - /space/tobaben/LAB/02_pi
  - Measure scaling and energy use
  - OMP_NUM_THREADS from 1 to 16

Thank You!

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