Leibniz Supercomputing Centre – site update

Salvatore Cielo, LRZ

LRZ in a nutshell

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LRZ Systems and Access

National and International
PRACE
GCS

Local and Regional
Munich TUM and LMU
~30% of SuperMUC usage

***Students**
 Training future experts

Bavarian projects
 <1 million CPU hours

SuperMUC-NG

Cluster
- CoolMUC-2
- CoolMUC-3
- Teramem
- DGX-1
- VM Ware
  High Availability Cloud
- Compute Cloud
  Open Stack
  Open Nebula

System Overview

LRZ HPC
SuperMUC-NG (Next Generation)

Specs
- Peak Performance: 26.7 Pflop/s
- 719 Tbyte main memory and
- 70 Pbyte disk storage
- 6,480 Lenovo ThinkSystem nodes with Intel Xeon processors (Skylake)
- 311,040 compute cores
- Intel Omni-Path interconnects
- Direct hot water cooled + Adsorption coolers (47 C)

HPC + Cloud
- Usage of own and individual virtual machines (integrated cloud)
- Pre- and post-processing with user's individual software
- Integrated development, ability to use familiar software and tools
- Remote visualization and integration to V2C

SuperMUC-NG (Next Generation)

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#9

in the world
Overall performance
(as of June 2019)

TOP 500

#1

in the world
Data-intensive applications
SSSP benchmark

GRAPH 500

#5

in the world
Data-intensive applications
BFS benchmark

#1

System in the EU

HPCwire Award

for Energy Efficiency

200 research fields

7.6 Billions
Compute hours utilized

5.6 Millions
Computing jobs performed

750
Research projects supported

1,995
Researchers as users

Highlights

Highlights from HPC and APPlication labs

Work on AI in HPC environments

- See ~~David's~~ ~~Walter's~~ Sofia's talk of yesterday, „Deploying AI Frameworks on Secure HPC Systems with Containers"

Code profiling and optimization

- 2nd and 3rd level support (LRZ and GCS)
- Extreme-scaling activities
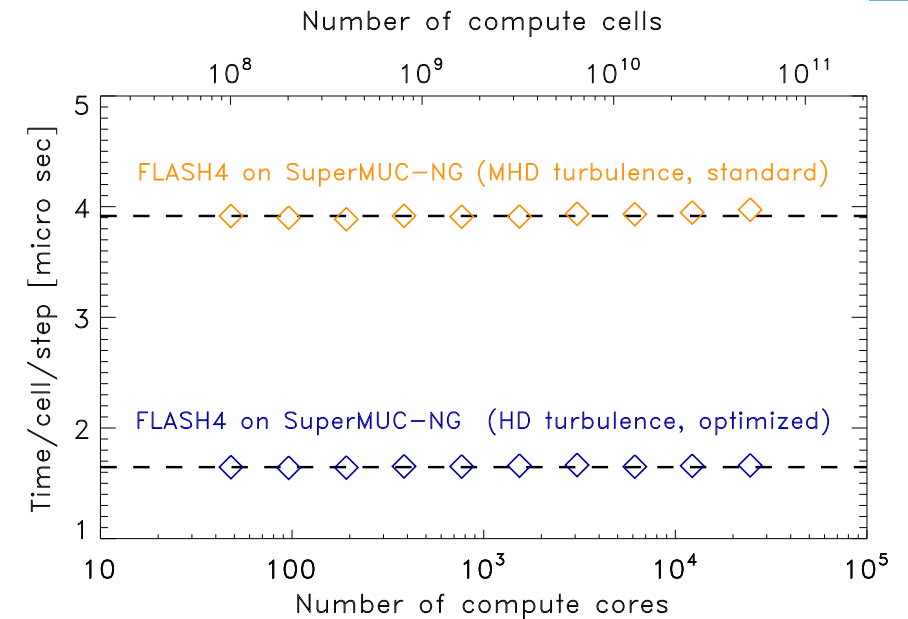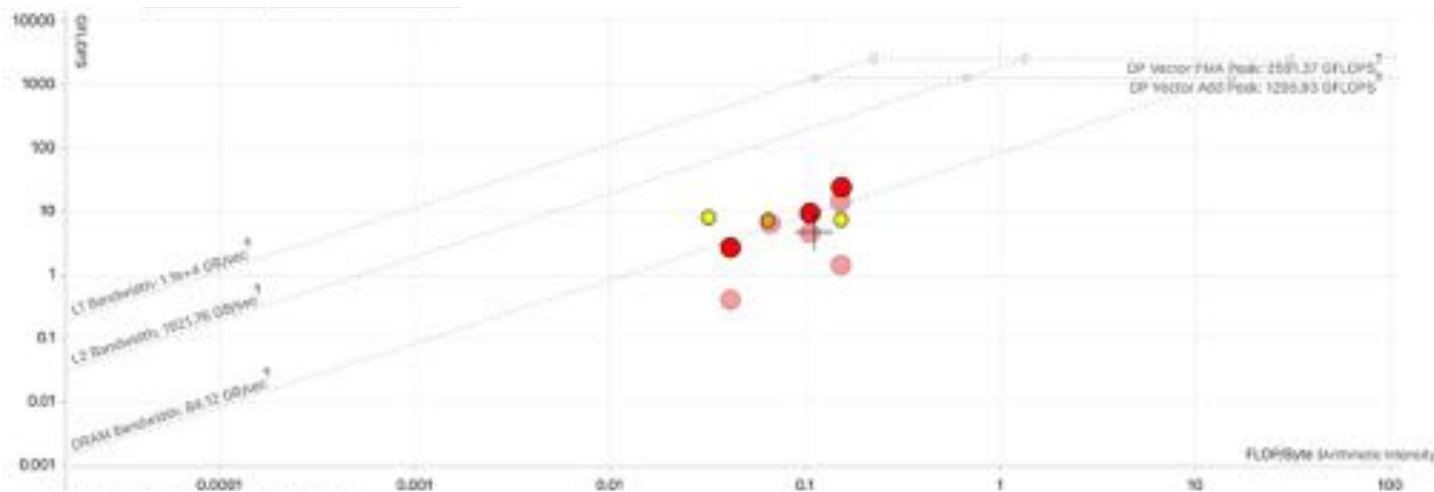
▲ Scaling of FLASH code in large turbulent simulation (user: Prof. C. Federrath)

◀ Roofline analysis of ECHO GR-MHD code (user M. Bugli) with Intel Advisor

What do the *first image of a black hole* and HPC have in common?

Image reduction:
PBytes of data

Theoretical modeling:
comparison with
simulations is necessary

ECHO-3DHPC has been
part of the comparison
project of general relativity
simulation codes (Porth et
al. 2019, arXiv: 1904.04923)
to validate the observational
results

Both ECHO and BHAC
(Black Hole Accretion Code;
Porth et al.) have been
optimized in collaboration
with LRZ

The use of both SuperMUC
and Hazel Hen (HLRS
Stuttgart) is acknowledged
in the EHT papers

(credits: EHT Collaboration 2019)

VisIt + OSPRay on HPC systems

finalist at SC19 SciViz

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VisIt

- Data processing and visualization tool
- GUI or batch-cli mode (for HPC)
- Broad range of supported data format, used across all science and beyond
- Parallel rendering up to ~1k of cores

OSPRay

- Improves parallelism and performance
- Hybrid MPI-TBB parallelism
- Aftereffects "for free"

Advantages of SDV

- Analysis and visualization on same place
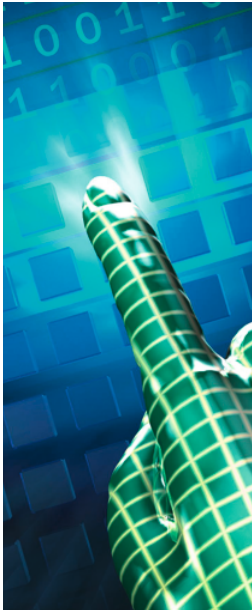- Full-HPC capabilites

SciViz at SC19 ►

- FLASH dataset
- $(10k)^3$ grids → 40 TB
- Volume + Streamlines
- Intel HPC DevCon
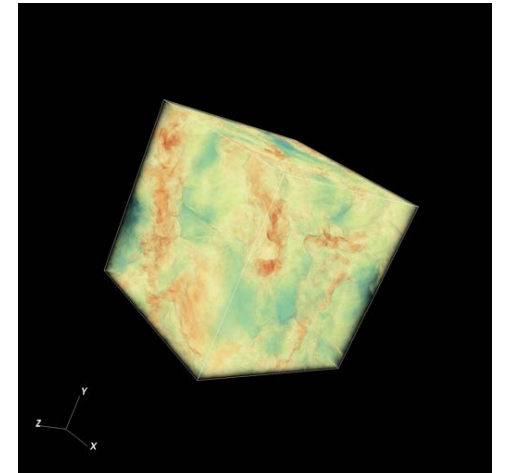
You can count on us!

STORAGE SERVICES

GREEN IT

RESEARCH & DEVELOPMENT

VIRTUAL REALITY

SUPPORT

SUPERCOMPUTING

MUNICH SCIENTIFIC NETWORK, MWN

IT SECURITY

LRZ supports ground-breaking research and education throughout a wide range of scientific disciplines by offering highly available, secure and energy-efficient services based on cutting-edge IT technology.

Today it is one of the foremost European computing centres in the area of scientific research by academic communities.

Leibniz Supercomputing Centre

Leibniz Supercomputing Centre (Leibniz-Rechenzentrum, LRZ) of the Bavarian Academy of Sciences and Humanities is the IT service provider for all Munich universities as well as a growing number of research organisations throughout Bavaria. In addition to this regional focus, LRZ also plays an important role as one of the members of the Gauss Centre for Supercomputing (GCS), delivering top-tier HPC services on the national and European level.

LRZ was founded in 1962. Its facilities are located on the Research Campus in Garching.