John-von-Neumann-Institute for Computing
25 Years of Partnership for Science

Dietrich E. Wolf   University of Duisburg-Essen / NIC   21.04.2023

The Root
The Fruit
On Route to
…

- Top-ranking computing power needed for competitive science in Germany !

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An den Bundesminister
für Forschung und Technologie
Herrn Dr. H. Riesenhuber

Heinemannstraße 2

Bielefeld, den 5. Juni 1985

5300 Bonn 2

⋮

Prof. Dr. K. Binder
Institut für Theoretische Physik
Universität Mainz
Ruf an das Supercomputer Research Institute
Florida State University
Tallahassee / Florida

Prof. Dr. H. Satz
Fakultät für Physik
Universität Bielefeld
Ruf an das Brookhaven National Laboratory
Upton, New York

Prof. Dr. J. Zabolitzky
Institut für Theoretische Physik
Universität Köln
Ruf an das Supercomputer Institute
University of Minnesota
Minneapolis, Minnesota

1985

- Top-ranking computing power needed for competitive science in Germany !

- Instrumental for getting political and institutional support:

Brilliant lobbyist for computational science,
Prof. Horst Rollnik

Far-sighted director of computer facilities
in Jülich, Prof. Friedel Hoßfeld

1987

- Cooperation agreement by KFA (now FZJ), DESY and GMD: The first German supercomputer center (Höchstleistungs-rechenzentrum, HLRZ) was born.

Mission of the HLRZ / NIC:

- *Independent* interface between operator of top level computers and a nationwide academic user community:

  - Scientific Council
  - Peer Review Board

Chairpersons of Scientific Council

Horst Rollnik	Dietrich Wolf	Gernot Münster	Kurt Binder	Marcus Müller
1987 - 1999	2000 – 2005	2006 – 2011	2012 – 2017	2018 - 2023

Mission of the HLRZ / NIC:

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  - Scientific Council
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- HPC – community formation by

  - User support
  - User – symposia
  - Topical workshops

Detail of Prof. Giovanni Ciccotti's bookshelf in Rome

- Research groups for international visibility

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HöchstLeistungsRechenZentrum

https://www.tomemoffatt.com/tongue-twister/

| 1998 |

• GMD terminates its HLRZ-involvement and becomes a Fraunhofer institute.

• DESY and FZJ renew their cooperation agreement and rename HLRZ into NIC.
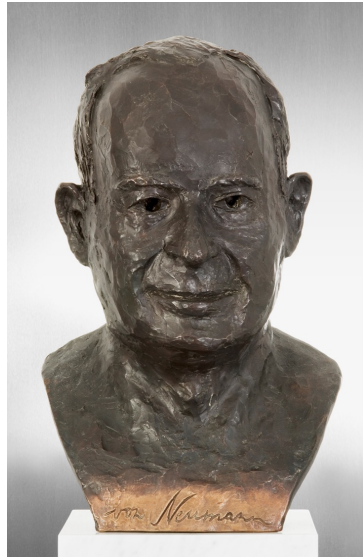
Sculpture by
   Gabriella Bollobas

| 2004 |

• Prof. Thomas Lippert new director of Jülich Supercomputing Center (JSC)

| 2006 |

• GSI joins NIC.

The Fruit

- Tier-0 partnership: Gauß Center for Supercomputing (GCS)
- European outreach
- Training for exascale readiness
- Novel supercomputer concepts
- Scientific highlights

Tier-0 Partners – **G**auß **C**enter for **S**upercomputing

1995	• Inception of the High Performance Computing Center Stuttgart (HLRS).

• Leibnitz Supercomputer Center München (LRZ) becomes the third national supercomputer center. **[1999]**

• "Congregation" (H. Rollnik): Regular meetings of the three centers, coordination of innovation spiral.
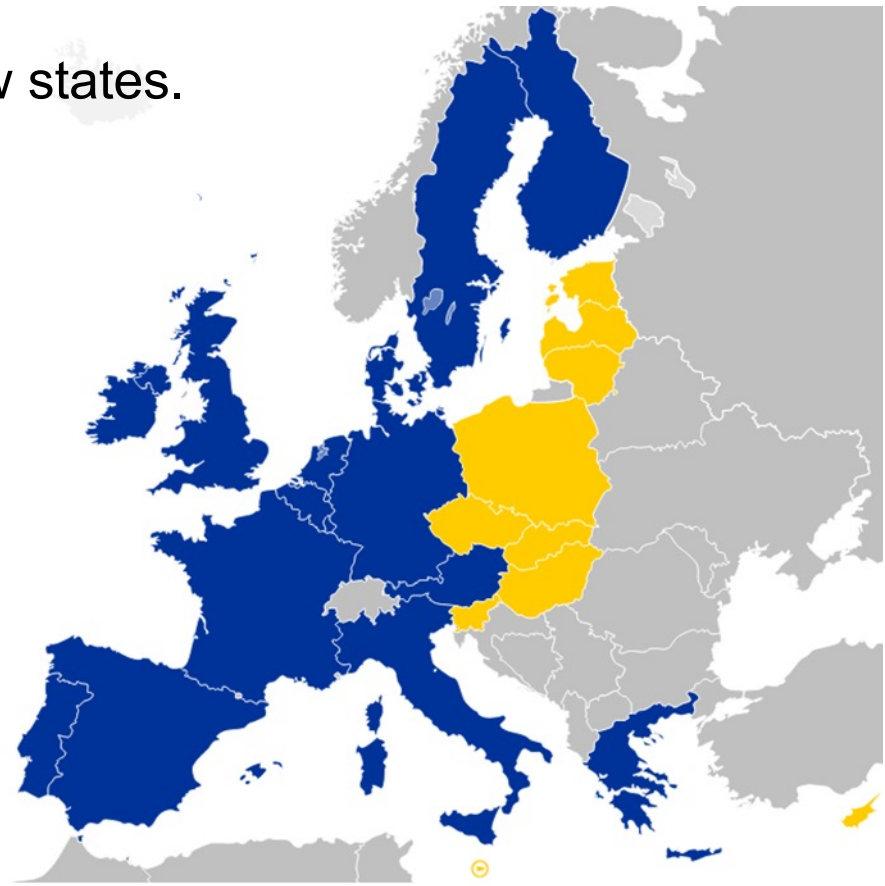
2007

• Merger of the three centers into a single German Supercomputer Center, GCS:

– Most powerful supercomputing infrastructure in Europe.

– Coordinated peer review of Large Scale Projects.

– Common online portal for managing proposals, JARDS.
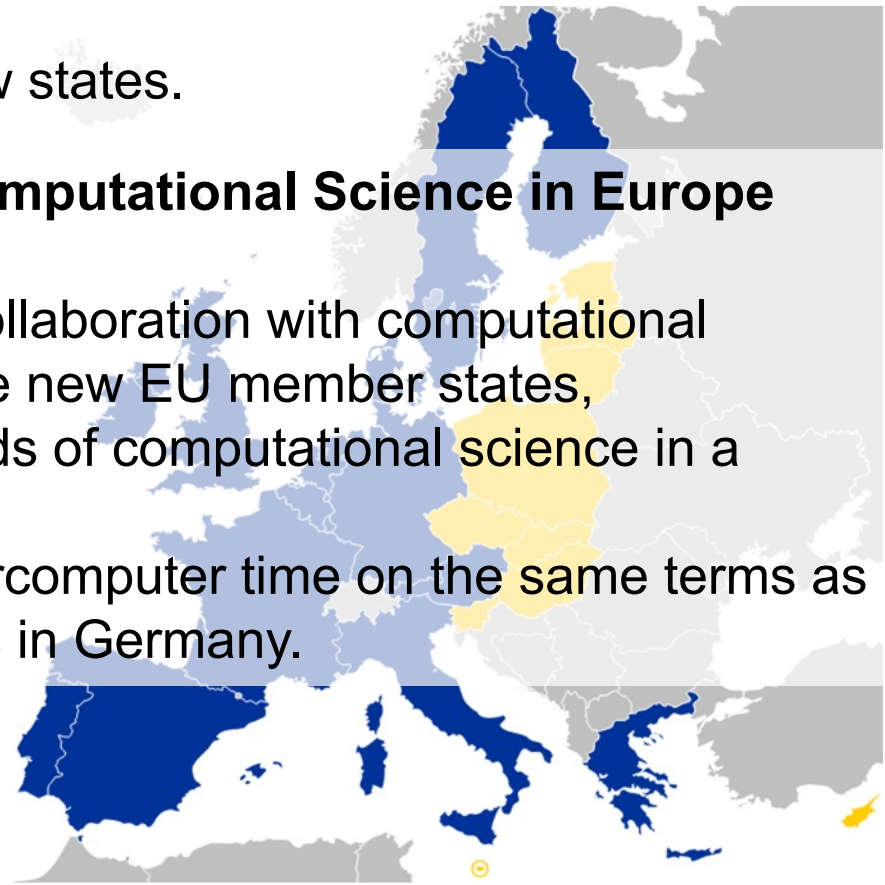
European outreach

2004

- EU grows by 10 new states.

2004

2006

- EU grows by 10 new states.

- **Strenghtening Computational Science in Europe**
  Initiative to
  - ➤ advance the collaboration with computational scientists of the new EU member states,
  - ➤ define the needs of computational science in a larger Europe,
  - ➤ offer free supercomputer time on the same terms as for researchers in Germany.

2004

- EU grows by 10 new states

2006

- **Strenghtening Computational Science in Europe** NIC-Initiative to
    - ➤ advance the collaboration with computational scientists of the new EU member states,
    - ➤ define the needs of computational science in a larger Europe,
    - ➤ offer free supercomputer time on the same terms as for researchers in Germany; proposals will undergo a peer reviewing process.

2010

- Partnership for Advanced Computing in Europe (PRACE)
    - ➤ 25 member states
    - ➤ Germany, France, Italy, Spain, and Switzerland provide HPC-resources.

2022

- EuroHPC: EU co-finances European pre-exascale computers and decides for Jülich as location for the first European exascale computer.
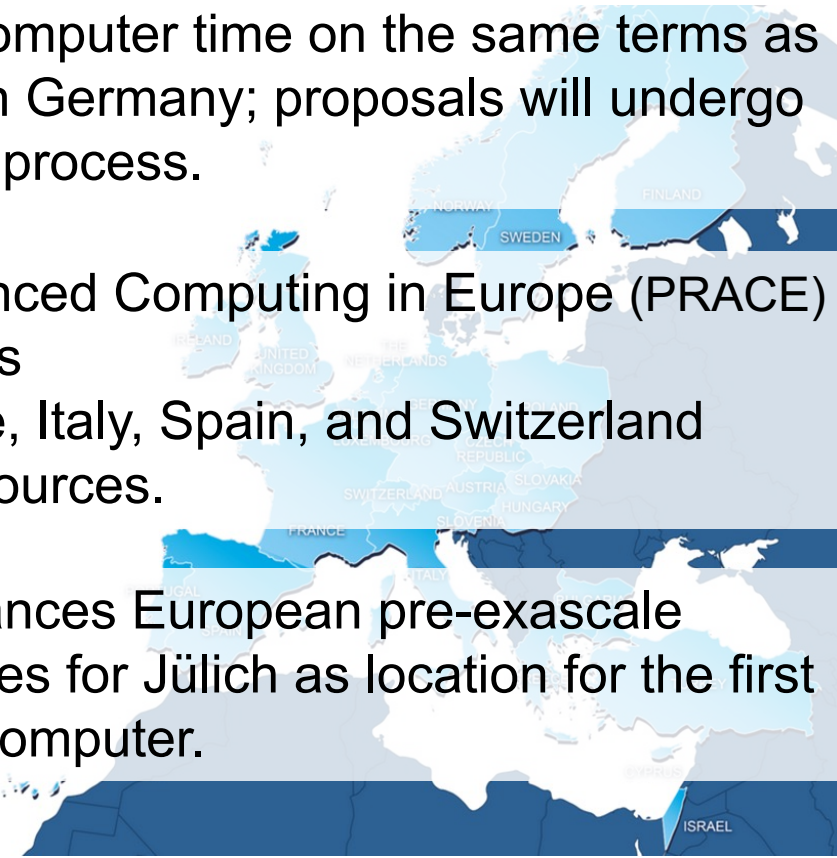
Training for exascale readiness

- Early Access programs
- Simulation- and Data-Labs
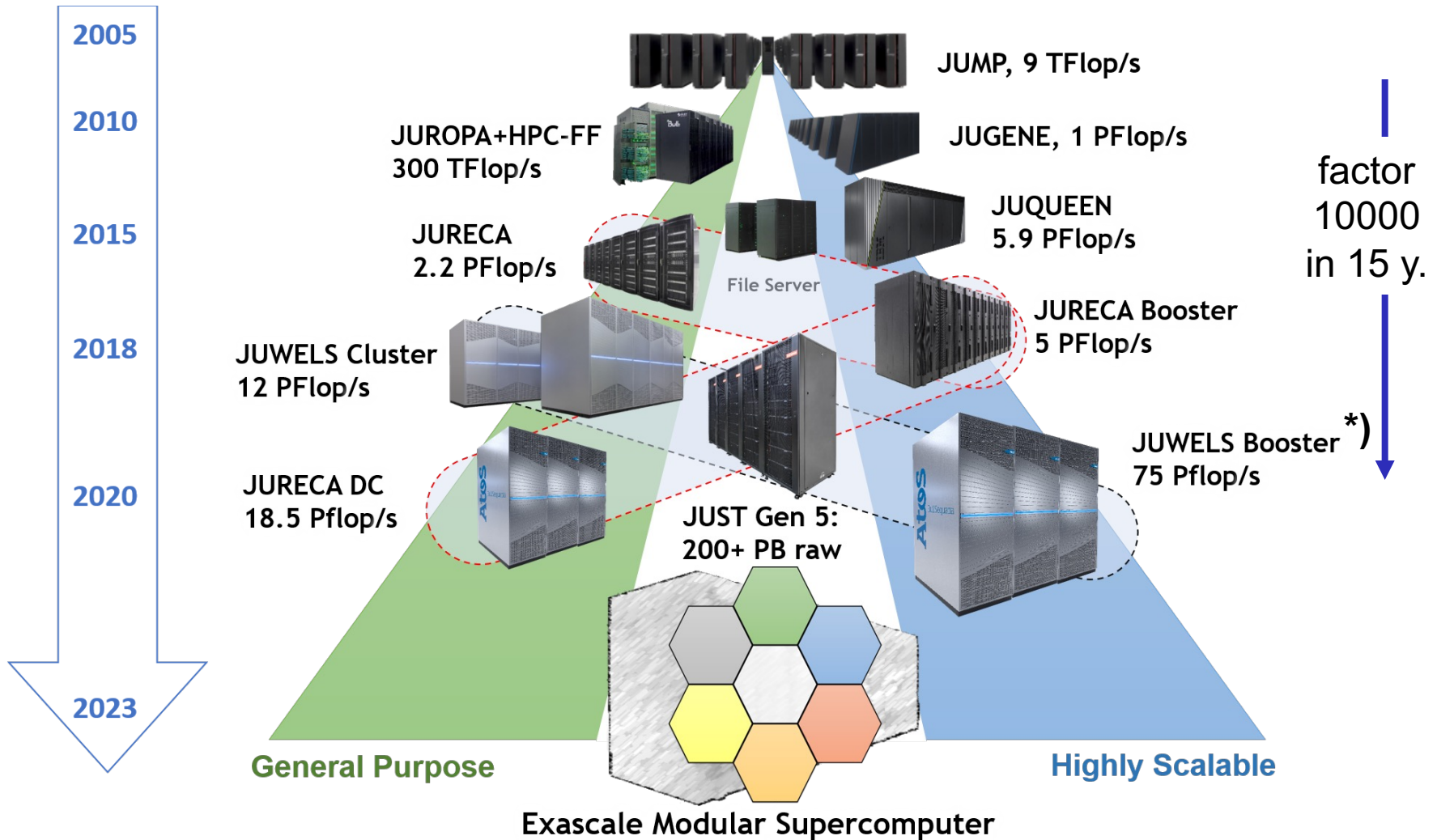- Workshops
- High-Q Club

2017

High-Q Club:

- 32 application codes demonstrating extreme scaling on JUQUEEN (IBM Blue Gene/Q, 458752 cores)

- Diverse fields: Fluid dynamics, earth system research, astrophysics, quantum mechanics of solids, plasma physics, lattice QCD with dynamic fermions, molecular dynamics, …

Development of novel supercomputer concepts: green, quantum, modular

(DUAL) hardware strategy at JSC

2005

2010

2015

2018

2020

2023

JUMP, 9 TFlop/s

JUGENE, 1 PFlop/s

JUROPA+HPC-FF
300 TFlop/s

JUQUEEN
5.9 PFlop/s

JURECA
2.2 PFlop/s

File Server

JURECA Booster
5 PFlop/s

JUWELS Cluster
12 PFlop/s

JUWELS Booster *)
75 Pflop/s

JURECA DC
18.5 Pflop/s

JUST Gen 5:
200+ PB raw

factor
10000
in 15 y.

General Purpose
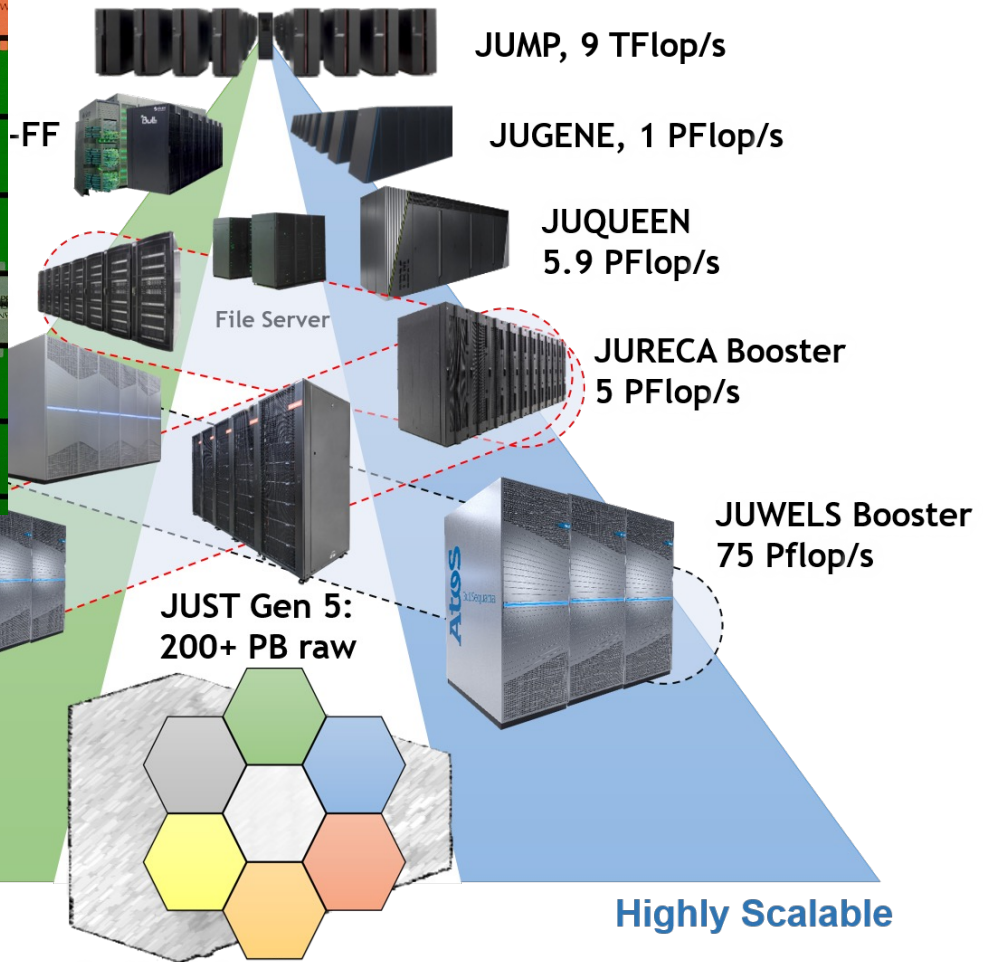
Highly Scalable

Exascale Modular Supercomputer

*) Highest efficiency (Gflops/Watts) among the 150 top supercomputers worldwide.

… and Evolution to a
Modular supercomputing architecture

Module 1
Cluster

CN CN

CN CN

Climatology
workflow

Module 6
Multi-tier Storage System

Storage system   Storage system

Module 2
Booster

BN BN BN

BN BN BN

BN BN BN

Human Brain Project
Data Analytics
workflow

Modular Supercomputer

Deep Learning workflow

Module 5
Quantum Module

QN QN

Module 3
Data Analytics Module

AN AN AN

Module 4
Neuromorphic Module

NN NN
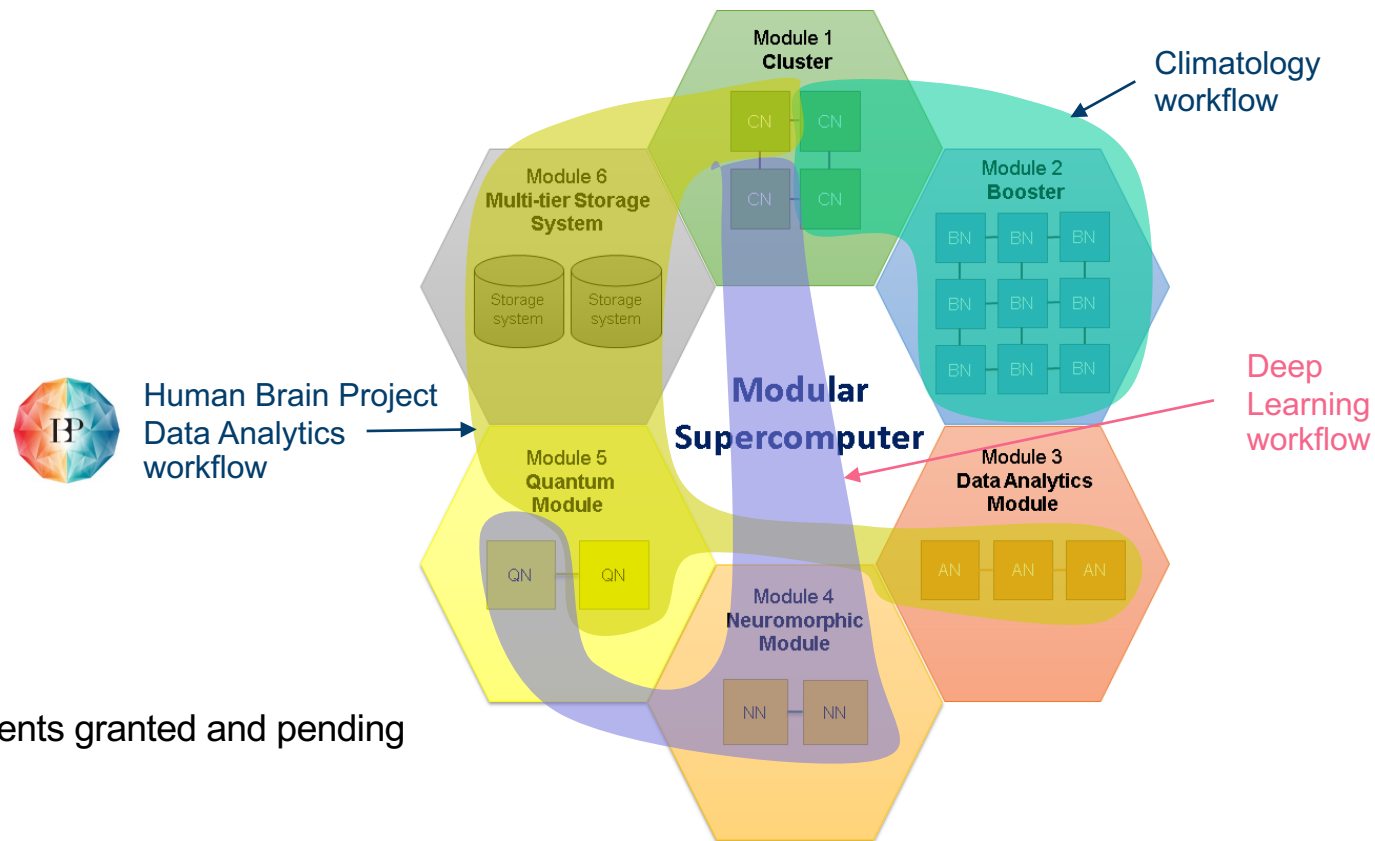
*Patents granted and pending

ware strategy at JSC

JUMP, 9 TFlop/s

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JUQUEEN
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File Server

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JUST Gen 5:
200+ PB raw

2020

2023

General Purpose

Highly Scalable

Exascale Modular Supercomputer

Scientific Highlights

- NIC-Excellence Project awarded twice a year
- NIC-Research Groups

Grassberger   Hansmann   Müser   Gohlke   Schug

Jansen   Fodor   Sommer

Karsch   Bleicher   Philipsen

NIC research groups
1998 – 2023

– at JSC
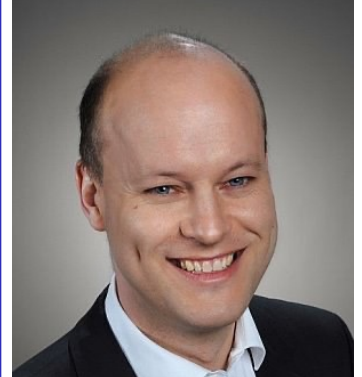– at DESY
– at GSI

NIC research groups
1998 – 2023

- at JSC
- at DESY
- at GSI

Presentations later today!

On Route to …

- European Exascale Computer JUPITER
- Data Science and Artificial Intelligence
- Quantum Computing (D-Wave JUNIQ)
- Improved gender balance

Chairpersons of Scientific Council

Gernot Münster
2006 – 2011

Kurt Binder
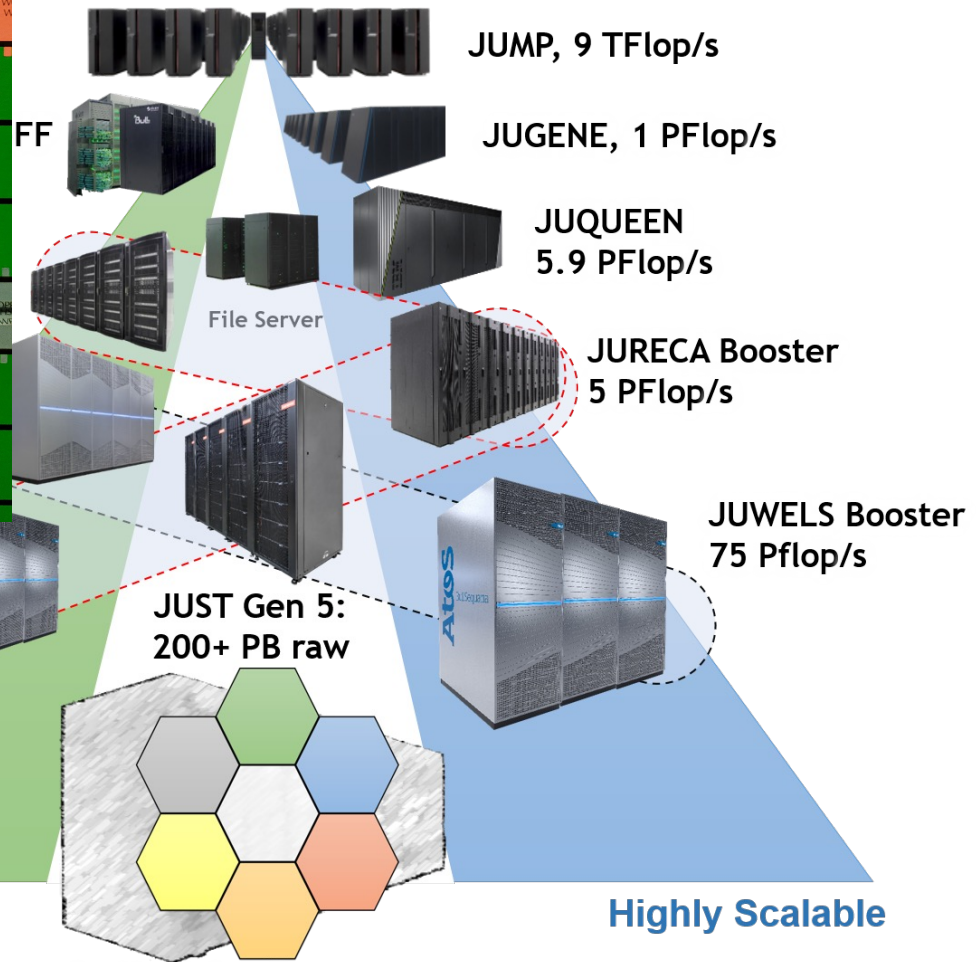2012 – 2017

Marcus Müller
2018 - 2023

Christine Peter
2024 -

NIC

**Keep flourishing
as trailblazer for computational science!**

... ware strategy at JSC

2020

2023

JUMP, 9 TFlop/s

JUGENE, 1 PFlop/s

JUQUEEN 5.9 PFlop/s

JURECA Booster 5 PFlop/s

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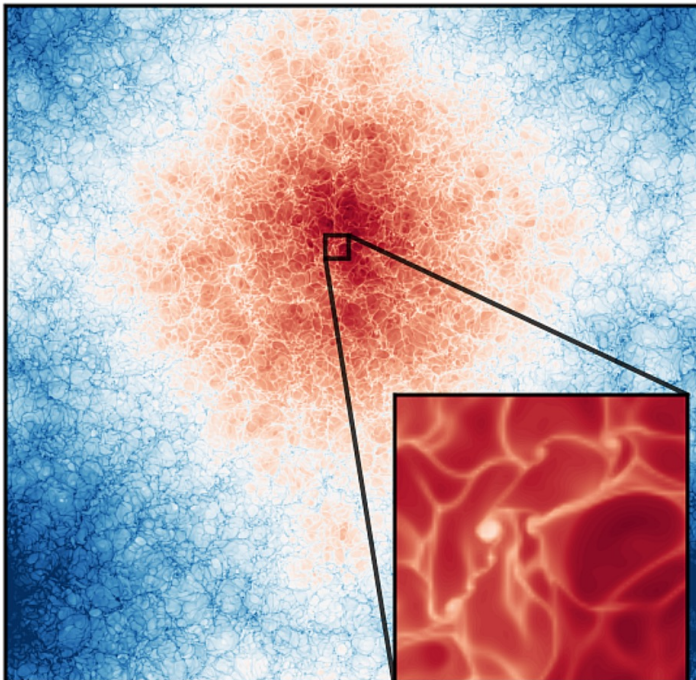JUST Gen 5: 200+ PB raw

File Server

General Purpose

Highly Scalable

Exascale Modular Supercomputer

- The NIC Peer Review Board awards the title "NIC Excellence Project" to outstanding simulation projects twice a year.

NIC Excellence Project 2022/1

Turbulente Konvektion: Wie entsteht Ordnung auf der Mesoskala?

Prof. Jörg Schumacher (TU Ilmenau)

- The NIC Peer Review Board awards the title "NIC Excellence Project" to outstanding simulation projects twice a year.

NIC Excellence Project 2021/1

JÜLICH Forschungszentrum | JÜLICH SUPERCOMPUTING CENTRE

NATURE 593 (7857), 51-55 (2021)
DOI: 10.1038/S41586-021-03418-1

S. Borsanyi, Z. Fodor, T. Lippert, ..., K. Szabo et al.

Leading hadronic contribution to the muon magnetic moment from lattice QCD

Computations were carried out on JUQUEEN and JUWELS