

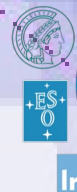
Collaborative Research Project
R&D Computing
Innovative Digital Technologies
for Research on
Universe and Matter



Bundesministerium
für Bildung
und Forschung

HSF / OSG / WLCG
Workshop
22.03.2019

Thomas Kuhr
LMU München



Digital Agenda

Digitalisierung ist Chefsache



WIR GESTALTEN DIE DIGITALISIERUNG

Digital Agenda:

1. Digitalen Wandel in der Wissenschaft forcieren

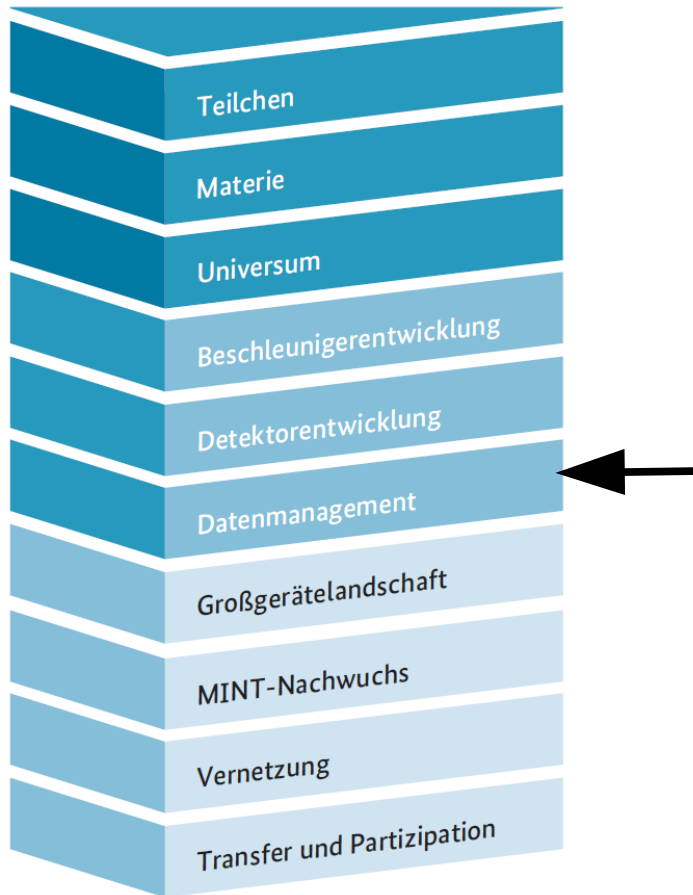
Um eine breite, disziplin- und organisationsübergreifende Zugänglichkeit und Nutzbarkeit von digitalen Informationen sicher zu stellen, werden die wissenschaftlichen Informationsinfrastrukturen gestärkt, ausgebaut und besser vernetzt.

1. Accelerate Digital Transformation in Science

To secure a broad, discipline and organization overarching access to and availability of digital information, the scientific information infrastructures are strengthened, extended. and better connected.

Erforschung von Universum und Materie – ErUM

Rahmenprogramm des Bundesministeriums für Bildung und Forschung

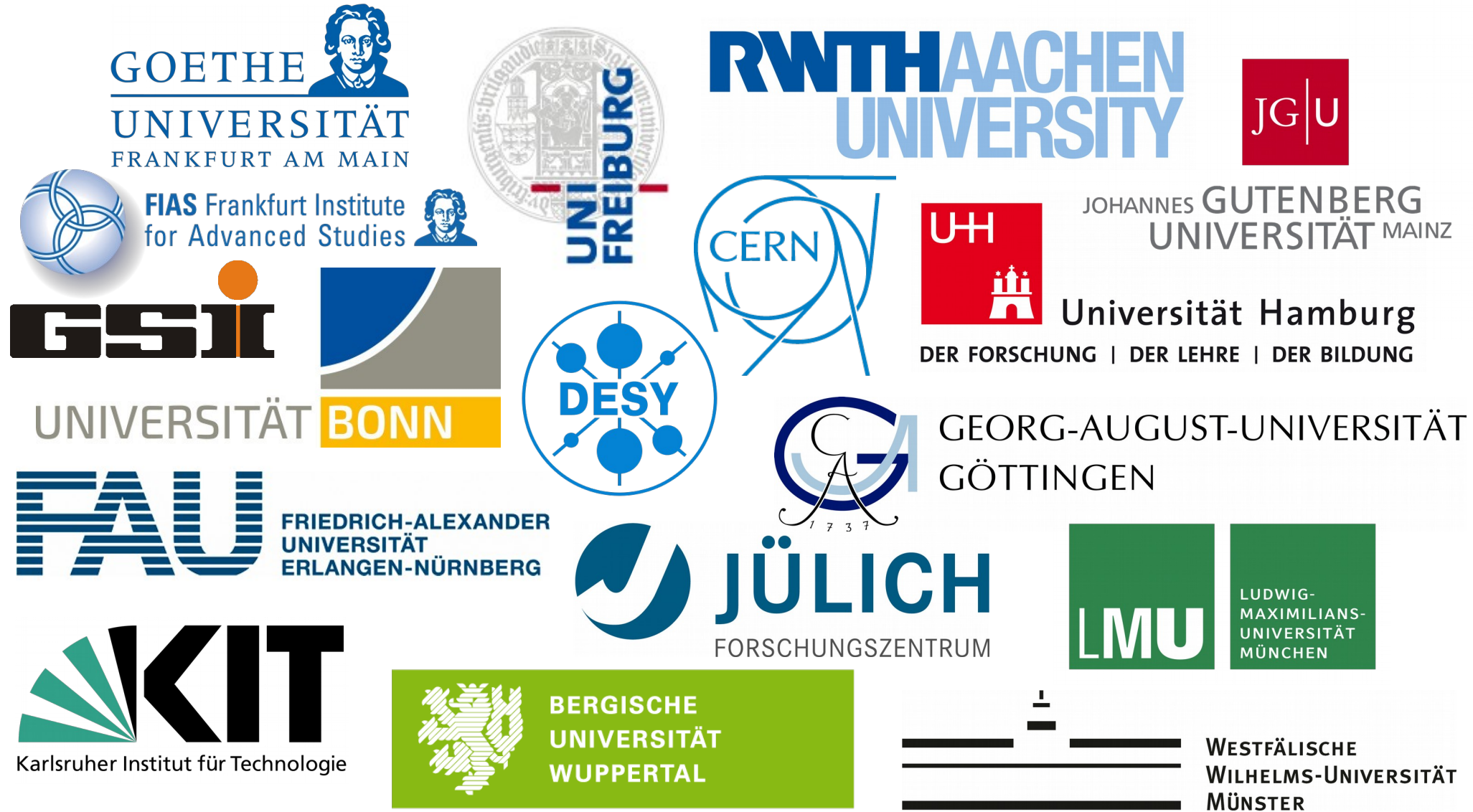


Natural science fundamental research is a central area of application of new digital methods and techniques. It is a significant driver for further developments. Increasing computational effort and complex data management is addressed by site overarching work techniques and the elimination of technological bottlenecks. Open access and long term data management must continue to take into account the requirements and specifics of the different research infrastructures. Young scientists acquire a unique expertise in data management. New services and holistic solutions can arise in future based on the know-how in fundamental research.

- **Innovative Digital Technologies for Research on Universe and Matter**
- Application of partners from
 - ✓ Particle Physics (ATLAS, Belle II, CMS)
 - ✓ Hadron and Nuclear Physics (ALICE, CBM, PANDA)
 - ✓ Astroparticle Physics (Auger, CTA, IceCube)
- ➔ to develop experiment overarching solutions

- Evaluated by panel including computer scientists
- ➔ Got 3.6 M€ for 3 years, starting October 2018

Project Partners



Subject Area A

- Developments for the provision of technologies for the use of heterogeneous computing resources

A1: Tools for integration <ul style="list-style-type: none">• Scheduling of cloud jobs• Container technologies• Database access	A2: Efficient Use <ul style="list-style-type: none">• Transient data caches• Transparent access to distributed data
A3: Workflow Control <ul style="list-style-type: none">• Optimization with data mining	

Subject Area B

- Application and test of virtualized software components in the environment of heterogeneous computing resources

<p>B1: Tests of Components Implementation and test on different platforms</p> <ul style="list-style-type: none">• Storage and caching solutions• Virtualized services (databases, monitoring, accounting)	<p>B2: Job and Resource Management Job distribution and monitoring in a heterogeneous computing resource environment using container technologies</p>
<p>B3: Virtualization of User Jobs</p> <ul style="list-style-type: none">• Requirement capture• Determination and creation of run time environment• Creation of container and meta data	<p>B4: Combined Tests Test of complete system on different platforms regarding</p> <ul style="list-style-type: none">• Installation and maintenance• Performance• Scalability• Robustness

Subject Area C

- Deep Learning, Gain of knowledge by substantiated data-driven methods

C1: Processing of Sensor Data

- Signal filter, noise suppression
- Processing of time dependent data

C2: Object Reconstruction

- Track and cluster reconstruction, jet forming, event reconstruction
- Questions of placement, order, assignment of data
- Extraction of small signals in case of large backgrounds

C3: Network Accelerated Simulations

- Generative adversarial networks, adjustment of simulation to data
- Methods for the evaluation of the quality of network simulations

C4: Quality of Network Predictions

- Reduction of experimental systematic uncertainties
- Special learning strategies
- Prediction relevant information
- Uncertainty of predictions

Subject Area D

- Event reconstruction: Cost- and energy-efficient use of computing resources

D1: Track Finding <ul style="list-style-type: none">• Alternative algorithms, e.g. cellular automata• Alternative architectures, e.g. GPUs	D2: Parameter Determination <ul style="list-style-type: none">• Connection of GenFit2-ACTS

ErUM Data

- IDT-UM is a pilot project for ErUM Data
- ErUM Data action plan of BMBF planned for this year
- Input from ErUM communities being prepared
 - ✓ Federated infrastructure
 - ✓ Big data analytics
 - ✓ Data management
- Communities: HEP, nuclear physics, astro particle physics, astronomy, accelerator physics, physics with synchrotron radiation / neutrons / ions
- ➔ Even broader: initiative of federal government and states to build a national research data infrastructure (NFDI)

Summary

- Climate favorable for funding of digital technology developments
- Development of common solutions encouraged by funding agencies
- ➔ Pilot project with partners from particle, hadron and nuclear, and astro particle physics
- Kickoff / collaboration meetings:
<https://indico.physik.uni-muenchen.de/category/5/>
- ➔ Facilities better integration in international community
- ➔ More to come...

