High Performance Computing for Science & Engineering

'Bridges between Experiment and Theory'

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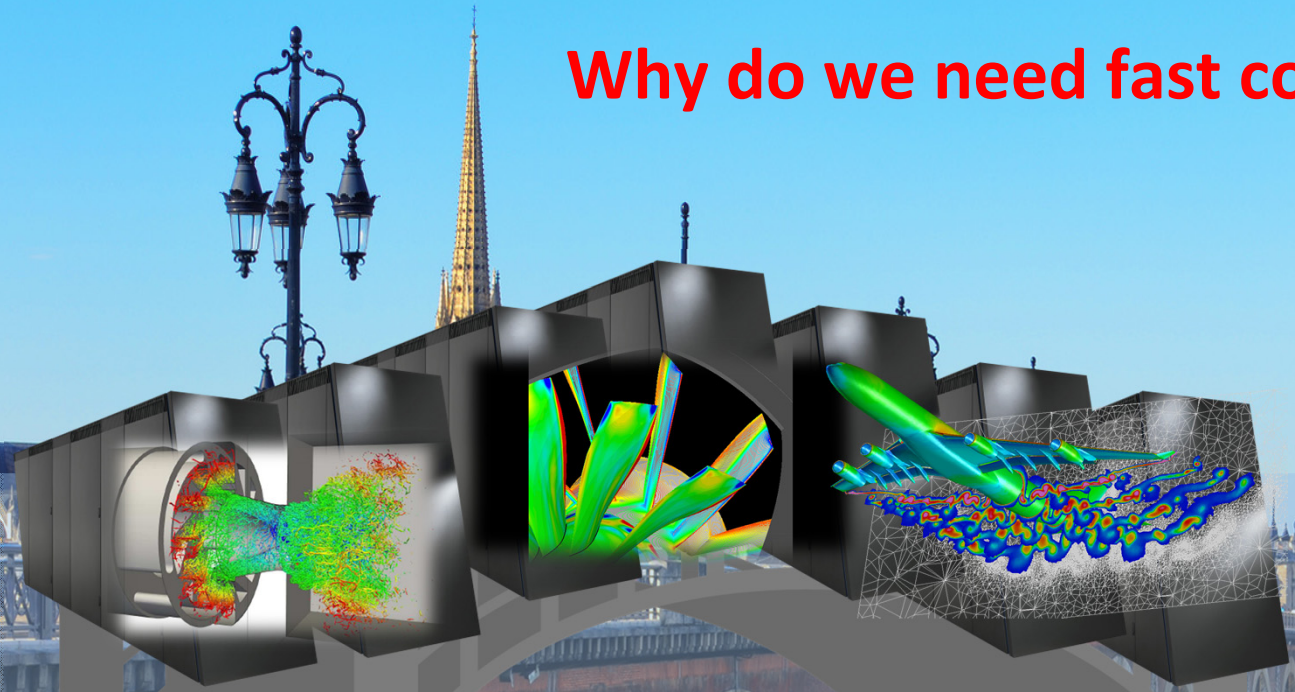
High Performance Computing

Why do we need fast computing?



Numerical calculations… Model

…simulation over time

Experiment
'we observe the nature'

Theory
'we create a model of nature'

Fast = n Floating Point Operations (FLOP) per one second

1 FLOP/s
Example:
*93386.25 *10^8*
= ???

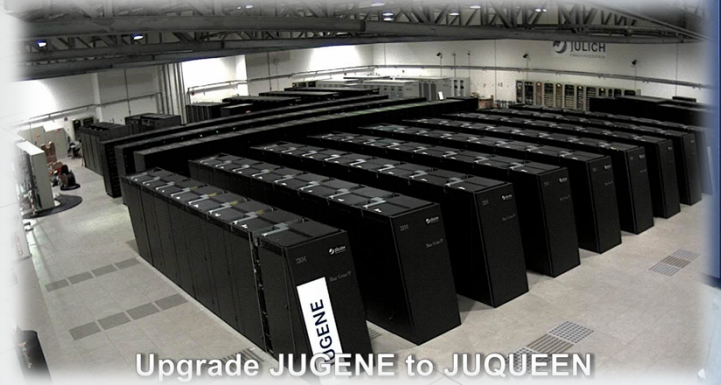
>5.000.000.000.000.000 FLOP/s
~ 500.000 cores
~ 2015

supercomputer Blue Gene

JÜLICH
JUQUEEN

1.000.000.000.000.000 FLOP/s

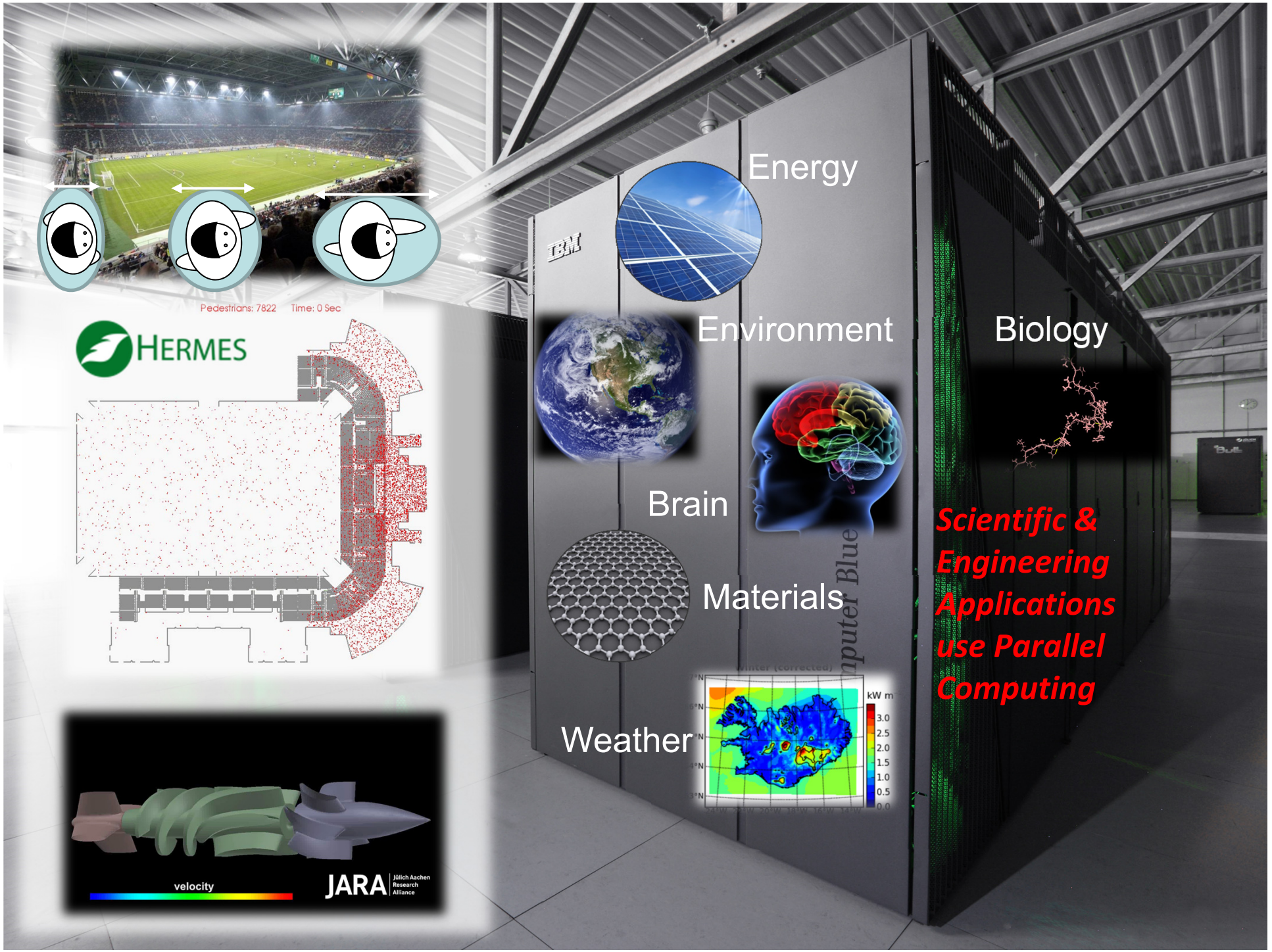
~295.000 cores~2008 (JUGENE)



Upgrade JUGENE to JUQUEEN

1.000.000 FLOP/s

~1984


Pedestrians: 7822 Time: 0 Sec
HERMES
velocity
JARA
Jülich Aachen Research Alliance
Energy
Environment
Biology
Brain
Materials
Weather
kW m
3.0
2.5
2.0
1.5
1.0
0.5
Scientific & Engineering Applications use Parallel Computing

Reseach on ‘Big Data Waves‘ in Science & Engineering

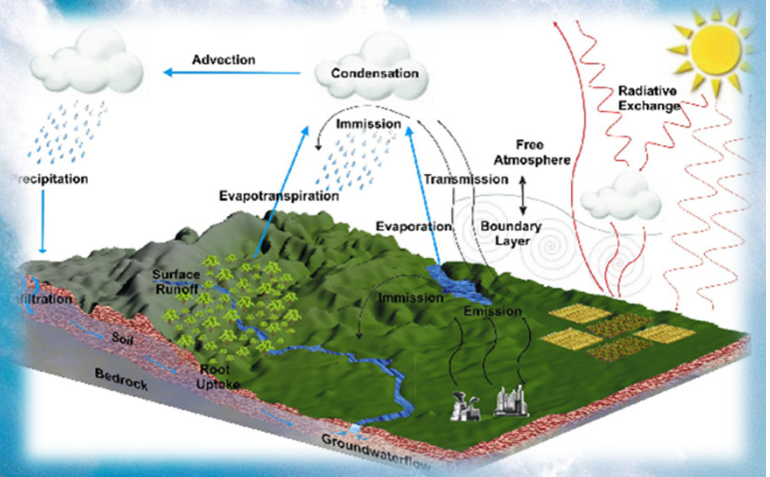
How can we manage the rising tide of ever-increasing data?

Unsolved questions:

Scale
Heterogeneity
Stewardship
Curation
Long-Term Access and Storage

Challenges:

Collection, Trust, Usability
Interoperability, Diversity
Security
Education and training
Data publication and access
Commercial exploitation
New social paradigms
Preservation and sustainability

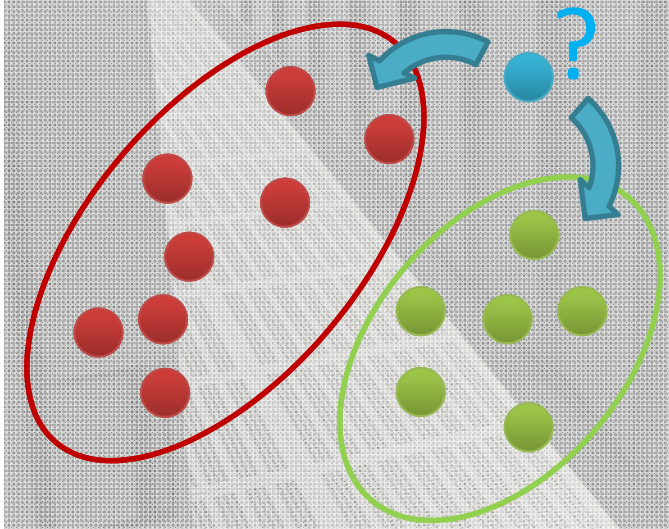


How do we efficiently analyse these large quantities of data?

Making use of Big Data

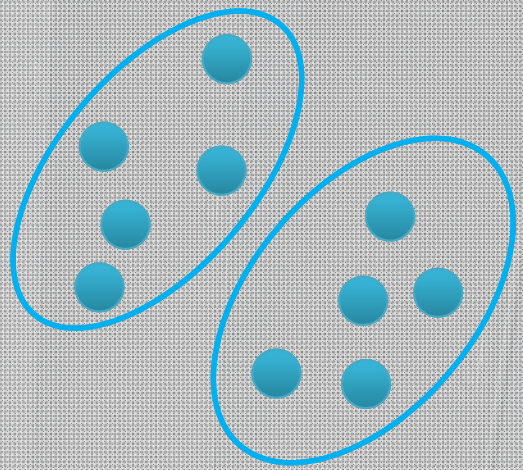
Applying 'smart data analytics' techniques

Classification



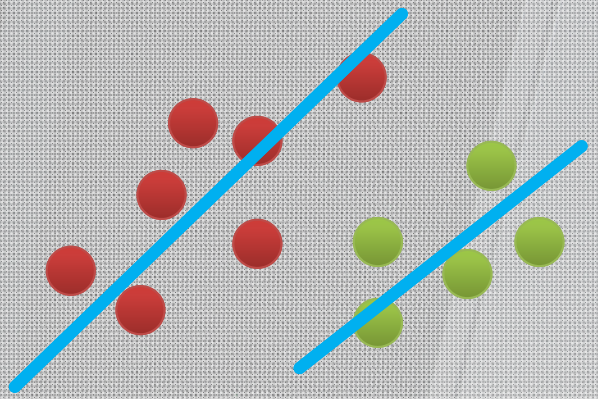
- ✓ ***Groups of data exist***
- ✓ ***New data classified to existing groups***

Clustering



- ✓ ***No groups of data exist***
- ✓ ***Create groups from data close to each other***

Regression



- ✓ ***Identify a line with a certain slope describing the data***

➢ ***Serial algorithms for large volumes of data exist since decades, 'big data' needs their parallelization***

Can I do this in Iceland? – Yes!

Where do I get fast computing?

Nordic HPC

Joint Nordic Supercomputer in Iceland

UNIVERSITY OF ICELAND

advania thor data center

SNIC

nhpc

DCSC
Danish Center for Scientific Computing

UNINETT sigma

Contact:

nhpc@hi.is

HPC System Garðar

Where do I get the skills? Get involved! Contact Us!

Selected Teaching Activities @ HI → morris@hi.is

Statistical Data Mining Course & Seminars

Big Data Analytics Techniques, Data Analysis, Parallel & Scalable Machine Learning

High Performance Computing A/B Course & Seminars

Parallel Programming, Simulation Sciences, MPI/OpenMP, Map-Reduce/Hadoop/Spark