



HBP - HUMAN BRAIN PROJECT

SP7: High Performance Computing Platform

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HIGH PERFORMANCE COMPUTING PLATFORM

“Provide the HBP Consortium and the broader European neuroscience community with:

- supercomputing, Big Data & Cloud capabilities at exascale
- system software, middleware, interactive computational steering & visualisation support

necessary to create and simulate multi-scale brain models and ... whole brain modelling.”

[<https://www.humanbrainproject.eu/nl/high-performance-computing-platform>]

HPC IN THE NETHERLANDS

Research groups: VU, Leiden, Groningen, Eindhoven, Delft

Data research centers: Amsterdam, TU/e, ...

NWO/SURF Netherlands eScience Center

Enable researchers to make scientific
breakthroughs with ICT

COMMIT/:

Large (100 M€) public-private Dutch ICT program

Projects on eScience

DOME: ASTRON & IBM Center for Exascale technology

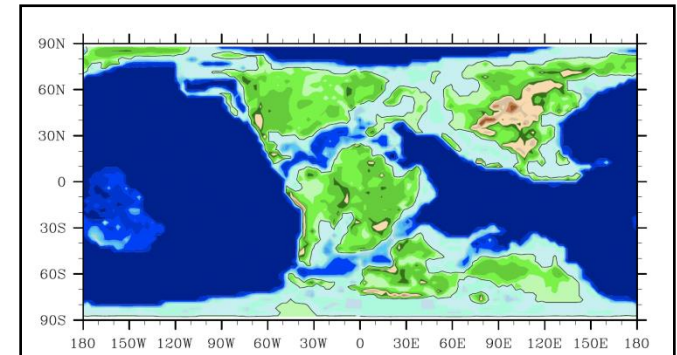
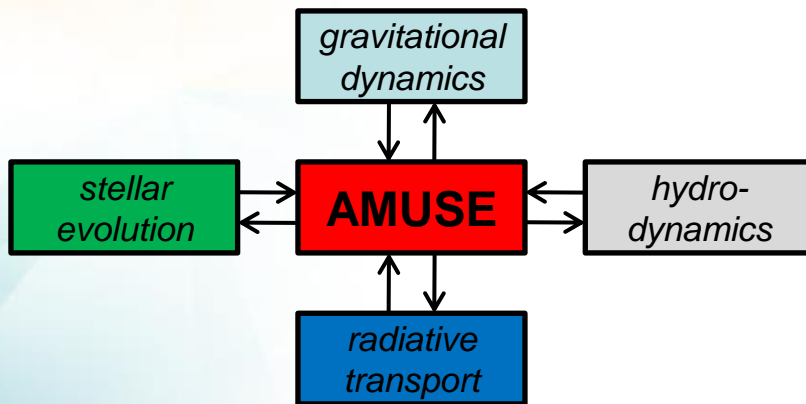
SURFsara: supercomputing, storage, visualization

SURFnet: networking, services

SUPERCOMPUTING AT EXASCALE

Many applications need exascale (10^{18}) performance
(<http://www.exascale.org/iesp>)

Multi-scale multi-model simulations



Computational Astrophysics (Leiden)

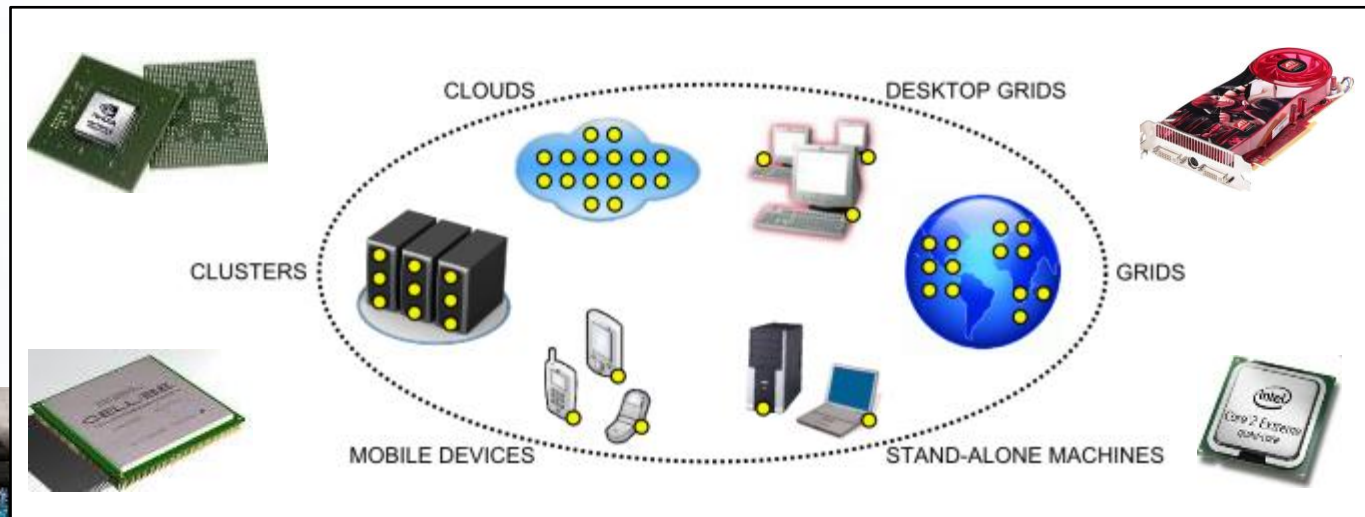
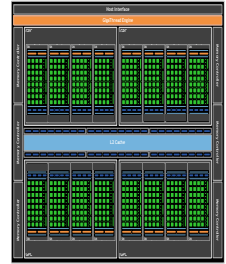
- ✓ Gravitational dynamics: GPU accelerators
- ✓ Stellar evolution: Cluster / Cloud
- ✓ Hydro-dynamics, Radiative transport: Supercomputer

Climate simulations

(Atmosphere, ocean, ice, ...)

DISTRIBUTED HETEROGENEOUS SYSTEMS

- Diversity of processors, systems, networks
 - Accelerators: Graphics Processing Units (GPUs)
 - Huge performance gains, very hard to program/optimize
 - Use many distributed resources (“Jungle computing”)
 - Example: High-Resolution Climate Simulations (EYR-G award)



BIG DATA

Multiple types of data explosions:

- Big data: huge processing/transportation demands
- Complex heterogeneous data



10-100 x global internet traffic per year
exascale processing



www.dome-exascale.nl



Complex data

SEMANTIC WEB

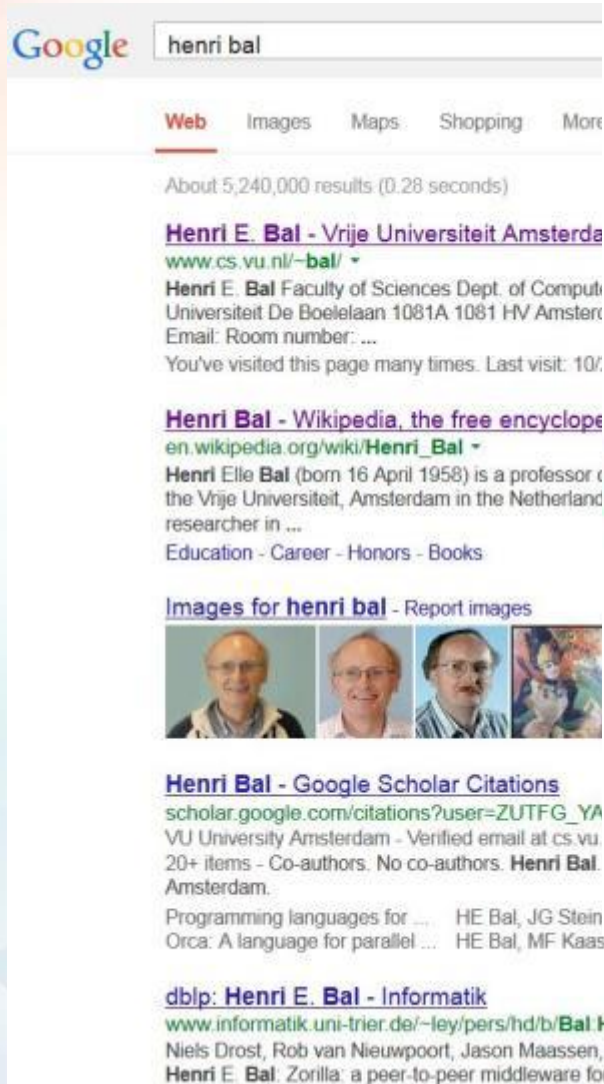
Make the Web smarter by injecting meaning so that machines can “understand” it.

- initial idea by Tim Berners-Lee in 2001

Now attracted the interest of big IT companies



GOOGLE EXAMPLE



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Niels Drost, Rob van Nieuwpoort, Jason Maassen, Frank J. Seinstra,
Henri E. Bal. Zorilla: a peer-to-peer middleware for real-world distributed

Henri Bal



Computer Geek

Henri Elle Bal is a
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DISTRIBUTED REASONING

Derive new information by automatic reasoning over distributed semantic web data

Challenge: real-time incremental reasoning on web scale, combining new (streaming) data & existing historic data

Cf. INCF Program on Ontologies of Neural Structures
(<http://www.incf.org/programs/pons>)

COMMIT/

STRENGTHS & OPPORTUNITIES (SUMMARY)

Supercomputing at exascale:

- Multi-scale multi-model simulations & distributed heterogeneous computing (NLeSC)

Big-data:

- Exascale data: (DOME)
- Heterogeneous data: semantic web (COMMIT/)

Interactive visualization:

- TU/e, Groningen, NLeSC



NLeSC Collaboratorium