Examples of Global research projects

Agenda

- Introduction
- International ICT infrastructure and services are enabling Research
  - Examples
Examples of Global research projects

• Introduction

Hans Gankema consultant & project manager
SURF (the Dutch National Research and Education Network)
Support 4 Research
National Coordination Platform Research Data Management
University of Groningen (in the north of the Netherlands)
Research & Innovation Support (RIS) department of the Centre for Information Technology (CIT)
Examples of Global research projects

About SURF

- **SURF SARA**: High-performance computing, data and visualisation for science
- **SURF NET**: Connects users and ICT services and creates new functional possibilities
- **SURF SCIENT CENTER**: Reinforces and accelerates multi-disciplinary and data-intensive research
- **SURF MARKET**: Favourable conditions for ICT services, software, content
Examples of Global research projects

E-infrastructure providers/partners in the Netherlands

LARGE-SCALE SCIENTIFIC INFRASTRUCTURE:
www.onderzoeksfaciliteiten.nl

- Compute
- Storage
- Network
- Visualization
- Authentication & Authorization
- Research ICT support
Examples of Global research projects

Example collaborations

- How to process 1 million news articles per day
- How to calculate the chance of increasing sea levels?
- Researchers the universe with thousands antennas
- Billions of tweets of research data
- Computational catalysis for sustainable energy

- 100 PFlop/s
- 100 gigabit/s
- 100 petabytes
- Dedicated GPUs
- Collaboration & access management
Examples of Global research projects

E-Infrastructure landscape beyond NL
Examples of Global research projects

Our portfolio

- High-end **computing** solutions, in different flavors
- Research **data storage**, repository services, short and long term preservation
- Fast **networks** for data transfers and compute scale out
- Federated **access management** solutions
- Facilities to **share data** and to **collaborate online**
- Powerful remote **visualisation** service
Examples of Global research projects

Services of RIS, CIT, University of Groningen

- Courses
- Data management
- Geo services
- High Performance Computing
- Visualization
- Knowledge dissemination
Examples of Global research projects

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Examples of Global research projects

• Astronomy
  • LOFAR (the largest radio telescope)
  • SKA (next generation radio telescope)
  • EUCLID (new European Space Agency Optical Satellite)
Examples of Global research projects

LOFAR

- One of the largest radio telescopes in the world
- ~100,000 omni-directional antennas
- 10–250 MHz
- 100x more sensitive
- Hundreds of teraFLOPS
- LOFAR raw data rate: 10 Tbit/s, 200 Gbit/s to supercomputer
- Peak data rate at the AMS-IX is 5.5 Tbit/s
Examples of Global research projects

• Astronomy
• LOFAR (the largest radio telescope)
• SKA (next generation radio telescope)
Examples of Global research projects

Two LOFAR pipelines
Examples of Global research projects

Two LOFAR pipelines

1. Sustainability
2. Platform selection
3. Real-time processing
4. Scale up to SKA size
Examples of Global research projects

First Euclid flight hardware delivered
07 February 2017 An important milestone has been passed in the development of Euclid, a pioneering ESA mission to observe billions of faint galaxies and investigate the nature of dark matter and dark energy. The first flight hardware, in the form of four detectors known as Charge Coupled Devices (CCDs), has been delivered to Mullard Space Science Laboratory (MSSL) by UK company e2v.

Euclid dark Universe mission ready to take shape
17 December 2015 Euclid, ESA’s dark Universe mission, has passed its preliminary design review, providing confidence that the spacecraft and its payload can be built. It’s time to start ‘cutting metal’.
Examples of Global research projects

One-slide summary

- **Euclid**
  - ESA Flagship cosmology mission 2020-2025
  - 3D map of galaxy distribution ($10^9$ !)
    - history of growth of structure and of expansion of the Universe
    - study properties of dark matter and dark energy, galaxy formation
  - *Beyond the standard model: fundamental physics!*

- **SDC-NL**
  - Facility for Euclid data access for NL astronomers and physicists
  - Platform for NL-led development work
  - NL contribution to Euclid Consortium
Examples of Global research projects

The Euclid mission

• 3D map of:
  ➢ $10^9$ galaxies
  ➢ 8 bln. lightyears (redshift ~2)
  ➢ last 60% of the history of the Universe
  ➢ gravitational lensing $\Rightarrow$ dark matter distribution

• Observe from above the atmosphere:
  ➢ Light of galaxies shifted to (infra)red
  ➢ Shapes of galaxies blurred by atmosphere

• *Substantial* amount of associated ground-based data - EXT
  ➢ Colours of galaxies $\Rightarrow$ redshifts $\Rightarrow$ distances
Examples of Global research projects

Huge e-science system

- 9 SDCs
- 100+ institutes
- 1400 researchers

Spin-off and cooperation on IT research with:
- Target/ERCET: CIT, Target Holding bv, IBM, AI, Material Science, Astron/Lofar
- Faculty FWN-RuG: Data Science & Systems Complexity
- NL e-science center: “db on demand” → other disciplines

Knowledge dissemination programme / Target-ERCET

- Professionals
- SMEs
- Public
Examples of Global research projects

• High Energy Physics
  - the Large Hadron Collider | CERN
  - Antiproton Physics with PANDA at FAIR | Darmstadt
Examples of Global research projects

- **High Energy Physics**
  - the Large Hadron Collider | CERN
  - Antiproton Physics with PANDA at FAIR | Darmstadt
Examples of Global research projects

- Nationale roadmap 2014: ~15,2 M€
  - Upgrade LHC detectoren
  - Computing infrastructuur

<table>
<thead>
<tr>
<th>Project</th>
<th>Budget (M€)</th>
</tr>
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<tbody>
<tr>
<td>ATLAS</td>
<td>5.2</td>
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<tr>
<td>LHCb</td>
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<tr>
<td>ALICE</td>
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<tr>
<td>NL/Tier1</td>
<td>3.7</td>
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Examples of Global research projects

- Antiproton Physics with PANDA at FAIR | Darmstad
Examples of Global research projects

Agenda

- International ICT infrastructure and services are enabling Research
- Regional Examples
Examples of Global research projects

- **Recent development of solutions**
  - Virtual Research Environment
    - virtual cloud desktop environments
      - open source and closed source (commercial)
      - standardized web based workflows
  - Research Data Management
    - FAIR
    - Open science
  - Challenges: Identity/Authorisation/Security/Privacy/Legal/Policy/Collaboration/Open/Closed/Shared resources/Education/Support/Multi Centre studies
Examples of Global research projects
Examples of Global research projects

Solutions for scalable workflow

1. Auto provisioning, dynamically scalable Jupyter as a Service

2. Web GUI and object store (CWL) workflow with dockers.
Examples of Global research projects

- **Recent development of solutions**
  - Research Data Management
    - FAIR (Findable, Accessible, Interoperable, Reusable)
  - Open science
  - Challenges: Identity/ Authorisation/ Security/ Privacy/ Legal/ Policy/ Collaboration / Open/ Closed / Shared resources/ Education/ Support/ Multi Centre studies
Examples of Global research projects

- The Future

A normal day at the office...
Examples of Global research projects

Thank You!

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