Some personal thoughts on Training/Education of e-Infrastructure Users

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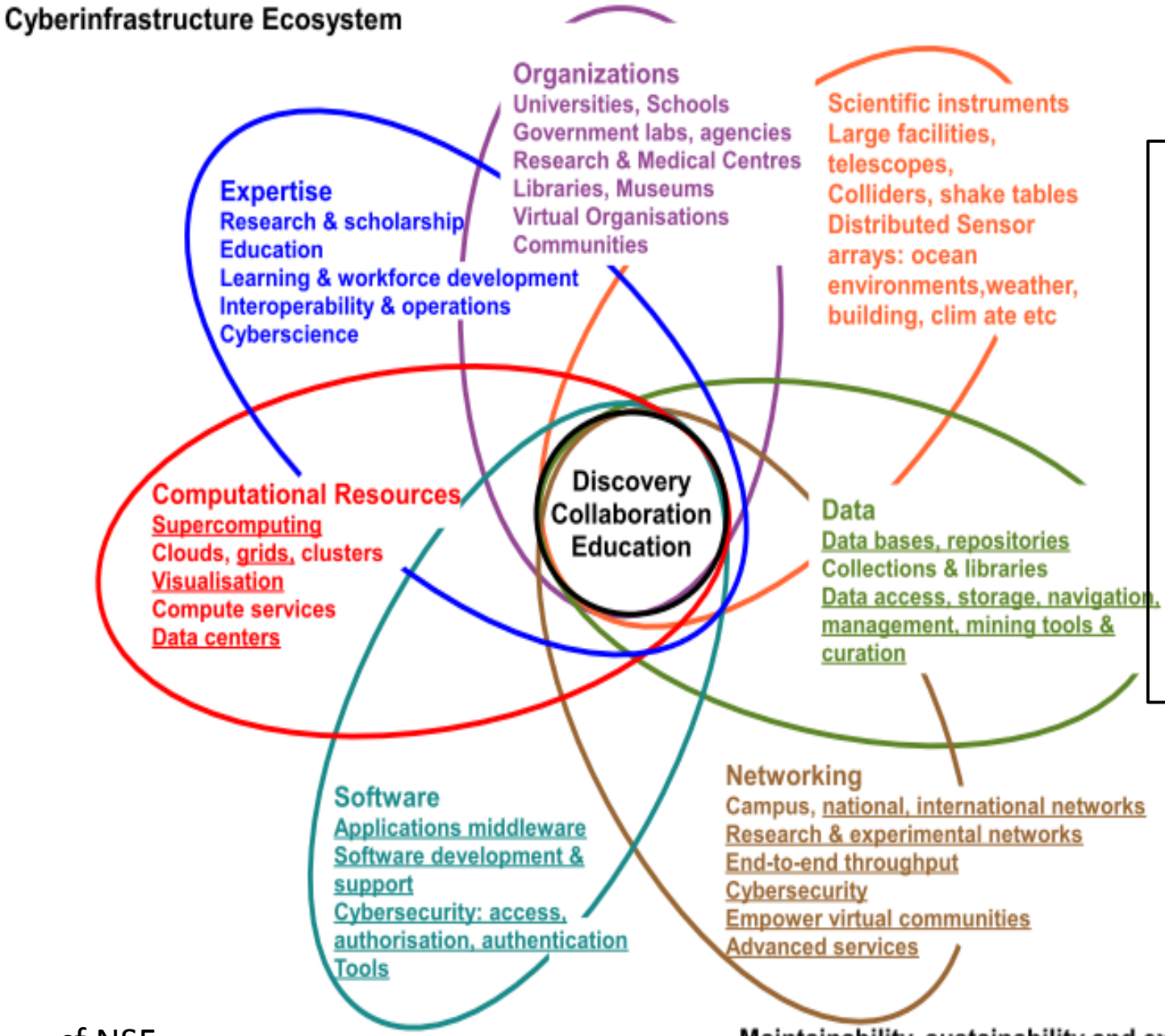
Role of e-Infrastructures

A1

E-Infrastructures support many areas of research

E-Infrastructures integrate resources and services …..

- **Networking**
- **Computing**
- **Data**
- **Software**
- **User Interfaces**



A2

Cyber-Infrastructure

- Network Infrastructure
- Middleware & organisation
- Resources (supercomputers, data repositories, sensors, …)
- Research Data Infrastructures

cf NSF

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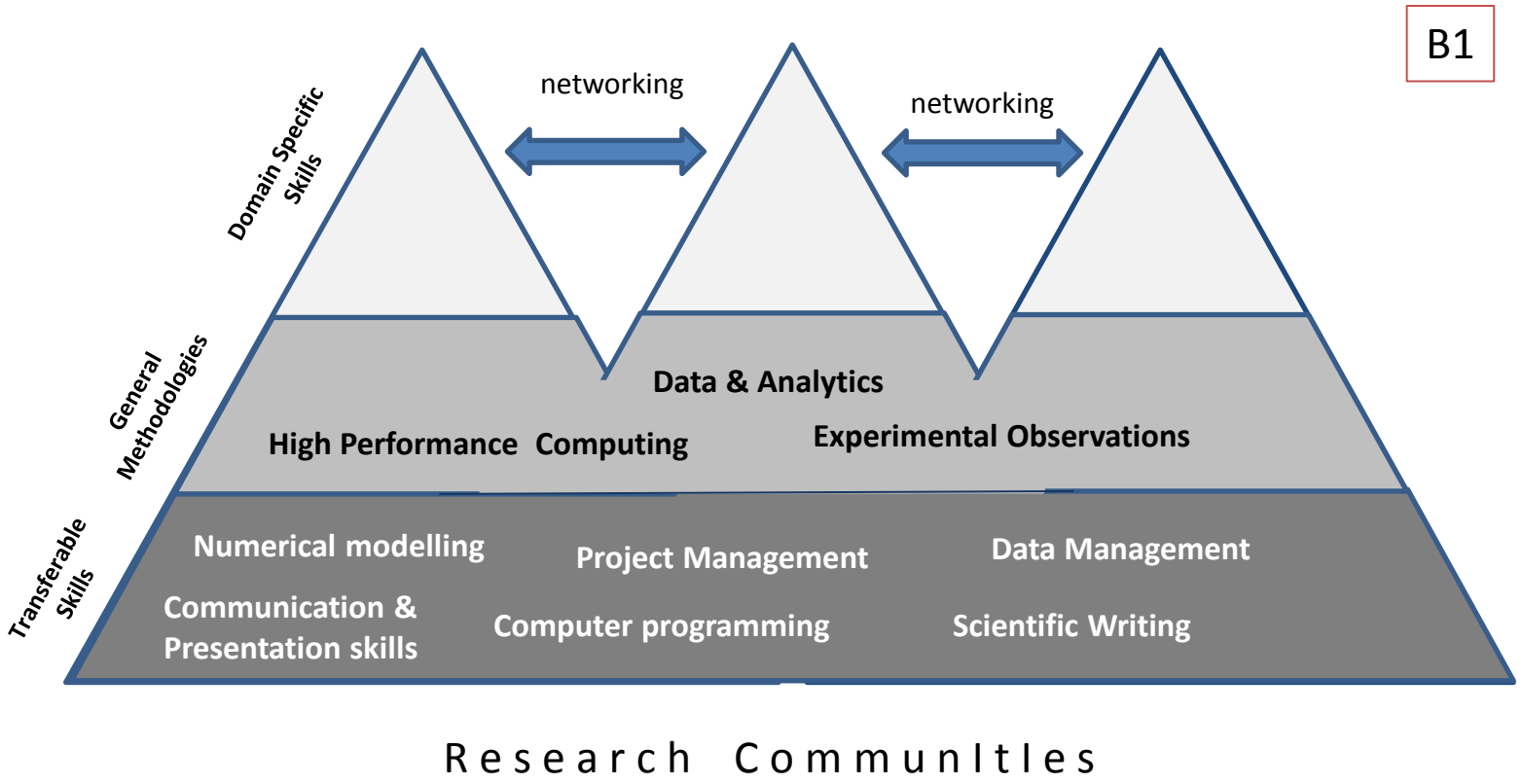
Skills Sets and Capabilities needed by Researchers in Academia and Industry



Pekka Manninen: “Skills and Human Resources for e-Infrastructures within Horizon 2020”

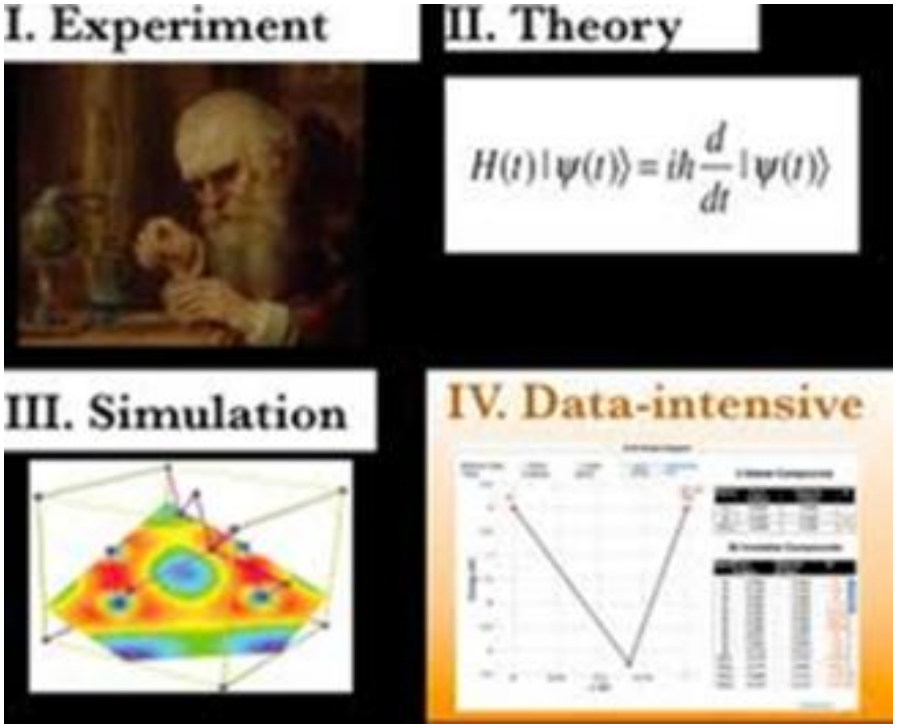
e-Infrastructures skills and human resources: specific aspects

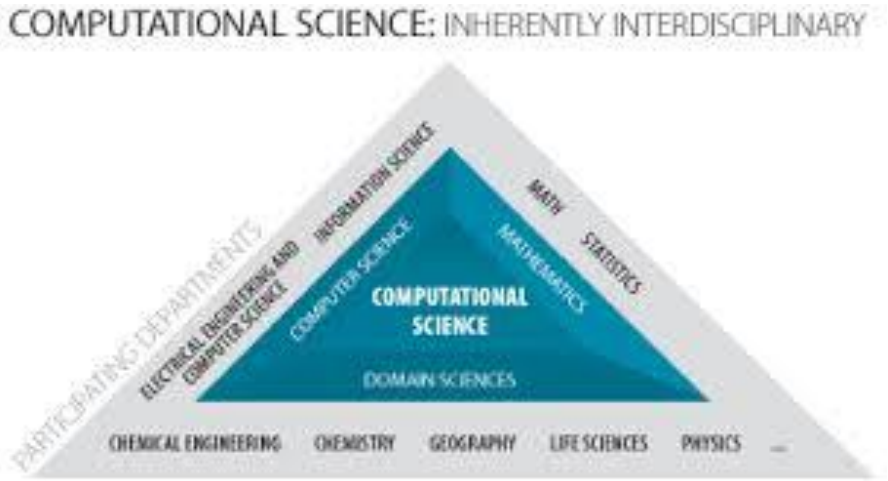
B2

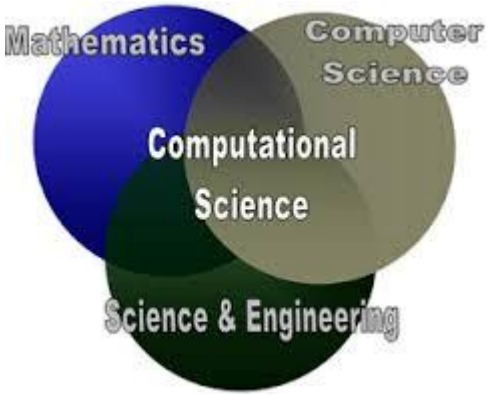
1. e-Infrastructures development
   - Context dependent needs for specific skills
   - Skills and practice to communicate with scientific users
2. e-Infrastructures service provision
   - Skills for understanding service context
   - Low appreciation of the job profile
   - Hardware and Telecoms Skills
3. ***Scientific usage of e-Infrastructures***
   - ***Computation***
   - ***Simulation***
   - ***Data Analytics skills***
   - ***Visualisation***
   - ***Software skills: software engineering***
4. ***Changes in research institutions***
   - ***Need for institutional leadership***
   - ***Need to support professional development***
5. ***New careers***
   - ***Professional recognition***

Own experience …

C1







- App Maths → Comp & App Math
- Computational Sciences
- Faculty & Institutional lethargy
- Curriculum renewal …

Cooks tour of e-Infrastructure Skills training: not a green field

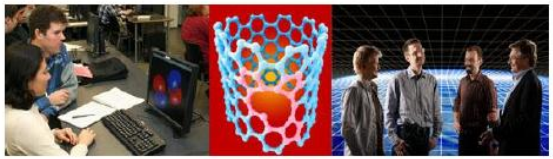
D1

2. XSEDE, USA

Exsede
innovation, realization, success

- Succeeding TeraGrid
- An integrating e-Infrastructure for digital resources in US
- $121m, 5 years

- *Education & Outreach Blog*
- *Curriculum and Educator Programs*
- *Campus Bridging*
- *Campus Champions*
- *Training*
- *XSEDE Scholars Program*
- *Student Engagement*
- *Speakers Bureau*
- *Educational Resources*
- *Campus Champions Fellows Program*



CSC

Services for researchers

CSC provides modeling, computing, and information services for universities, polytechnics, research institutions and industrial companies. The expert services in the field of science are meant for the academic research community as a whole.

Researchers can use the largest collection of scientific sofware and databases in Finland through Funet network.

Courses and events

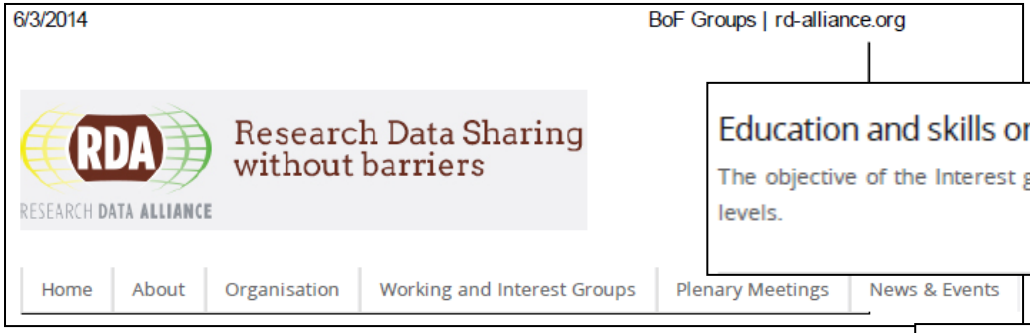
12.06.2014	Seminar at HY/Meilahti: How to utilize new CSC computing resources in your research
16.06.2014 - 17.06.2014	Elmer FEM Course
18.06.2014	Elmer Coding Day
30.06.2014 - 09.07.2014	CSC Summer School in High-Performance Computing 2014

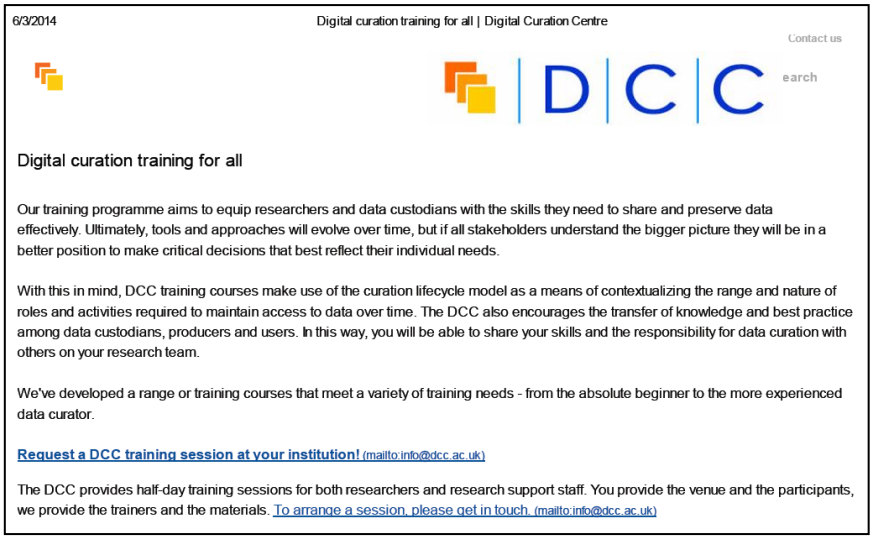
Course and event calendar

Projects
- EUDAT
- ELIXIR
- …..

Skills Training … 2

D2





Skills Training … 3

TERENA Training

Overview

As part of the GÉANT project, TERENA is involved in kshops aimed at promoting the use of and providing the updates to some of the tools and services which have been developed under previous projects, and new tools developed within the current project.

The training courses are listed below and their respective webpages are linked.

TRANSITS CSIRT Training

More details >> [http://www.terena.org/activities/transits/]

PerfSONAR

More details >> [perfsonar/]

Security toolset

D3

e-IRG's 2020 vision for Europe needs a single "e-Infrastructure Commons" ….

A necessary consequence of the vision … is that the e-Infrastructure's user base needs to be expanded to meet the challenges set in Horizon 2020. An analysis of options to expand the user base of e-Infrastructure services is needed, ….

Horizon 2020: Work Programme 2014—2015: a few that mention training are:

- Mathematics and ICT—Starting Communities
- Distributed, multidisciplinary infrastructure on Big Data and social data mining
- Pan-European High Performance Computing Infrastructure and Services
- Provision of core services across e-infrastructures
- Research and Education Networking—GEANT
- New professions and skills for e-infrastructures
- Centres of excellence for computing applications
- Network of HPC Competence Centres for SMEs

National Science Foundation
WHERE DISCOVERIES BEGIN

NSF-wide

CYBERINFRASTRUCTURE TRAINING, EDUCATION, ADVANCEMENT, AND MENTORING FOR OUR 21ST CENTURY WORKFORCE (CI-TEAM) (CI-TEAM)

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D4

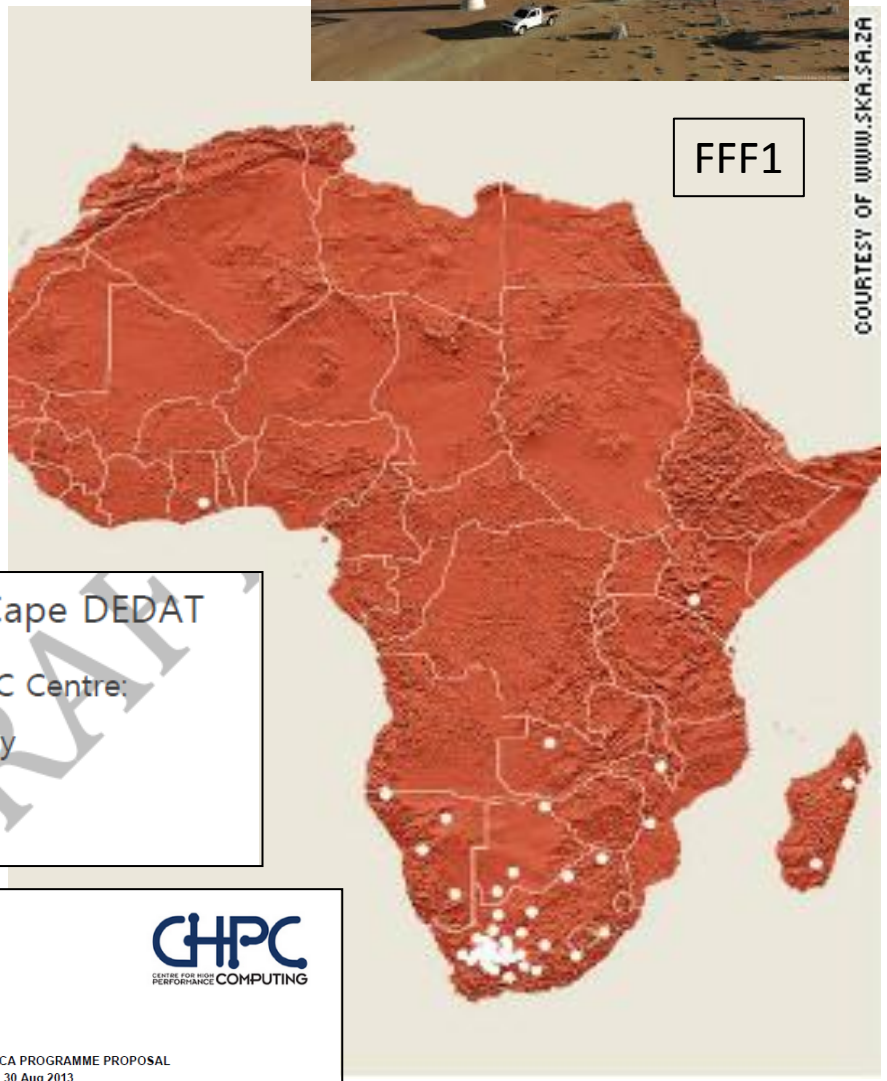
SA Drivers

E1

SKA—the BIG one

Each dish: ~160Gb/s. Design choices re data transport & processing still to be made. Requirements: Computation in multi petaflops range (but data); Networking terabit/s range at minimum. Storage Exabytes. Infrastructure and skills challenges immense.

FFF1



Western Cape DEDAT

Big Data HPC Centre:

Pre Feasibility

DRAFT

DRAFT

SKA AFRICA SQUARE KILOMETRE ARRAY

CHPC CENTRE FOR HIGH PERFORMANCE COMPUTING

BIG DATA AFRICA PROGRAMME PROPOSAL
30 Aug 2013

Executive Summary

E2

More SA Drivers …

- **Bioinformatics** a heavy users of SA e-infrastructure. Complex and highly heterogeneous requirements for software by this community.
- **High Energy Physics (CERN):** formally collaborate on both ATLAS and ALICE experiments. Need data transport, storage, processors and people. Grid Computing.

- **Earth Observation**: large data sets, fast networks and HPC (GEOSS, SAEON).
- **Open Access Scholarly Publishing:** National and international initiatives (SA DIRISA).
- **Palaeo…** (Mrs Ples)

- **Humanities and Social Sciences:** Currently few examples where e-I has been used to support research in HSS. Projects: digital libraries, digitising key heritage datasets (e.g., Bleek archives, Rock Art resources) and HLT.
- **Climate Change** (ACCESS), **Southern Oceans**
- **Simulation**
- **Visualisation**
- **Applied Sciences**
- **Computational Chemistry / Physics / Biology/ Material Science / …**

SA National Cyberinfrastructure System

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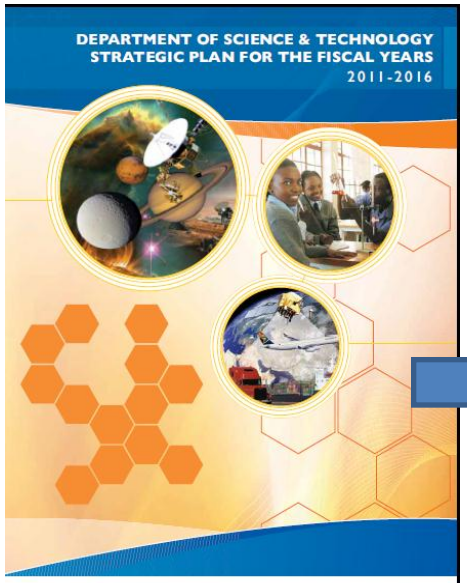
Science Imperatives led DST into the arena

…. NICI System



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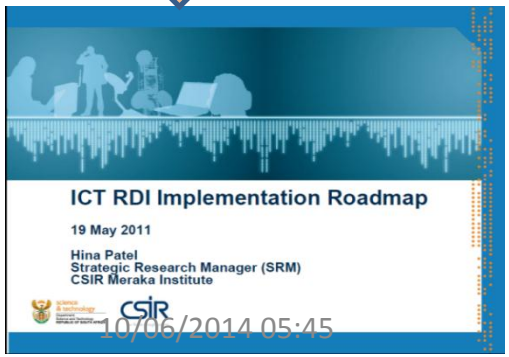
CHPC
CENTRE FOR HIGH PERFORMANCE COMPUTING

SANReN
South African National Research Network

SOUTH AFRICAN NATIONAL GRID



VLDB / DIRISA

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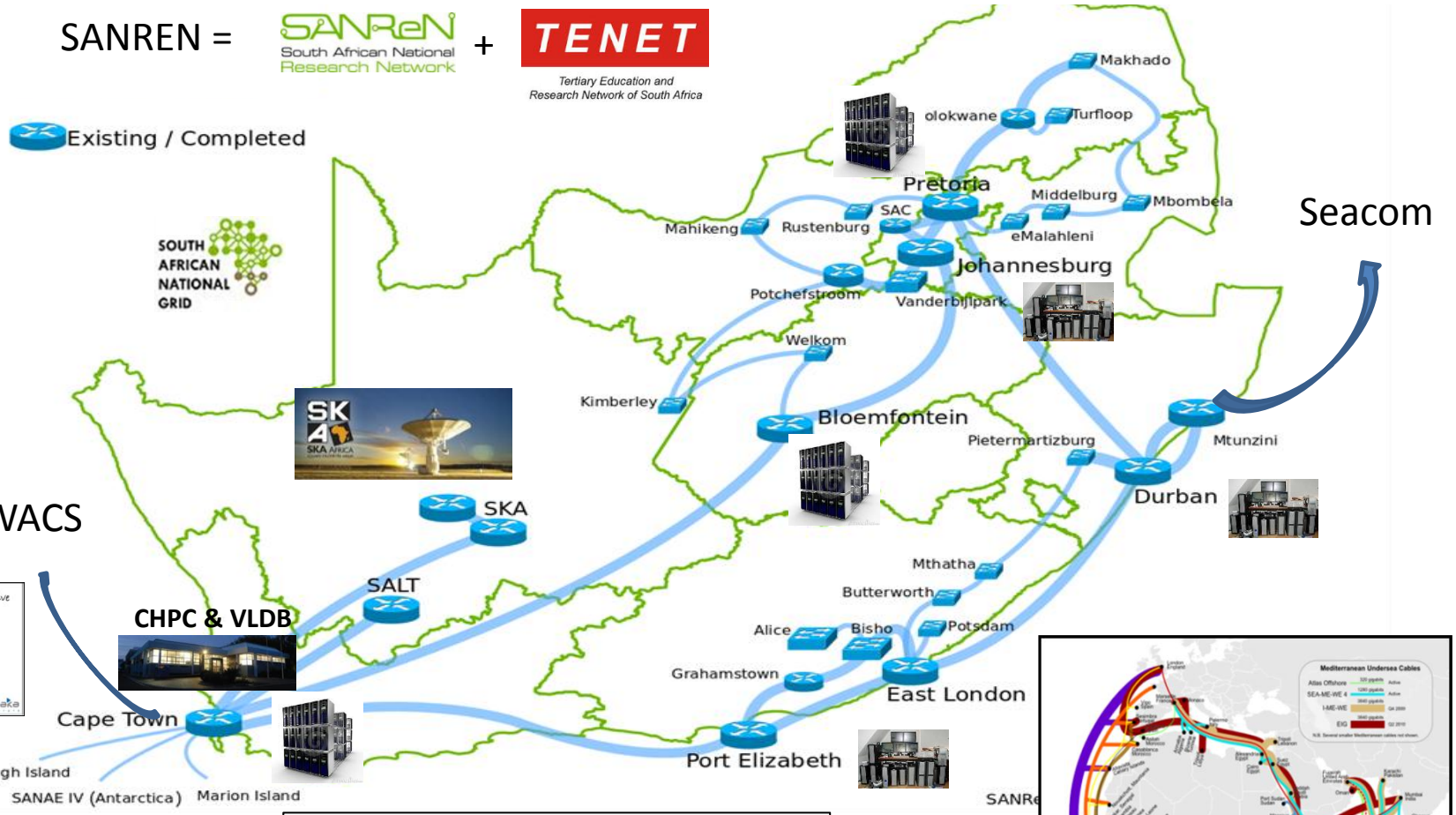
SANREN Backbone

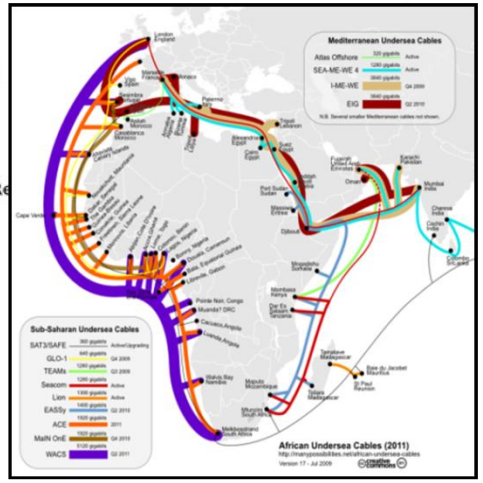
F2

SANREN = SANReN South African National Research Network + TENET Tertiary Education and Research Network of South Africa



- ~165 sites
- FETs …
- DBE

- 1Gbps /10Gbps
- SEACOM 10Gbps
- WACS 40Gbps -> 440 Gbps
- Optical fibre



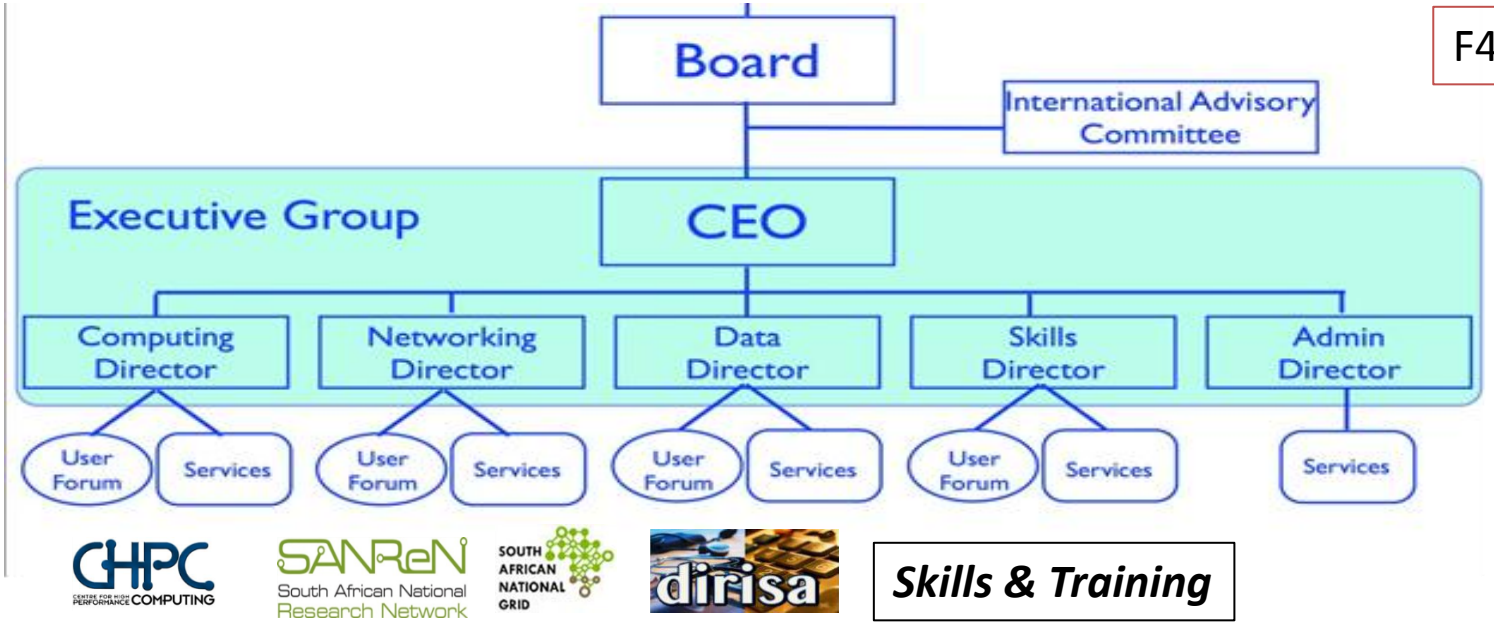
2012/13 Review of SA CyberInfrastructure → NICIS F3

Internal Structure, Governance and Management

- *Amalgamate separate organisations into a single integrated CI (e-I) organisation (NICIS) encompassing networking, compute, data.*
- ***Create a new Skills and Training entity within this new integrated organisation, with collaboration between the national organisation and the universities, particularly in the area of human skills and training.***
- *High-level of accountability of the sectors to the stakeholders (DST, universities, etc.).*

Not a “bricks and mortar” institute but rather an enabling, facilitating organisation.

Proposal: NICIS (National Integrated Cyber-Infrastructure System)



- A national “Cyber-Infrastructure” platform
- Recognise unique features and characteristics of each sector.
- Provide bandwidth, compute cycles and data storage; through to value-added services e.g. advanced user support, data curation, cloud and grid services, FID, eduroam, training activities
- Skills and Training Service Area coordinate cross-cutting HCD theme interactively with HEIs.

A first step towards National One stop shop

Proposal re: NICIS Skills and Training Services Area

G1

- ***The shortage of e-I skills is global phenomenon.***
- ***Should offer effective coordination of e-I Skills and Training services within a sustainable framework.***
- ***Collaborations between the national organisation and the universities, particularly in the area of human skills and training.***
- ***Role is to work with and through HEIs and RCs to grow e-I savvy cohort.***
- ***Build cohort of data professionals to support research infrastructure development.***

Examples

- eResearch
- Data Science
- Computational ….
- HPC
- Data analytics
- …….

The main targets of these services are

- Cyber-infrastructure professionals (support personnel), for developing their operational knowledge of CI.
- Researchers who use, or could benefit from using, CI services to enhance their research or collaboration capacities.
- Link to “next generation” of students in computer science who could become future CI experts and students in other disciplines who could become future users.

G2

Collaboration ….

- Change culture of institutions.
- Co-develop and coordinate courses with stakeholders; support community in developing educational activities, programs;
- Across disciplines and faculties. Engage with key disciplines (e.g. computer science, numerical analysis, statistics and electrical engineering departments, software eng, …);
- Relate to the entire value-chain of knowledge creation;
- Remote education (MOOCs) in CI, standardise training material & make openly available;
- Campus Champions as liaisons to the NICIS services and local sources of knowledge (EXSEDE model);
- Organise events; road shows and ensure presence at conferences.

G3

Training:

- Develop skills at multiple levels: e.g incorporate e-I training into established doctoral training programmes.
- Training module scope to include:
  - computational science, numerical algorithms, grid-computing, parallel programming, cloud computing, data-centric computing, e-science, computer animation / graphics.
  - data management needs particular attention in view of data deluge; including maintaining essential research data infrastructure; data science including analysis and visualisation, curation and long term preservation; and auditing.
- Oversight of curriculum development in area of data management in higher education institutions.
- Enable users to use e-I provided advanced services.
- Commerce & industry training modules on “commercial basis”.
- Domain specific workshops in partnership with research community.
- Ad hoc and programmatic interventions.

G4

Student Engagement:

- prepare them to be future researchers and educators;
- recruit nationally, with focus on under-represented groups and institutions;
- provide students with real-world research and development experience to encourage them to pursue a future career or advanced degree in digital science.

Closure: Issues for Consideration

H1

- Training offered by amongst others: PRACE, EXSEDE, CSC, GEANT, TERENA, DCC, ANDS, RDA, CHAIN-REDS, e-Science, … Projects. Strategic leadership: e-IRG, NSF, H2020 …… and yet there is still much to do!
  - Culture change
  - Is existing training coherent across providers?
  - Enable optimal use of e-Infrastructure Commons
  - Dearth of Data Scientists
  - Research in increasingly more disciplines is becoming e-I dependent
  - Re-skill mid career researchers (ad hoc)
  - Appropriately skill early career researchers (programmatic)
  - Silo mentality … collaborative model.
- Jobs are changing hence need solid disciplinary underpinning.
- Cross international boundaries—some parts of developing world have a dearth of CI / e-I skills.
- Appropriate educational skills are not all in one place.

Issues for Consideration … 2

H2

- e-Infrastructures → Institutions → Users.
- Enable users of T0, T1, T2 and T3 e-Infrastructures—who should train?
- Train innovative thinkers.
- Upskill users to utilise technological advances (S/W & H/W) .
- Vertical programme integration; Horizontal integration across disciplinary boundaries.
- Integrate computational training and thinking into curricula at all levels.
- Doctoral and Postdoctoral training of future e-Infrastructure leaders and users.
- Intensify engagement with users.
- Computational and Data skills.
- Monitor Performance (KPIs).

Thank You