



A (personal) journey through the Dutch e- Infrastructure landscape

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| My institute: Nikhef



Nikhef: the Dutch National Institute for Subatomic Physics

1946: establishment of IKO (FOM i.e. the Physics Research Council, City of Amsterdam and Philips); institute for nuclear physics; legal predecessor of Nikhef

1975: formation of the Nikhef partnership (FOM and four Dutch universities) to coordinate Dutch activities in nuclear and particle physics;

1980: Nikhef main building concentrated on Amsterdam Science Park, adjacent to the Mathematical Center (MC – established 1946) and SARA (established 1971)

| The (predecessors of the) Dutch e-infrastructure players

1971: establishment of SARA: compute centre for the two Amsterdam universities and the national Mathematical Center ('CWI')

1986: establishment Stichting SURF 'Samenwerkende Universitaire RekenFaciliteiten' by Hans Rosenberg, astrophysicist;

1988: establishment SURFnet: roll out of the first Dutch research and education network;

1988: establishment of Stichting NCF, tasked with providing supercomputing facilities in the Netherlands;

| Meanwhile: internet really took off ...

1989: Tim Berners-Lee submits a proposal for an information management system to his boss, Mike Sendall.

1986 – 1999: emergence of

RARE (TERENA)

RIPE NCC

AMS-IX (Amsterdam Internet Exchange)

.... all with their first offices at Nikhef;



| The story continues ...

[1.1.1999: Arjen joins Nikhef]

1999: first discussions at CERN on distributed processing of LHC data: 'datagrid'

2000 – 2005: first national projects on development of grid infrastructure, supported by various national funds;

2007 – 2012: BiG Grid: 28 M€ project for the roll-out of distributed data processing facilities in The Netherlands; consortium: NCF, NBIC (Bioinformatics) and Nikhef; SARA a prominent partner in this project. Project delivered a.o. the Dutch Tier-1 for WLCG;

2008: report of the national 'ICT regie-orgaan' on ICT facilities for research, advising the Ministry of Education Culture and Science to 'bring all ICT facilities under one roof, preferably SURF';

| ... and continues ...

[2009: Amsterdam Science Park wins competition for hosting head office EGI, first offices at Nikhef;]

[2012: Arjen joins e-IRG]

2013: SURF and SARA merge into one organization; under SURF three separate business units: SURFnet, SURFsara and SURFmarket; Grid infrastructure incorporated in national e-infrastructure; NCF meanwhile dissolved;

2021 – 2025: Nikhef and SURF continue to work together in the Dutch national e-Infrastructure;

2021: merger of SURF business units in one entity (SURF B.V.)



| My 20+ year take away

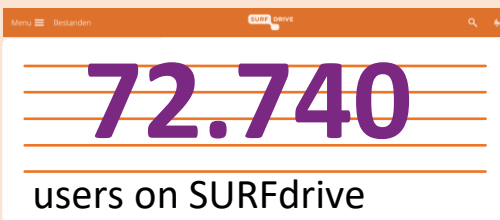
- Change takes time;
- You need a bit of luck now and then; and it helps being closely located together (such as Nikhef and SARA being colocated on the Amsterdam Science Park);
- e-Infrastructure innovation and development can profit from the dynamics of a demanding user community, that likes to work closely with technologies to serve their needs;
- Researchers and research communities are usually not interested in how the various (ICT) services (computing, data, networking) reach them; you better hide your organizational complexities from them ...;
- SURF as *the* e-infrastructure service provider in NL really worked out.
- Hence my advocacy of the national node concept.

SURF Milestones



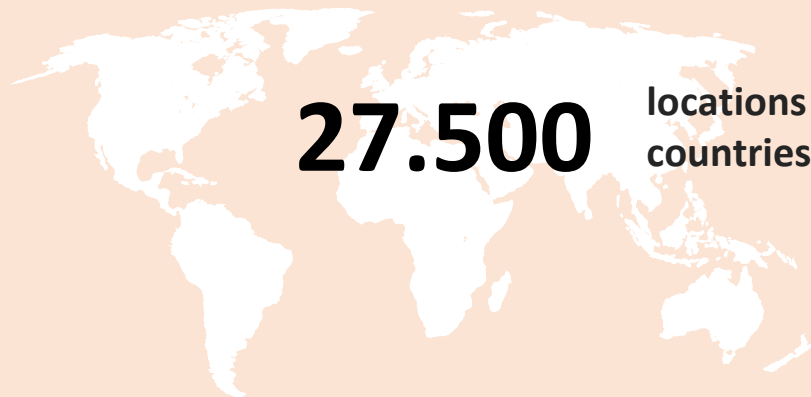
260 million

unique logins with
SURFconext in 2022



72.740

users on SURFdrive



27.500

locations in 101
countries with Eduroam



100 million

in purchasing contracts



14

**petaflop/
s**

peak performance of the
National Supercomputer
Snellius

SURF



International programmes

...

EOSC

Euro-HPC

E-IRG

Géant



Programmes at national level

Npuls

Learning Materials

Flexible Education

Education Data

Online Education

OS Directing Body

Open Science

Sensitive Data

(T) DCCs

Infrastructure

Skills & Capacity

Integral Security

Cybersecurity

NREN

Public Values: *open source, national cloud, GPT models*



Try out, pilot and test on local level

- International interoperability
- Future Campus/XR
- EdTech
- Education data
- Digital Testing

- International cooperation
- LCRDM
- Community VRE
- National Growth Fund
- Skills & capacity
- Sensitive data

- SSI/SRAM+/EduID
- 2STiC/SurfNet9
- SURF-SOC



Overarching Innovation Lab

o.a. Future computing, Quantum communication, AI, GPT-NL, XR, - 800Gb/s

Education

Research

Combined: *Network-Security-Public Values*

6 Technologies, 29 trends!

English copy



Dutch copy



Artificial Intelligence

- Towards 'Frankenmodels'
- More efficient approaches towards AI systems
- New ways to access data
- Towards trustworthy AI
- More accessible computing and models



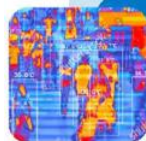
Advanced Computing

- Computing continuum
- Energy sustainability in digital infrastructures
- Protect sovereignty in digital infrastructure
- Unconventional paradigms for computing
- High-end computing in qualitative research fields



Quantum

- Quantum Key Distribution (QKD) gaining momentum
- Quantum Computing as a Service (QCaaS)
- Hybrid quantum/classical computing
- Error correction techniques
- Quantum curiosity



Edge

- Cloud-Edge Continuum
- Digital Twins
- Actual real-time data streams
- Run code anywhere
- Robotic Automation



Network

- Big Tech and networking
- Intelligent networks
- Edge and campus architecture
- Next generation networks

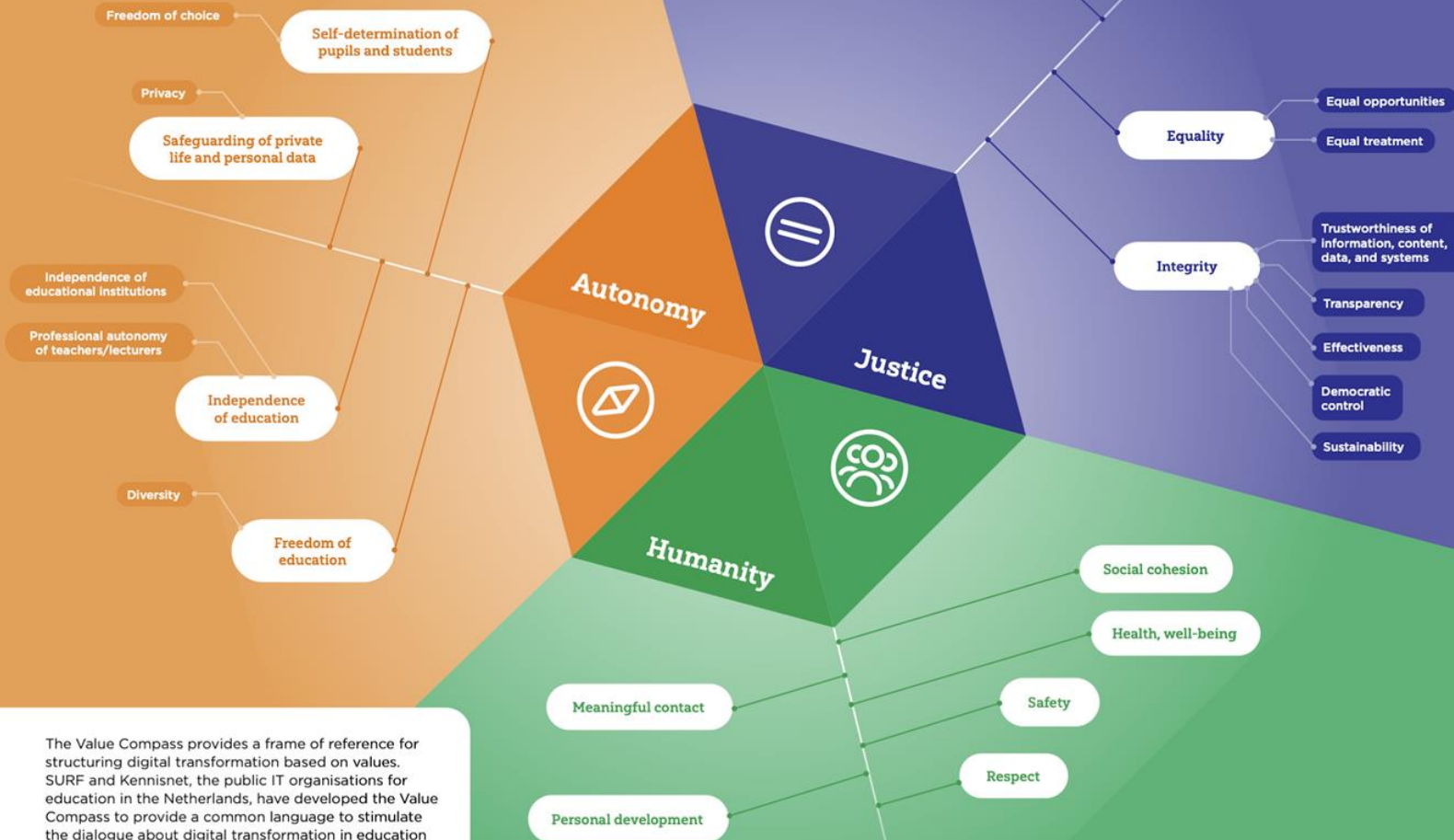


eXtended Reality

- Enriching XR by combining technologies
- Virtual social interactions are getting more advanced
- New gear for new realities
- An increasing number of ethical concerns
- A fragmented ecosystem

Public Values!

Value Compass for digital transformation of education



The Value Compass provides a frame of reference for structuring digital transformation based on values. SURF and Kennisnet, the public IT organisations for education in the Netherlands, have developed the Value Compass to provide a common language to stimulate the dialogue about digital transformation in education and the importance of educational values.

