System and Network Engineering Research for Big Data eSciences

Cees de Laat

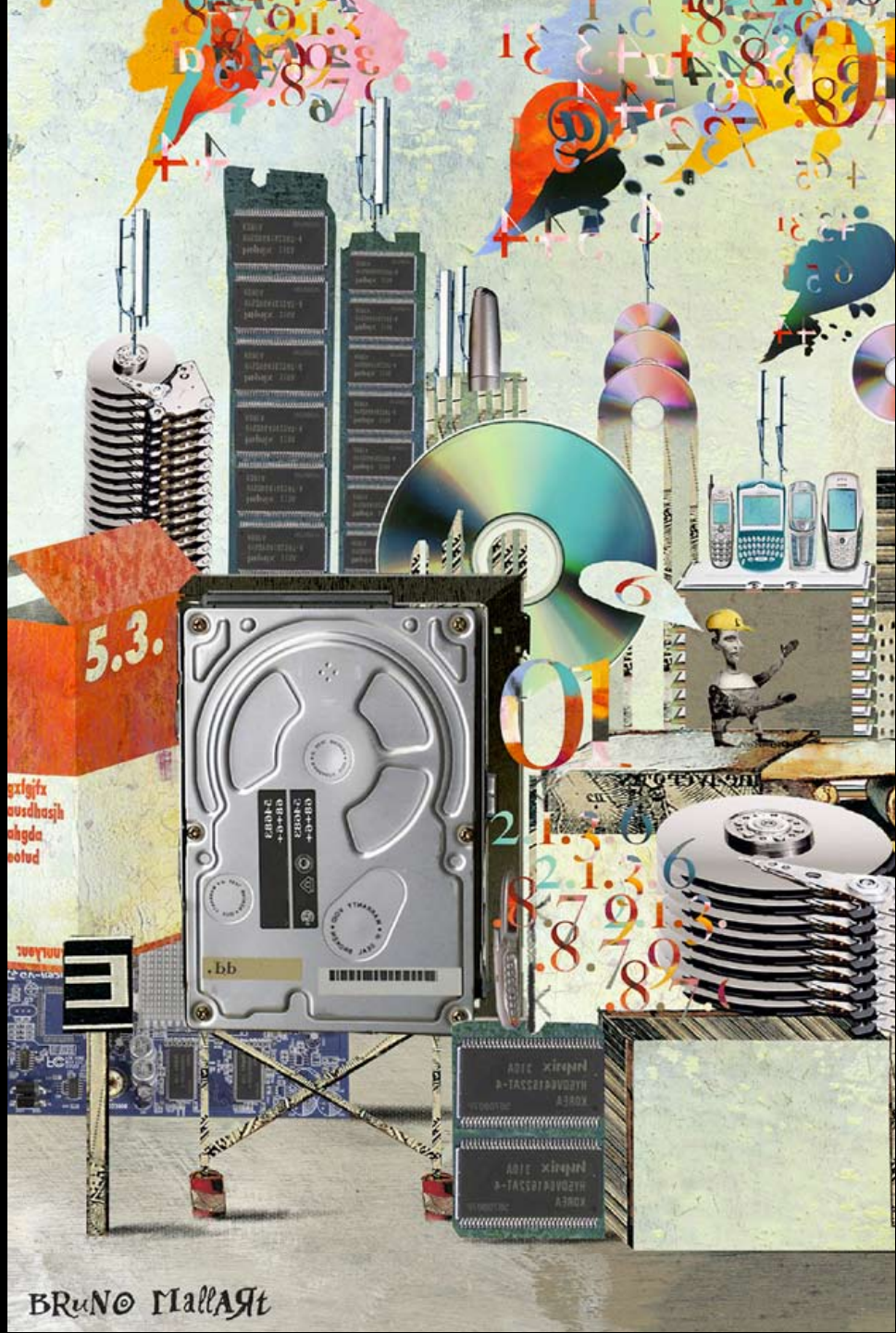
From King's Dutch Academy of Sciences

The Dutch Research Agenda

"Information technology (IT) now permeates all aspects of public, commercial, social, and personal life. bank cards, satnav, and weather radar... IT has become completely indispensable."

"But to guarantee the reliability and quality of constantly bigger and more complicated IT, we will need to find answers to some fundamental questions!"

https://www.knaw.nl/nl/actueel/publicaties/the-dutch-research-agenda/@@download/pdf_file/20111029.pdf



Context

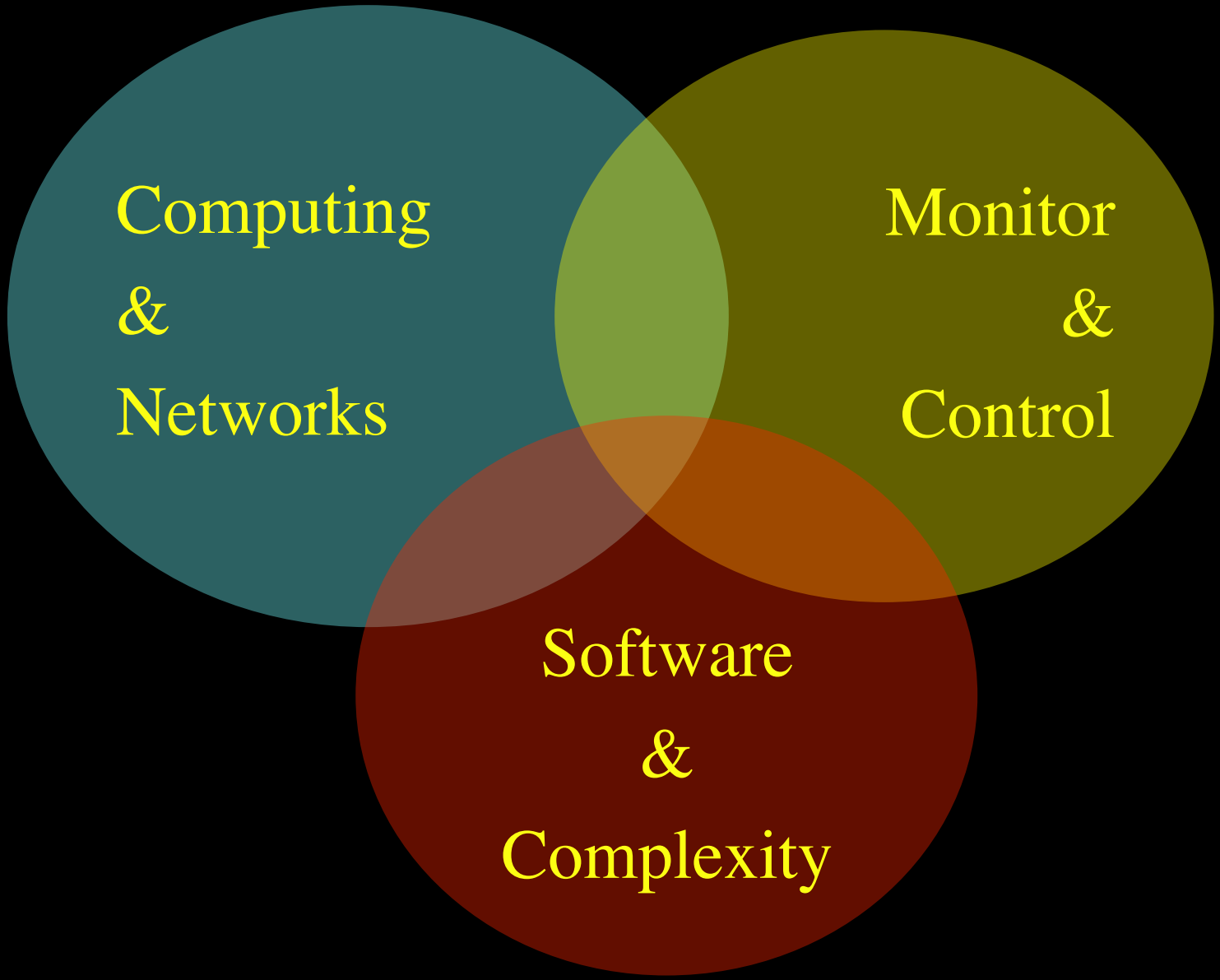
- *Cyber infrastructure components become more and more programmable, complex and online.*
- *Applications in science and society have diverse needs.*
- *Use of infrastructure resources in application-specific ways must be enabled.*

Mission

Can we create smart and safe data processing infrastructures that can be tailored to diverse application needs?

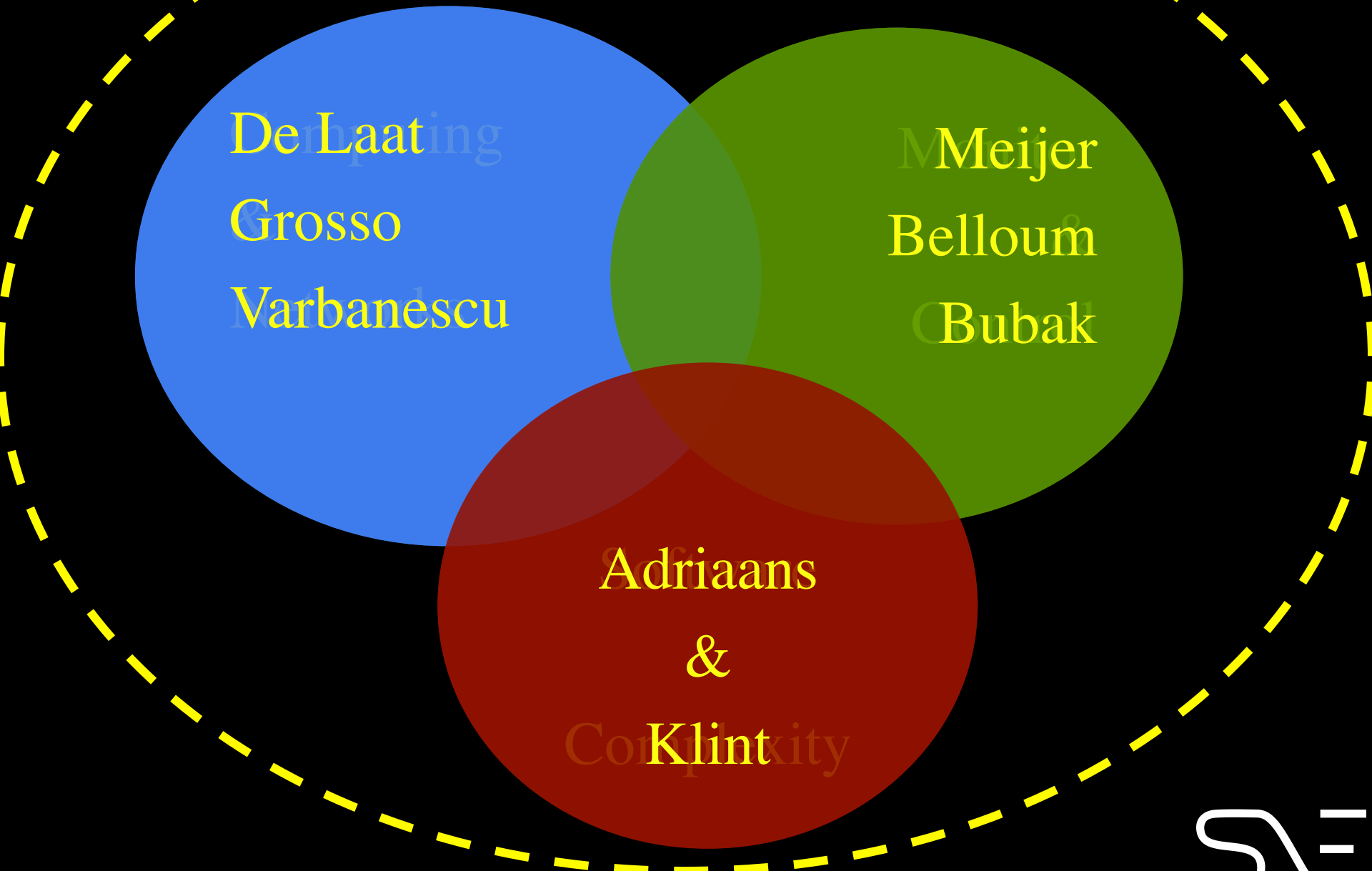
- *Capacity*
  - *Bandwidth on demand, QoS, architectures, photonics, performance*
- *Capability*
  - *Programmability, virtualization, complexity, semantics, workflows*
- *Security*
  - *Anonymity, integrity of data in distributed data processing*
- *Sustainability*
  - *Greening infrastructure, awareness*
- *Resilience*
  - *Systems under attack, failures, disasters*

SNE Section Themes

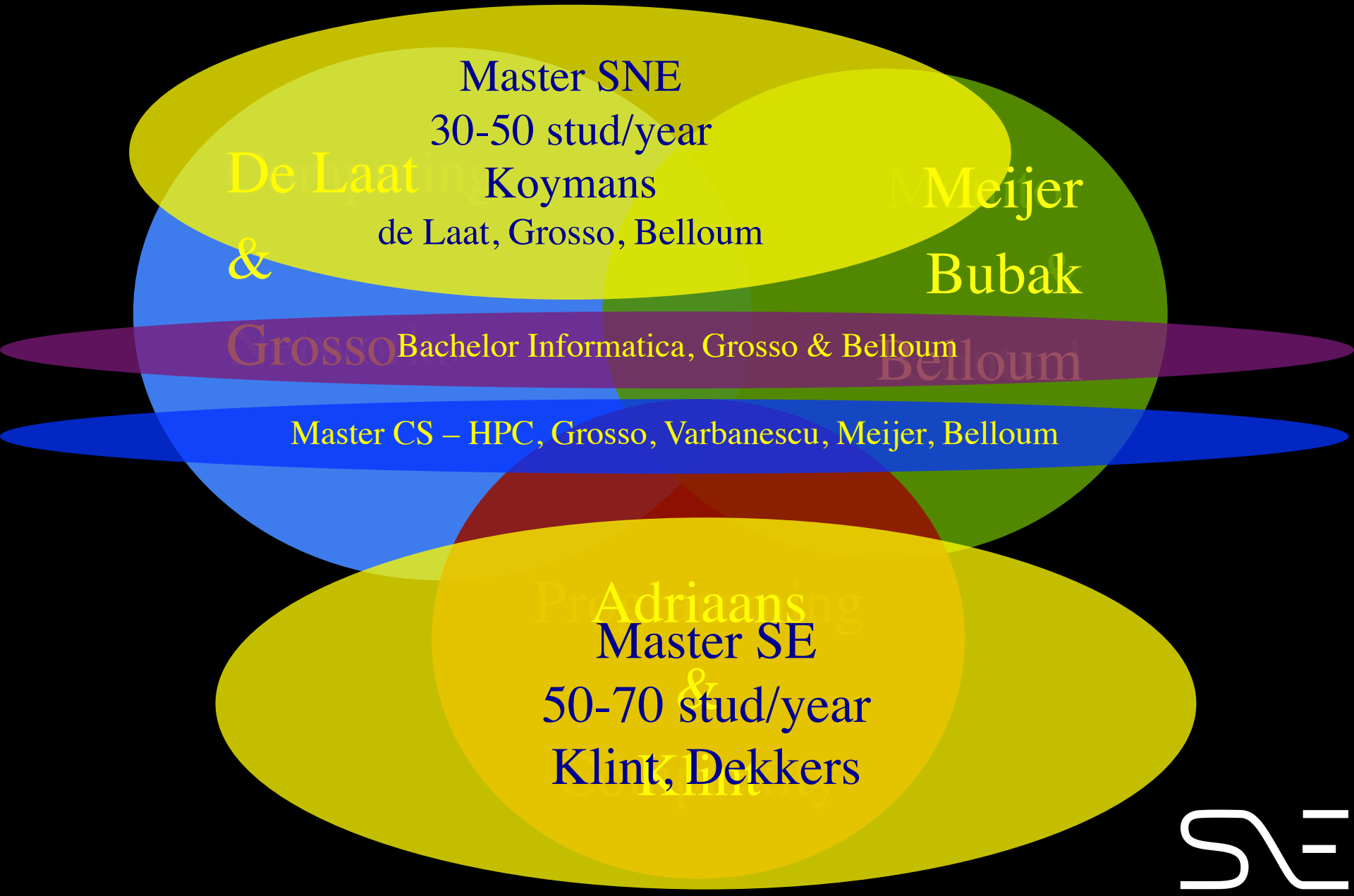


SNE Section Structure

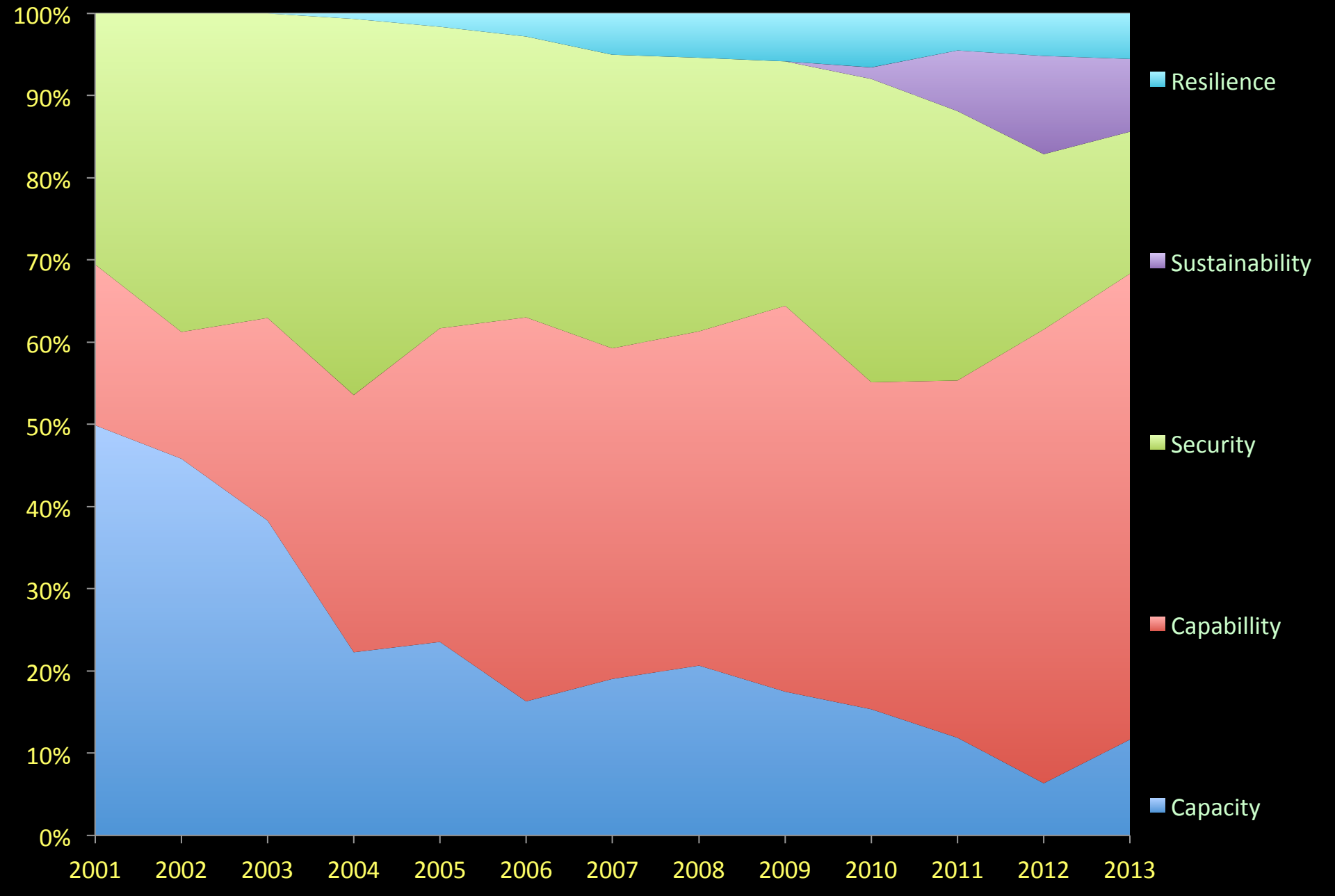
De Laat



SNE - EDU - impact

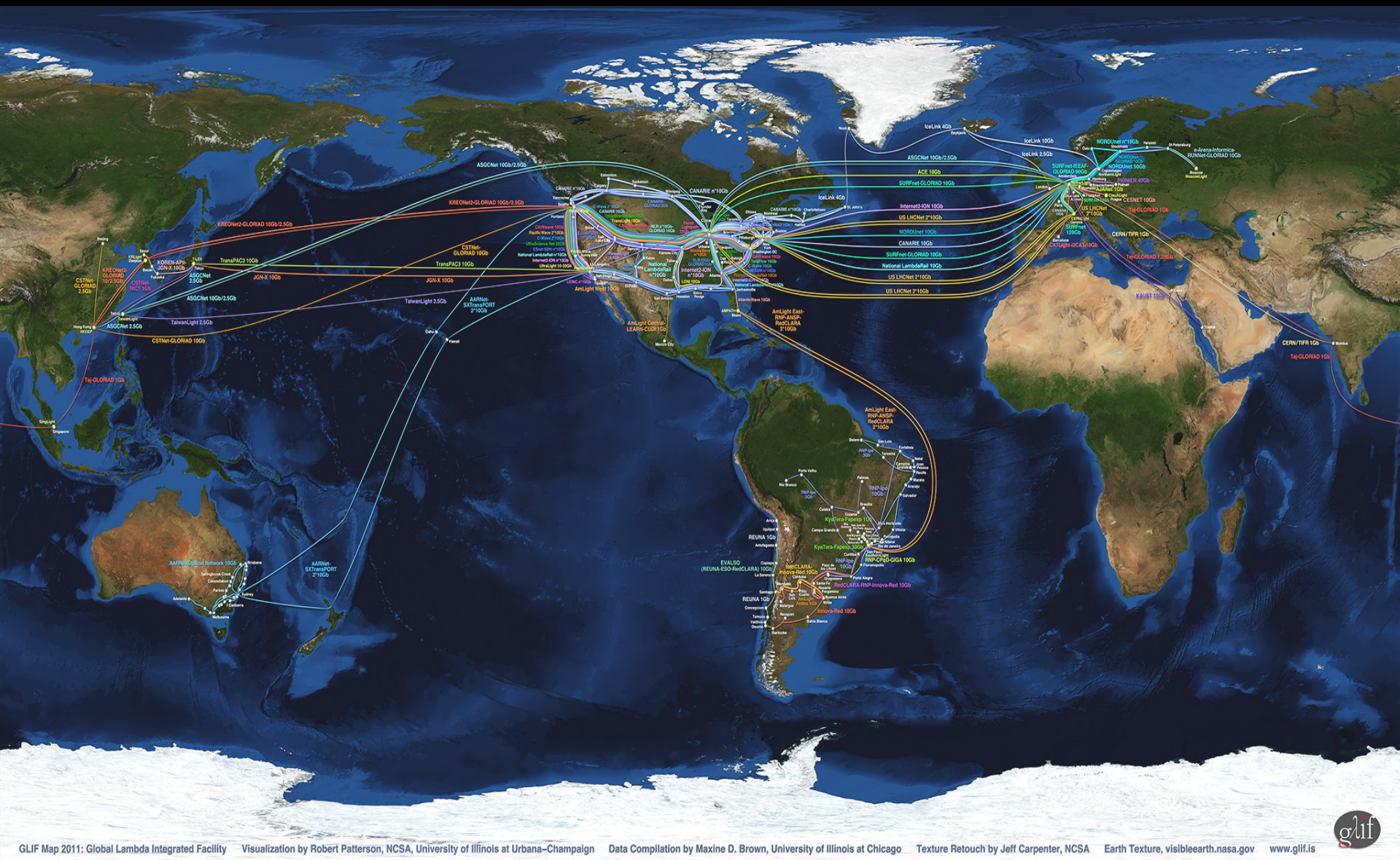


Strategic Research Focus Shift (fte's)



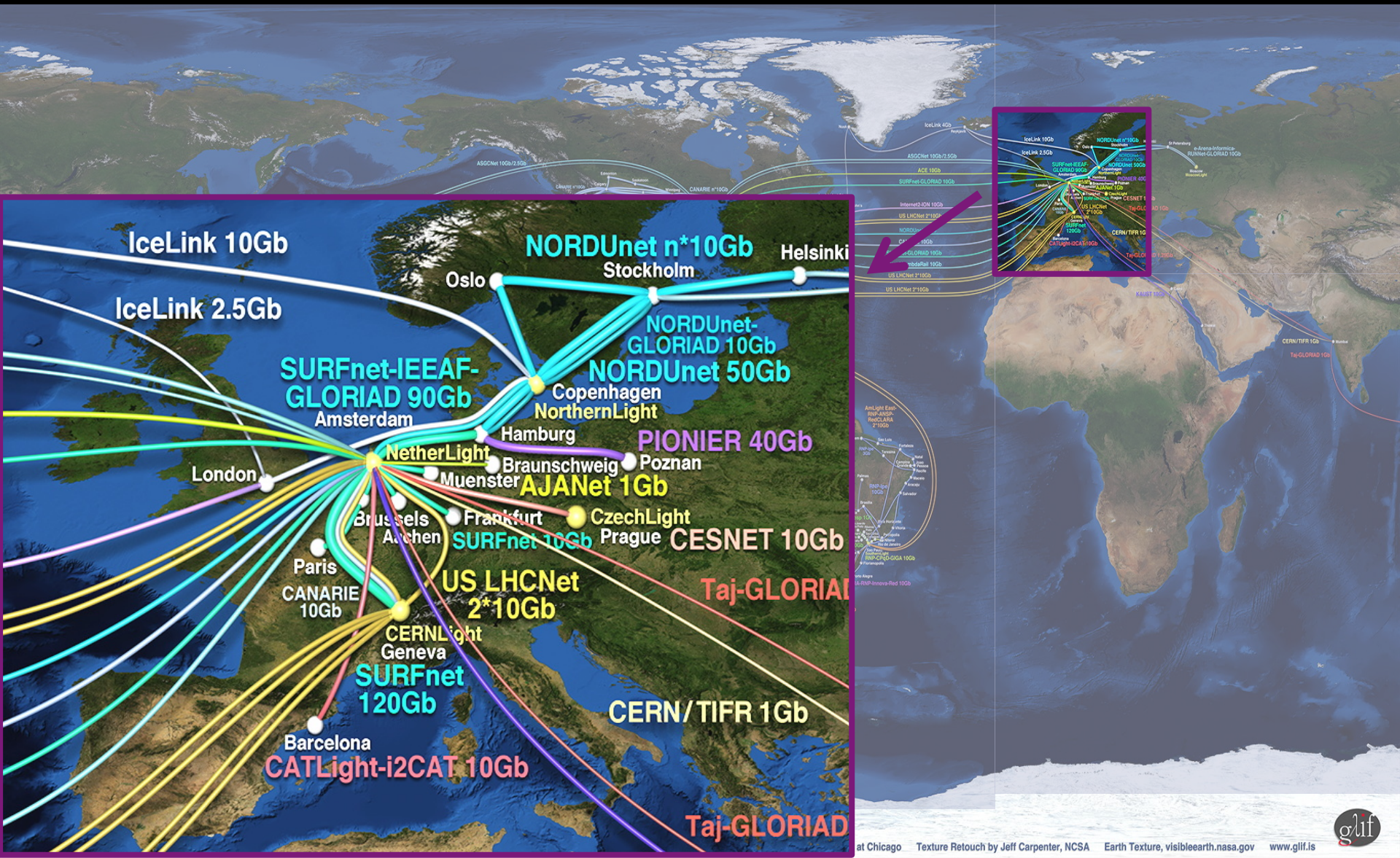
The GLIF – LightPaths around the World

F Dijkstra, J van der Ham, P Grosso, C de Laat, “A path finding implementation for multi-layer networks”, Future Generation Computer Systems 25 (2), 142-146.



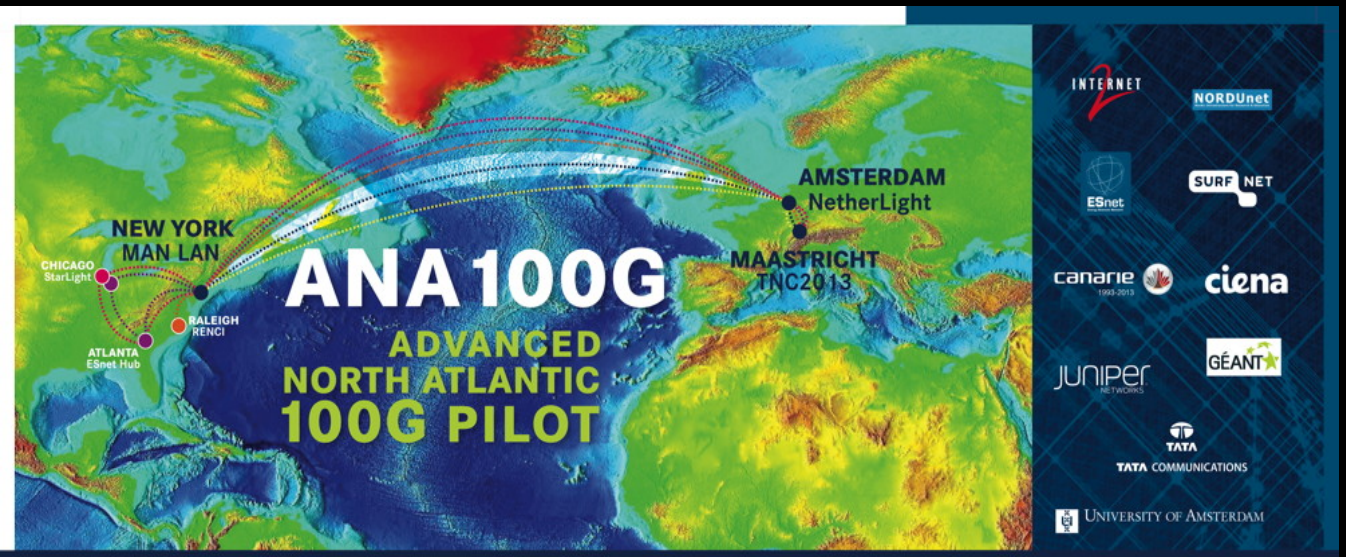
Amsterdam is a major hub in The GLIF

F Dijkstra, J van der Ham, P Grosso, C de Laat, “A path finding implementation for multi-layer networks”, Future Generation Computer Systems 25 (2), 142-146.



ExoGeni @ OpenLab - UvA

Installed and up June 3th 2013



TNC2013 DEMOS JUNE, 2013

DEMO	TITLE	OWNER	AFFILIATION	E-MAIL	A-SIDE	Z-SIDE	PORTS(S) MAN LAN	PORTS(S) TNC2013	DETAILS
1	Big data transfers with multipathing, OpenFlow and MPTCP	Ronald van der Pol	SURFnet	ronald.vanderpol@surfnet.nl	TNC/MECC, Maastricht NL	Chicago, IL	Existing 100G link between internet2 and ESnet	2x40GE (Juniper)+ 2x 10GE (OME6500)	In this demonstration we show how multipathing, OpenFlow and Multipath TCP (MPTCP) can help in large file transfers between data centres (Maastricht and Chicago). An OpenFlow application provisions multiple paths between the servers and MPTCP will be used on the servers to simultaneously send traffic across all those paths. This demo uses 2x40G on the transatlantic 100G link. ESnet provides 2x40G between MAN LAN and StarLight, ACE and USLHCnet provide additional 10GEs.
2	Visualize 100G traffic	Inder Monga	ESnet	imonga@es.net					Using an SNMP feed from the Juniper switch at TNC2013,and/or Brocade ALZS node in MANLAN, this demo would visualize the total traffic on the link, of all demos aggregated. The network diagram will show the transatlantic topology and some of the demo topologies.
3	How many modern servers can fill a 100Gbps Transatlantic Circuit?	Inder Monga	ESnet	imonga@es.net	Chicago, Ill	TNC showfloor	1x 100GE	8x 10GE	In this demonstration, we show that with the proper tuning and tool, only 2 hosts on each continent can generate almost 80Gbps of traffic. Each server has 4 100 NICS connected to a 40G virtual circuit, and has iperf3 running to generate traffic. ESnet's new "iperf3" throughput measurement tool, still in 'beta', combines the best features from other tools such as iperf, nuttcp, and netperf. See: https://my.es.net/demos/tnc2013/
4	First European ExoGENI at Work	Jeroen van der Ham	UvA	vdham@uva.nl	RENCI, NC	UvA, Amsterdam, NL	1x 10GE	1x 10GE	The ExoGENI racks at RENCI and UvA will be interconnected over a 10G pipe and be on continuously, showing GENI connectivity between Amsterdam and the rest of the GENI nodes in the USA.
5	Up and down North Atlantic @ 100G	Michael Enrico	DANTE	michael.enrico@dante.net	TNC showfloor	TNC showfloor	1x 100GE	1x 100GE	The DANTE 100GE test set will be placed at the TNC2013 showfloor and connected to the Juniper at 100G. When this demo is running a loop @ MAN LAN's Brocade switch will ensure that the traffic sent to MAN LAN returns to the showfloor. On display is the throughput and RTT (to show the traffic traveled the Atlantic twice)

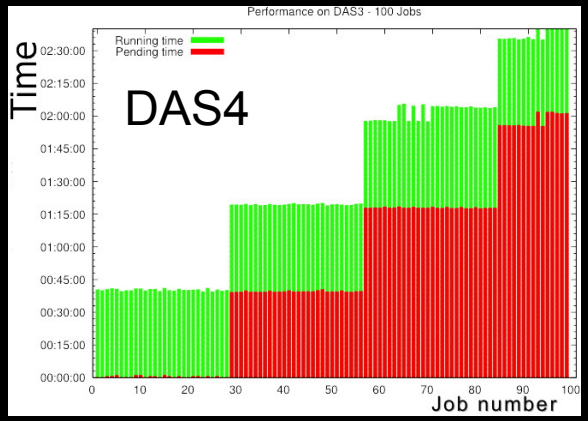
Connected via the new 100 Gb/s transatlantic To US-GENI

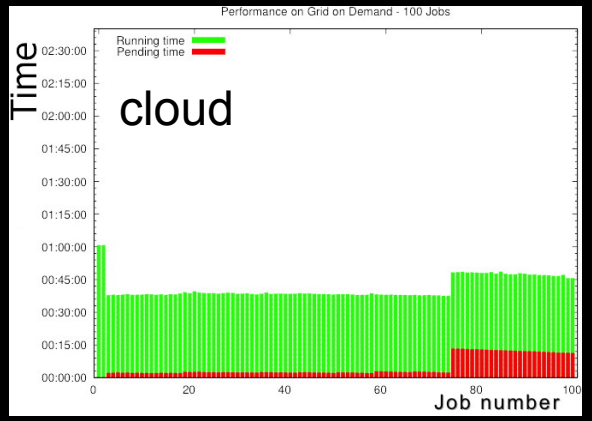
OpenLab Demonstration:
Optimizing the Cloud Data Processing Problem.

If computing is 'infinite' and movable, then workflows and applications can ***program*** the network.

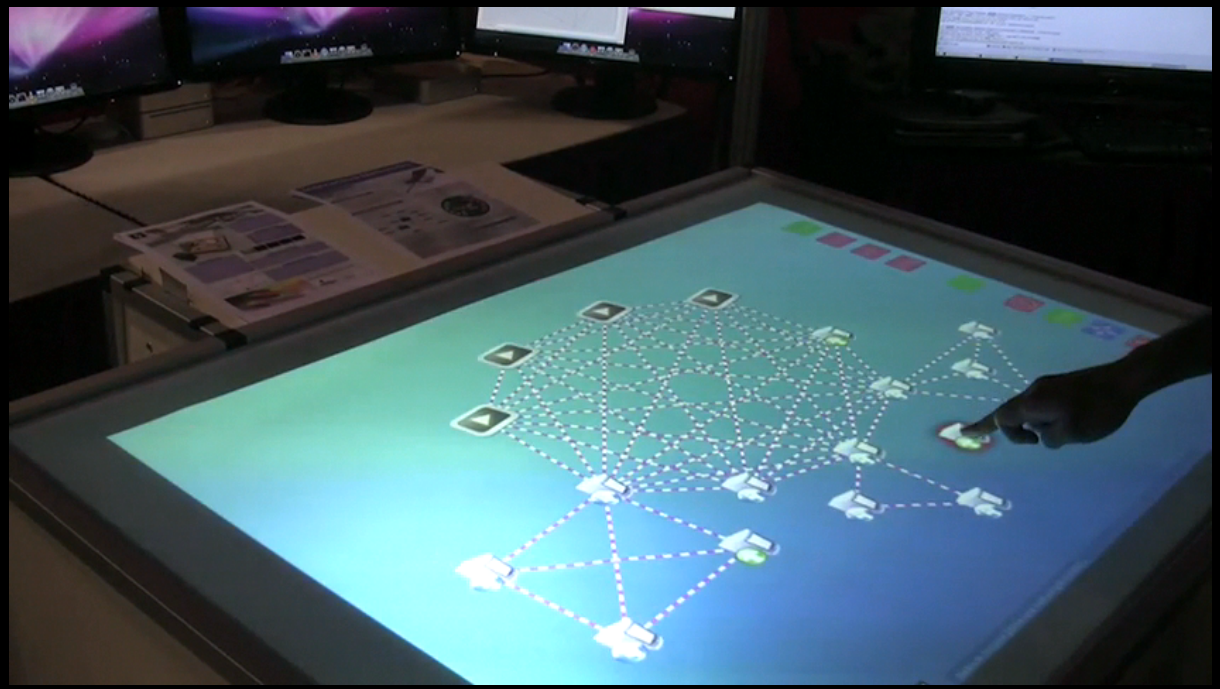
You can introduce new metrics when creating and optimizing these infrastructures (*e.g* power consumption)

Grid-on-demand





User programmable networks



R.Strijkers, W.Toorop, A.van Hoof, P.Grosso, A.Belloum, D.Vasuining, C. de Laat, R. Meijer, "AMOS: Using the Cloud for On-Demand Execution of e-Science Applications", In: Proc. eScience2010 conf, Dec. 2010.

Y. Demchenko, C.Ngo, M.Makkes, R.Strijkers, C. de Laat, "Defining Inter-Cloud Architecture for Interoperability and Integration.", 3th intl conf on Cloud Computing, GRIDs, and Virtualization (CLOUDCOM 2012), July 22-27, 2012, Nice, France. BEST PAPER AWARD

Collaborations & Connections

Scientific Inst.

I2CAT DANS
eScience_center
HealthGrid/MaatG
KNMI/ORFEUS IBBT
Fraunhofer
ASTRON
ESA

Universities

KEYO
Cardiff_Univ
ETHZ AIT TUBS
U-Leiden UEssex
VU TUD UNC
ELTE NTUA
UCSD UIC
GWU

Internet

SURFnet
DANTE SARA
DFN PSNC
INRIA GARR

Art-Societal

Blender
Mediagilde
Technicolor
Sandberg Instituut
Holland_Festival
IDFA NFTA
De Waag

Fora

W3C
ISOC TMF
IETF OGF
CineGrid

Industry

TNO Dell
CIENA NORTEL
CISCO Philips
ADVA Logica
KPN KPMG
NXW SAP
Elsevier

Research funding 2009-2013

- Eu-Phosphorus
- NCF-std support
- GigaPort, Research on Networks
- VL-e
- E-Science bridging
- CineGrid Amsterdam
- EU-GN3
- EU-NOVI
- EU-Geysers
- DAS3, DAS4
- EU-ENVRI
- NWO-GreenClouds
- COMMIT/ WP 20.1, 20.3, 23.1, 23.2
- McGillavry fellowship
- EuroBrazil
- BOSS
- MOTE GN3plus call
- OpenLab

Research direction

- Control of Infrastructure
- Information on Infrastructure
- Virtualization
- Networked data processing
- Sustainability & Complexity

Events on the horizon

- I4DW & DSRC
  - Launch Nov 13
- PIRE & OpenScienceDataCloud.org
  - Workshop June 2014 @ UvA
- Research Data Alliance
  - Conference in Amsterdam Sept 2014

The constant factor in our field is Change!

The 50 years it took Physicists to find one particle, the Higgs, we came from:

Fortran, COBOL, RSX11M, Unix, c, SmallTalk, DECnet, TCP/IP, c++, Internet, WWW, ATM, Semantic Web, Photonic networks, Google, Twitter, grid, cloud, SDN, Data^3, App's

to:

DDOS attacks destroying Banks and Bitcoins.

Conclusion:

Need for Safe, Smart, Resilient Sustainable Infrastructure.

LINKS

- http://sne.science.uva.nl
- http://www.os3.nl/
- http://i4dw.nl/
- http://dsrc.nl/
- http://sne.science.uva.nl/openlab/
- http://pire.opensciencedatacloud.org
- http://staff.science.uva.nl/~delaat/pire/
- https://rd-alliance.org