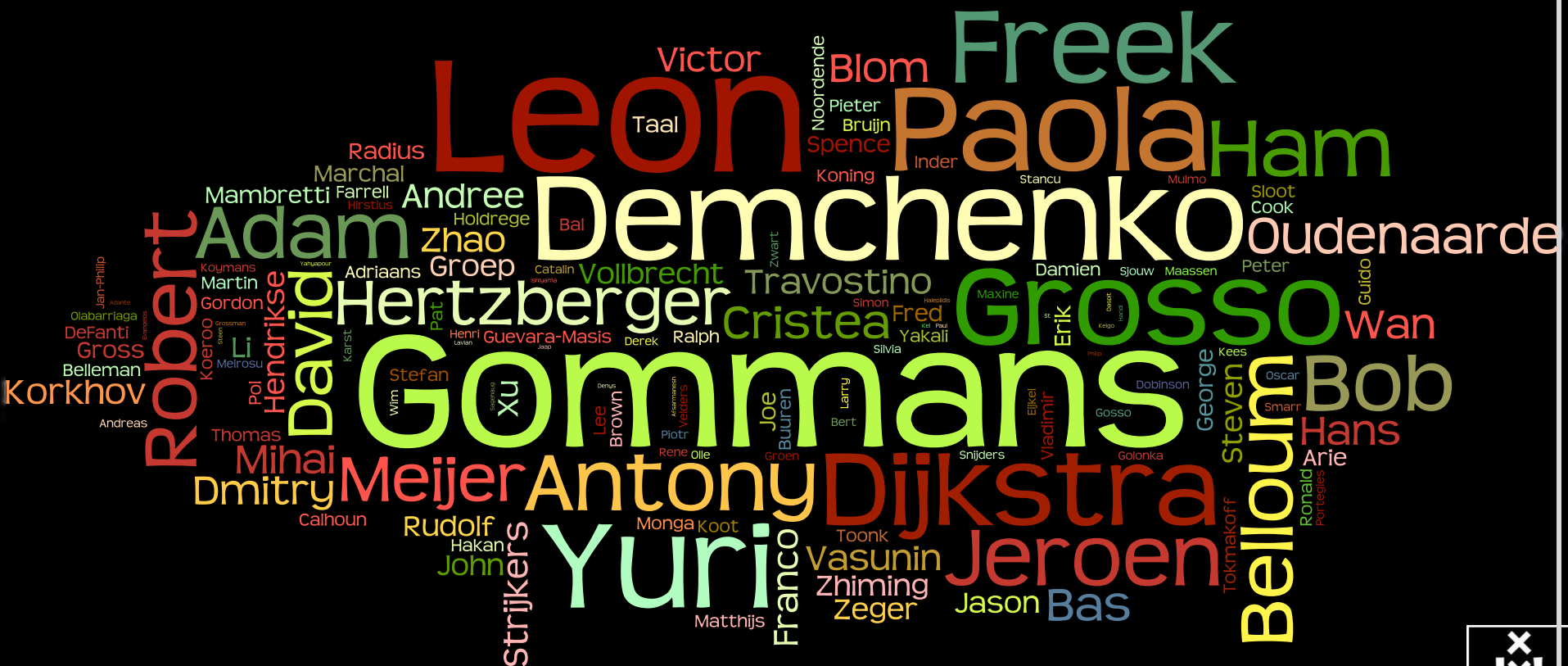


System and Network Engineering

Internet Innovation to support Science

Cees de Laat



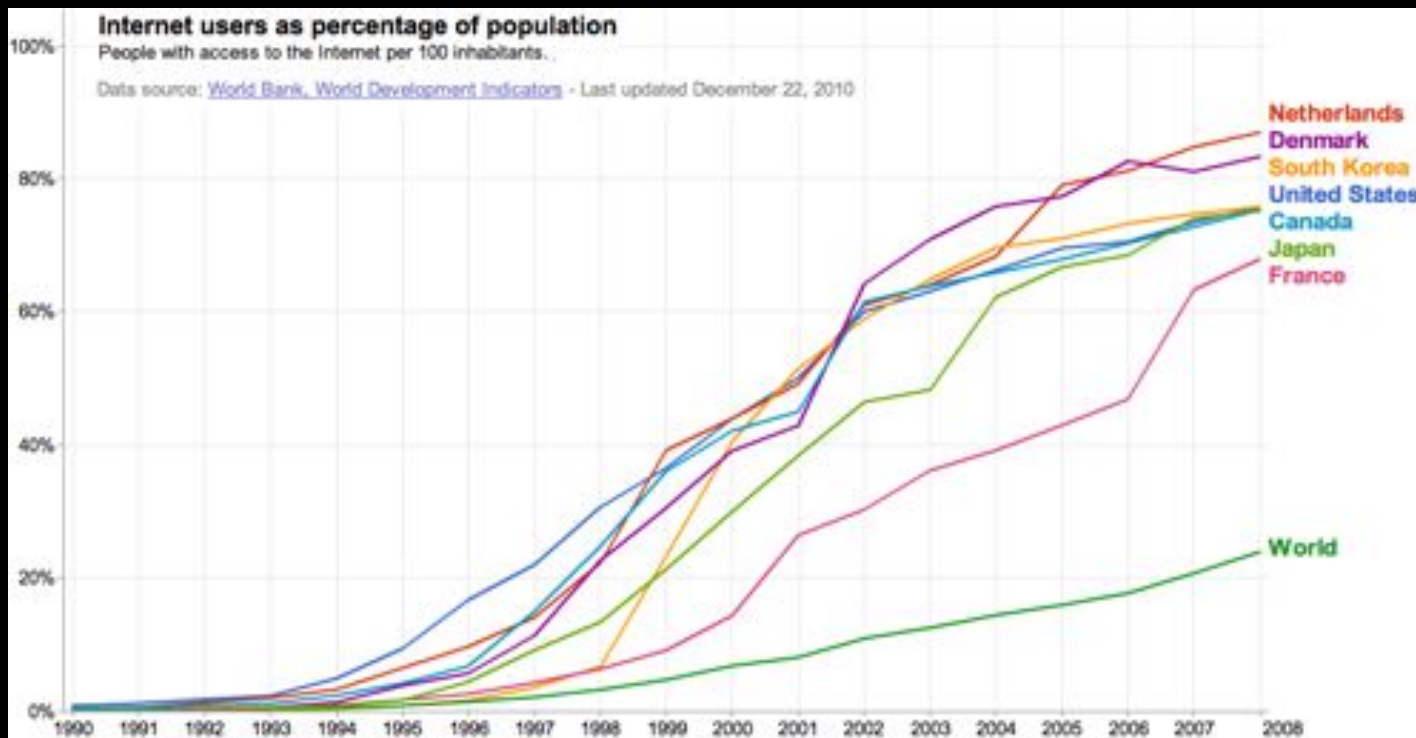
Internet

From a network experiment that never ended (Vint Cerf)

- 1974: for the first time the word **internet** (*RFC 675 - Specification of Internet Transmission Control Program*) [note -> Open process!]
- 1981: the **TCP/IP** standard was ready to be adopted (*RFC 791,792,793*)

To a network for society

- 1989: WWW was born



June 8th @ UvA

- Jan 2011 → IANA IPv4 address space depleted! →

Ipv6day.nl

Internet is a Billion - Business!

Google	197
Amazon	83
Facebook	50
BAIDU	37
eBay	36
Yahoo	22
PriceLine	21
SalesForce	18
F5 Networks	11
CheckPoint	9
NetFlix	9
Expedia	7



e.g.: Exxon Mobil 368
Apple Inc. 333



1 miljard in 100\$ biljetten

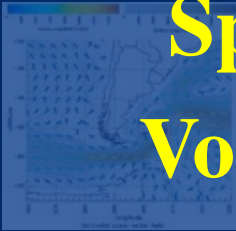
... more data!

Internet developments

Google

Speed
Volume

DATA



Deterministic

Real-time



twitter



Scalable

Secure

Linked in

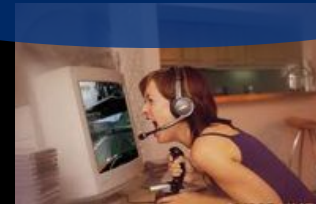


myspace

SchoolBANK

Hyves

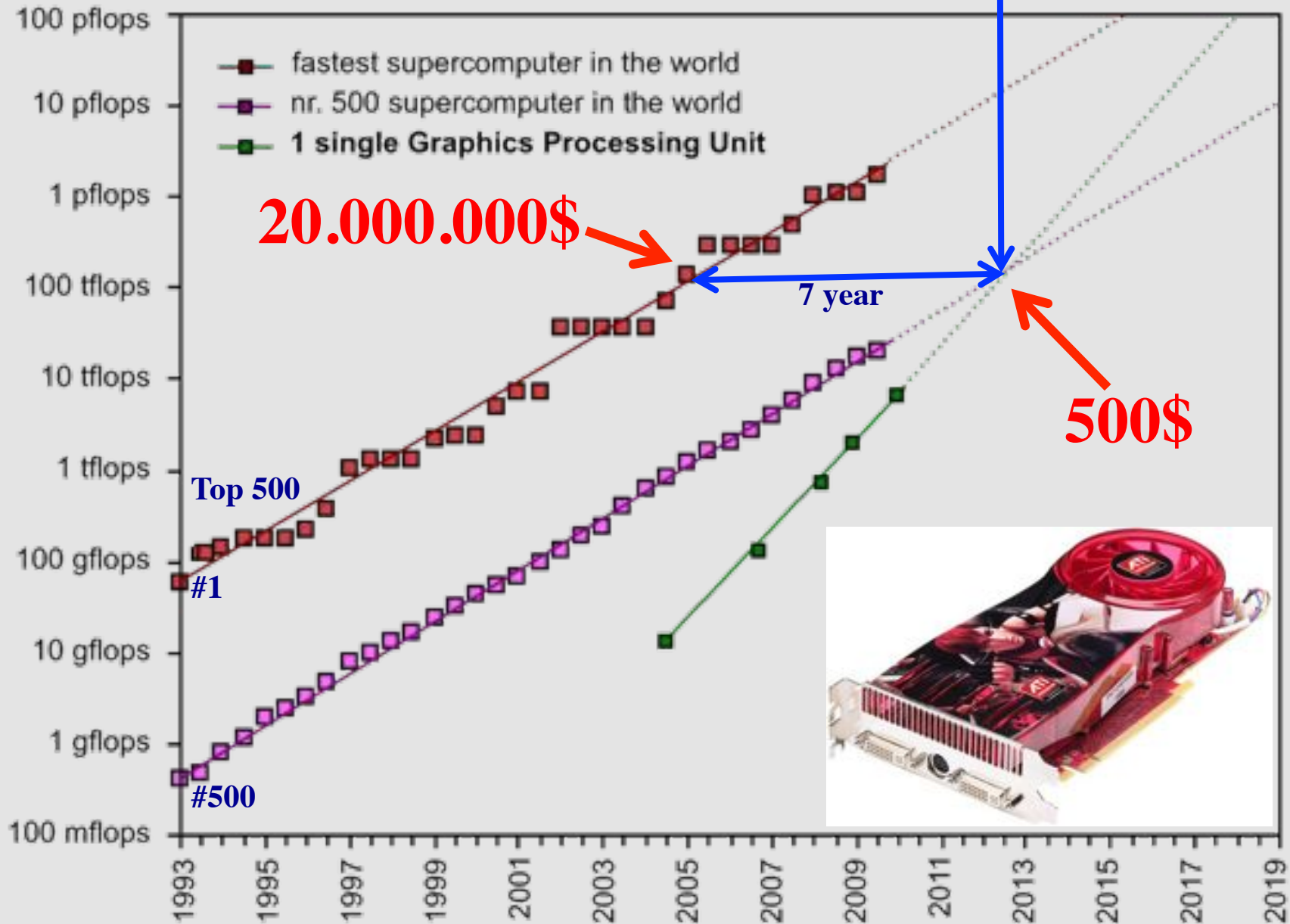
flickr



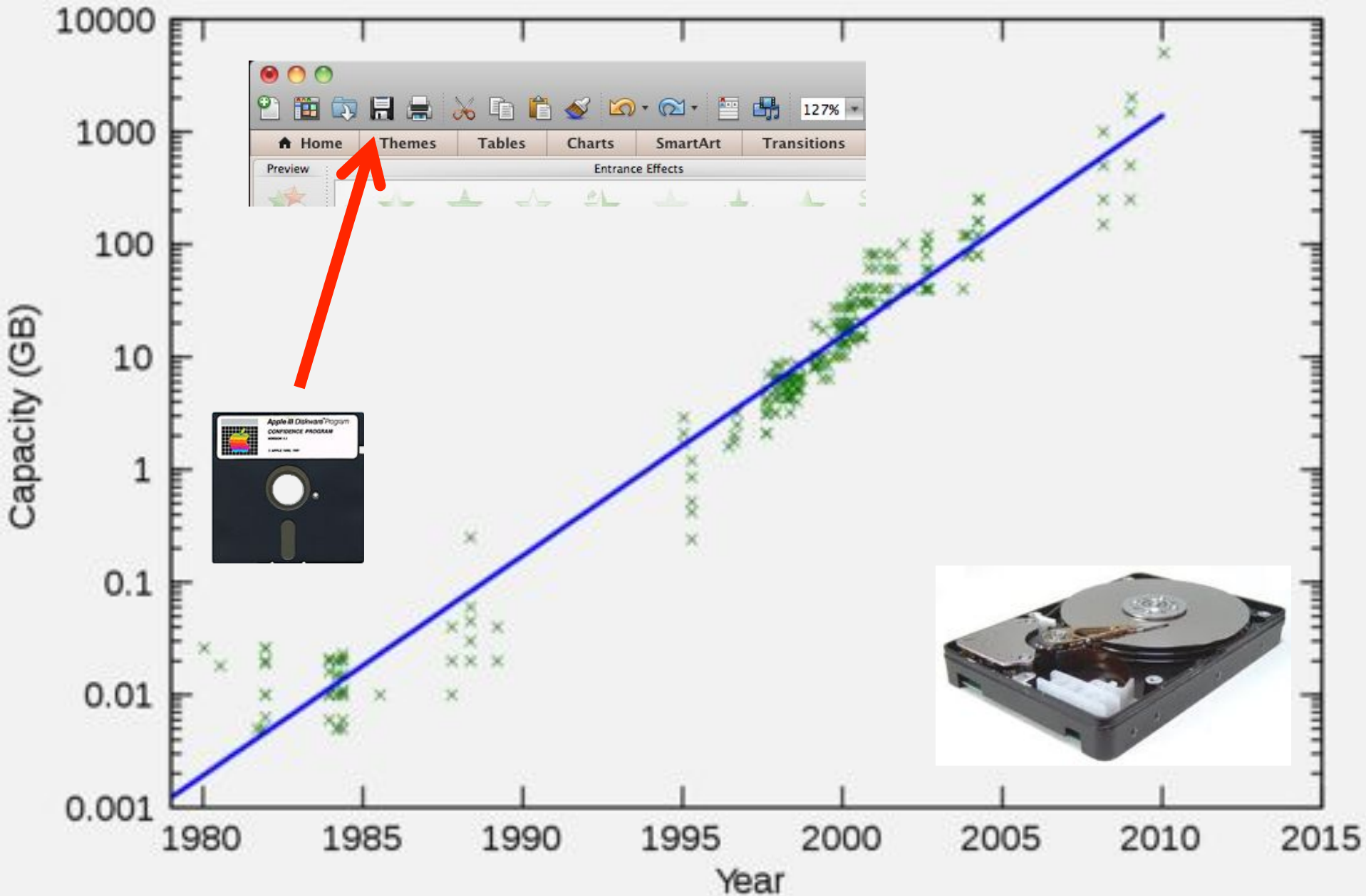
... more users!



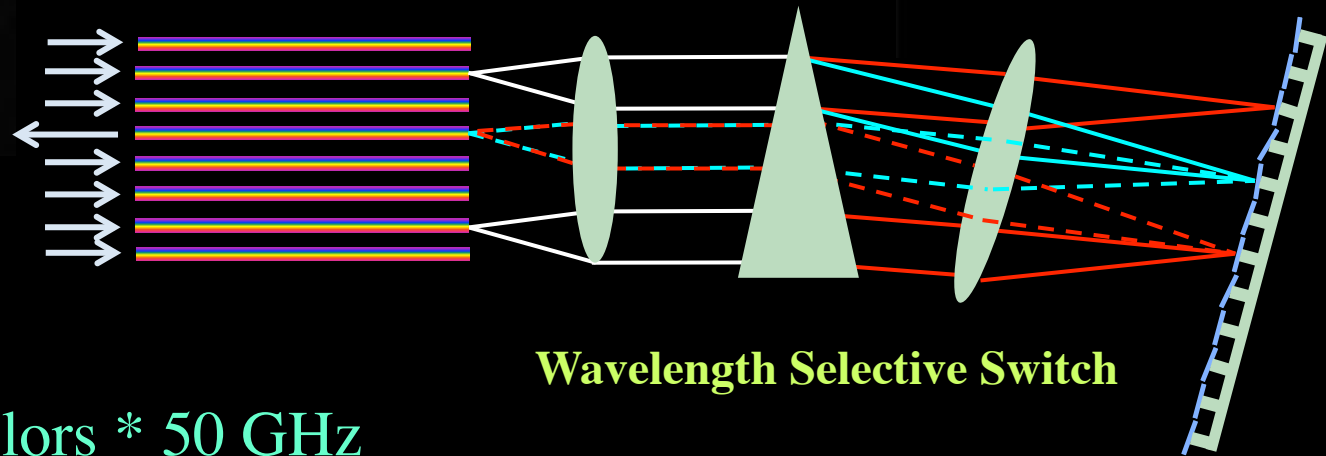
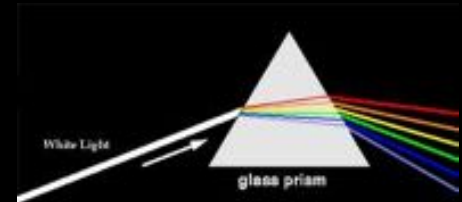
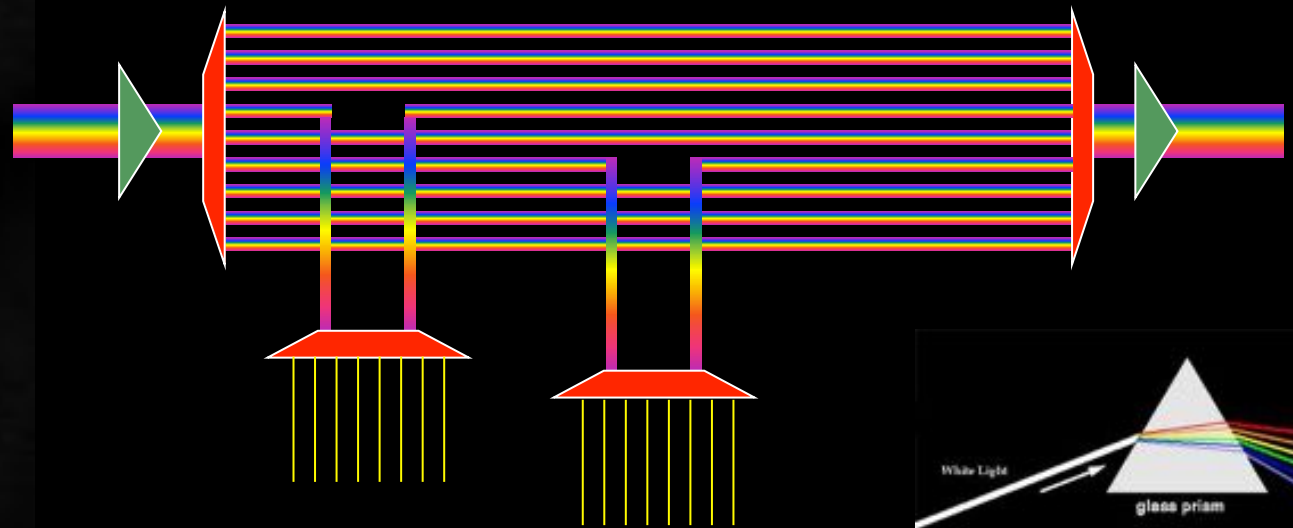
GPU cards are disruptive!



Data storage: doubling every 1.5 year!



Multiple colors / Fiber



Per fiber: ~ 80-100 colors * 50 GHz
Per color: 10 – 40 – 100 Gbit/s
BW * Distance ~ $2 \cdot 10^{17}$ bm/s

New: Hollow Fiber!
➔ less RTT!

Wireless Networks



COPYRIGHT: WORTEN HILSMANN

protocol LAN due to the easy comparison and convenience in the digital home. While consumer PC products has just started to migrate to a much higher bandwidth of 802.11n wireless LAN now working on next-generation standard definition is already in progress.

SNE @ UvA

Speed
Volume

Deterministic
Real-time

Scalable
Secure

Ijkdijk/Urban Flood

Medical

LifeWatch

CosmoGrid/eVLBI

CineGrid

EU-GN3/NOVI/Geysers

SURFnet/GLIF/Cloud

Green-IT

Privacy/Trust

Authorization/policy

Programmable networks

40-100Gig/TCP/WF/QoS

Topology/Architecture

Optical Photonic

X X

X

X

X X

X X

X

X

X

X

X

X

X

X

X

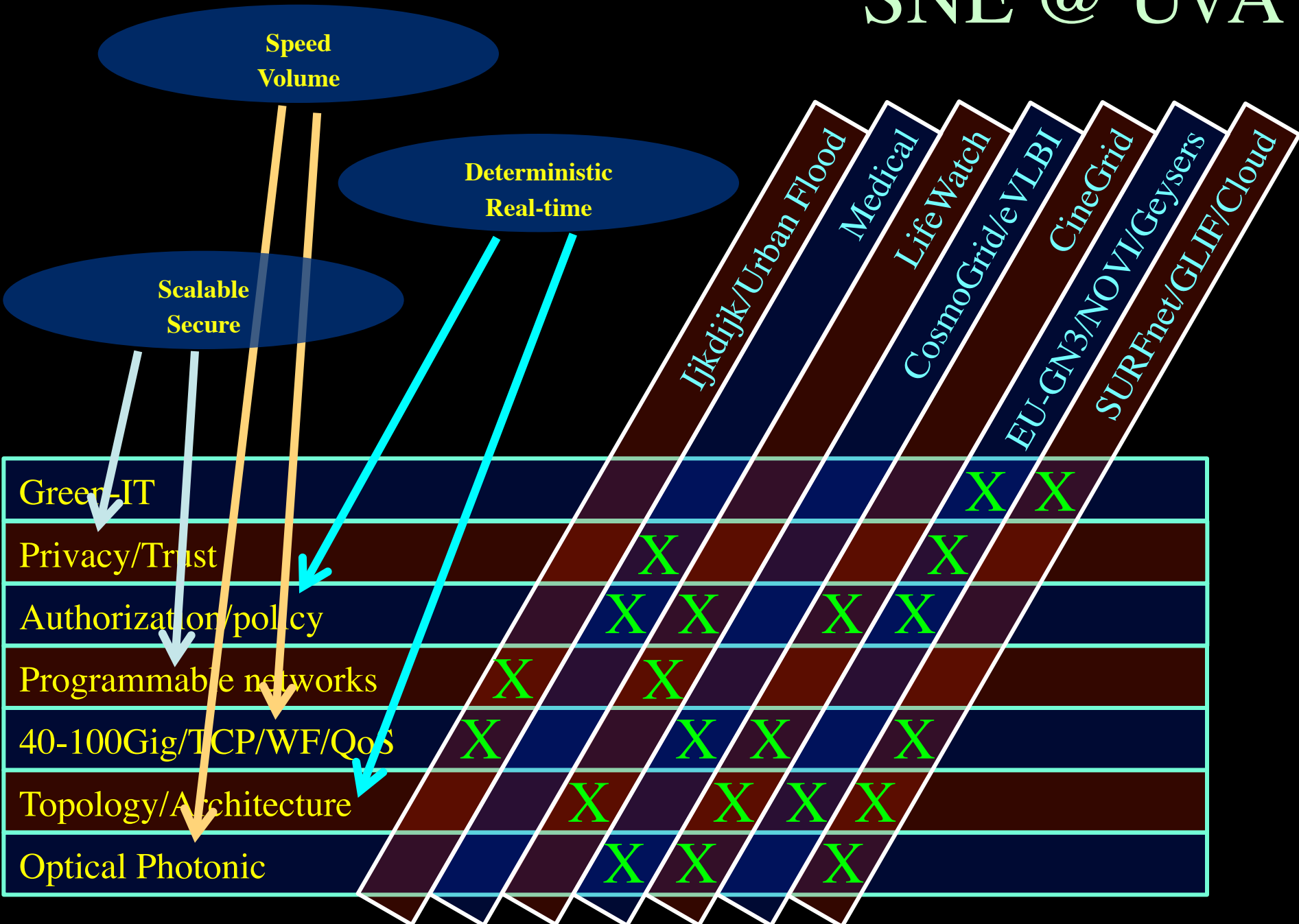
X

X

X

X

SNE @ UvA



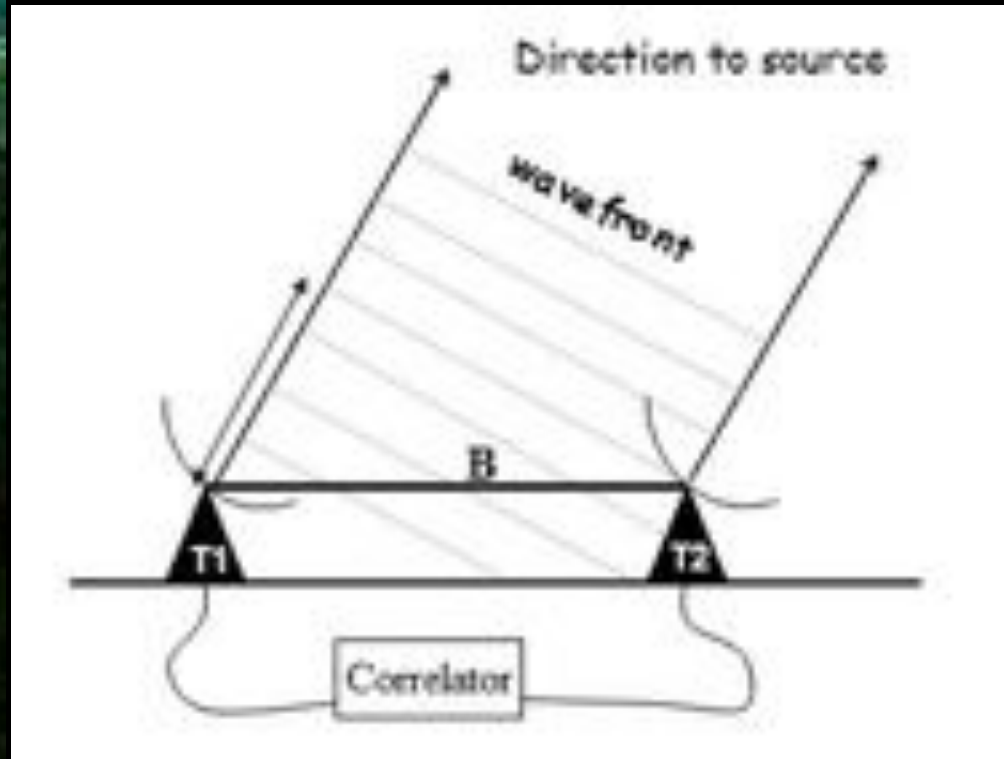
SNE @ UvA



	Ijkdijk/Urban Flood	Medical	LifeWatch	CosmoGrid/eVLBI	CineGrid	EU-GN3/NOVI/Geysers	SURFnet/GLIF/Cloud
Green-IT				X	X		
Privacy/Trust		X			X		
Authorization/policy		X	X	X	X		
Programmable networks	X	X					
40-100Gig/TCP/WF/QoS	X	X	X	X	X		
Topology/Architecture		X	X	X	X		
Optical Photonic		X	X	X			



e - Very Large Base Interferometer



eVLBI: European VLBI Network

Dec 4

Dec 5

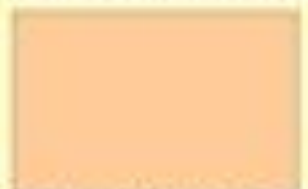
Dec 6

Deadline for submitting eVLBI observing proposals

Program committee decides if eVLBI science can be justified



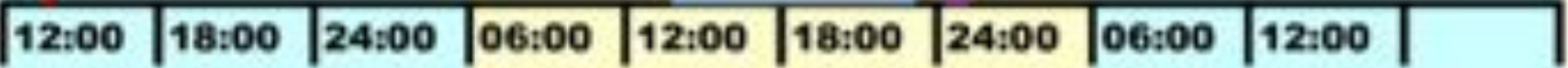
eVLBI Observing Run



Correlation at JIVE

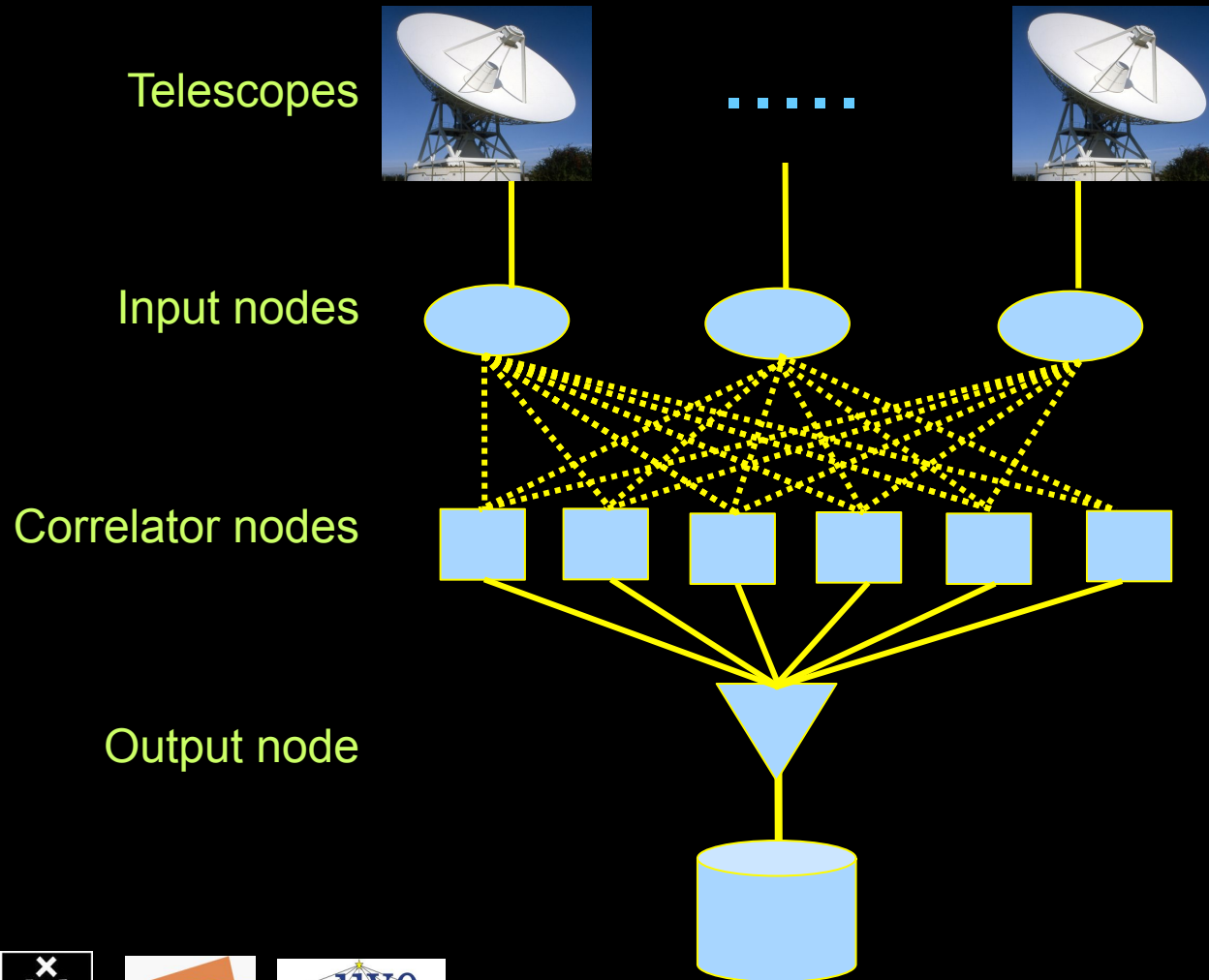


Scientist downloads data from www.jive.nl



The SCARIE project

SCARIE: a research project to create a Software Correlator for e-VLBI.
VLBI Correlation: signal processing technique to get high precision image from spatially distributed radio-telescope.



16 Gbit/s - 2 TfloP →
THIS IS A DATA FLOW PROBLEM !!!

Research:

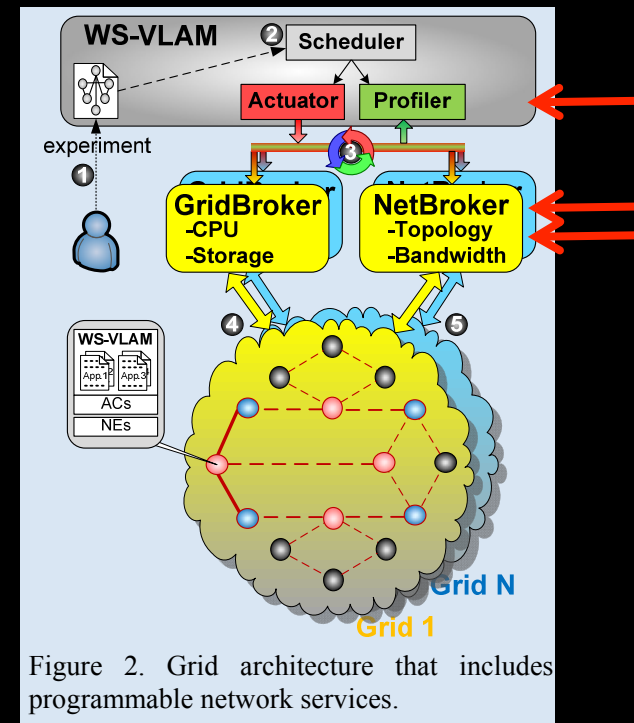
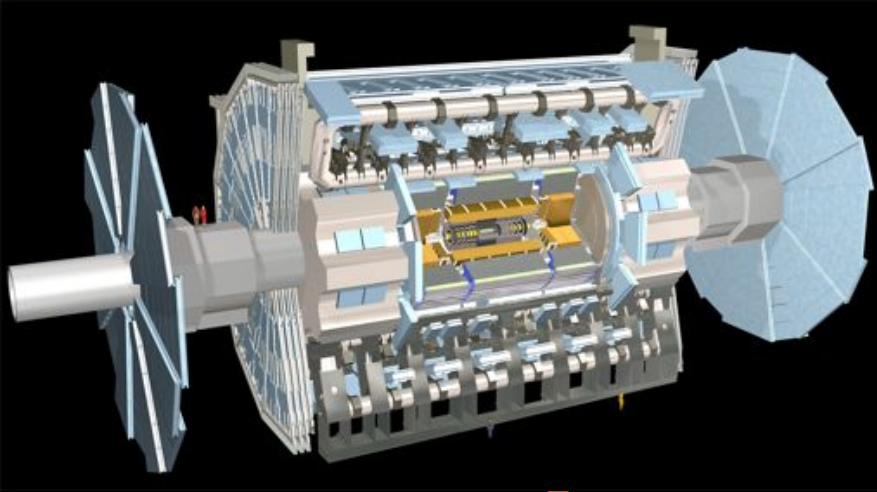


Figure 2. Grid architecture that includes programmable network services.



SNE @ UvA



Ijkdijk/Urban Flood

Medical

LifeWatch

CosmoGrid/eVLBI

CineGrid

SURFnet/GLIF/Cloud

Green-IT

Privacy/Trust

Authorization/policy

Programmable networks

40-100Gig/TCP/WF/QoS

Topology/Architecture

Optical Photonic

X X

X

X

X X

X X

X

X

X X

X

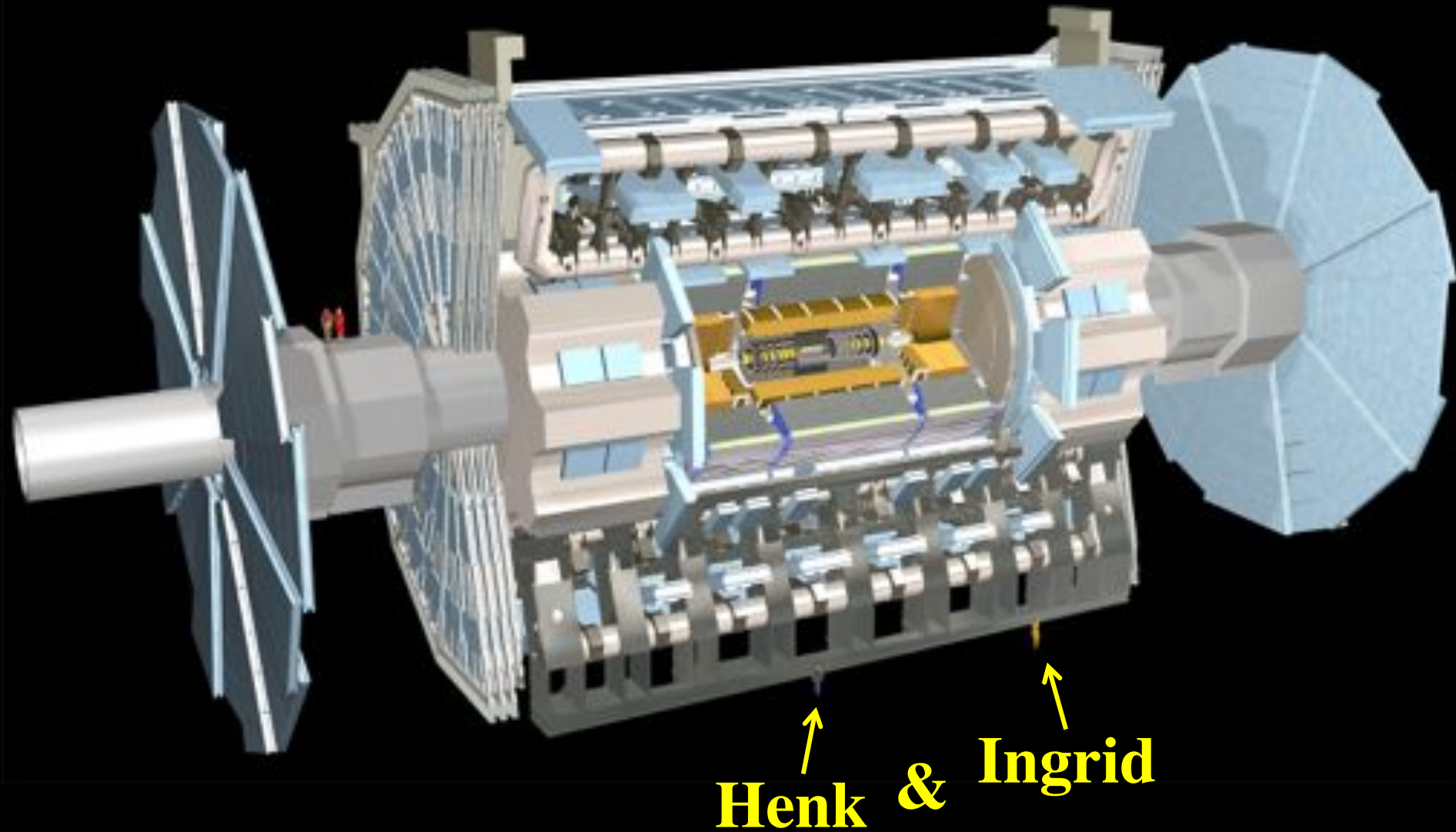
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X X

X

ATLAS detector @ CERN Geneve



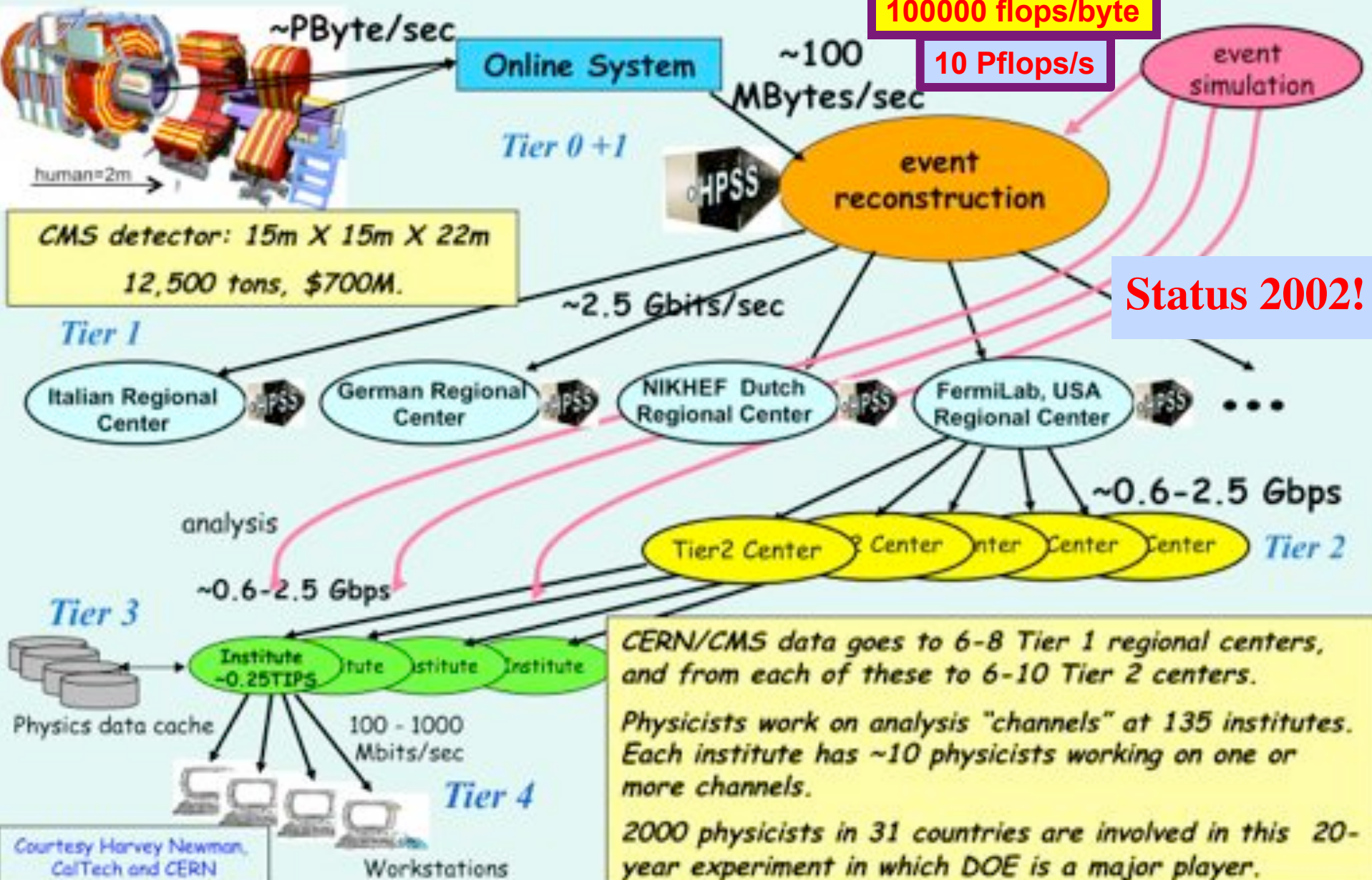
ATLAS detector @ CERN Geneve





LHC Data Grid Hierarchy

CMS as example, Atlas is similar



Courtesy Harvey Newman, CalTech and CERN



GLF Map (2011: Global Links Integrated Profile) - Visualization by Robert Farnham, NOAA, University of Illinois at Urbana-Champaign Data Collection by Marco B. Rosen, University of Illinois at Chicago - Future Network by Jeff Dreyfus, MIT - Earth Future, earthfuture.us.gov www.glf.it

We investigate:  for complex networks!



Where when will it happen?



Ijkdijk/Urban Flood

Medical

LifeWatch

CosmoGrid/eVLBI

CineGrid

EU-GN3/NOVI/Geysers

SURFnet/GLIF/Cloud

Green-IT

Privacy/Trust

Authorization/policy

Programmable networks

40-100Gig/TCP/WF/QoS

Topology/Architecture

Optical Photonic

X X

X

X

X X

X X

X

X

X

X X

X

X

X X X

X X

X



IJKDIJK

Sensors: 15000km* 800 bps/m ->12 Gbit/s to cover all Dutch dikes

Sensor grid: instrument the dikes

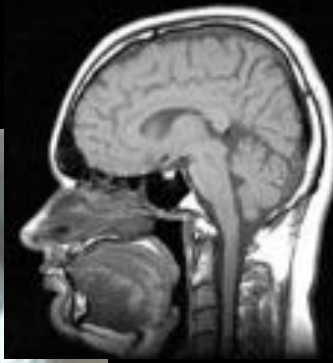
First controlled breach occurred on sept 27th '08:



Many Pflops/s

Many small flows -> 12 Gb/s

SNE @ UvA



Ijkdijk/Urban Flood

Medical

LifeWatch

CosmoGrid/eVLBI

CineGrid

EU-GN3/NOVI/Geysers

SURFnet/GLIF/Cloud

Green-IT

Privacy/Trust

Authorization/policy

Programmable networks

40-100Gig/TCP/WF/QoS

Topology/Architecture

Optical Photonic

X

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X X

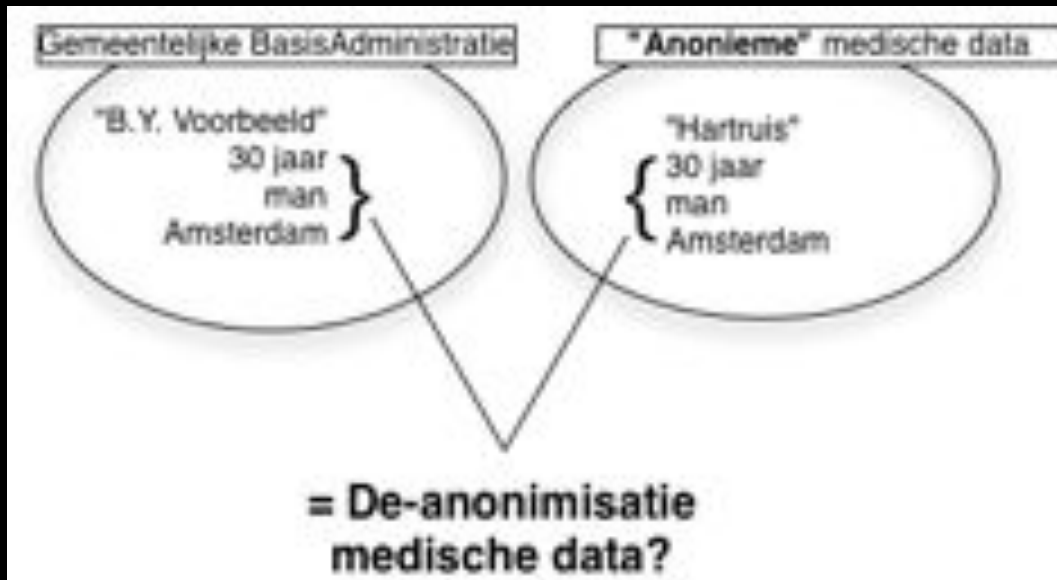
X X

X X X X

X X X X

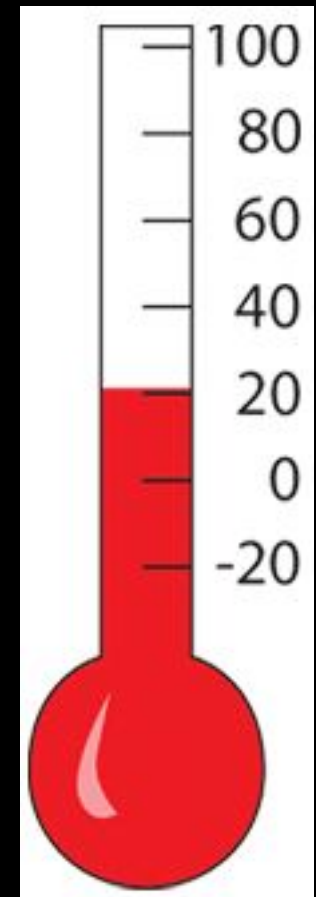
X X X

Anonimiteit of her-identificeerbaarheid



1. Empirische analyse van GBA
2. Kansrekening, bijv. kans op niet-uniciteit:

$$1 - \left(\frac{n-1}{n}\right)^{k-1}$$



Privacy
thermometer!

Education- Master SNE

- Open Source aanpak

☺ He takes
Notice of us!



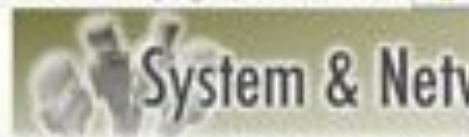
- Based on open and non-discriminatory standards
- Privacy and Security
- Digital security & forensics
- Advanced Internet infrastructure
- Master closely related to the research group!

DNSSEC

Secured by DNSSEC

Domain name:
www.os3.nl
is secured by DNSSEC.

Your computer is also secured by DNSSEC for this particular domain, so you are secured against domain name spoofing.



Trace: » Contents and links » InterNetwork

Master Education

SNE is the University of Amsterdam master education in System and Network Engineering.

We focus on **Open Standards**, **Open Software** and **Open Security**, hence the name **OS3**.

Information

General information and testimonials are available at the

- [Introductory page](#)

More in depth facts can be found on our

- [Master SNE page](#)

Contact

If you want to make a personal appointment to visit our education or to attend a lecture, please contact us via [info](mailto:info@os3.nl) at [os3 dot nl](mailto:os3@os3.nl).

You can visit our [facilities](#) at the Science Faculty of the University of Amsterdam located at the Science Park Amsterdam.

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Links

SNE-Master

• RP's

- 2005-21 Beveiliging banktransacties.
- 2005-30 SURFnet Intrusion Detection System (IDS).
- 2006-22 Beveiliging grote overheids organisatie: CERT procedures.
- 2006-24 Beveiliging grote overheids organisatie: Vertrouwd Toegangspad.
- 2007-23 CERT noodnet.
- 2007-32 Veiligheid van update mechanismen.
- 2007-41 Onderzoek naar de beveiliging van de wegwerp OV ritten kaart.
- 2008-18 Security and Reliability of Automated Waste Registration in The Netherlands.
- 2008-22 Detection of peer-to-peer botnets.
- 2008-33 Slimme meters.
- 2008-41 Security en privacy in het Landelijk Schakelpunt.
- 2009-02 Online Banking: Attacks & Defences.
- 2009-07 Browser Security.
- 2009-41 The DFRWS 2009 Challenge.
- 2010-07 Modern Age Burglars.
- 2010-15 Horse-ID.
- 2010-34 GPU-based password cracking.
- 2011-43 Passive LAN information gathering.
- 2011-08 PersLink Security.

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Turn Green Tech into Greenbacks

IT Certifications for Jobs That Make a Difference



Uptime Institute Accredited Tier Designer

The Uptime Institute has long been a proponent for green data center design and implementation. Its certification course on data center design embeds green principles into the curriculum.



SUSTAINABILITY
Your Career



facebook



Linked in

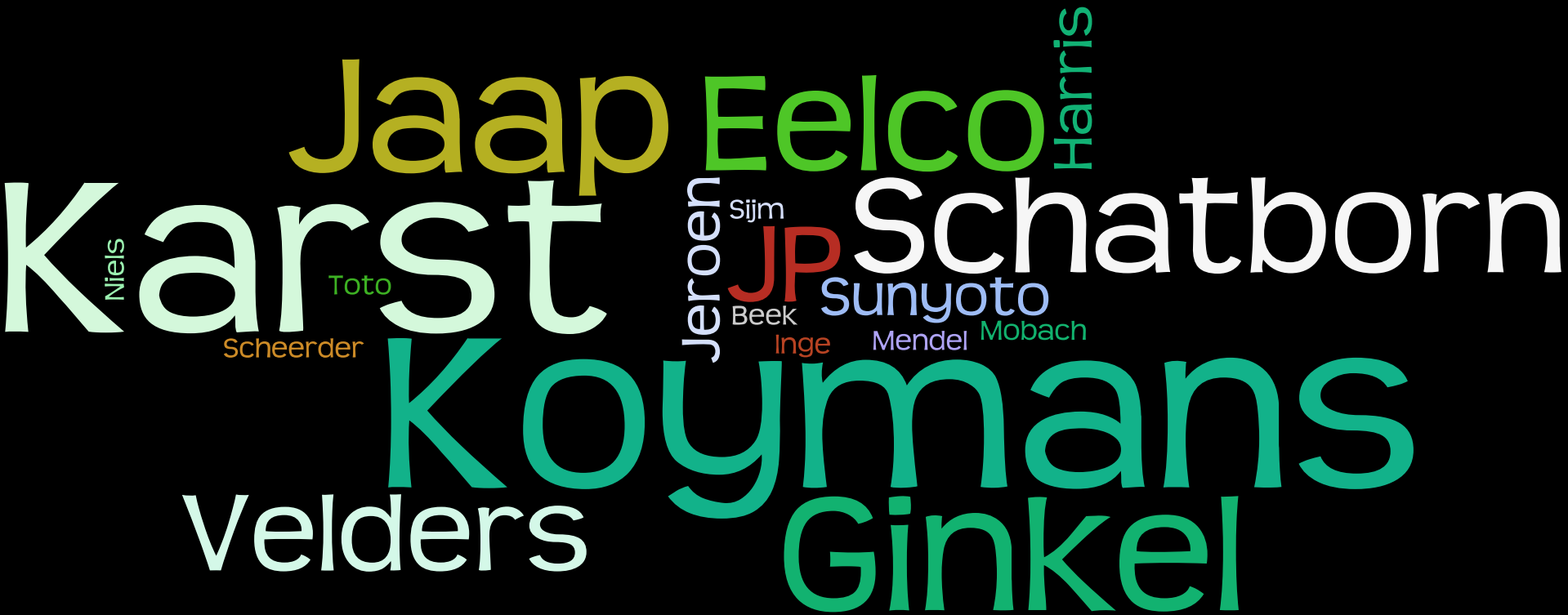
twitter

security



Master OS3!

(master sinds 2003 @ UvA)



A word cloud of names on a black background. The names are arranged in various sizes and orientations. The largest names are 'Karst', 'Koymans', and 'Schatborn'. Other prominent names include 'Jaap', 'Eelco', 'Ginkel', and 'Velders'. Smaller names include 'Niels', 'Toto', 'Scheerder', 'Jeroen', 'Sijm', 'JP', 'Beek', 'Inge', 'Mendel', 'Mobach', 'Sunyoto', and 'Harris'.

Niels
Jaap
Eelco
Harris
Karst
Toto
Scheerder
Jeroen
Sijm
JP
Beek
Inge
Mendel
Mobach
Sunyoto
Schatborn
Koymans
Velders
Ginkel



EU

SARA

SURF-ESRC

Pieken-in-de-Delta

SURFnet

FES

UVA

NWO

NWO-RCF