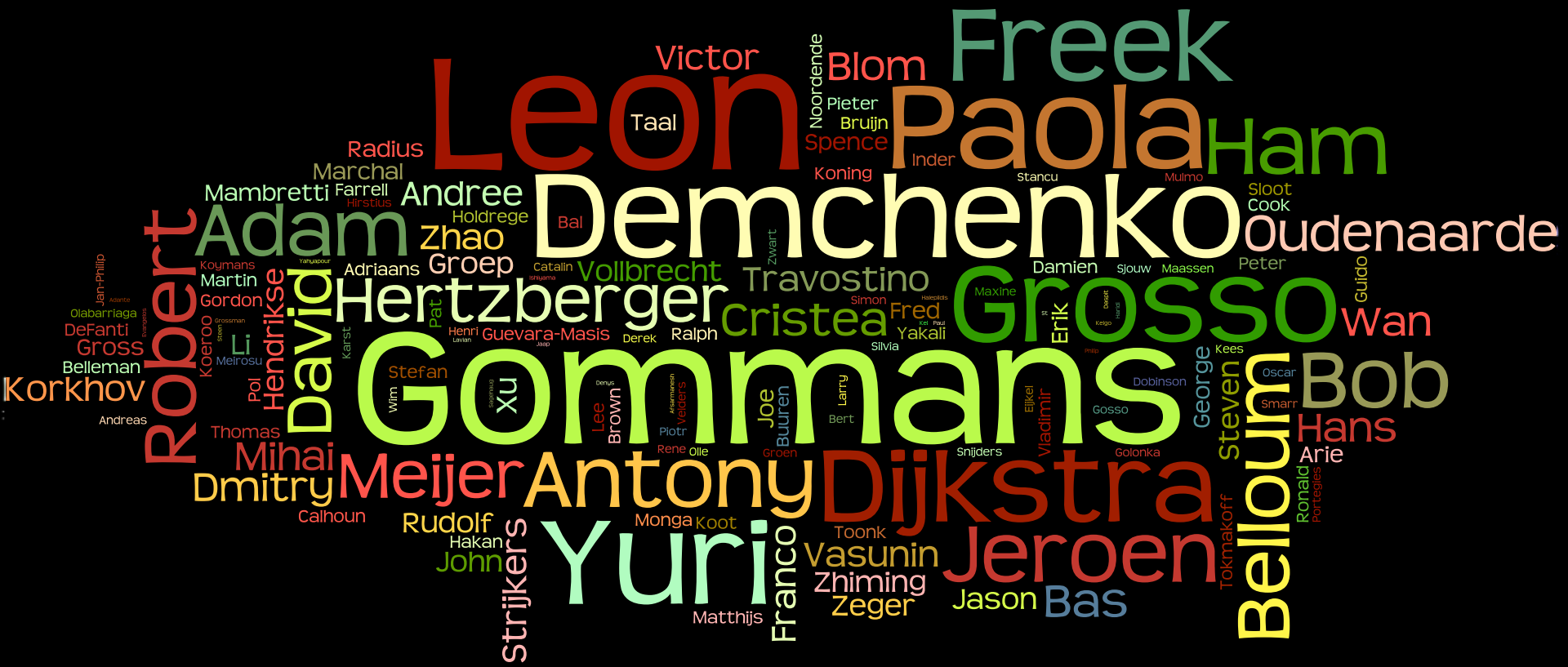
tem and Network Engineering Research @ U

Cees de Laat



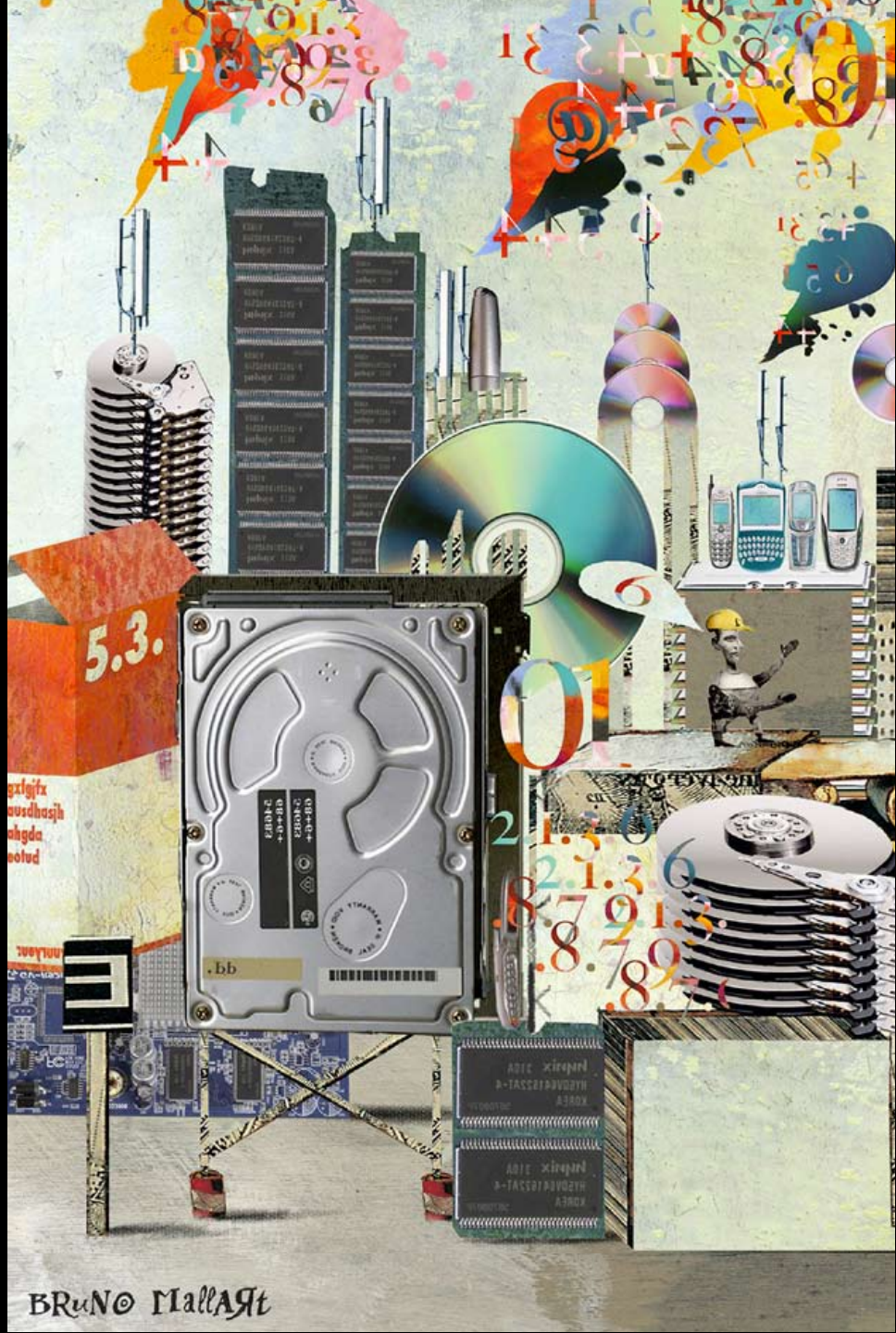
From

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!"

http://www.knaw.nl/Content/Internet_KNAW/publicaties/pdf/20111029.pdf

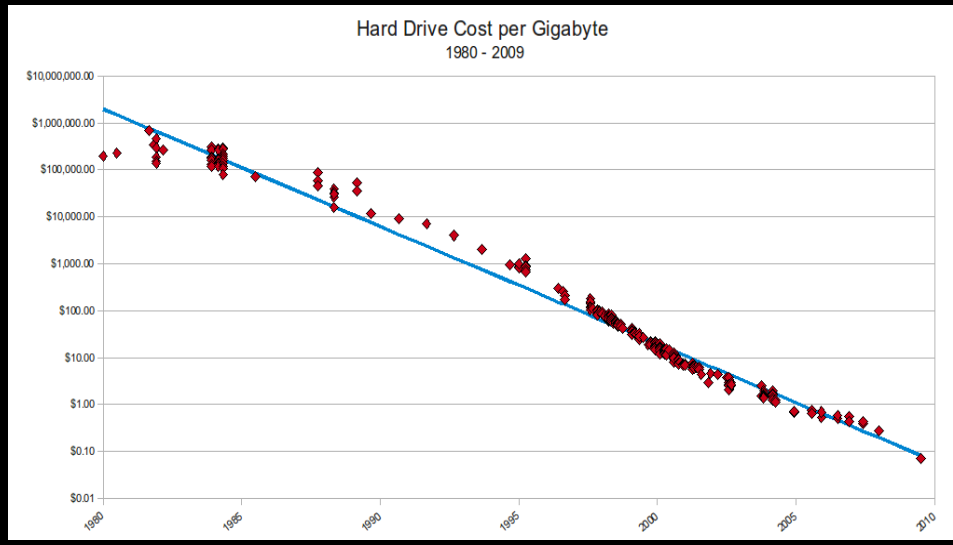


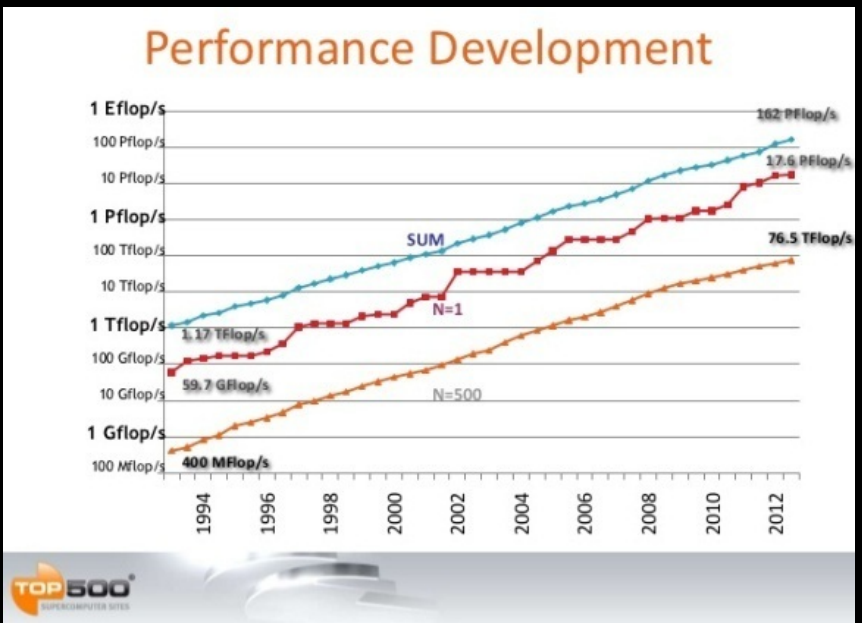
Reliable and Safe!

This omnipresence of IT makes us not only strong but also vulnerable.

- A virus, a hacker, or a system failure can instantly send digital shockwaves around the world.

The hardware and software that allow all our systems to operate is becoming bigger and more complex all the time, and the capacity of networks and data storage is increasing by leaps and bounds.





We will soon reach the limits of what is currently feasible and controllable.

http://www.knaw.nl/Content/Internet_KNAW/publicaties/pdf/20111029.pdf

Mission

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

Mission

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

- *Capacity*
- *Capability*
- *Security*
- *Sustainability*
- *Resilience*

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*
  - *Authorization, Anonymity, integrity of data in distributed data processing*
- *Sustainability*
  - *Greening infrastructure, awareness*
- *Resilience*
  - *Systems under attack, failures, disasters*

Reduction of Complexity by Integration

By combining services such as telephony, television, data, and computing capacity within a single network, we can cut down on complexity, energy consumption and maintenance.

- How can we describe and analyze complex information systems effectively?
- How can we specify and measure the quality and reliability of a system?
- How can we combine various different systems?
- How can we design systems in which separate processors can co-operate efficiently via mutual network connections within a much larger whole?
- Can we design information systems that can diagnose their own malfunctions and perhaps even repair them?
- How can we specify, predict, and measure system performance as effectively as possible?

SNE addresses a.o. the **highlighted** questions!

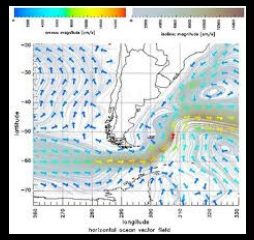
http://www.knaw.nl/Content/Internet_KNAW/publicaties/pdf/20111029.pdf

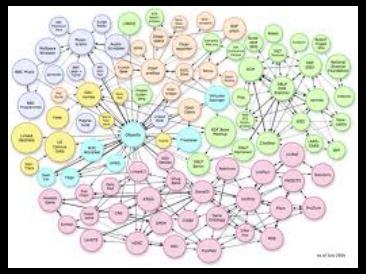
Internet developments

... more data!

... more realtime!

... more users!



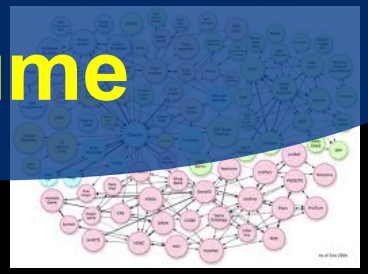


Internet developments

... more data!

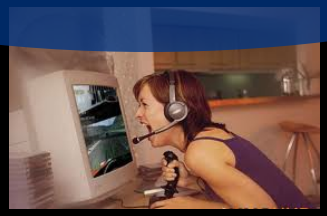
Speed

Volume



Deterministic

Real-time

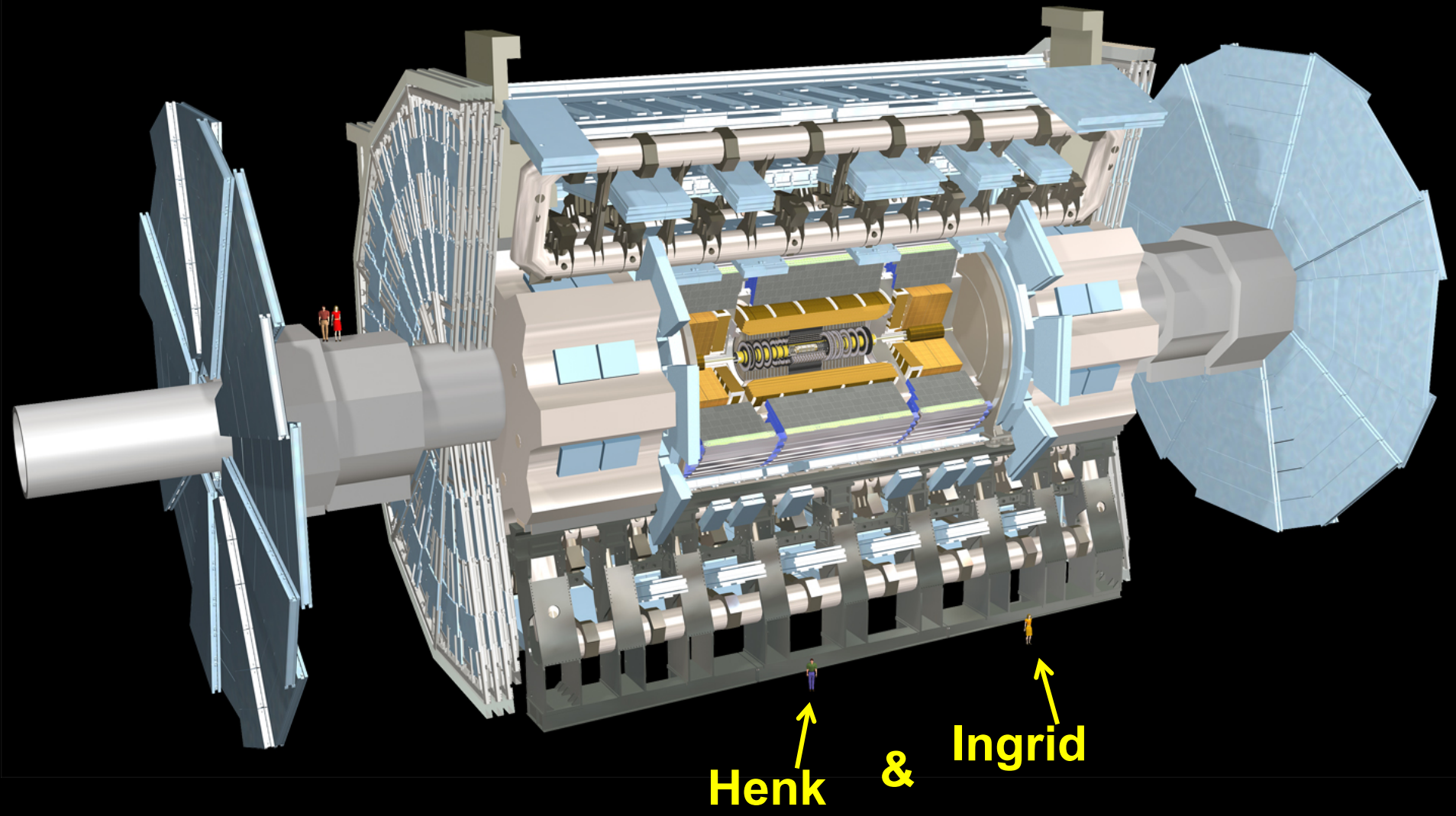


Scalable

Secure

... more users!

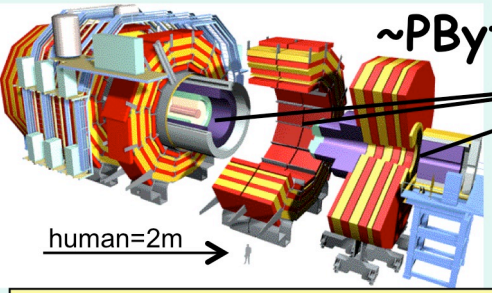
ATLAS detector @ CERN Geneve



ATLAS detector @ CERN Geneve

LHC Data Grid Hierarchy

CMS as example, Atlas is similar



~PByte/sec

Online System

~100 MBytes/sec

100000 flops/byte

10 Pflops/s

event simulation

Tier 0 +1

HPSS

event reconstruction

CMS detector: 15m X 15m X 22m

12,500 tons, $700M.

~2.5 Gbits/sec

Tier 1

Italian Regional Center

German Regional Center

NIKHEF Dutch Regional Center

FermiLab, USA Regional Center

...

~0.6-2.5 Gbps

analysis

Tier2 Center

Tier 2

~0.6-2.5 Gbps

Tier 3

Institute ~0.25TIPS

Physics data cache

100 - 1000 Mbits/sec

Tier 4

Workstations

Courtesy Harvey Newman, CalTech and CERN

CERN/CMS data goes to 6-8 Tier 1 regional centers, and from each of these to 6-10 Tier 2 centers.

Physicists work on analysis "channels" at 135 institutes. Each institute has ~10 physicists working on one or more channels.

2000 physicists in 31 countries are involved in this 20-year experiment in which DOE is a major player.

What Happens in an **Internet Minute?**

And **Future Growth** is **Staggering**

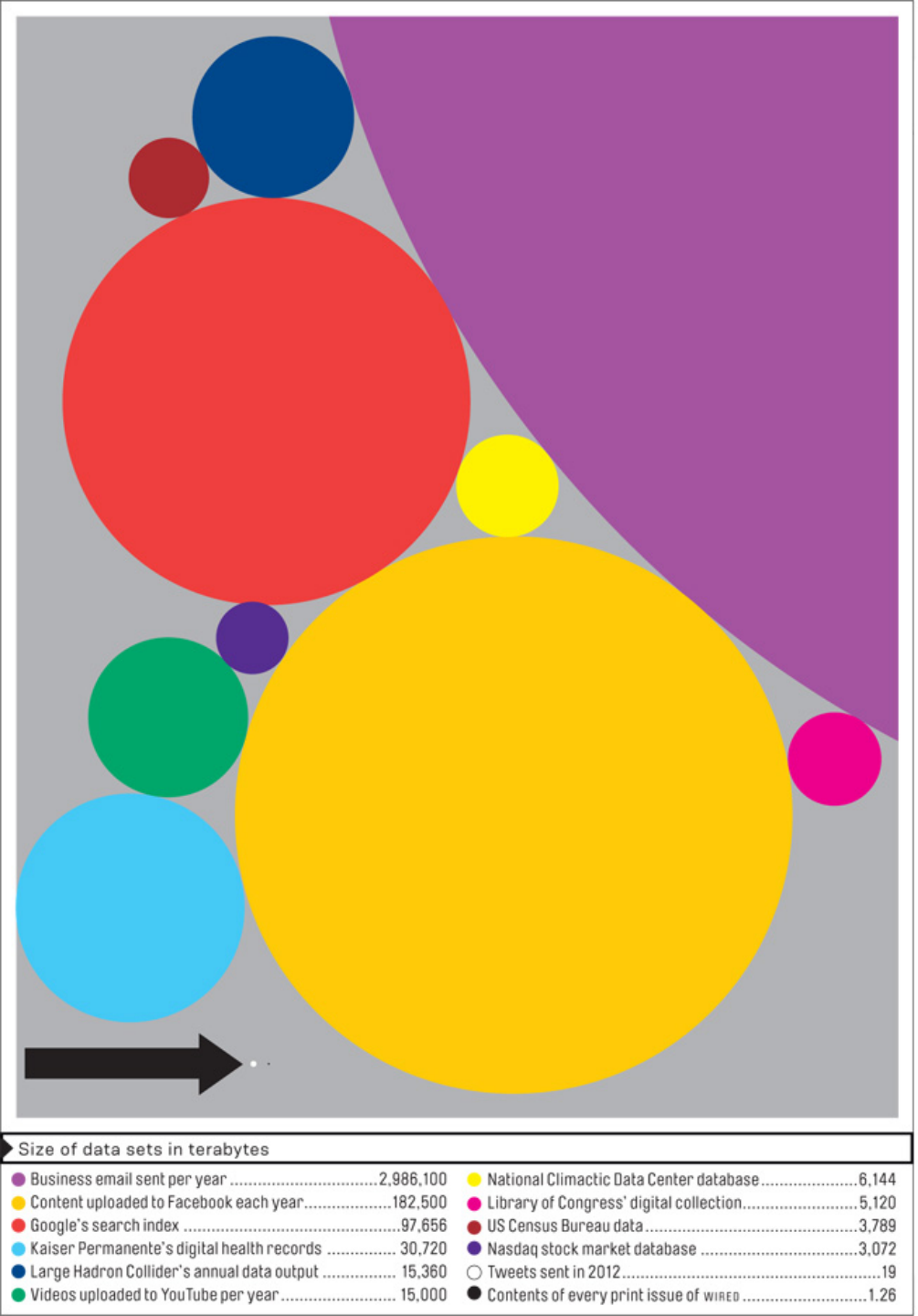
Today, the number of networked devices = the global population

By **2015**, the number of networked devices = 2x the global population

In **2015**, it would take you **5 years**

to view all video crossing IP networks each **second**

intel

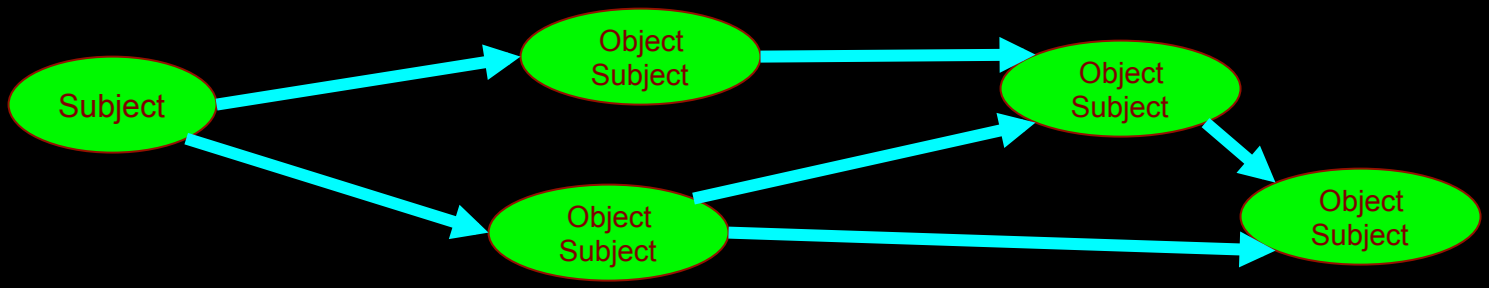


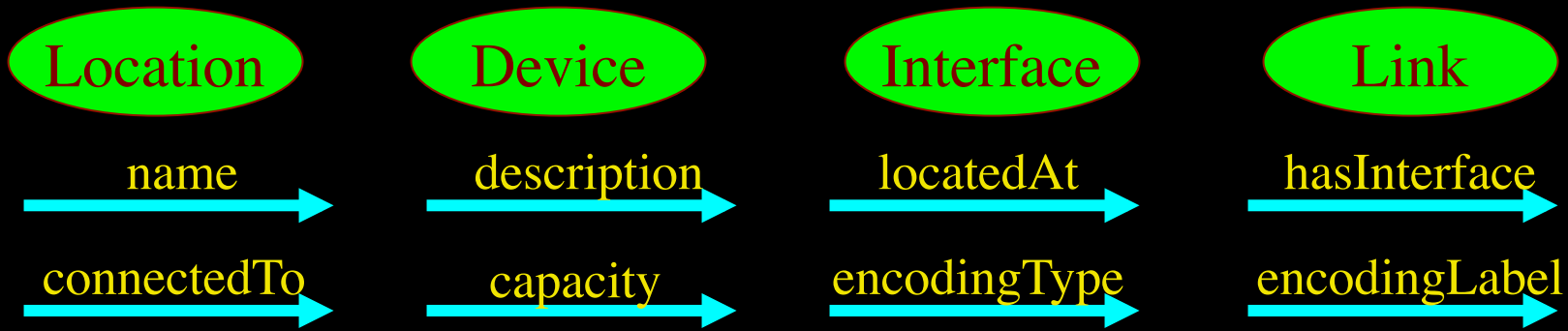
There is always a bigger fish

We investigate: for complex networks!

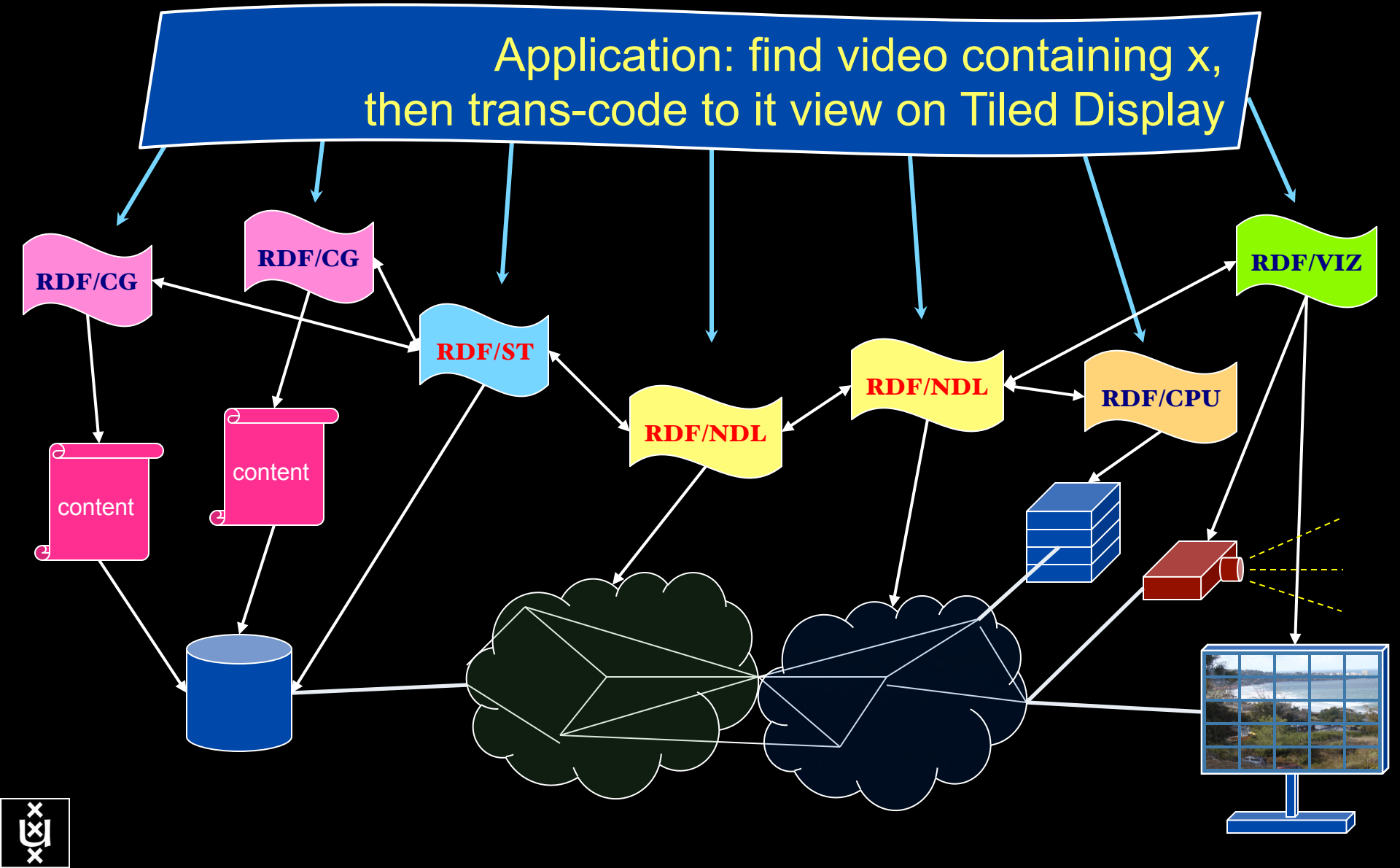
LinkedIN for Infrastructure

- From semantic Web / Resource Description Framework.
- The RDF uses XML as an interchange syntax.
- Data is described by triplets (Friend of a Friend):





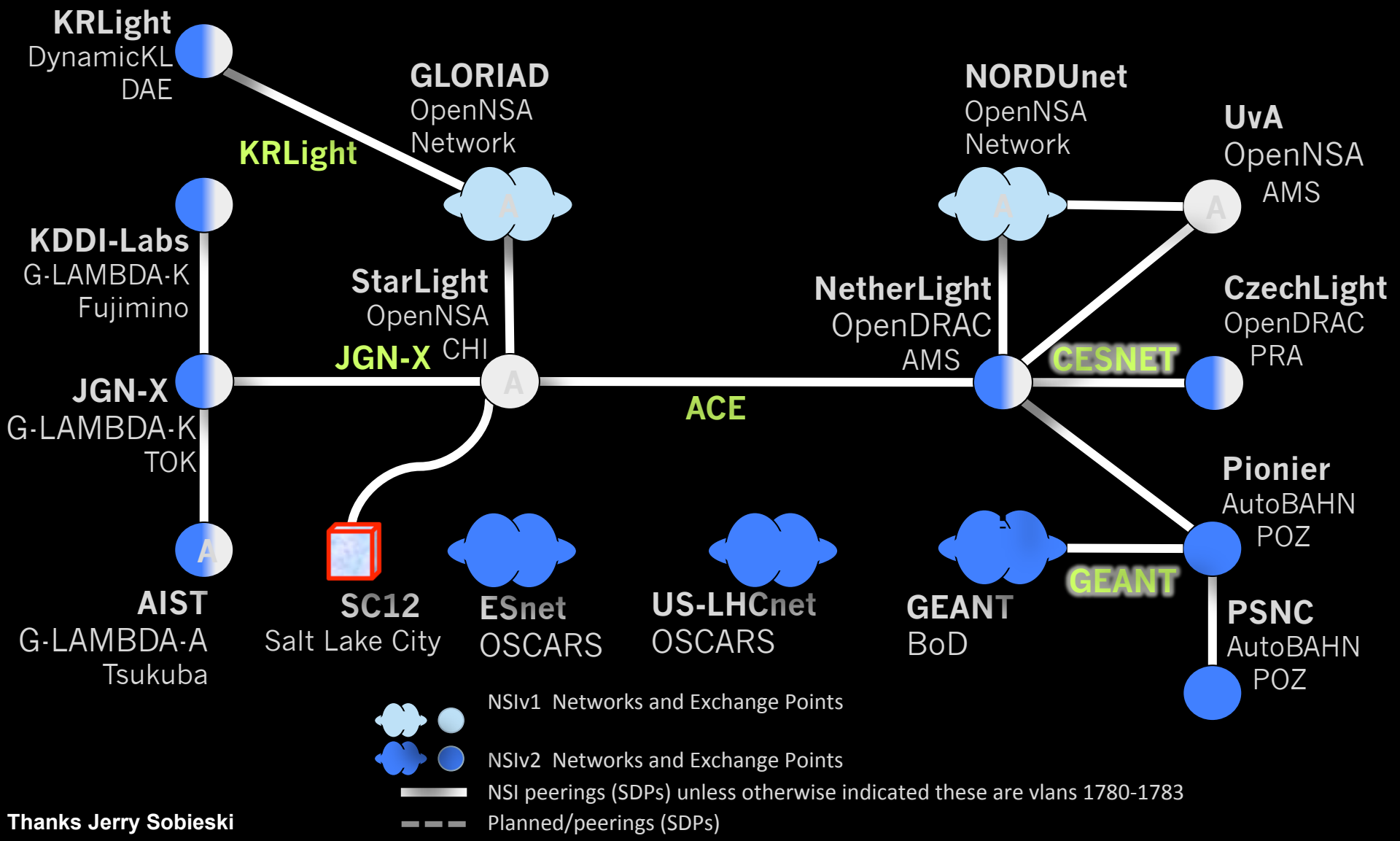
RDF describing Infrastructure "I want"



Automated GOLE + NSI

Joint NSI v1+v2 Beta Test Fabric Nov 2012

Ethernet Transport Service

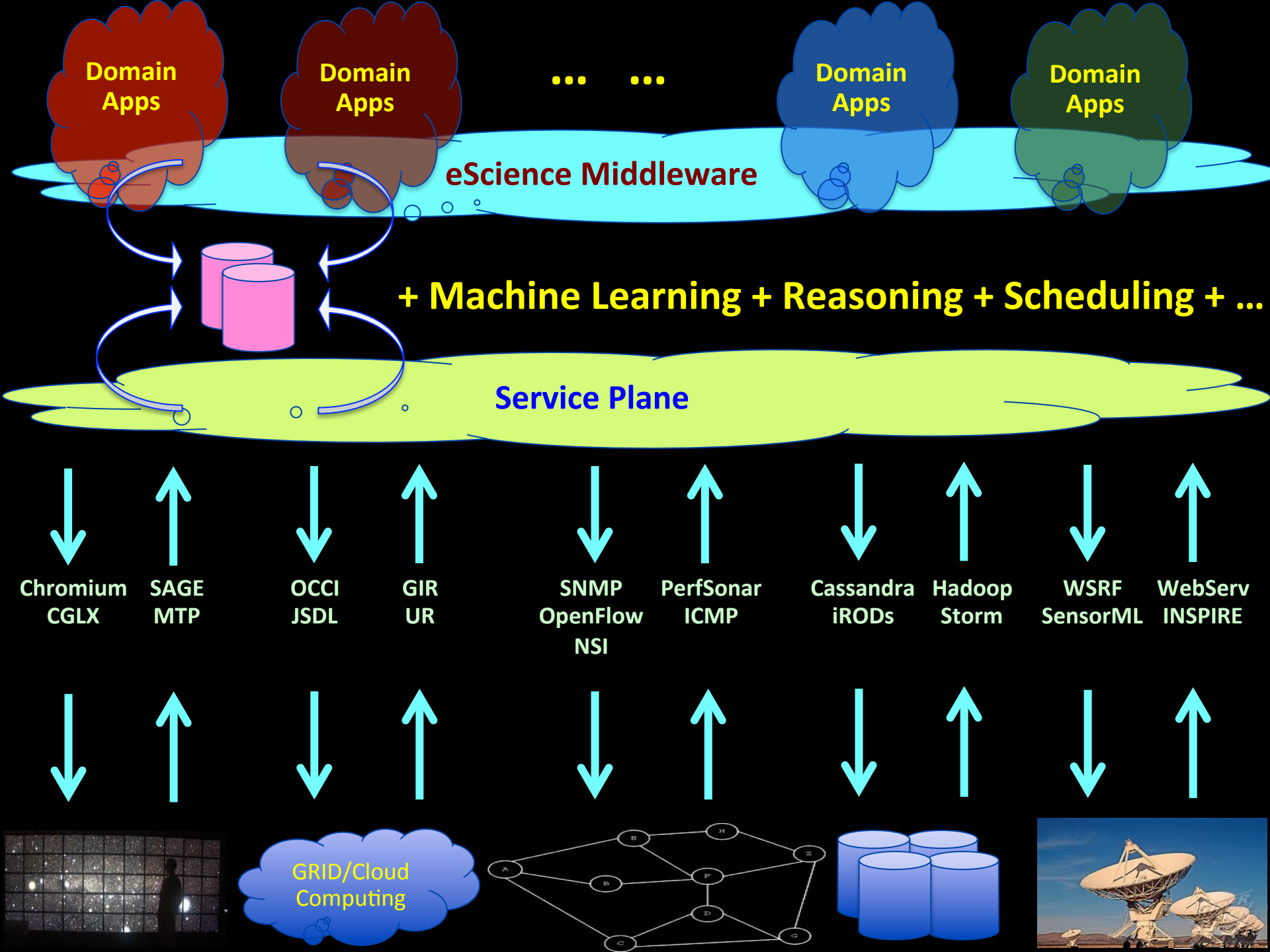


Thanks Jerry Sobieski

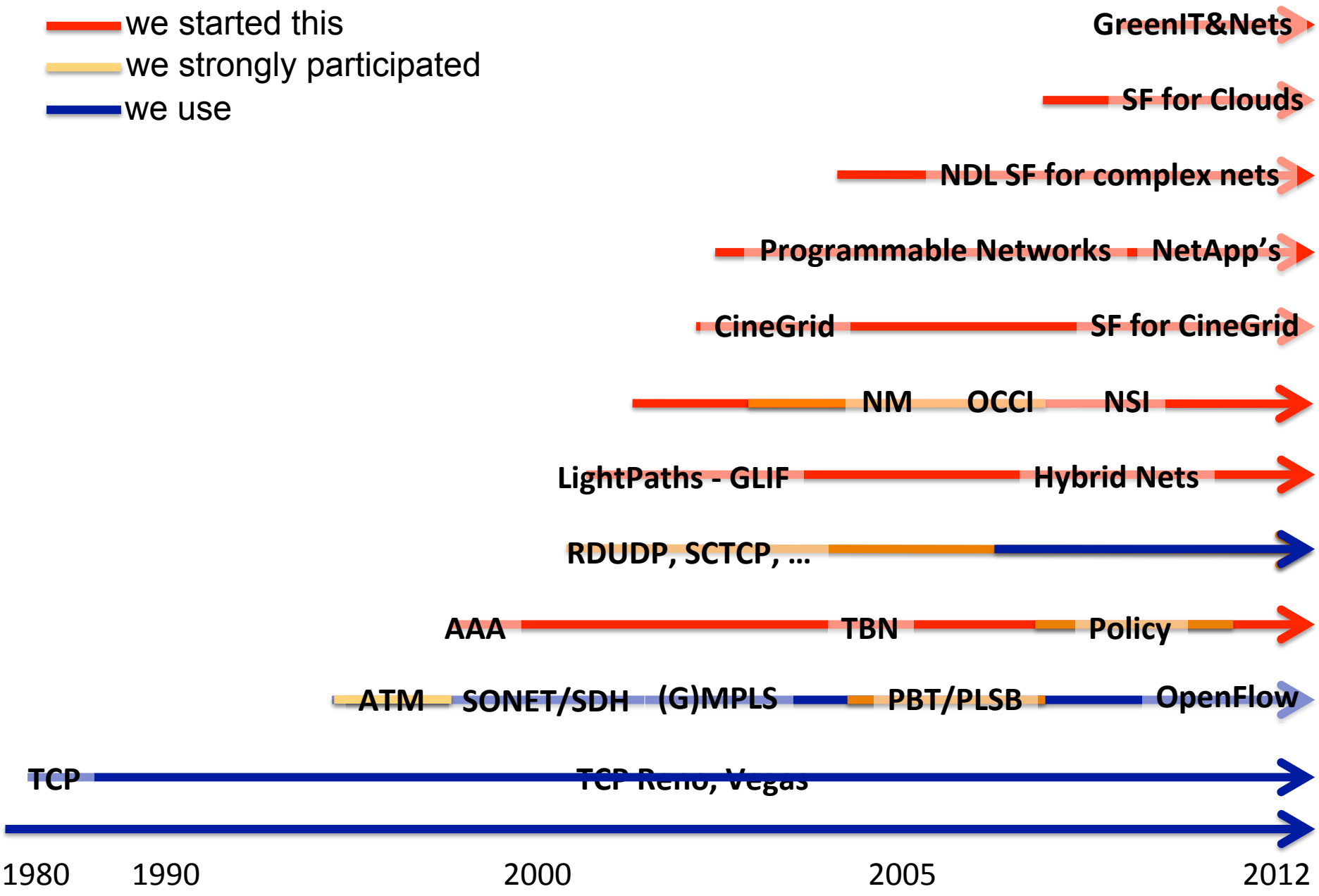
I want to

"Show Big Bug Bunny in 4K on my Tiled Display using green Infrastructure"

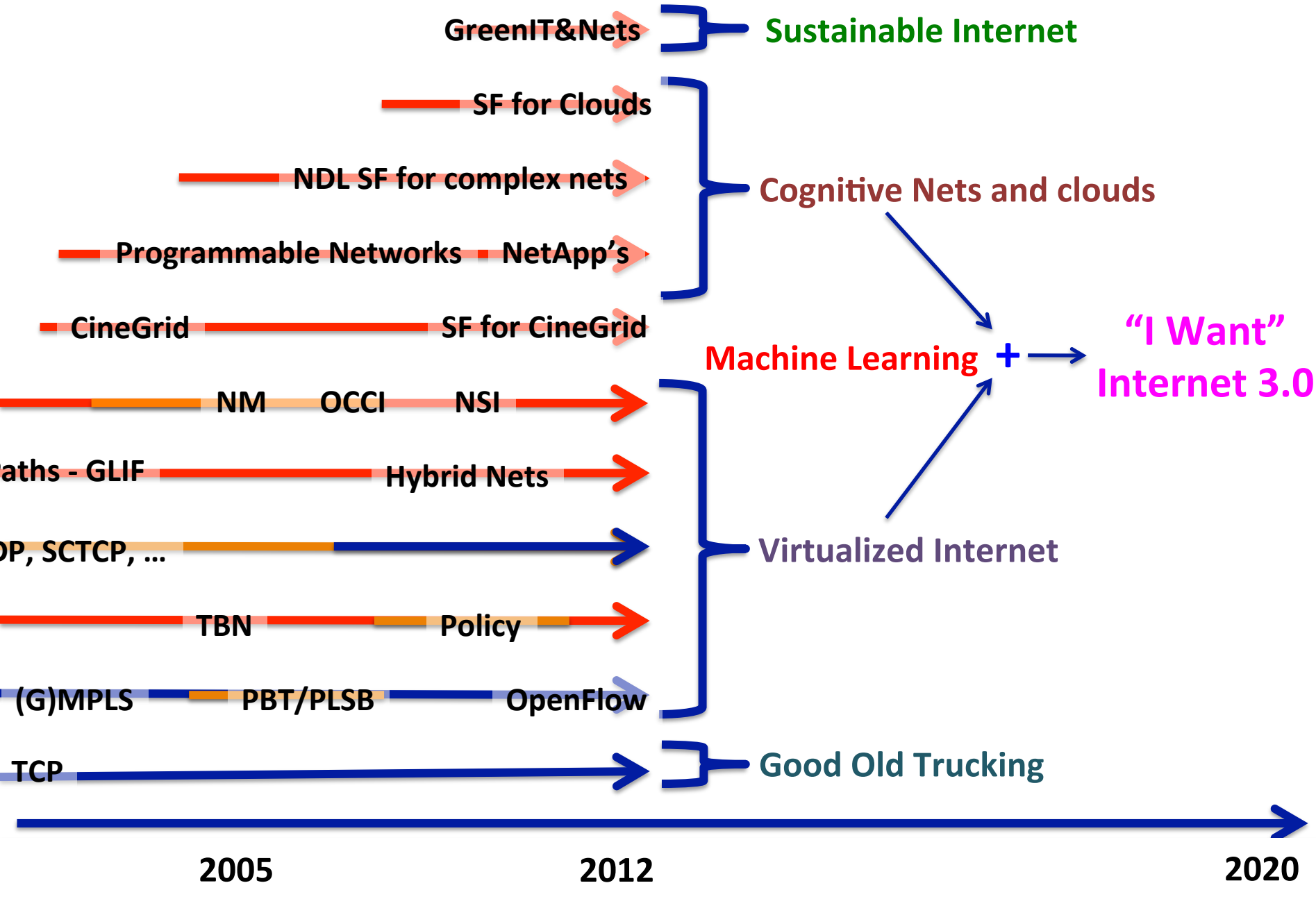
- Big Bugs Bunny can be on multiple servers on the Internet.
- Movie may need processing / recoding to get to 4K for Tiled Display.
- Needs deterministic Green infrastructure for Quality of Experience.
- Consumer / Scientist does not want to know the underlying details.
  ➔ His refrigerator also just works.


Domain Apps
Domain Apps
... ...
Domain Apps
Domain Apps
eScience Middleware
+ Machine Learning + Reasoning + Scheduling + …
Service Plane
Chromium CGLX
SAGE MTP
OCCI JSDL
GIR UR
SNMP OpenFlow NSI
PerfSonar ICMP
Cassandra iRODs
Hadoop Storm
WSRF SensorML
WebServ INSPIRE
GRID/Cloud Computing

TimeLine


we started this
we strongly participated
we use
GreenIT&Nets
SF for Clouds
NDL SF for complex nets
Programmable Networks
NetApp's
CineGrid
SF for CineGrid
NM
OCCI
NSI
LightPaths - GLIF
Hybrid Nets
RDUDP, SCTCP, …
AAA
TBN
Policy
ATM
SONET/SDH
(G)MPLS
PBT/PLSB
OpenFlow
TCP
TCP Reno, Vegas
1980
1990
2000
2005
2012

TimeLine


GreenIT&Nets
Sustainable Internet
SF for Clouds
NDL SF for complex nets
Programmable Networks
NetApp's
Cognitive Nets and clouds
CineGrid
SF for CineGrid
Machine Learning
+
"I Want"
Internet 3.0
NM
OCCI
NSI
aths - GLIF
Hybrid Nets
DP, SCTCP, ...
Virtualized Internet
TBN
Policy
(G)MPLS
PBT/PLSB
OpenFlow
TCP
Good Old Trucking
2005
2012
2020

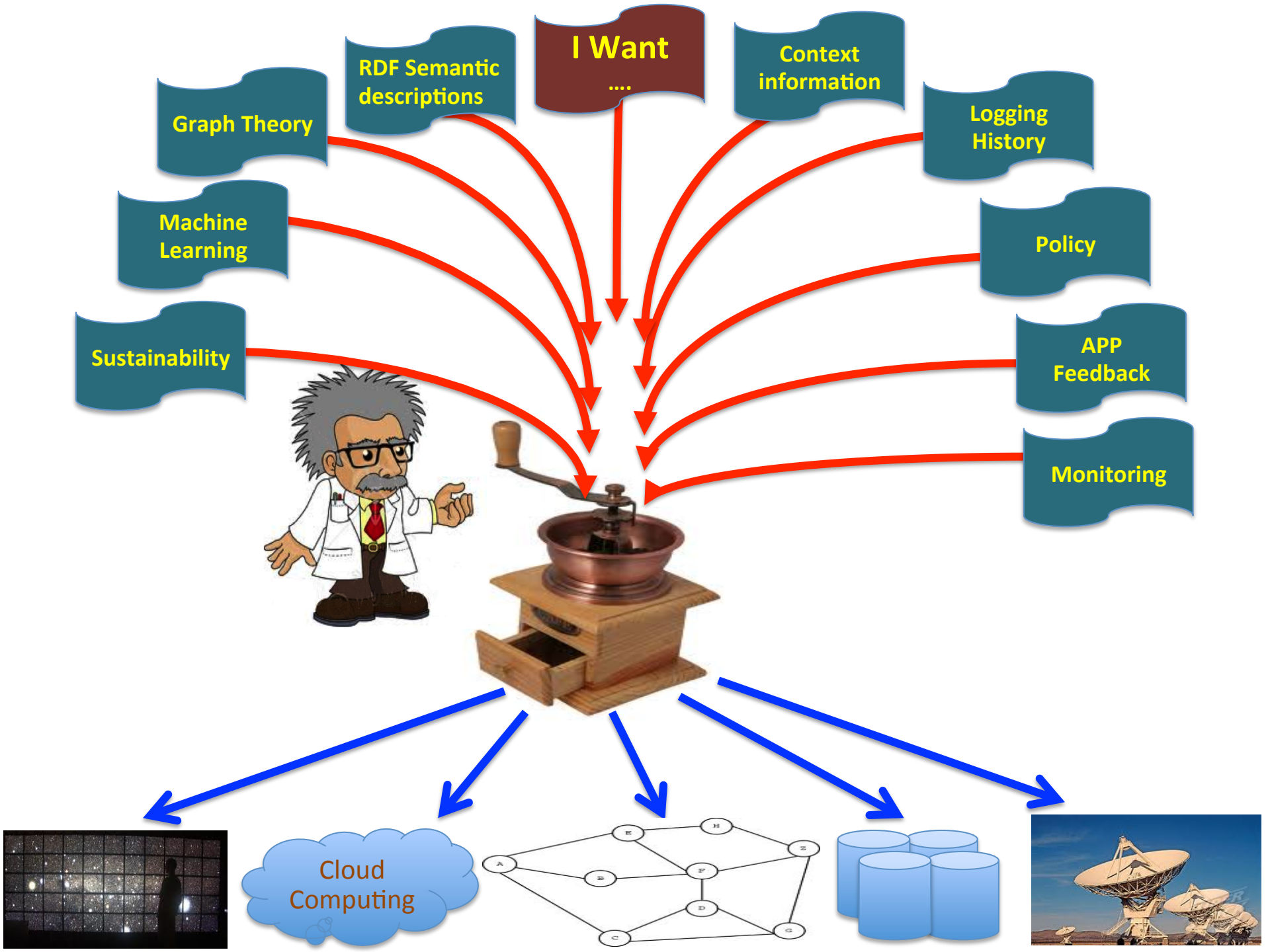
TimeLine

- Sustainable Internet
- Cognitive Nets and clouds
- Machine Learning + → "I Want" Internet 3.0
- Virtualized Internet
- Good Old Trucking

I retire

2020

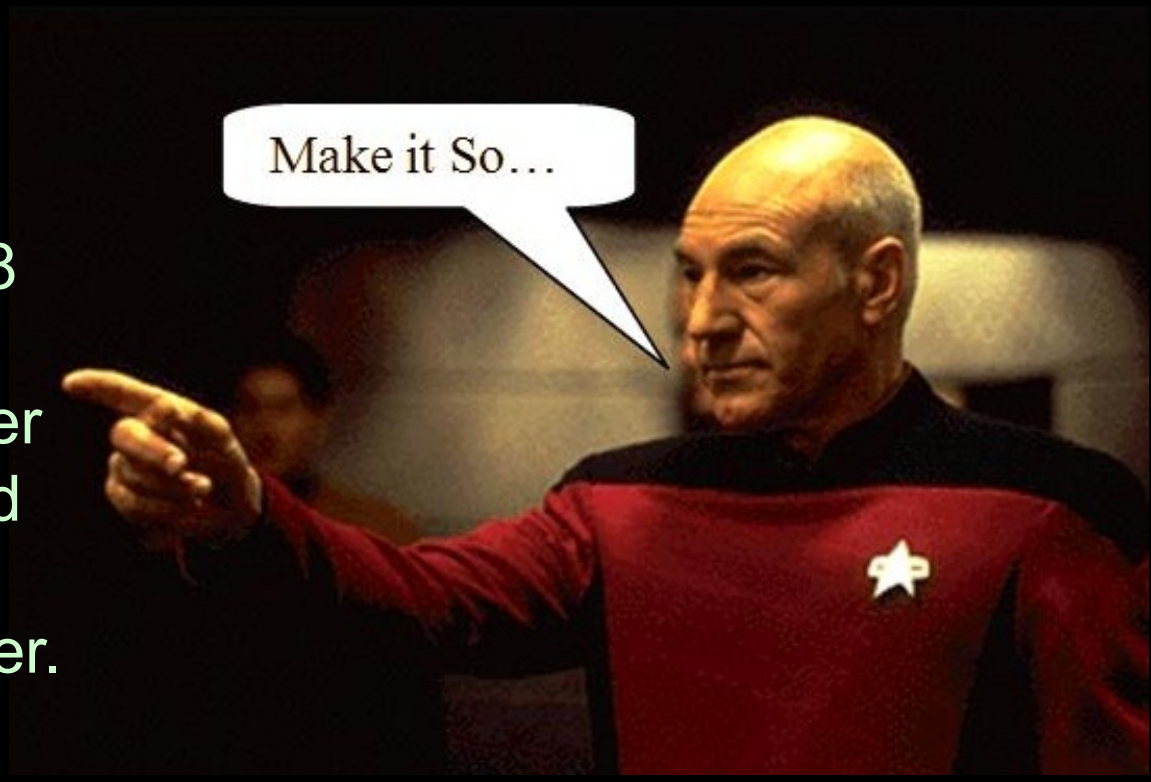
2040


I Want
....
Graph Theory
RDF Semantic descriptions
Context information
Logging History
Machine Learning
Policy
Sustainability
APP Feedback
Monitoring
Cloud Computing

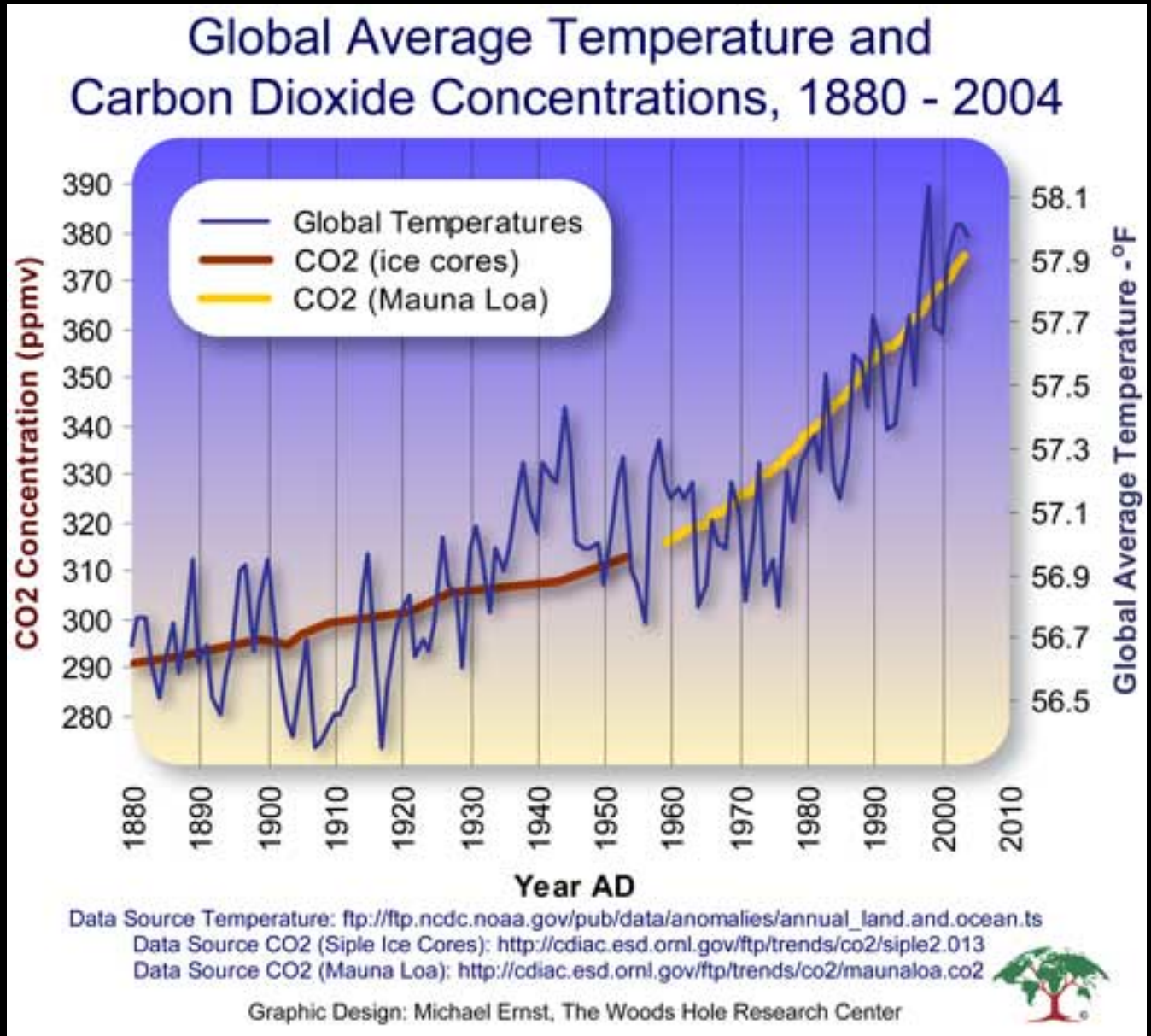
Conclusion

I want a MiS system!

Catchphrase first used in "Encounter At Farpoint" (28 September 1987) by Gene Roddenberry, and thereafter used in many episodes and films, instructing a crew member to execute an order.



Need for GreenIT



Greening the Processing System

ECO-Scheduling

Education- Master SNE

- Open Source aanpak

☺ He took 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!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File Edit View History Bookmarks Tools Help
os3.nl
https://www.os3.nl/
lxquick HTTPS
SNE/OS3 Homepage [OS3 Webs...
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.
System & Netw
Trace: » Contents and links » InterNetwork
Search
Master Education S
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
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You can visit our facilities at the Science Faculty of the University of Amsterdam located at the Science Park Amsterdam.
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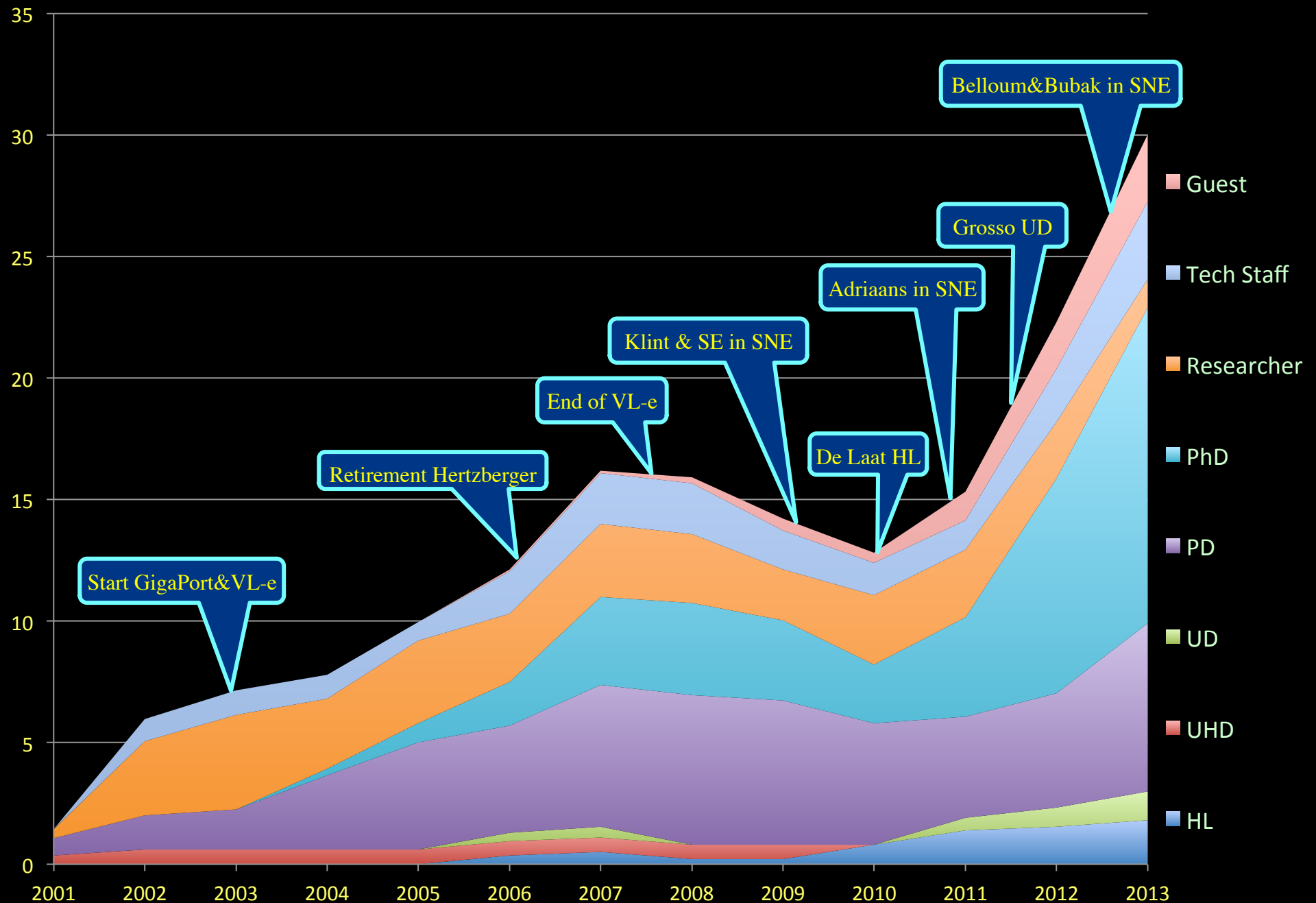
INR
CF
LIA
OT
ICP
VA
RP2
Colloquia
OS3 Masters Theses
Archive
Links

HR (fte's)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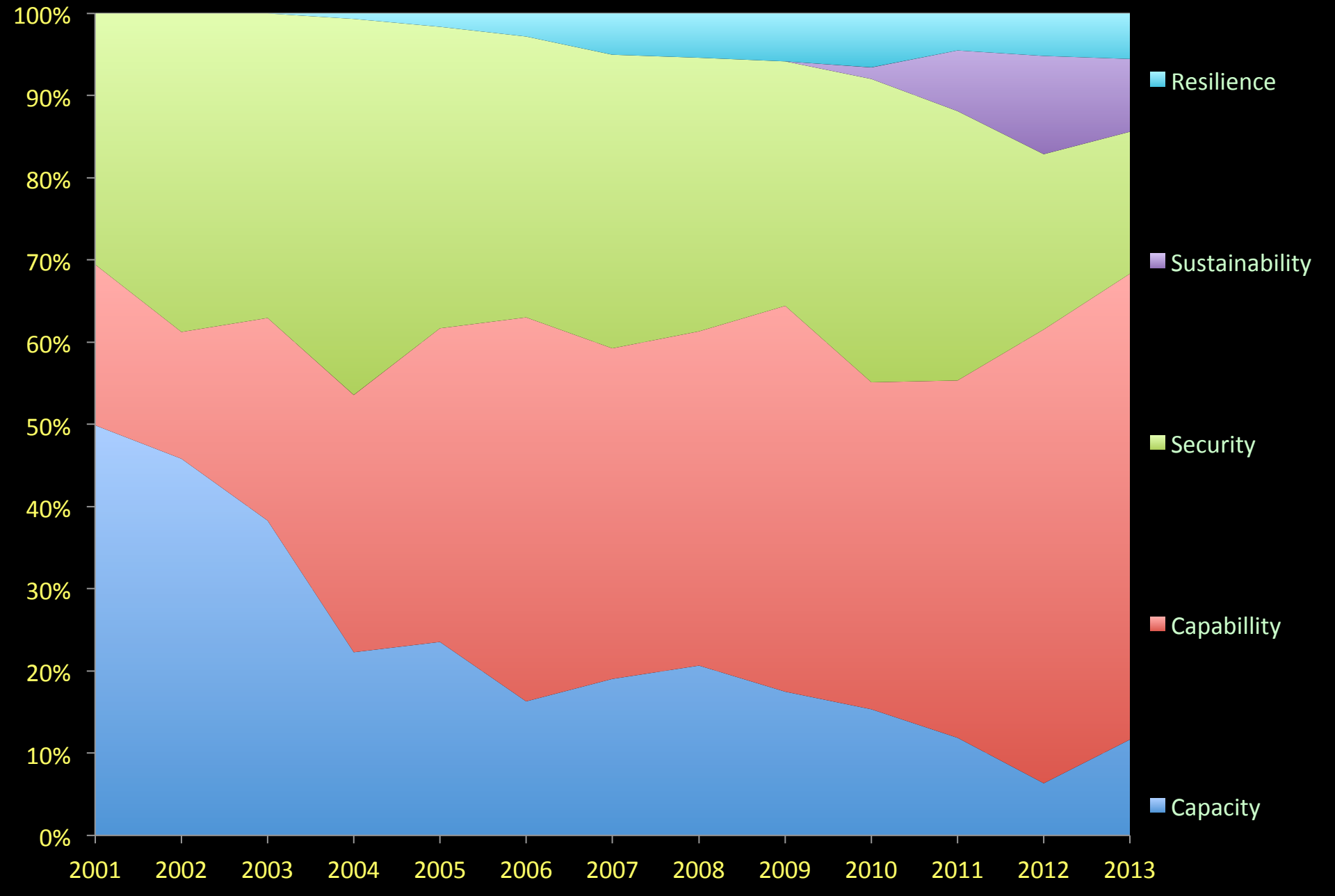
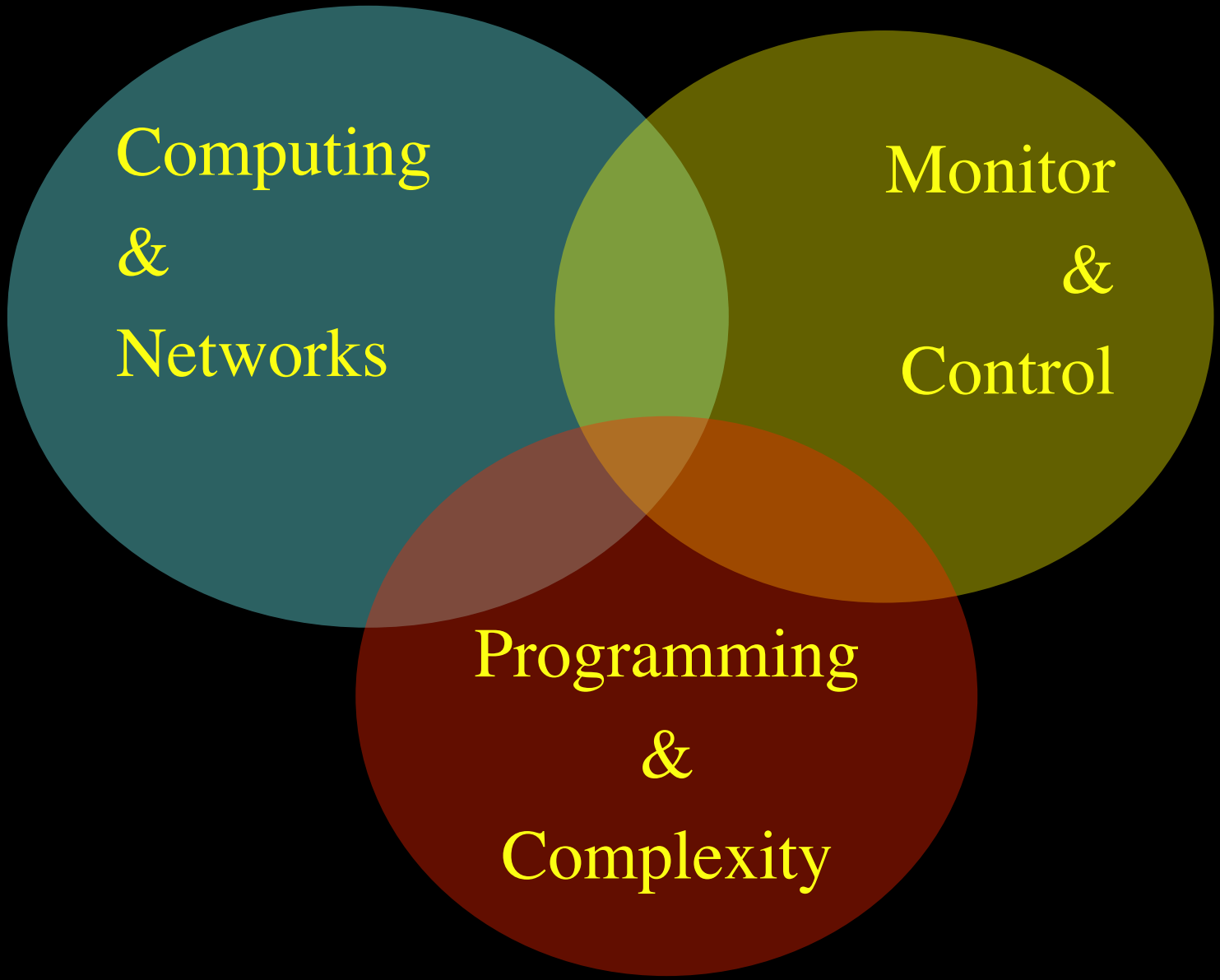
2013
Start GigaPort&VL-e
Retirement Hertzberger
End of VL-e
Klint & SE in SNE
De Laat HL
Adriaans in SNE
Grosso UD
Belloum&Bubak in SNE
Guest
Tech Staff
Researcher
PhD
PD
UD
UHD
HL

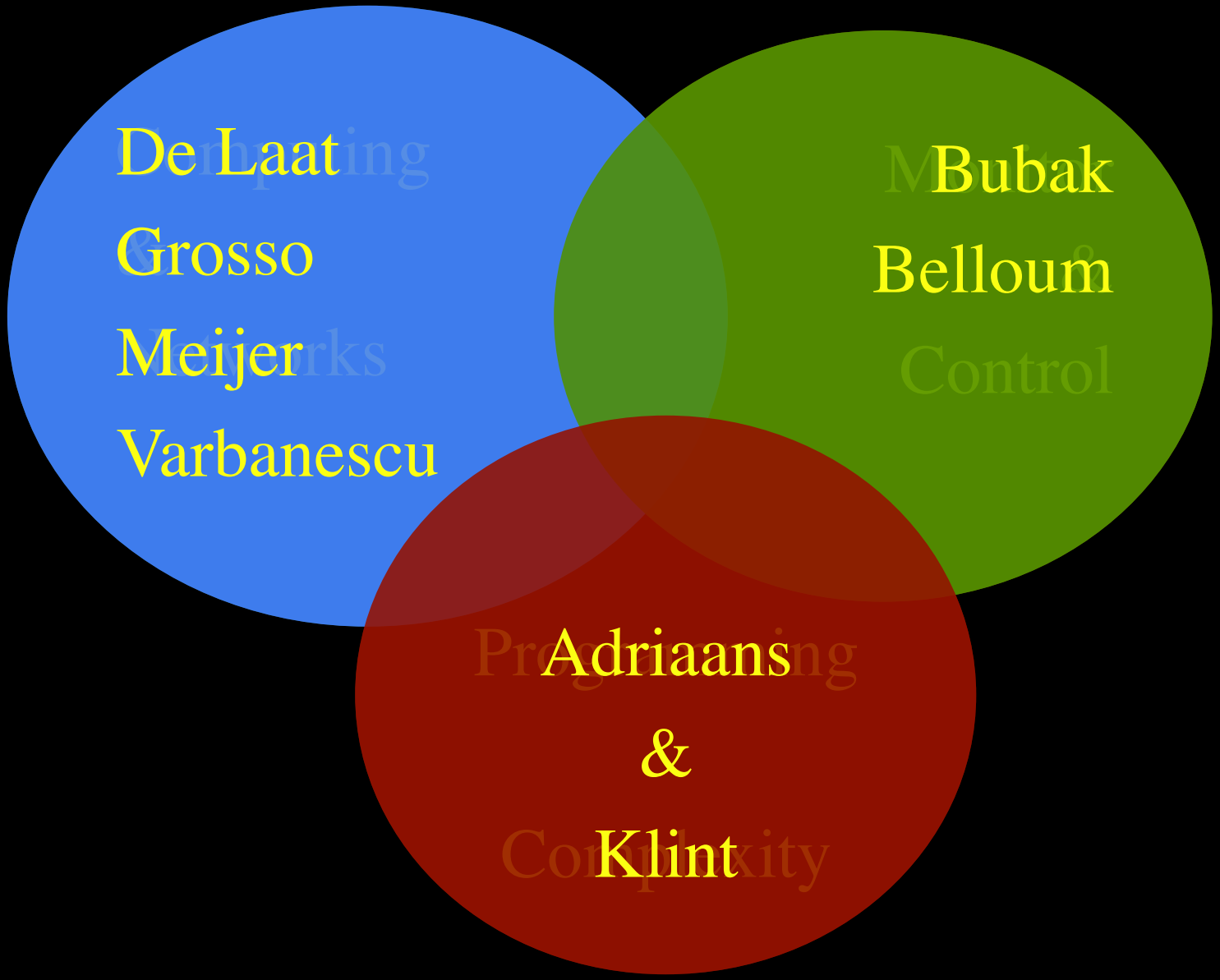
Strategic Research Focus Shift (fte's)



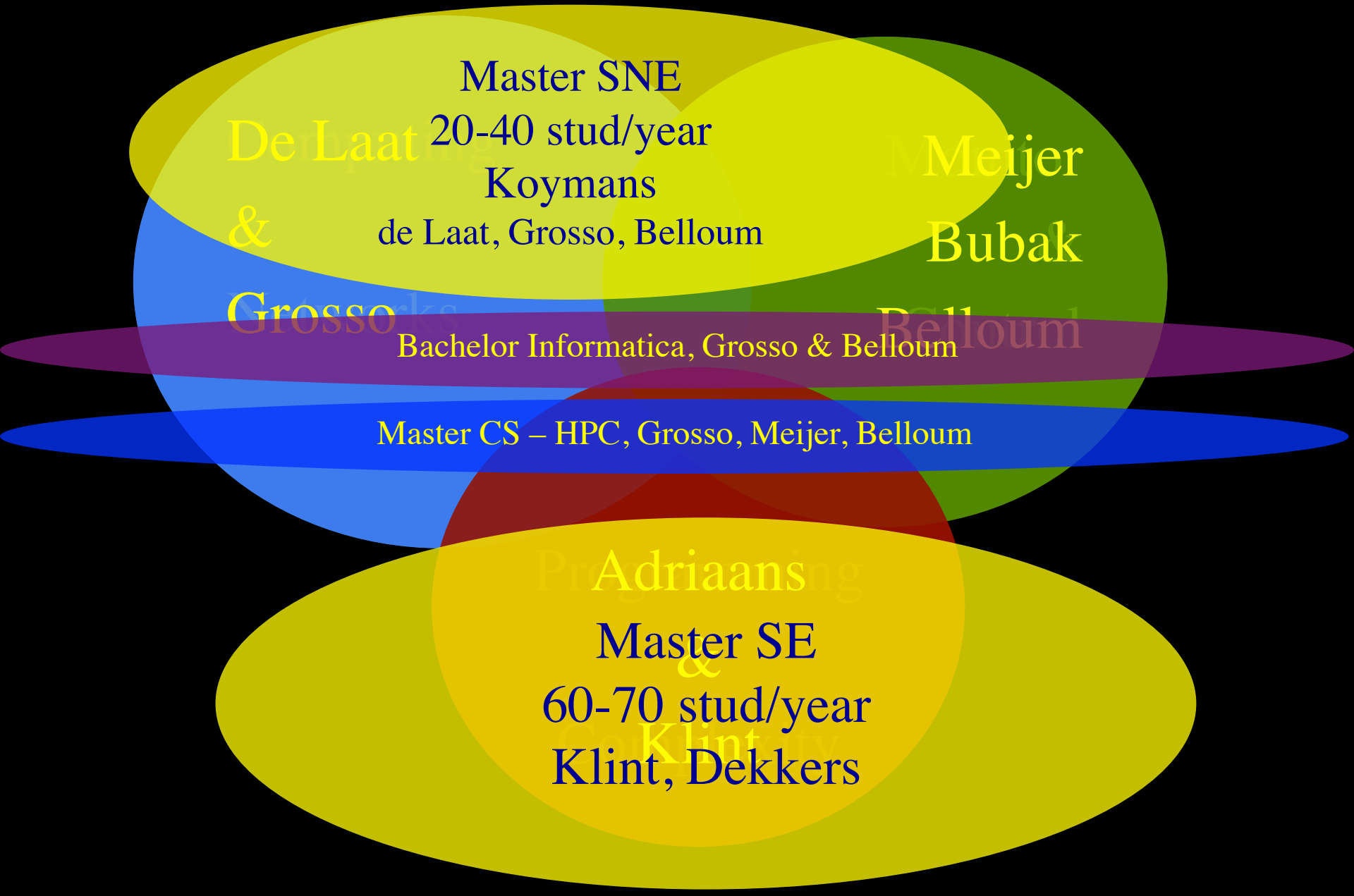
SNE Human Resources



SNE Human Resources



SNE Human Resources



Waves in the press

June 2007

Gezamenlijk persbericht Universiteit van Amsterdam en Trans Link Systems
Vrij reizen mogelijk door fout in software voor kaartlezers wegwerp OV-rittenkaart.

Studenten van de Universiteit van Amsterdam (UvA) hebben tijdens hun afstudeeronderzoek een fout ontdekt in de beveiligingssoftware voor papieren wegwerpkaarten voor het openbaar vervoer. Door deze fout konden bepaalde kaarten opnieuw worden gebruikt. De betrokken openbaar vervoerbedrijven nemen maatregelen.

De studenten van de Masteropleiding System and Network Engineering ontdekten tijdens een beveiligingsonderzoek dat door een softwarefout in de kaartlezer van de poortjes papieren wegwerpkaarten kunnen worden gemanipuleerd en opnieuw gebruikt. Het probleem werd niet veroorzaakt door de wegwerpkaart zelf, maar door de software in bepaalde kaartlezers op metrostations waar de geldigheid van wegwerpkaarten wordt gecontroleerd.

Nov 2012

SNE/OS3 news: Students discover weakness in banking app.

Students of the UvA master System and Network Engineering discovered a serious weakness in the ABN AMRO mobile banking Android app. During a practical assignment in the course Security of Systems and Networks they discovered the possibility of a man-in-the-middle attack. The vulnerability allowed to intercept and decrypt the secret pin code and user account data. It was even possible to change transactions on the wire and adjust the amount and account number money was transferred to.

ABN AMRO was notified in a responsible disclosure procedure. The vulnerability was demonstrated to them at the UvA where a possible fix was discussed. The bank responded very quickly and delivered a fixed version of the app The students visited the bank to test these fixes.

The new version of the app was available to users in the Google app store on December 17th only a few days after being notified which is very commendable.

Users who didn't update the app since are still vulnerable. These users might not be aware of the risk. The release notes only state:

“This is a security update which will make Mobiel Bankieren even more secure”.

You can read the report with the findings of Thijs Houtenbos, Jurgen Kloosterman, Javy de Koning en Bas Vlaszaty.

More Info:

- SNE - Master
- Report
- Security.NL

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.
  - 2007-32 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.
  - 2012-26 Visualizing attacks on honeypots.

The constant factor in our field is Change!

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

"Fortran goto", Unix, c, SmallTalk, DECnet, TCP/IP, c++, Internet, WWW, Semantic Web, Photonic networks, Google, grid, cloud, Data^3, App

to:

DDOS attacks destroying Banks and Bitcoins.

Conclusion:

Need for Safe, Smart, Resilient Sustainable Infrastructure.

Master SNE on top!

Keuzegids masters 2013

HBO I WO INFORMATICA

RANGLIJST

Instelling	Opleiding	noot	STUDENTENOORDELEN: Programma	Toetsing	Docenten	Wetensch. vorming	Vaardigheden	Voorber. loopbaan	Studielast	Informatie	Contact	Faciliteiten	EXPERTOORDEEL: Ambitie	Niveau programma	Personeel niveau	Personeel kwaliteit	Niveau afgestudeerden	SCORE: TOTAALSCORE	OORDEEL
WO INFORMATICA																			
Amsterdam UvA	System and Network Engineering	2	+	+	o	o	+	+	o	+	+	++	o	o	o	o	o	71	+
Leiden UL	Computer Science	2	o	+	+	+	+	o	+	+	+	o	o	o	o	o	o	69	+
Enschede UT	Computer Science	1	o	+	+	o	o	o	+	+	+	+	o	o	o	o	o	68	+
Open Universiteit	Computer Science		+	+	+	o	o	o	nb	+	+	nb	o	o	o	o	o	68	+
Groningen RUG	Computing Science	1	o	++	+	o	o	o	o	o	+	+	o	o	o	o	o	67	+
Amsterdam UvA	Software Engineering	1	+	o	+	o	o	+	o	o	+	o	o	+	o	o	o	67	+
Utrecht UU	Informatica		o	o	o	o	o	o	o	+	o	o	o	+	+	o	+	65	+
Amsterdam VU	Computer Science		o	+	+	o	o	o	o	o	o	+	o	o	+	o	o	65	+
Delft TUD	Computer Engineering	1	o	o	o	o	o	o	-	o	o	+	o	o	+	+	+	64	o
Delft TUD	Computer Science		o	o	o	+	+	o	o	o	o	+	o	o	o	o	o	64	o
Eindhoven TU/e	Computer Science and Engineering		o	+	o	o	o	o	-	+	+	o	o	o	+	o	o	64	o
Nijmegen RU	Informatica	2	o	o	o	o	o	o	o	-	o	o	o	o	o	o	o	59	o
WO THEMATISCHE INFORMATICA																			
Amsterdam VU	Parallel and Distributed Computer Systems		++	++	++	+	o	+	++	++	++	++	o	+	++	o	o	85	+++
Leiden UL	ICT in Business	2	-	o	-	-	o	o	-	-	-	- -	o	o	o	o	o	49	-

1) Vanwege kleine studentenaantallen zijn de gegevens van twee jaargangen gebruikt.
2) Vanwege kleine studentenaantallen zijn de gegevens van drie jaargangen gebruikt.
(r) = research master/onderzoeksmaster

Thanks!


Karst Koymans
Morteza Nahrwar
Maarten van Steen
Marcel Worring
Jeroen van Beek
Eelco Schatborn
Mendel Mobach
Jeroen Scheerder
Jaap van Ginkel
Jeroen van der Ham
Dick Heinhuis
Niels Sijm
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Harris Sunyoto
Toto van Inge
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Jan Bergstra