

# *Networking with Cees*

*Henri Bal*  
*Vrije Universiteit Amsterdam*

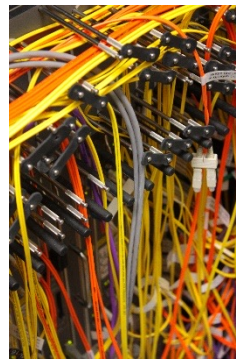
**From systems and networks to complex  
cyber infrastructures:**

**Symposium and reception in honor of  
Cees de Laat and Leon Gommans**





# *Traveling with Cees (HPDC'2010, Chicago)*



**Networking with Cees**



***Cees' strategy –  
always look many years ahead***

**Where will we  
be in 10 years?**





# *Cees' strategy – always look many years ahead*

**Where will we  
be in 10 years?**



# *This talk – looking backwards*

How did we  
get here?



# Outline

- Look back at Cees' work from last 25 years



- Infrastructure projects (DAS)
- Joint research projects



- Relate them to today's developments



# *Earlier 'retirement' talks*



Henk Sips



Dick Epema

# Data mining on emails

SIZE (bytes)	DATE
2014309	Jun 22 1989
668476	Jun 28 1990
1370069	Sep 2 1991
1462467	Jul 7 1992
2849405	Oct 14 1993
1513103	Apr 26 1994
2716685	Oct 13 1995
1623987	Jul 15 1996
4059096	Sep 4 1997
4789618	Oct 15 1998
2552727	Apr 26 1999
6363335	Feb 22 2000
26935129	May 18 2001

Date: Mon, 17 Jun 1996 20:35:57 +0200

To: peterslo@fwi.uva.nl (P.M.A. Sloot), rvd@nikhef.nl, miron@cs.wisc.edu,  
bjo@fwi.uva.nl, joep@fwi.uva.nl, frank@fwi.uva.nl, berry@fwi.uva.nl,  
epema@twi.tudelft.nl, ar@uni-paderborn.de, emmen@genias.nl,  
W.Lourens@fys.ruu.nl, C.T.A.M.deLaat@fys.ruu.nl, pier@nikhef.nl,  
wielinga@sara.nl, bal@cs.vu.nl, ast@cs.vu.nl

From: C.T.A.M.deLaat@fys.ruu.nl (C. de Laat)

Subject: Re: Meeting June 21th

> I herewith suggest the following agenda for the upcoming Distributed MetaComputing meeting:

Since I will be in the USA from wednesday 19th until sunday 23th on a business trip I will be unable to attend this meeting.

regards,

Cees de Laat.

Faculty of Physics and Astronomy, Utrecht University,  
Princetonplein 5, NL-3584CC Utrecht, The Netherlands.

[delaat@fys.ruu.nl](mailto:delaat@fys.ruu.nl), Tel: (31)30-2534585



## My mailboxes



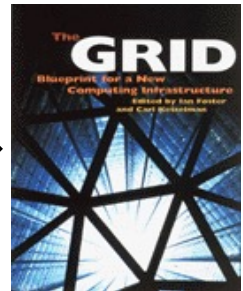
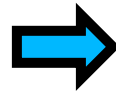
# First email (1996)

Date: Mon, 17 Jun 1996 20:35:57 +0200

To: peterslo@fwi.uva.nl (P.M.A. Sloot), rvd@nikhef.nl, miron@cs.wisc.edu,  
bjo@fwi.uva.nl, joep@fwi.uva.nl, frank@fwi.uva.nl, berry@fwi.uva.nl,  
epema@twi.tudelft.nl, ar@uni-paderborn.de, emmen@genias.nl,  
W.Lourens@fys.ruu.nl, C.T.A.M.deLaat@fys.ruu.nl, pier@nikhef.nl,  
wielinga@sara.nl, bal@cs.vu.nl, ast@cs.vu.nl

From: C.T.A.M.deLaat@fys.ruu.nl (C. de Laat)

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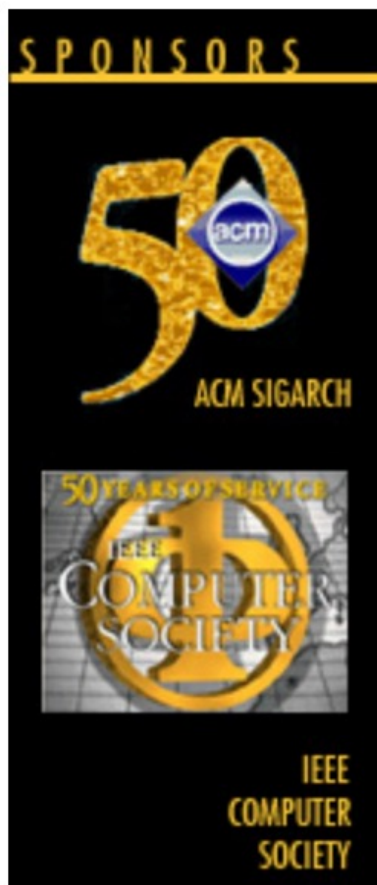
Cees de Laat.

Faculty of Physics and Astronomy, Utrecht University,  
Princetonplein 5, NL-3584CC Utrecht, The Netherlands.

delaat@fys.ruu.nl , Tel: (31)30-2534585

# DISTRIBUTED ASCI SUPERCOMPUTER

## *First email about DAS*



## SUPERCOMPUTING '96 CONFERENCE PROCEEDINGS

THE INTERNATIONAL CONFERENCE ON  
HIGH PERFORMANCE COMPUTING  
AND COMMUNICATIONS



NOVEMBER 17-22  
PITTSBURGH PA

Conference sponsored by [ACM SIGARCH](#) and [IEEE Computer Society](#)




# *DAS-1 ATM network*


Date: Tue, 11 Feb 1997 22:36:49 +0100

To: ast@cs.vu.nl (Andy Tanenbaum)

From: "C. de Laat" <C.T.A.M.deLaat@fys.ruu.nl>

Subject: Re: DAS

- 
- >>3. We can use SURFNET-3 or SURFNET-4. SURFNET-3 is currently operational,
    - > but uses classical routers and is slow and will eventually be replaced.
    - > SURFNET-4 is fully ATM, bypasses many routers, and is the future.
    - > If we choose for SURFNET-4 and ATM, there are issues to be considered.

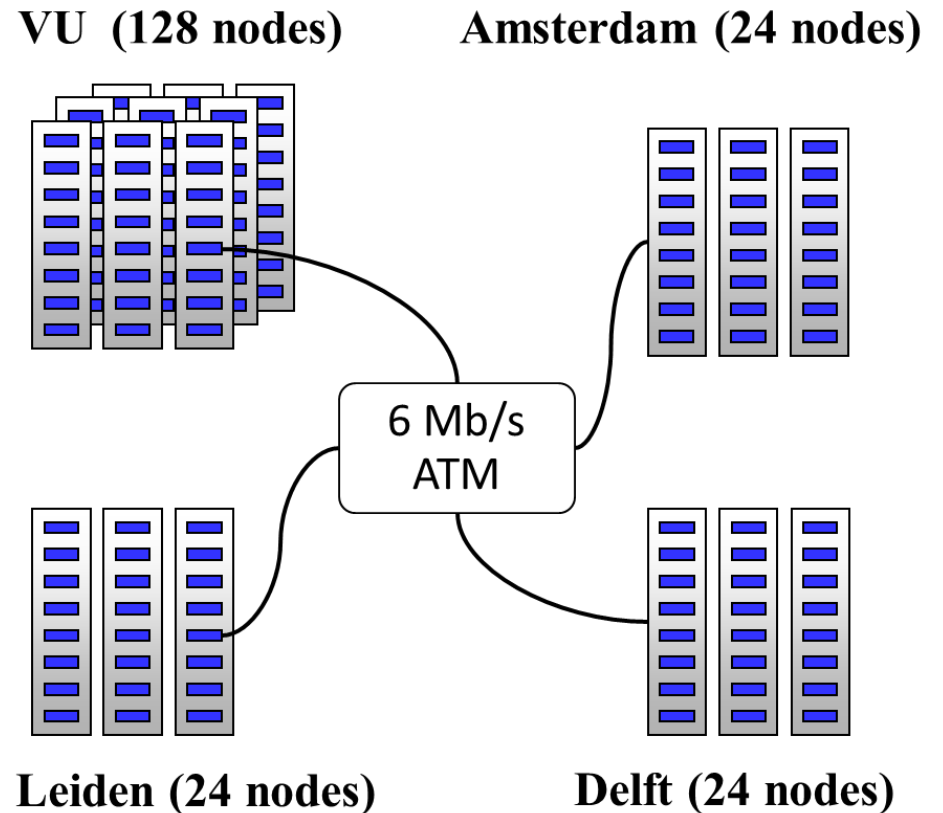


I have discussed this application at SURFnet. They see this as an native ATM application which they can support. I even most probably can get manpower money from SURFnet to do part of the work which is needed in the wan.

# ***DAS: Distributed ASCI Supercomputer (1997)***



**VU DAS-1 cluster**



# DAS-1

- Laboratory environment for controlled experiments, vastly simpler than Grids:

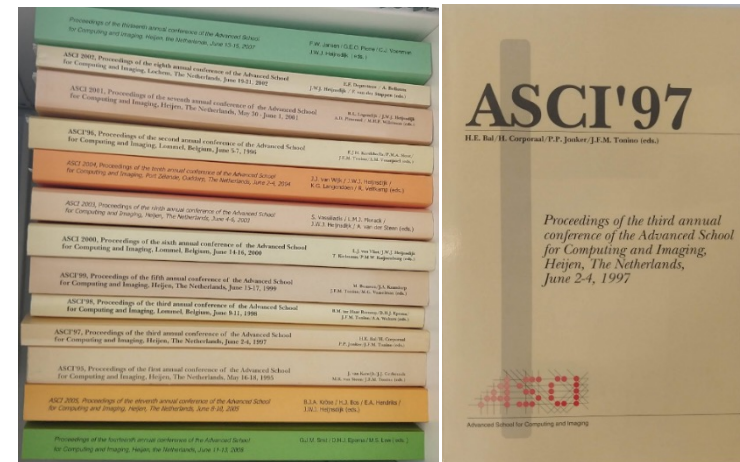
- Wide-area algorithms (with Aske Plaat)
- Wide-area MPI (with Thilo Kielmann)
- Multi-cluster scheduling (TUD, Dick Epema)
- Cees:



SURFnet Relatiedagen (1998)

# DAS-2 – DAS-6

- Cees had a huge impact on the design of all subsequent DAS systems
- DAS-2: Grid computing
- DAS-3: Optical Grid
- DAS-4: Clouds, diversity, green IT
- DAS-5: Diversity, data-explosion
- DAS-6: Distributed research ecosystem
- DAS used by >150 PhD theses



Henri Bal, VU University Amsterdam  
 Dick Epema, Delft University of Technology  
 Cees de Laat, University of Amsterdam  
 Rob van Nieuwpoort, Netherlands eScience Center  
 John Romein, ASTRON  
 Frank Seimstra, Netherlands eScience Center  
 Cees Snoek, University of Amsterdam  
 Harry Wijshoff, Leiden University

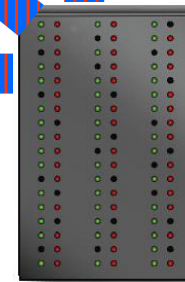
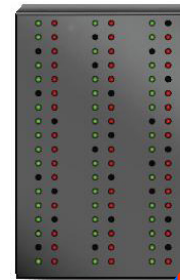
Like any science that heavily uses experimentation, computer science depends on



# *DAS-3 (2006-2010) optical grid*

**UvA/MultimediaN (40/46)**

**VU (85)**



**SURFnet6**

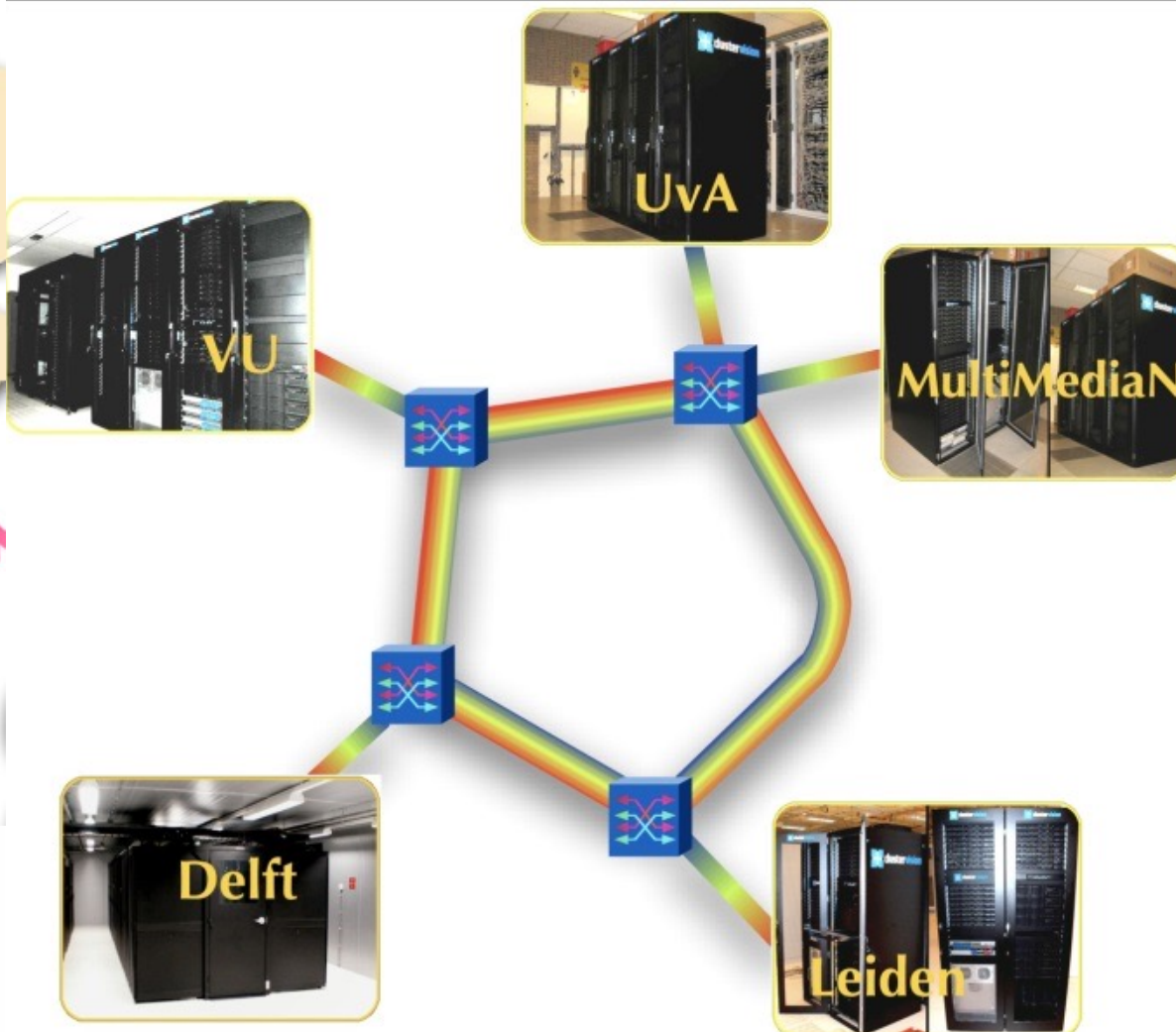
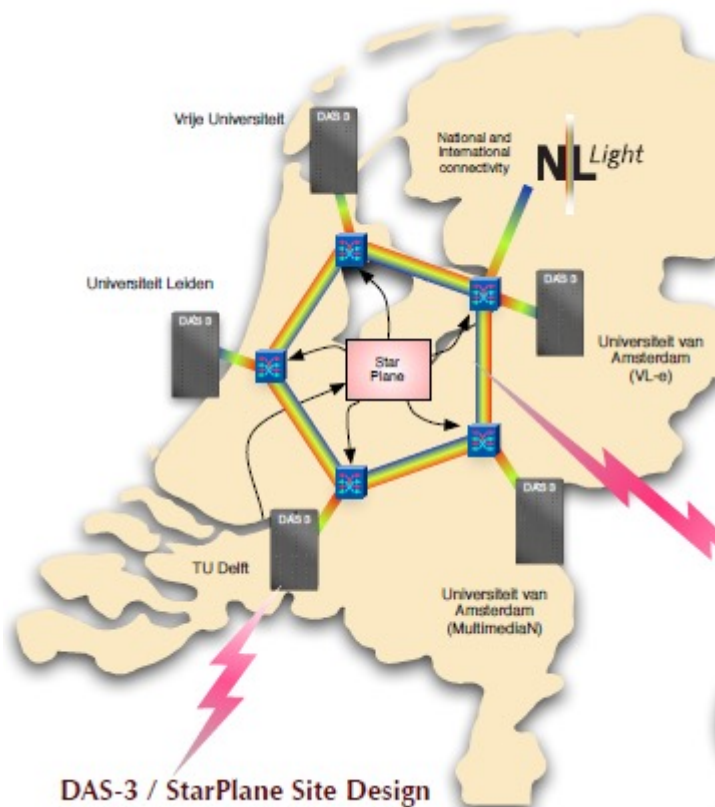
**10 Gb/s**

**TU Delft (68)**

**Leiden (32)**



# StarPlane





# ***NWO Starplane project***

## **Assessing the Impact of Future Reconfigurable Optical Networks on Application Performance**

Jason Maassen, Kees Verstoep, Henri E. Bal

VU University Amsterdam, The Netherlands, {jason,versto,bal}@cs.vu.nl

Paola Grosso, Cees de Laat

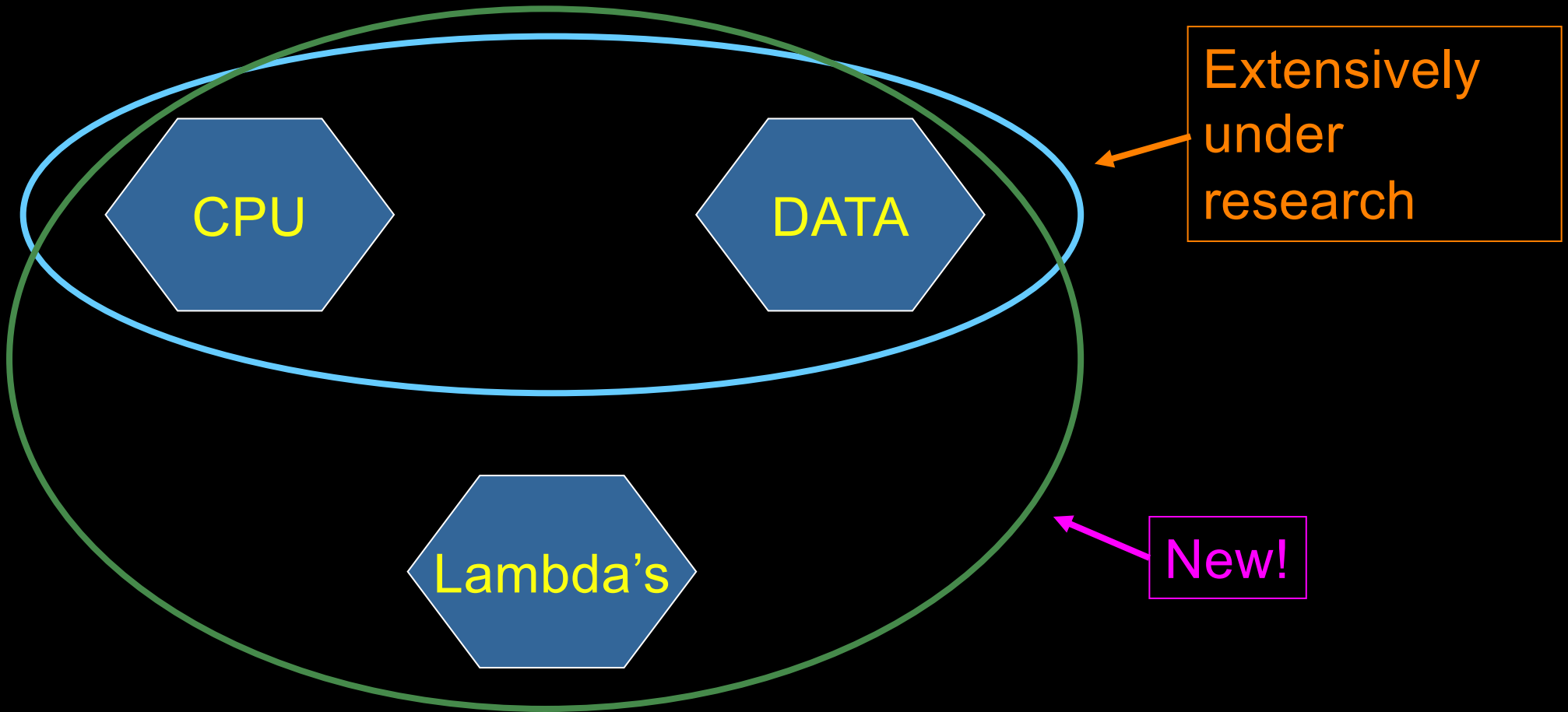
University of Amsterdam, The Netherlands, {p.grosso,delaat}@uva.nl

- Applications
  - model-checking
  - video-processing
  - supernova detection

# *DAS-3 workshop 2007*



# GRID Co-scheduling problem space



The StarPlane vision is to give flexibility directly to the applications by allowing them to choose the logical topology in real time, ultimately with sub-second lambda switching times on part of the SURFnet6 infrastructure.

# Acknowledgement

- All “black” slides are taken from delaatt.net



## Presentations & Keynotes

If you want to receive a presentation, ask me.

### 2022

[2022-10-21](#) SNE Master Graduation Ceremony, UvA: "ICT to support Science & Society in the Roaring Twenties."

[2022-03-02](#) At [SC-Asia](#) in the Asia Pacific Research Platform (APRP) session chaired by mr. Yves Poppe (NSCC): "Secure data sharing in the Responsible Internet."

### 2021

[2020-12-03](#) UvA Informatica Bachelor, introductie CCI: "CCI" Complex Cyber Infrastructure"

[2021-09-28](#) VU CS bachelor, VU: "ICT to support the transformation of Science in the Roaring Twenties"

[2021-03-03](#) At [SC-Asia](#) in the Asia Pacific Research Platform (APRP) [session](#) chaired by mr. Yves Poppe (NSCC): "ICT to support the transformation of Science in the Roaring Twenties".

### 2020

[2020-12-03](#) At [Fabric Facilities Workshop](#); Partner Description from UvA: "Testbeds to Prototype Tomorrows Digital World"

[2020-11-13](#) At SC20 - SCinet - XNET session: "Future of CI and role of XNET"

[2020-11-12](#) At SC20 - INDIS workshop: "INNOVATING THE NETWORK FOR DATA INTENSIVE SCIENCE - A Brief History"

[2020-09-29](#) VU CS bachelor, VU: "ICT to support the transformation of Science in the Roaring Twenties"

[2020-01-15](#) AF/KLM r&d team meeting at UvA, Amsterdam: "Globally Distributed Secure Data Exchange Fabrics"

### 2019

[2019-11-19](#) BOF at SC19 Global Research Platform (GRP): Creating Worldwide Advanced Services and Infrastructure for Science, duo presentation with Paola Grosso: "Globally Distributed Secure Data Exchange Fabrics"

[2019-10-11](#) Department of Computer Science, AGH University of Science and Technology Krakow colloquium: "ICT to support the transformation of Science in the Roaring Twenties."

[2019-09-25](#) eScience conference [Visionary track](#), San Diego: "ICT to support the transformation of Science in the Roaring Twenties."

[2019-09-24](#) Bridging from Concepts to Data and Computation for eScience ([BC2DC'19](#)) (for Sara Shakeri): "Modeling and Matching Digital Data Marketplace Policies"

[2019-09-18](#) Global Research Platform ([GRP](#)) presentation, San Diego: "Globally Distributed Secure Data Exchange Fabrics"

[2019-08-22](#) CIENA executive briefing invited science presentation, Ottawa: "ICT to support the transformation of Science in the Roaring Twenties."

[2019-05-28](#) [Closing event SARNET project](#) @ UvA, Amsterdam, Jun 21, 2019: "SARNET: Secure Autonomous Response Networks".

[2019-05-28](#) Mid Term Research review Ivl, UvA, Amsterdam: Systems and Networking Theme".

[2019-05-27](#) [Information and Communication Sciences Research Infrastructures Awareness Day \(ICSRI\) Workshop](#), Paris: "ICT to support the transformation of Science in the Roaring Twenties."

[2019-04-15](#) [Dutch STEM Research Ethics Committees workshop](#) presentation on FEC and ECIS: "FNWI Ethics Committee (FEC)"

[2019-01-17](#) [New Year reception Internet Organizations NL](#), Amsterdam: "Digital Data Markets: Trusted Data Processing in Untrusted Environments".

### 2018

[2018-12-18](#) SURFSARA Superdag 2018 talk: "Digital Data Markets: Trusted Data Processing in Untrusted Environments".

[2018-11-28](#) Presentation at 2nd NWO Big Data Logistics meeting, Utrecht by Cees de Laat: "Digital Data Markets: real time ICT for logistics; Data Logistics 4 Logistics Data (dl4d) Research".

[2018-10-07](#) [APC2018](#): "Data Protection Digital Marketplaces Using Novel Infrastructure Models! The Global Big Data Hub infrastructure inspired by PRP."

[2018-10-01](#) FNWI-faculty colloquium 15 minutes part: "FNWI Ethics Committee (FEC)"

[2018-09-19](#) UvA - Minor Privacy and Security, UvA, guest lecture: "Snowden & Internet."

[2018-05-30](#) More-IP Amsterdam conference: "Secure Cyber Infrastructure for Valuable Big Data Processing!"

[2018-05-09](#) [Session](#) at I2 Global Summit: "Digital Marketplaces Using Novel Infrastructure Models!"

[2018-03-08](#) University of South California, Information Sciences Institute colloquium: Secure Cyber Infrastructure for Valuable Big Data Processing! The Global Big Data Hub infrastructure inspired by PRP.

[2018-01-18](#) IT4RIs '18 workshop, UvA Amsterdam: Digital Data Markets: real time ICT for logistics; Data Logistics 4 Logistics Data (dl4d)

# Power is a big issue



- UvA cluster uses (max) 30 kWh
- 1 kWh ~ 0.1 €
- per year -> 26 k€/y
- add cooling 50% -> 39 k€/y
- Emergency power system -> 50 k€/y
- per rack 10 kWh is now normal
- **YOU BURN ABOUT HALF THE CLUSTER OVER ITS LIFETIME!**
- Terminating a 10 Gb/s wave costs about 200 W
- Entire loaded fiber -> 16 kW
- Wavelength Selective Switch : few W!

# Toward an International Computer Science Grid

DAS3 Workshop, Delft

Franck Cappello

*INRIA*

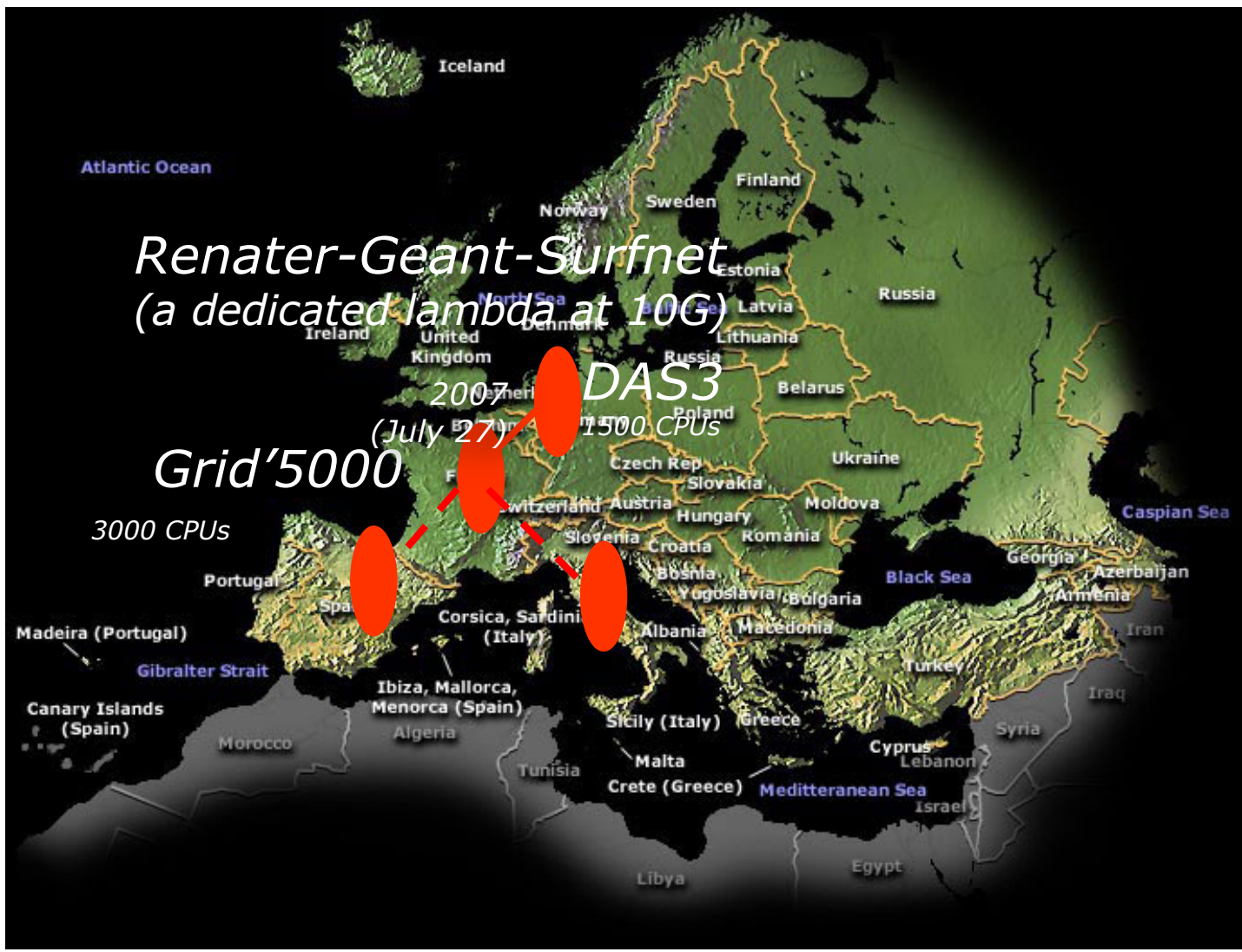
Director of Grid'5000

Email: [fci@lri.fr](mailto:fci@lri.fr)

<http://www.lri.fr/~fci>

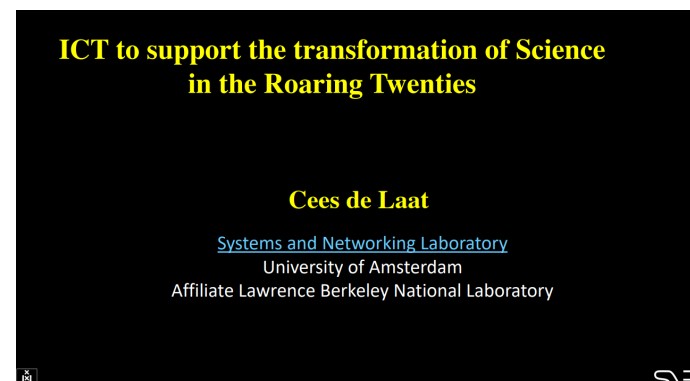


# A Prototype of an European Computer Science Grid



# Grid'5000 – DAS collaborations

- Optical 10 Gb/s link Paris – Amsterdam (2007)
- Many, many meetings
- 2019: initiative for ESFRI roadmap
  - SLICES: Scientific Large-scale Infrastructure for Computing/Communication Experimental Studies







# SLICES added to ESFRI 2021 Roadmap

8 July 2021

The Complex Cyber Infrastructure (CCI) research group of IvI and especially Yuri Demchenko, Wouter Los and Cees de Laat are very pleased that the proposal they worked on with partners from 14 different European countries, has been accepted.

*'This is excellent news and helps to shape the European vision of an experimental digital data infrastructure according to European standards and values', says Cees de Laat, group leader [CCI](#).*

[SLICES](#) stands for Large-scale Infrastructure for Computing/Communication Experimental Studies and it's ambition is to become an impactful research Infrastructure in Digital Sciences, including concerns regarding energy consumption and the implementation of the Green Deal.

SLICES is a flexible platform designed to support large-scale, experimental research focused on networking protocols, radio technologies, services, data collection, parallel and distributed computing and in particular cloud and edge-based computing architectures and



# SLICES-RI: Current status of the partnership

Countries	Government	Research and Academia		Industry	Clusters, networks and others	NRENs	Worldwide support
	National support	Partners	Support				
	Local support confirmed						

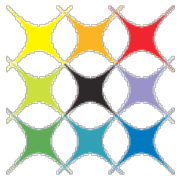
Core partners



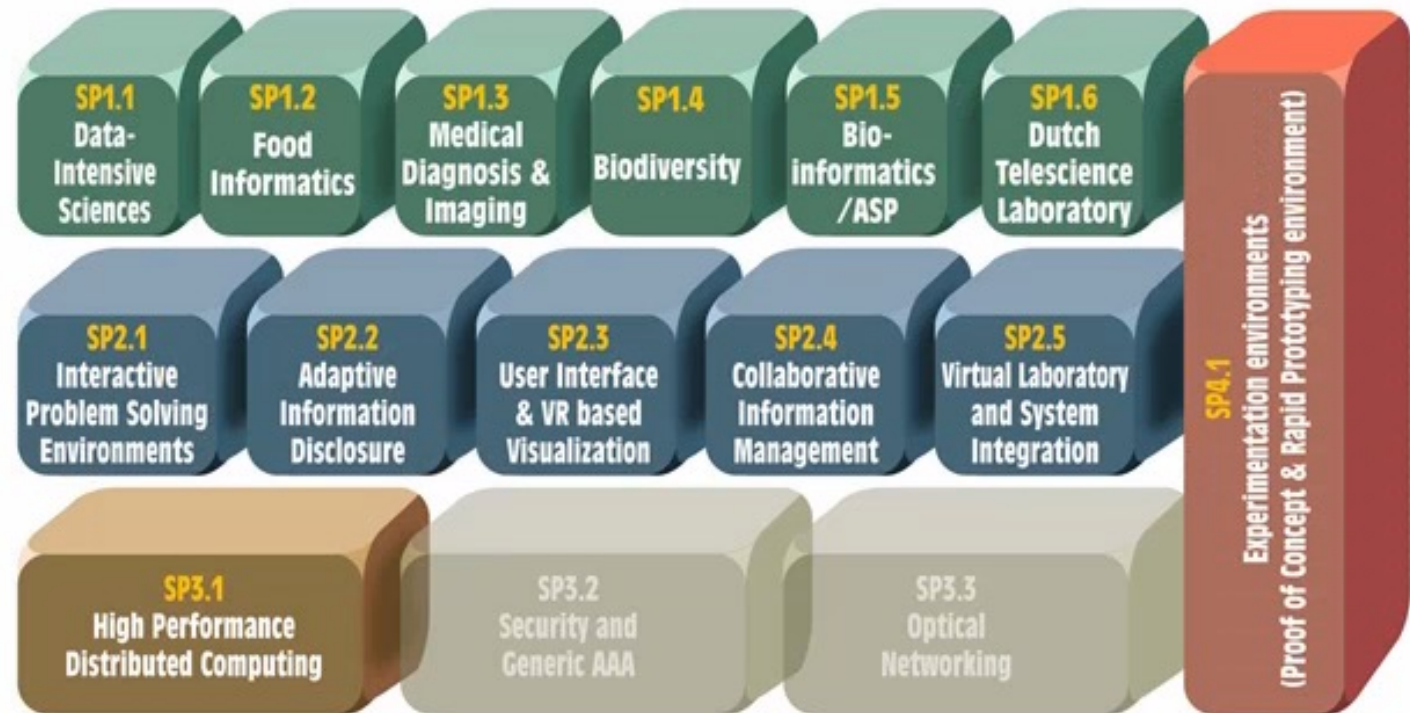
# Joint research projects

- VL-e: Virtual Laboratory for e-Science, BSIK, (2003-2009)
- COMMIT/, BSIK (2011-217)
- StarPlane, NWO (2006-2011)
- GreenClouds, NWO (2011-2015)
- NWA Startimpuls programma VWData (2018-2019)
- Secure scalable policy-enforced distributed data processing, NWO COMMIT2DATA (2018-2022)
- EPI: Enabling Personalized Interventions, NWO-DATA2PERSON (2018-2023)
- Efficient Deep Learning, NWO-Perspective (2018-2024)





# *Virtual Lab for e-Science (2003-2009), led by Bob Hertzberger*



- Huge (20 M€) national BSIK project on e-Science
  - VU/TUD worked in SP3.1 on Ibis, KOALA, ...
  - Cees worked in SP3.2/3.3, funded by Gigaport

## Trends

- We have made baby-steps on the path to optical networking

- GLIF & SN6
- Still many mails and phone calls to set up paths

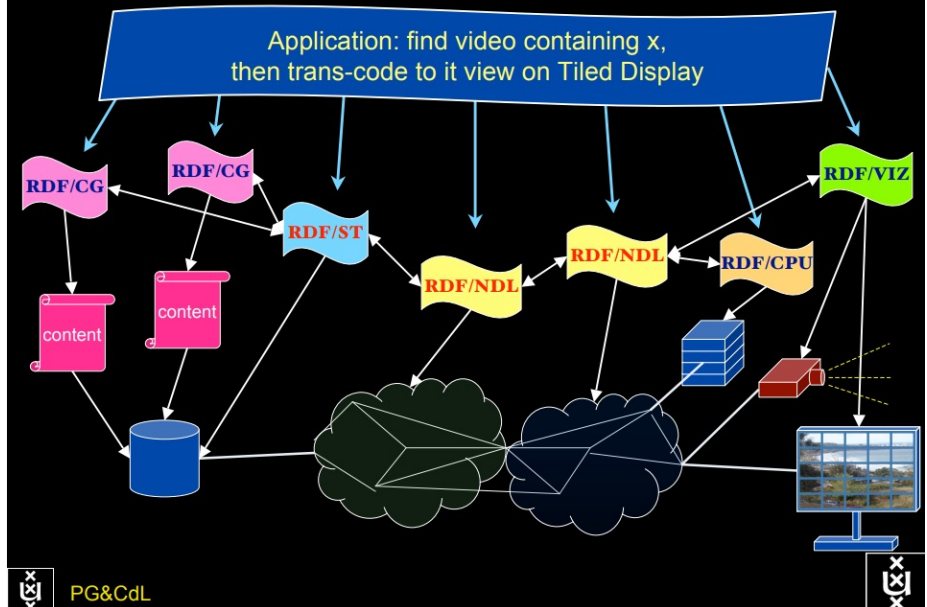


- See several trends:

- More applications need better predictable behavior
- Lambda's get fatter and cheaper
- Photonic technology cheap per bandwidth
- Embedded computation capacity increasing
- Ethernet is getting circuit properties (PBT)
- Latency and high bandwidth congestion avoidance conflict

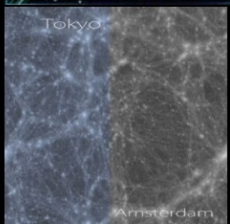


## "I want" approach



## Flows

- Many small streams (sensor grids, ijkdijk)
  - programmable networks, capability networking
- Few big flows (LHC, eVLBI, LOFAR)
  - photonic nets, capacity networking
- SuperGrids (e.g. Cosmogrid)
  - capability & capacity processing
- TeraApps programming model
  - TFlops -> MPI / Globus
  - TBytes -> OGSA/DAIS
  - TPixels -> SAGE
  - TSensors -> LOFAR, LHC, ...
  - Tbit/s -> ?



## Security Infrastructure & Infrastructure Security

- Distributed Authorization & Authentication & Accounting
- Privacy (identity theft)
- Data integrity & confidentiality
  - eHealth (medical dossier, imaging)
  - Industry (competitive advantage)
  - also in e Science! (the toothbrush example)
- Emergency response and prevention (eCERT)
- Safe infrastructure (embedded chips)





Henri, Guus Schreiber, Bob Hertzberger, Cees  
(VL-e workshop 2008)

# Aftermath VL-e

- Midterm review (2008) recommended: investigate support for a “national institute for e-Science”
- Final evaluation (2011) gave “excellent” to VL-e (+Gigaport, MultimediaN)
- 2008-2011 discussions on new center for eScience
- 2012:

netherlands  
**eScience center**

Rob van Nieuwpoort, professor by special appointment of Efficient Computing for eScience

22 September 2012

Dr. R.V. van Nieuwpoort (1972) has been named professor by special appointment of Efficient Computing for eScience at the University of Amsterdam's (UvA) Faculty of Science. This chair has been established with the support of the Netherlands eScience Center (NL-eSC). Van Nieuwpoort is combining his post as professor by special appointment with his position as director of eScience Technology at the Netherlands eScience Center.



# *COMMIT/ (2011-2017) led by Arnold Smeulders*



- **Public-private Dutch ICT program, 100 M€ BSIK funding**



# COMMIT/

## IV-E: E-INFRASTRUCTURE VIRTUALIZATION FOR E-SCIENCE APPLICATIONS (P20)

P20 in 140 characters

VU University Amsterdam  
University of Amsterdam  
Delft University of Technology  
TNO  
Solvinity  
LIACS  
ONVZ



# 140 CHARACTER CHALLENGE

**From systems and networks to complex  
cyber infrastructures:**

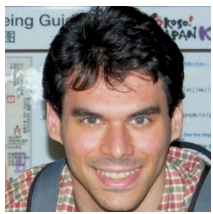
**Symposium and reception in honor of  
Cees de Laat and Leon Gommans**

= 181 characters !

COMMIT/

# CHAR P20[140];

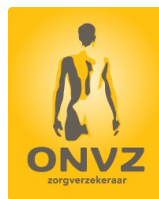
Dutch ICT Research  
Young KNAW  
VIDI  
URC



3 VENI  
EuroPar  
5 Best Paper



ONVZ  
Lotto-Jumbo  
Bitbrains  
KLM



# COMMIT/

6 H2020




EPD, Whitebox



DAS-5



11 PhD theses

**HENRI BAL P20 IN 140 CHARACTERS.PPTX**  
 11 Henri Bal **P20** in 140 characters.pptx Title IV-e: e-Infrastructure Virtualization for e-Science ... Solvinity LIACS ONVZ Commit/ **P20** in 140 characters commit/ char **P20**[140]; Dutch ICT Research Young KNAW VIDI ... Applications (**P20**) Henri Bal VU  University Amsterdam University of Amsterdam Delft University of Technology TNO application/vnd.openxmlformats-officedocument.presentationml.presentation *attached to:Program*



# COMMIT Aftermath

- SARNET: Security Autonomous Response with programmable NETWORKS (NWO + COMMIT)

## SARNET: Security Autonomous Response with programmable NETWORKS

Marc Lyonnais, Leon Gommans, Rodney Wilson, Rob Meijer, Frank Fransen Tom van Engers, Paola Grosso, Gauravdeep Shami, Cees de Laat, Ameneh Deljoo, Ralph Koning, Ben de Graaff, Gleb Polevoy, Stojan Travanovski.

 UNIVERSITY OF AMSTERDAM

AIRFRANCE KLM



  
Netherlands Organisation  
for Scientific Research









# Leon Gommans, professor by special appointment of Data Exchange Systems

## 2019

12 September 2019

Dr L.H.M. Gommans (1957) has been named professor by special appointment of Data Exchange Systems at the University of Amsterdam's (UvA) Faculty of Science. The chair was designated on behalf of the Bèta Plus Foundation (Stichting Bèta Plus).



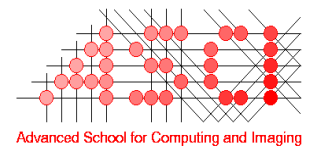
Sharing (big) data provides great benefits to organisations that wish to reach a shared goal that would be impossible on an individual basis. But how can they do so in a secure and reliable manner? Leo Gommans conducts research into systems that enable data exchange based on digital data marketplaces. His research builds on his doctoral research into multi-domain authorisation systems and the facilitation of the inter-organisational trust necessary for such systems.

**2020-2021**



# Committees

- Member Scientific Advisory Committee of FABRIC
- Affiliate Lawrence Berkeley National Laboratory
- Member VU HPC - Advisory Committee
- Chair of the UvA ICT for Research Committee
- Member board ASCI Research School
  - Member program committee ASCI CompSys conferences





# From systems and networks to complex cyber infrastructures:

IPN PLATFORM NETHERLANDS

## SIG FUTURE COMPUTER & NETWORK SYSTEMS

### FUTURE COMPUTER SYSTEMS AND NETWORKING RESEARCH IN THE NETHERLANDS: A MANIFESTO

Dec 2,  
2022



Prof.dr.ir. Fernando Kuipers



dr. Paola  
Grosso



dr.ir. Ana Lucia  
Varbanescu



Prof.dr.ir. Alexandru Iosup

Many thanks to all our collaborators.

[bit.ly/ManifestoCompSysNL](https://bit.ly/ManifestoCompSysNL)

***Happy retirement!***

