

# System and Network Engineering

Prof. dr. ir. Cees de Laat

Friday December 9, 2022



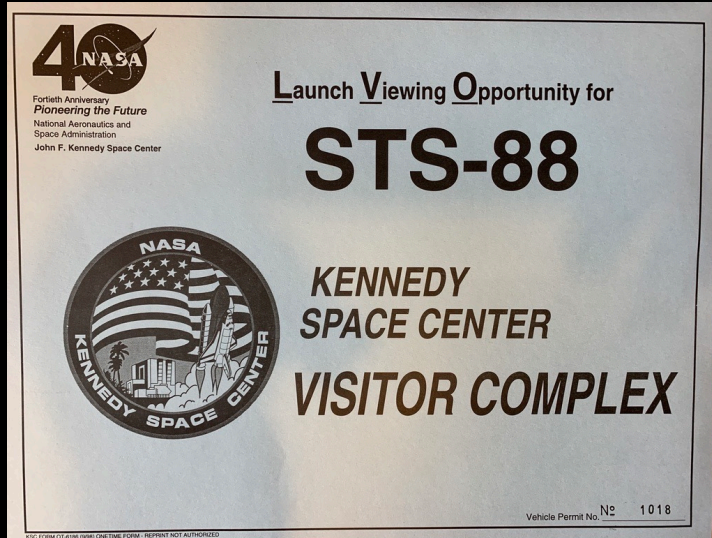
# Overview

- Some history
- Where are we now
- What's next
- Some anecdotal stories
- Thanks

# Some history

- Fascination for technology inspired by uncle, electronics, space age
- During early highschool I drove the physics teachers to madness with questions on symmetry breaking (weak interaction) 1 book in town lib
- Ended up studying Physics at TH-Delft, hence the ir. title
- PhD in Physics on Exotic Atoms, experiments at PSI Villeggen, NIKHEF and occasionally visiting CERN
- Assistant professor in “Fysische Informatica” at Uni Utrecht
- Associate professor Advanced Networks at Univ. Amsterdam
- Full professor System and Network Engineering at Univ. Amsterdam

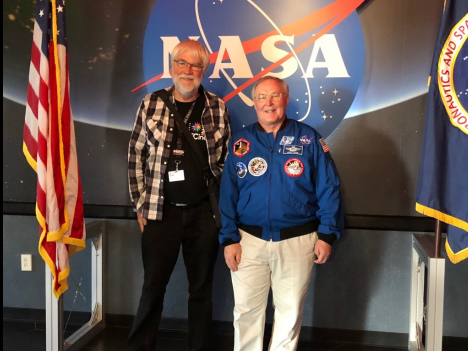
# Finally got to attend a launch – STS88



Dec 1998



In oct 2018 – Jerry Ross



True color => orange/yellow

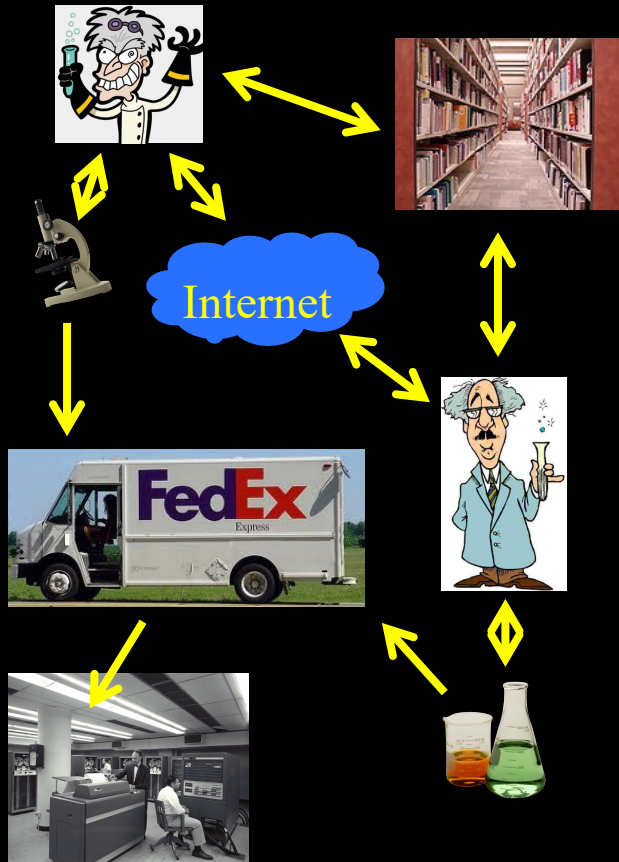


# The constant factor is Change!

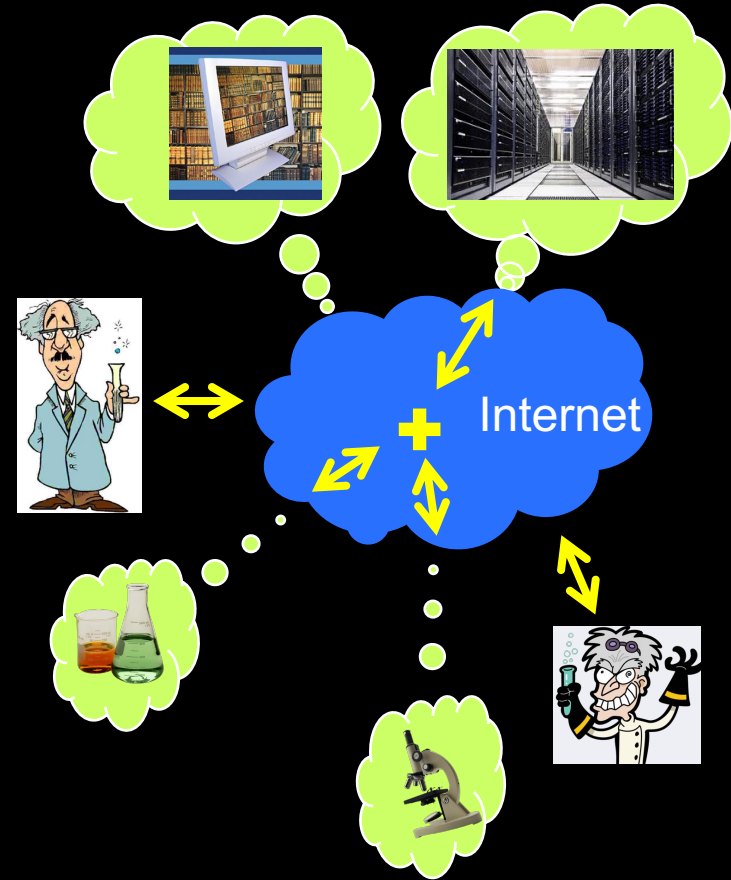
- Physics
- Data Acquisition and processing, VxWorks, RTlinux
- Networks (decnet, TCP/IP)
- Internet – Capacity, Architecture and Authorisation
- GRID - Cloud
- DATA - data aware internet - AMdEX
- Sovereignty, autonomy and security
- Common theme: Multi Domain Issues
- **Change about every 5 year!**

# Virtual Laboratories

pre 2000



post 2000



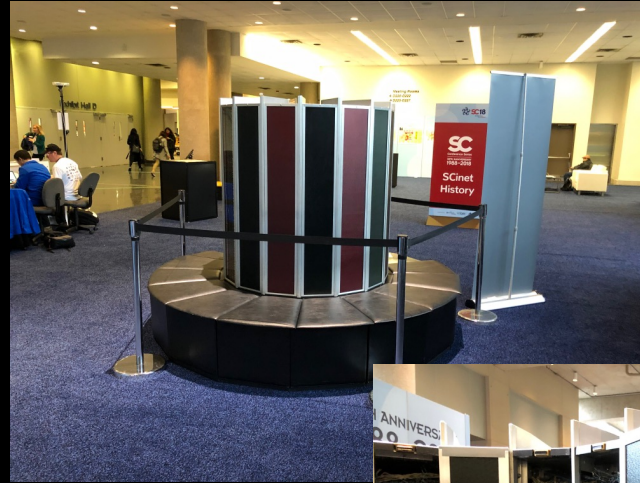
# Some progress

2018

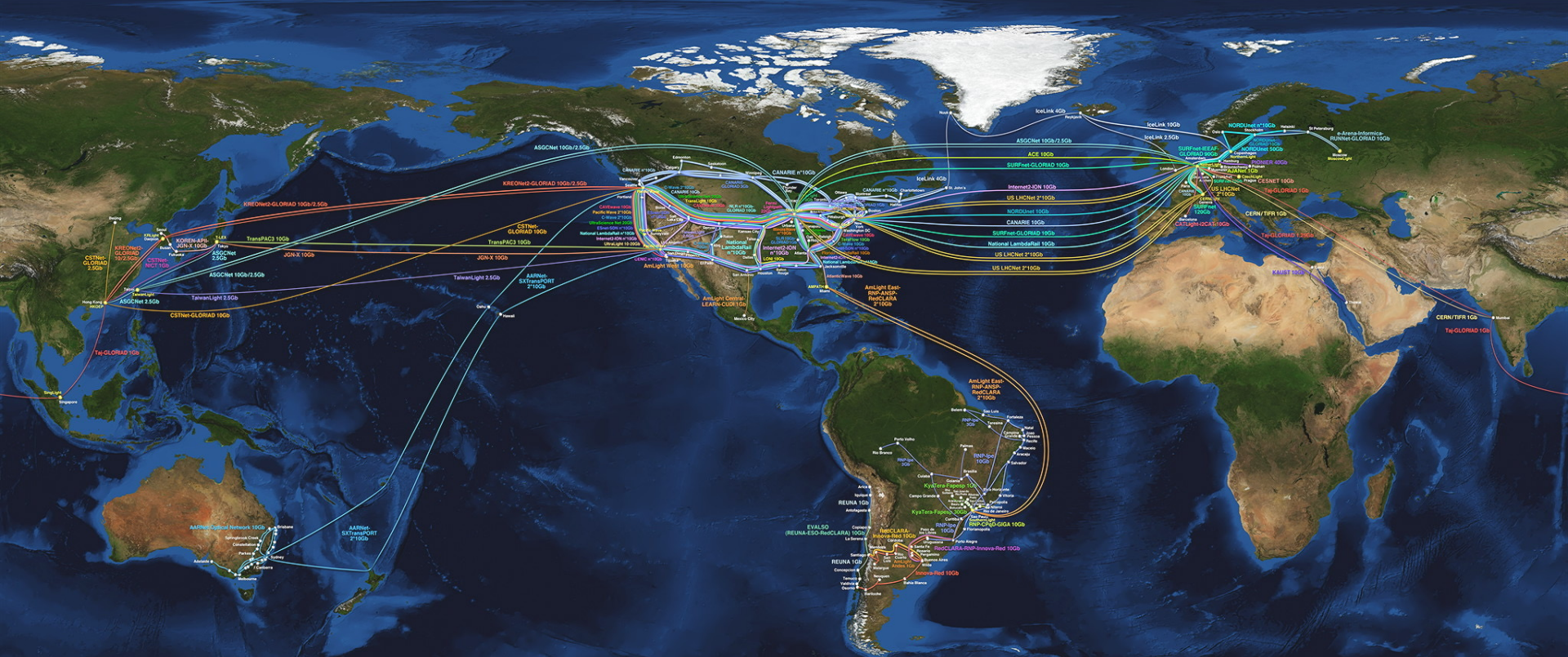
= ~7x


540 MHz  
~ GFlops  
1000 MByte memory  
16000 MByte ssd  
0,0012 kWh – 18 h

1976



80 MHz  
160 MFlops  
8 MByte memory  
300 MByte disks  
120 kW



We research:  for complex networks!

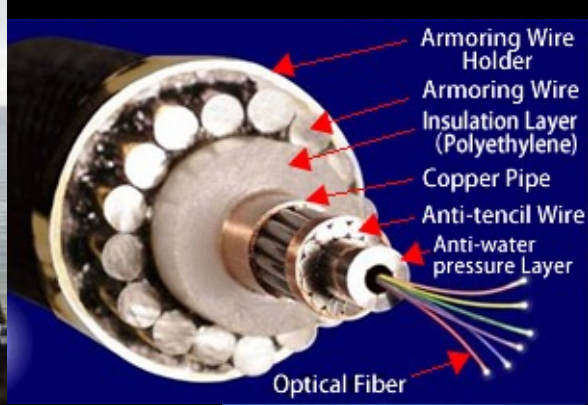


GLIF Map 2011: Global Lambda Inter

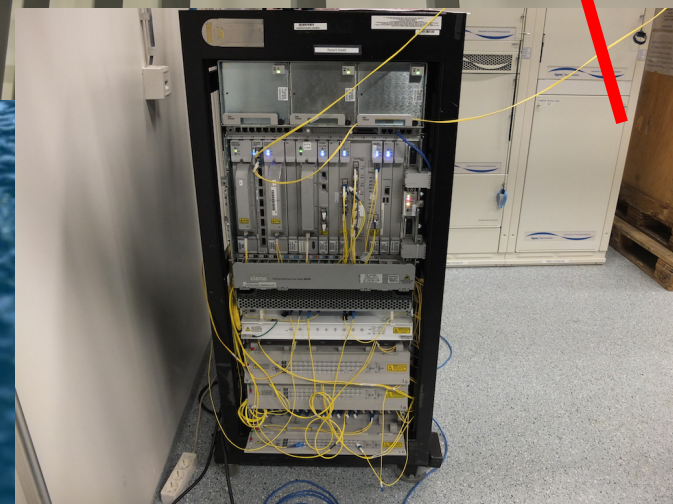
asa.gov www.glif.is







The voltages applied to the cables can be high **3,000 to 4,000 volts** for a typical trans-Atlantic telecommunications cable system, and 1,000 volts for a cross-channel telecommunications cable system.



# Undersea Cable HV

# Alien light From idea to realisation!



## 40Gb/s alien wavelength transmission via a multi-vendor 10Gb/s DWDM infrastructure



### Alien wavelength advantages

- Direct connection of customer equipment<sup>[1]</sup>  
→ cost savings
- Avoid OEO regeneration → power savings
- Faster time to service<sup>[2]</sup> → time savings
- Support of different modulation formats<sup>[2]</sup>  
→ extend network lifetime

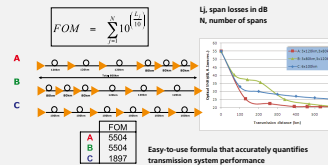
### Alien wavelength challenges

- Complex end-to-end optical path engineering in terms of linear (i.e. OSNR, dispersion) and non-linear (FWM, SPM, XPM, Raman) transmission effects for different modulation formats.
- Complex interoperability testing.
- End-to-end monitoring, fault isolation and resolution.
- End-to-end service activation.

In this demonstration we will investigate the performance of a 40Gb/s PM-QPSK alien wavelength installed on a 10Gb/s DWDM infrastructure.

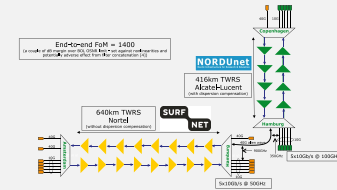
### New method to present fiber link quality, FoM (Figure of Merit)

In order to quantify optical link grade, we propose a new method of representing system quality: the FOM (Figure of Merit) for concatenated fiber spans.

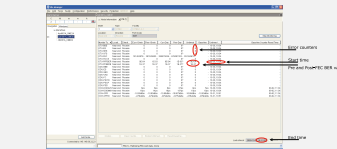


### Transmission system setup

JOINT SURFnet/NORDUnet 40Gb/s PM-QPSK alien wavelength DEMONSTRATION.



### Test results



Error-free transmission for 23 hours, 17 minutes → BER < 3,0 · 10<sup>-15</sup>

### Conclusions

- We have investigated experimentally the all-optical transmission of a 40Gb/s PM-QPSK alien wavelength via a concatenated native and third party DWDM system that both were carrying live 10Gb/s wavelengths.
- The end-to-end transmission system consisted of 1056 km of TWRS (TrueWave Reduced Slope) transmission fiber.
- We demonstrated error-free transmission (i.e. BER below 10<sup>-15</sup>) during a 23 hour period.
- More detailed system performance analysis will be presented in an upcoming paper.



### REFERENCES

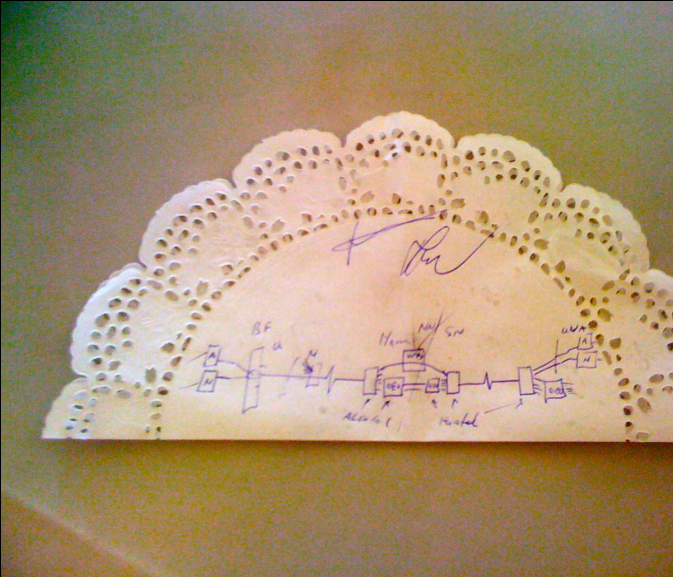
[1] "OPERATIONAL SOLUTIONS FOR AN OPEN DWDM LAYER", O. GERSTEL ET AL., QIC 2009. [2] "AT/AT OPTICAL TRANSPORT SERVICES", BARBARA E. SMITH, QIC 2009.

### ACKNOWLEDGEMENTS

WE ARE GRATEFUL TO NORDUNET FOR PROVIDING US WITH BANDWIDTH ON THEIR DWDM LINK FOR THIS EXPERIMENT AND ALSO FOR THEIR SUPPORT AND ASSISTANCE DURING THE EXPERIMENTS. WE ALSO ACKNOWLEDGE TELINDUS AND NORTEL FOR THEIR INTEGRATION WORK AND SIMULATION SUPPORT.



# Alien light From idea to realisation!



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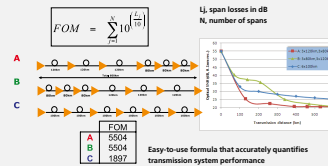
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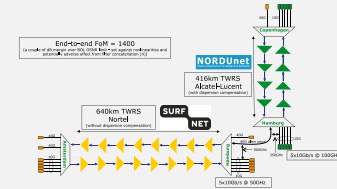
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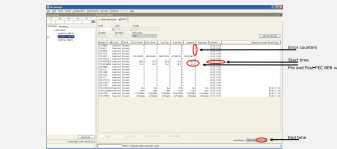


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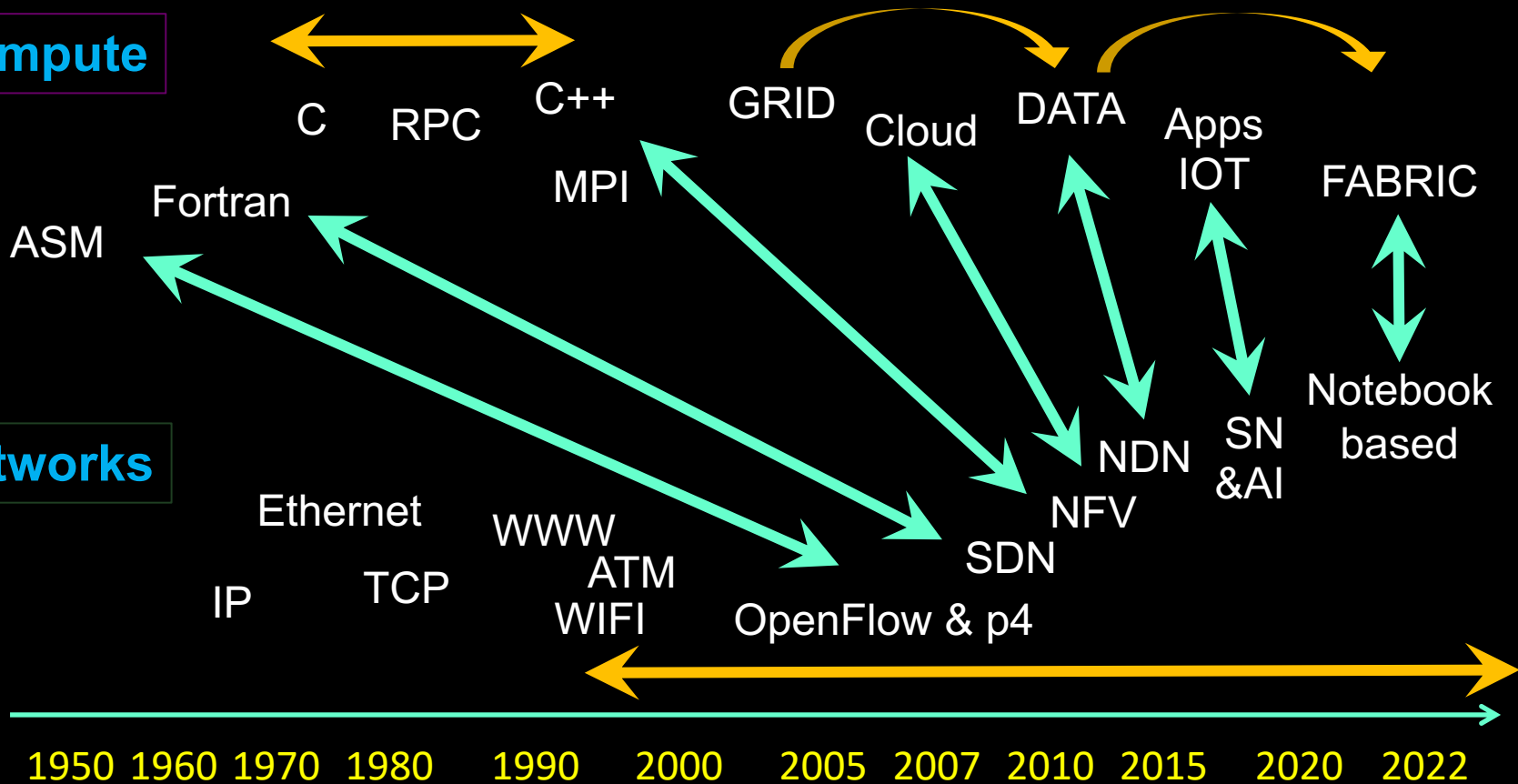
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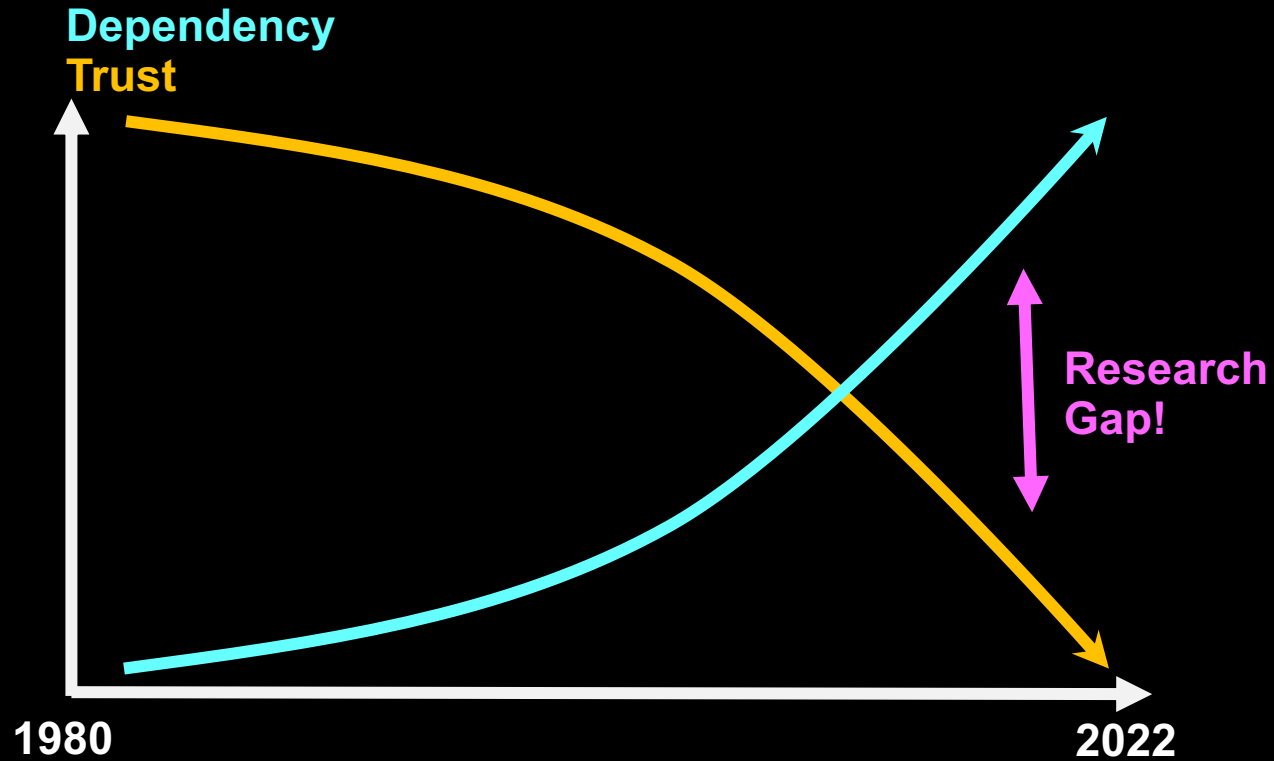
# My involvement

Compute

Networks



# Fading Trust in Internet



# Challenges ahead

- Knowledge safety (“kennisveiligheid”)
- Security – the attacks on our CI
- Cyber Infrastructure is not resilient wrt geopolitical changes
- The transformation of Science in the digital age
- The (in)dependence on big tech, plan a-b, exit strategies, etc.
- Sovereignty: **Be yourself in a digital world!**

# Some OneLiners

- The Dead Cat Demo
  - Highly interactive distributed visualization
  - <https://delaat.net/sc/sc04/>
- The DSC story
- The Library 3.0
- The Rolex story
- Master of your house



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Future Generation Computer Systems 22 (2006) 896–900

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Highly interactive distributed visualization

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<sup>a</sup> Section Computational Science, Scientific Visualization and Virtual Reality Group, Informatics Institute, Faculty of Science, Universiteit van Amsterdam, Kruislaan 403, 1098 SJ Amsterdam, Netherlands

<sup>b</sup> Advanced Internet Research Group, Informatics Institute, Faculty of Science, Universiteit van Amsterdam, Kruislaan 403, 1098 SJ Amsterdam, Netherlands



# Some Anekdoten

- Brown Purse
- SouthPark
- AirBNB
- Car key safety
- UvA ID card
- Carnaval
- PayBack time

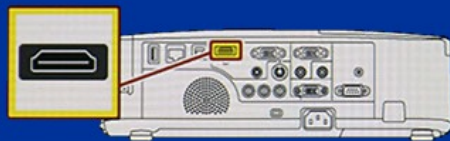


# Some tricks/Jokes

- Slide Counter
- No signal
- Zoom



NO SIGNAL on RGB1



CHECK THE INPUT TERMINAL.

JUST KIDDING





**NWO**

**UVA** **SURFnet** **FES** **CIENA** **KPMG**

**EU**

Best IT Master in  
Keuzegids 2021  
(Dutch)



**KEUZEGIDS**  
2021  
masters

# Master OS3!

(master sinds 2003 @ UvA)



Bas Terwijn

Mick Pouw

Vincent Breider

Peter Prjevara

Jeroen van Beek

Karst Koymans

Jan Philip Velders

Jaap van Ginkel

Jeroen van der Ham

Junaid Chaudry

Arno Bakker

Harris Sunyoto Jeroen Scheerder

Roy Vermeulen

Eelco Schatborn

Mendel Mobach

Niels Sijm



# Many Thanks

- Many many persons to thank!





And then this:

I kindly ask you not to form a traditional congratulatory queue at the reception but to immediately grab the drinks and snacks!

I will come to You.

This presentation will be available via my homepage: <https://delaat.net>

