

Back to the Future!

Cees de Laat

EU
COMMIT
UvA

NWO

PID/EFRO

SURFnet

TNO

NCF





Why?



I want to:



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



Why?



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



Why?



I want to:



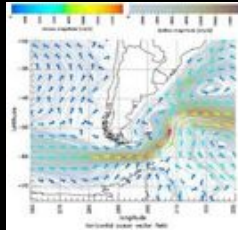
“Show Big Bug Bunny in 4K on my Tiled Display using green Infrastructure”

- 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.

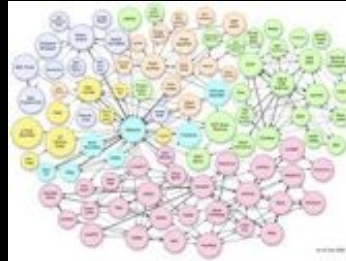
... more data!

Internet developments

Google



DATA



... more realtime!



twitter



myspace
a place for freedom



SchoolBANK



Linked in

Hyves

flickr®
from YAHOO!



facebook

... more users!

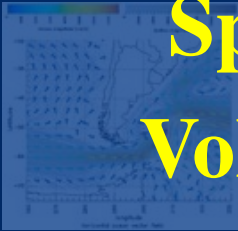
... more data!

Internet developments

Google

Speed
Volume

DATA



Deterministic

Real-time



twitter



Scalable

Secure

Linked in

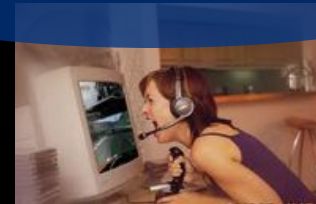


myspace

SchoolBANK

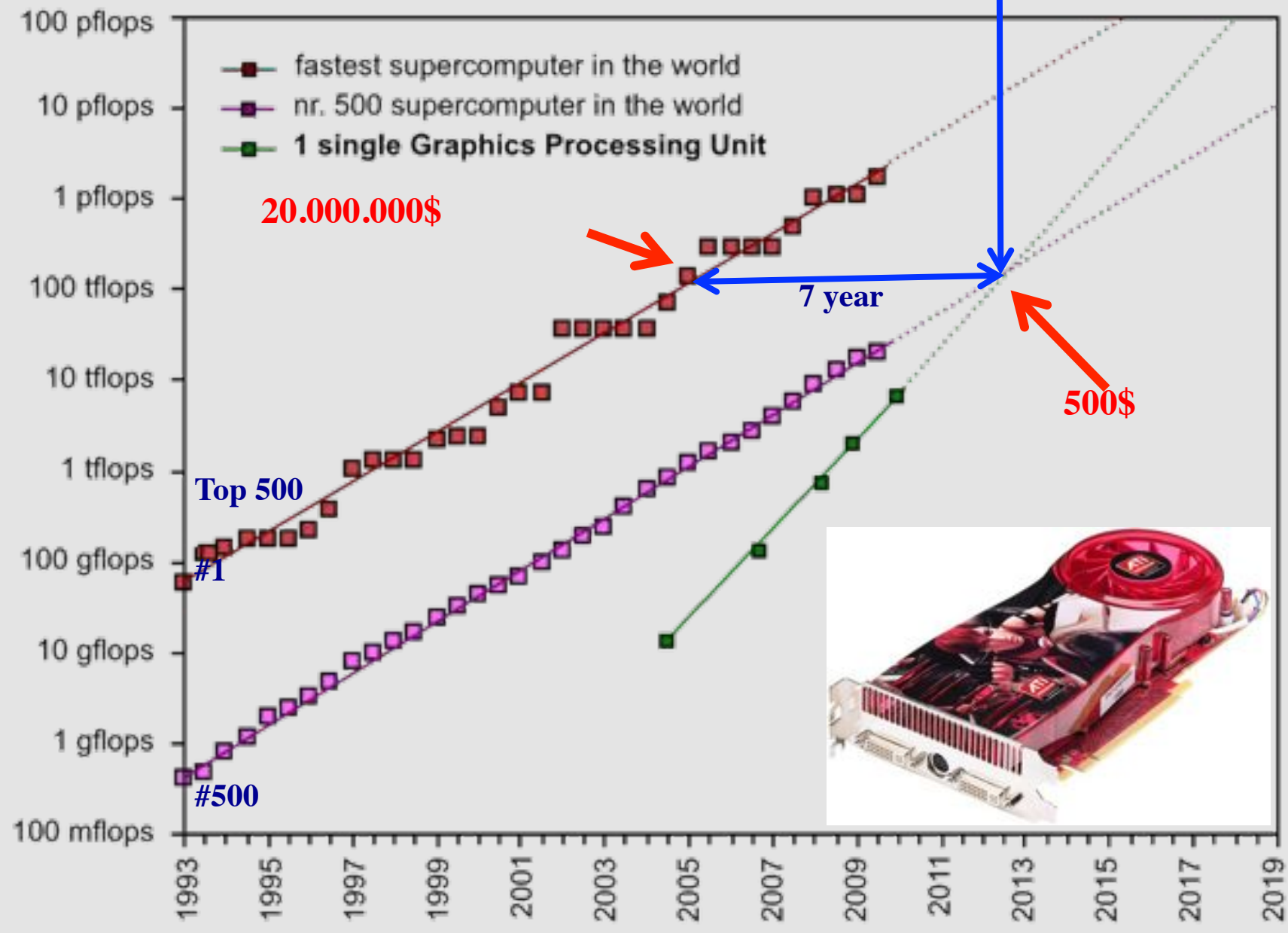
Hyves

flickr

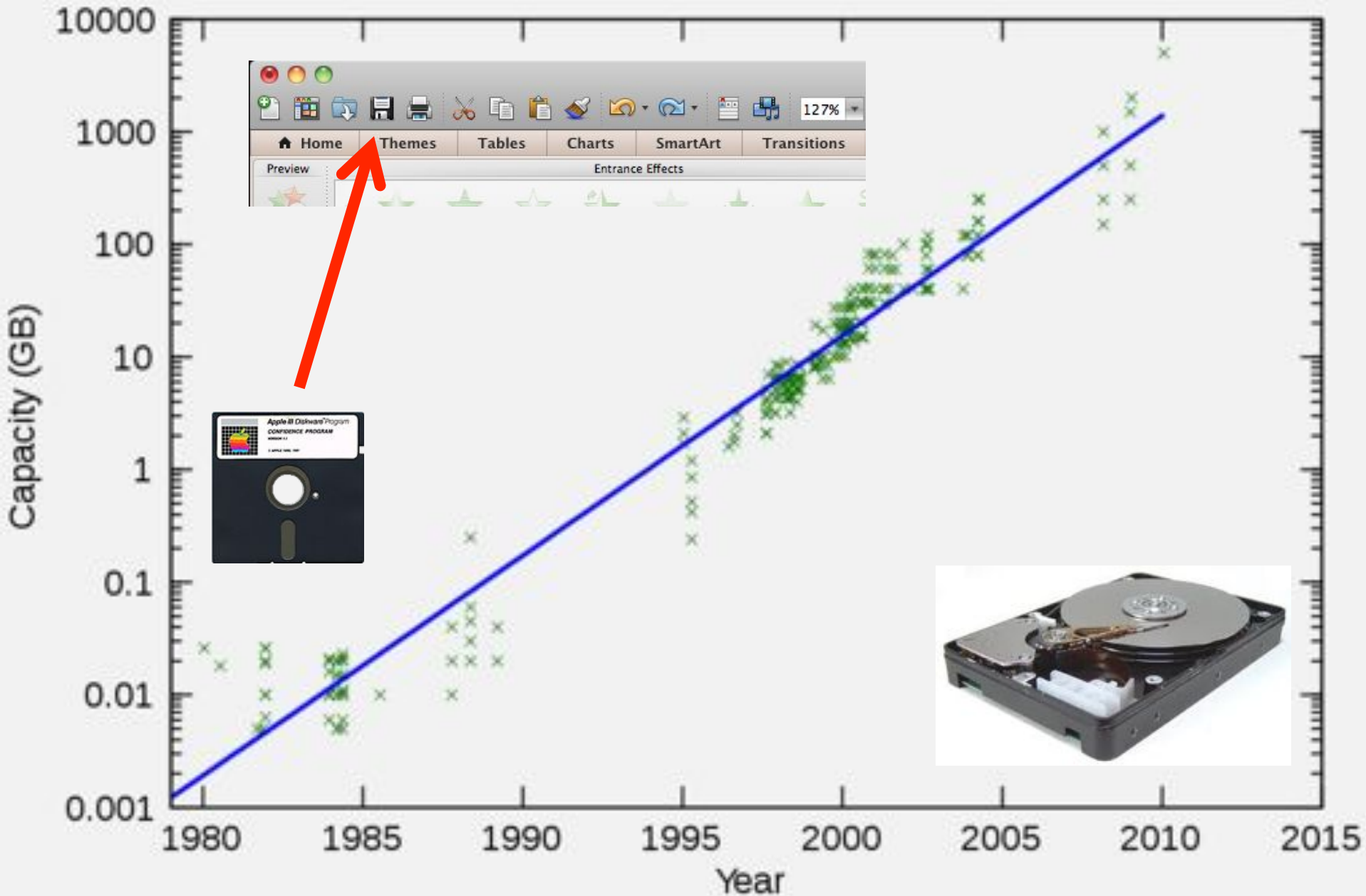


... more users!

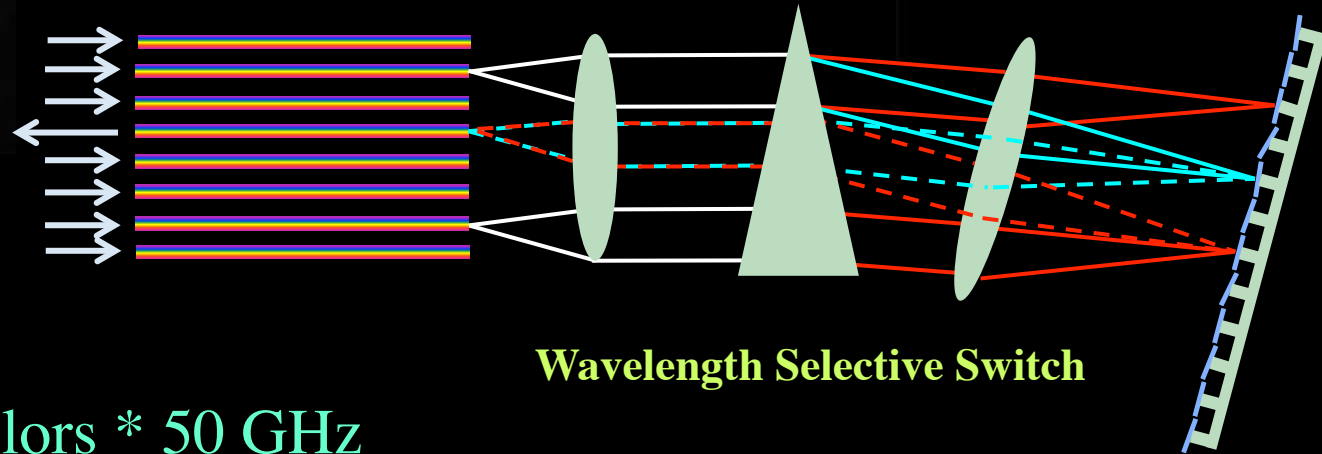
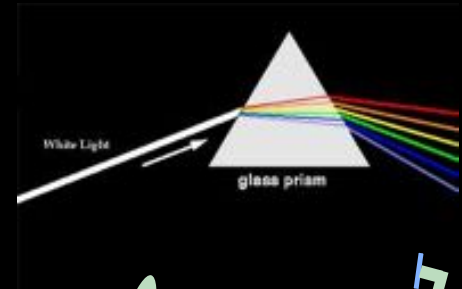
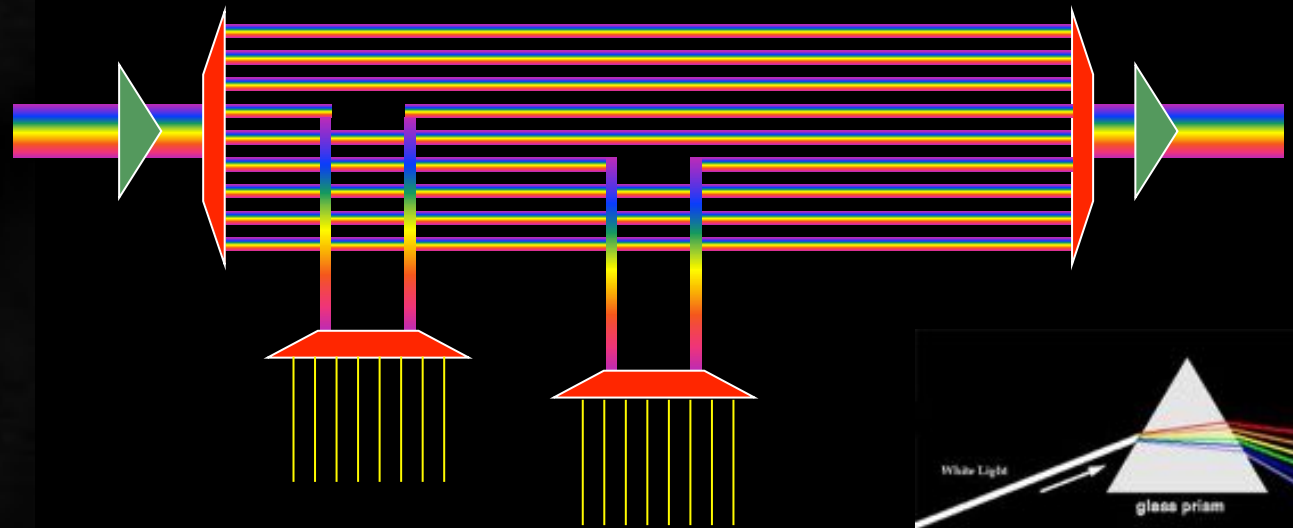
GPU cards are disruptive!



Data storage: doubling every 1.5 year!



Multiple colors / Fiber

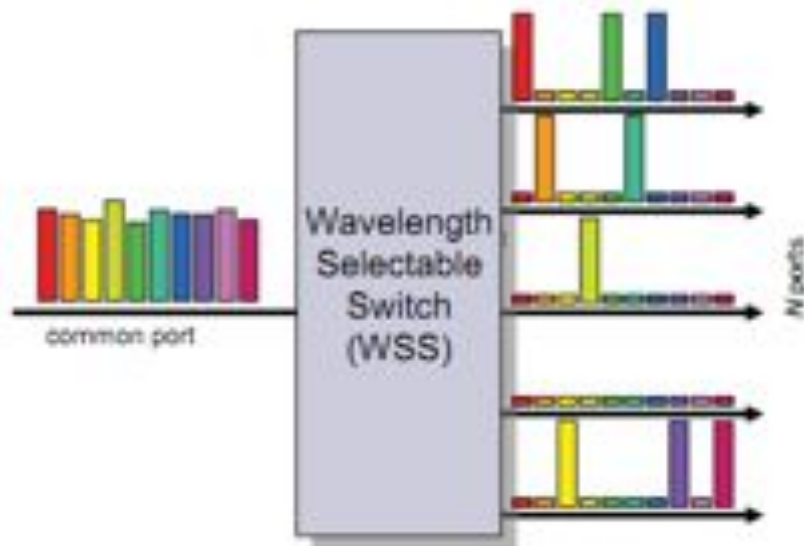
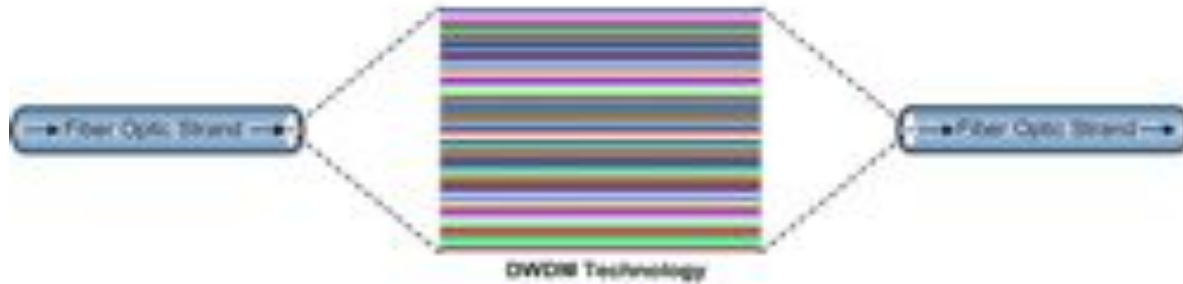
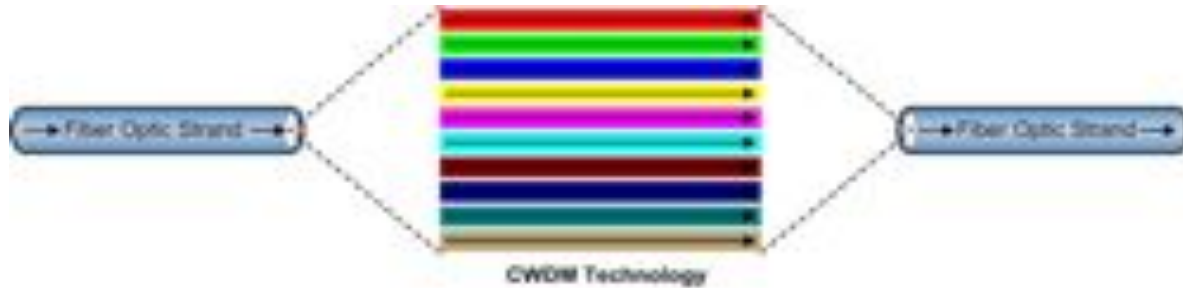


Per fiber: ~ 80-100 colors * 50 GHz
Per color: 10 – 40 – 100 Gbit/s
BW * Distance ~ $2 \cdot 10^{17}$ bm/s

New: Hollow Fiber!
➔ less RTT!

Optical transmission

... more possibilities



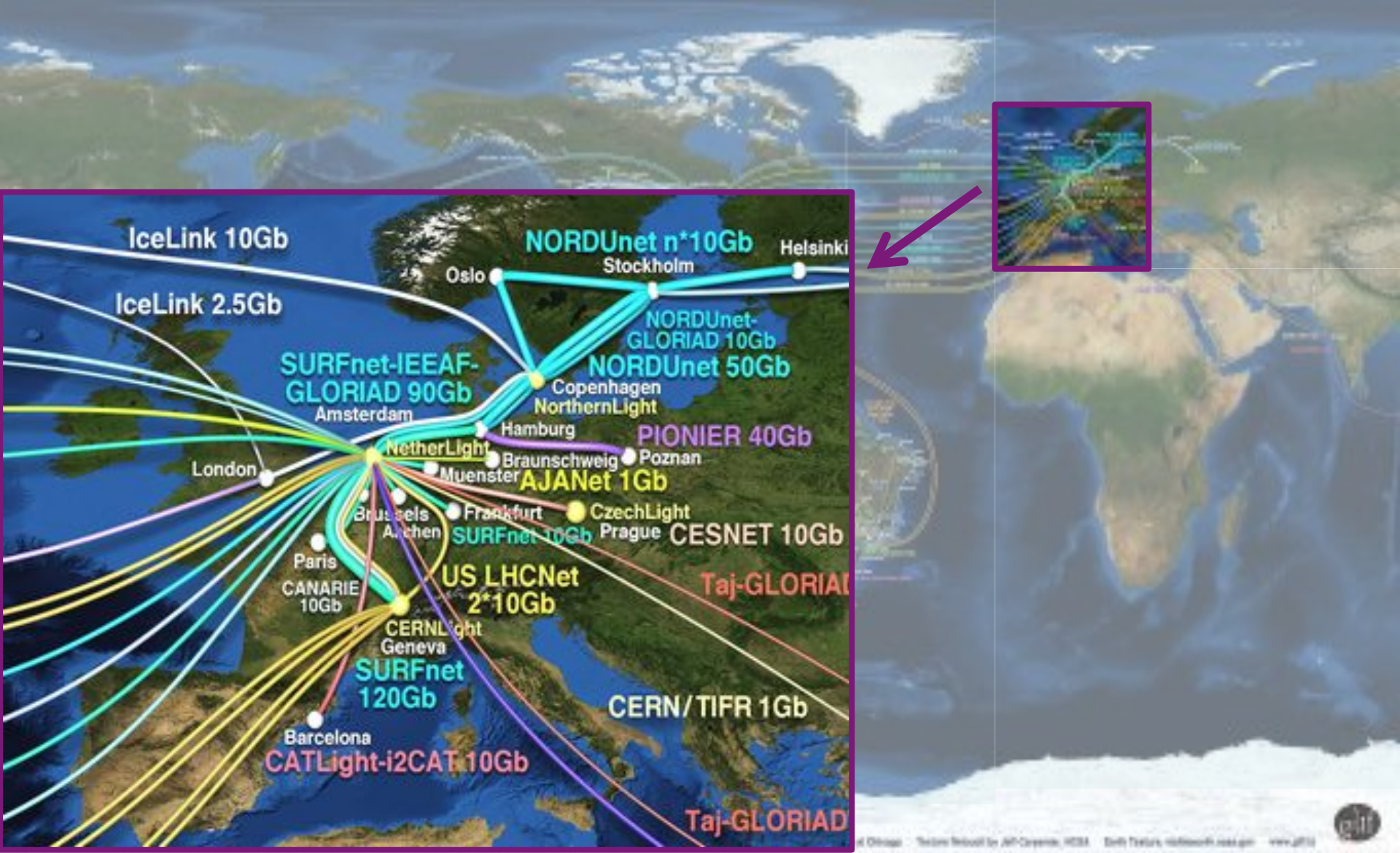
Virtualization



The GLIF – lightpaths around the world



The GLIF – lightpaths around the world



The Ten Problems with the Internet

1. Energy Efficient Communication
2. Separation of Identity and Address
3. Location Awareness
4. Explicit Support for Client-Server Traffic and Distributed Services
5. Person-to-Person Communication
6. Security
7. Control, Management, and Data Plane separation
8. Isolation
9. Symmetric/Asymmetric Protocols
10. Quality of Service

Nice to have:

- Global Routing with Local Control of Naming and Addressing
- Real Time Services
- Cross-Layer Communication
- Multicast
- Receiver Control
- Support for Data Aggregation and Transformation
- Support for Streaming Data
- Virtualization

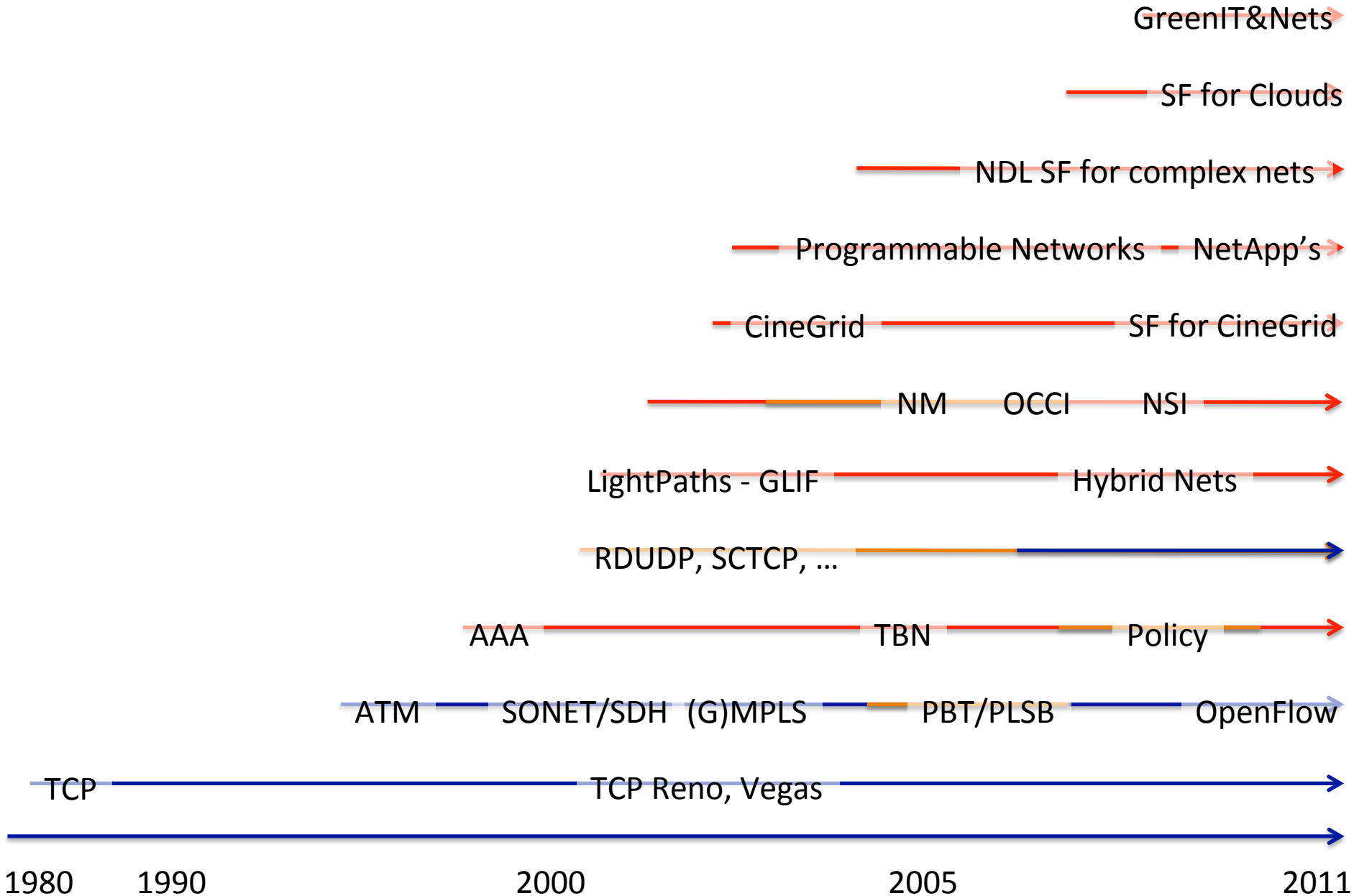
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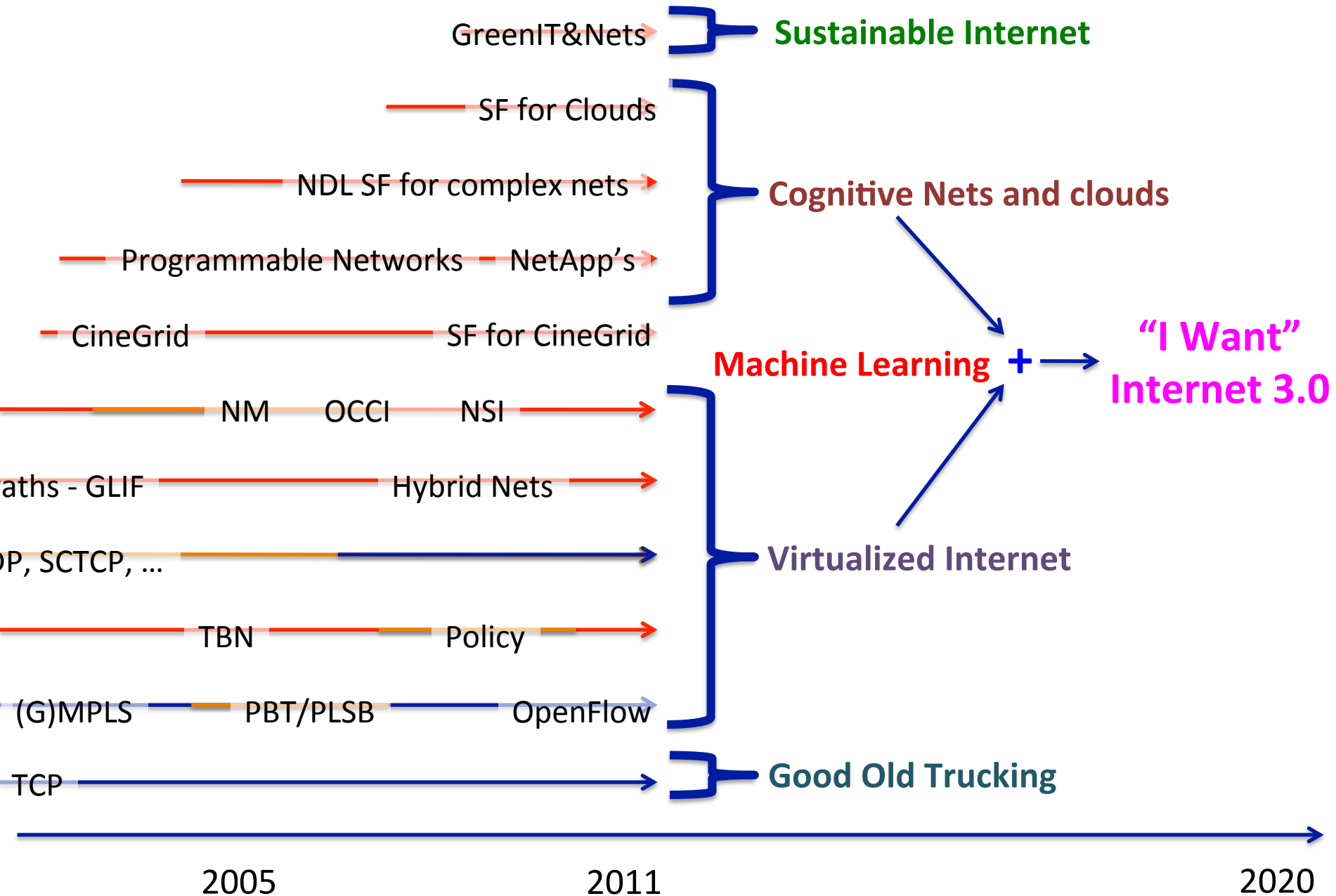
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- **Virtualization**

TimeLine



TimeLine



TimeLine

• Sustainable Internet

• Cognitive Nets and clouds

• Machine Learning +

“I Want”
Internet 3.0

• Virtualized Internet

• Good Old Trucking

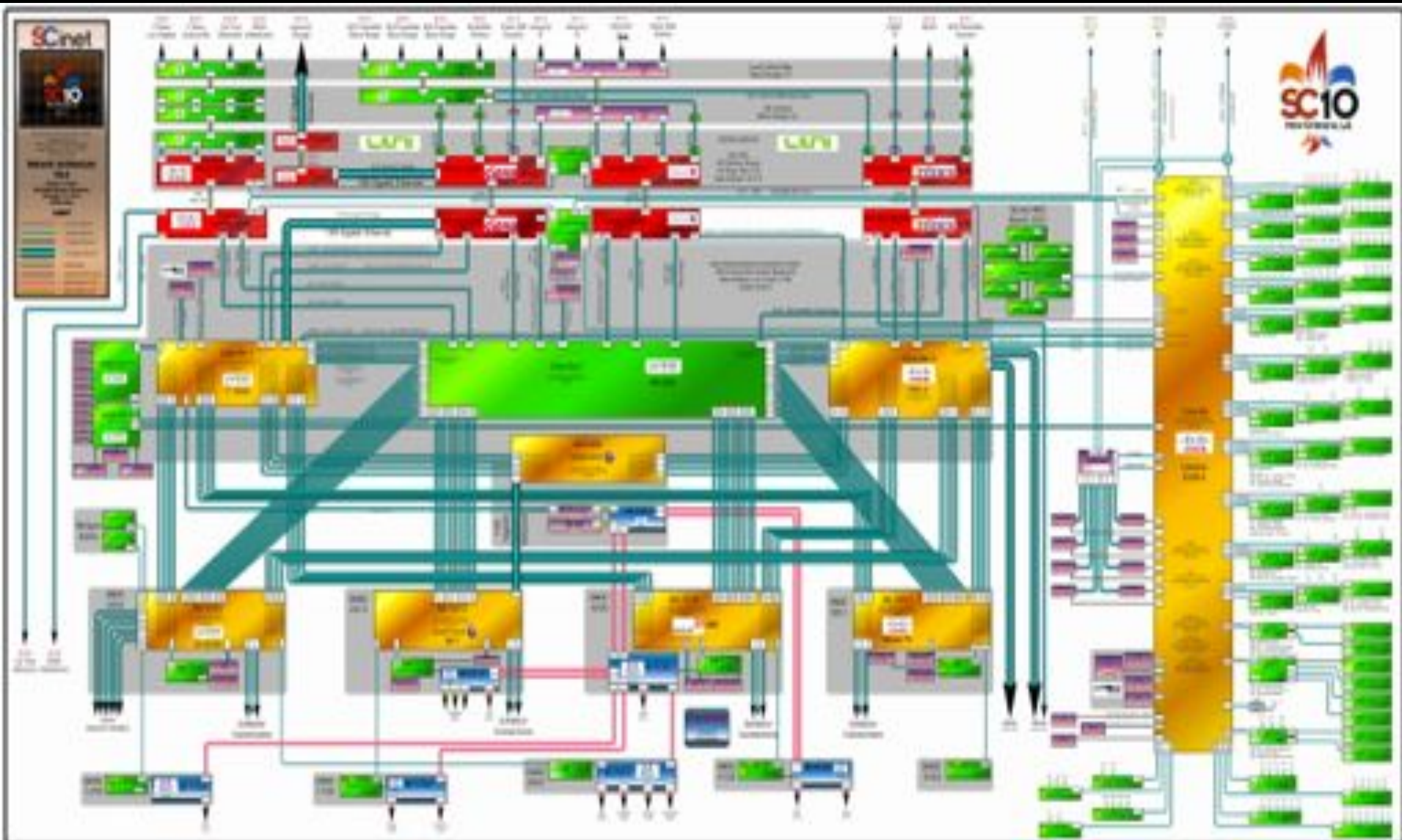


I
retire

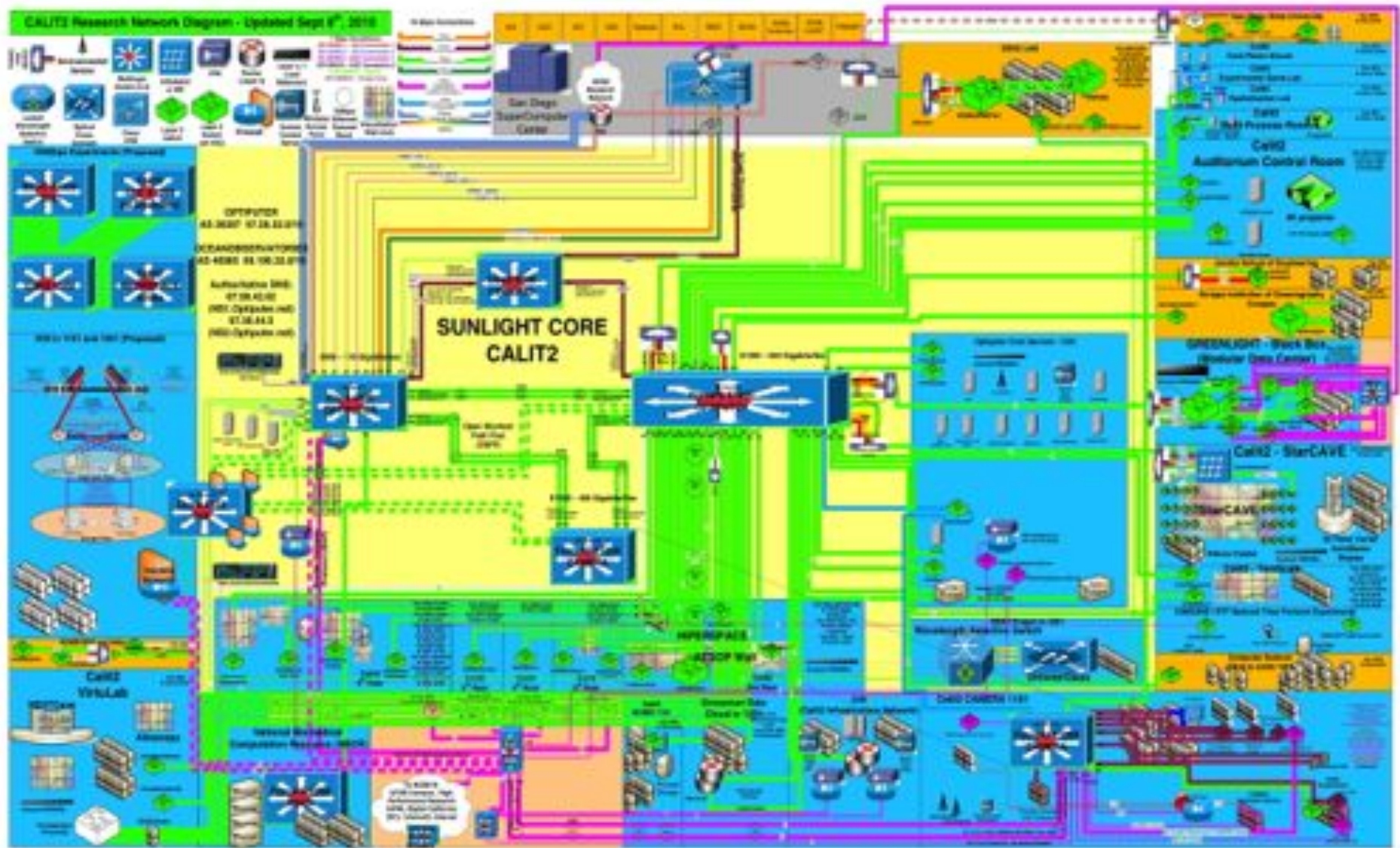
2020

2040

Complex e-Infrastructure!



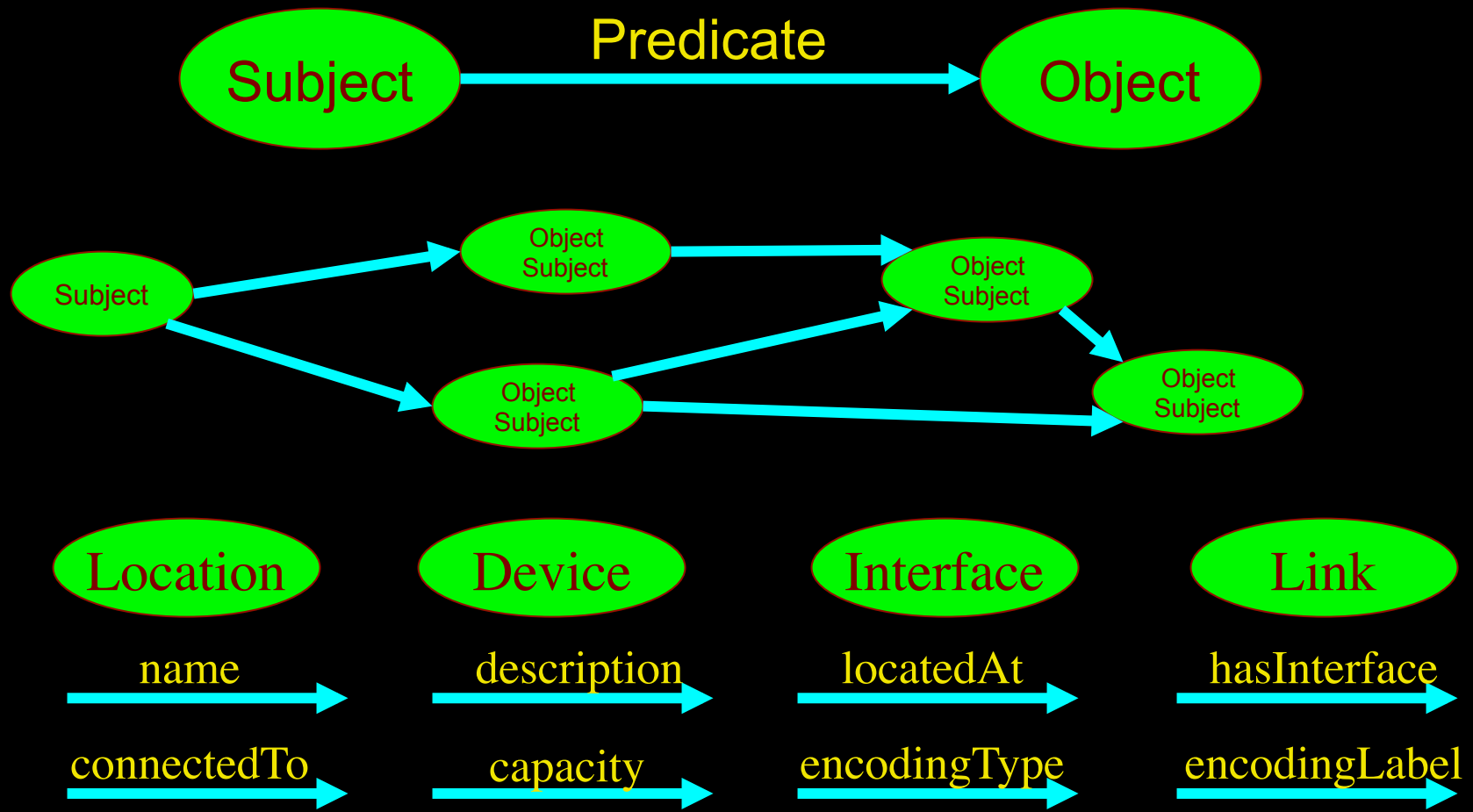
Complex e-Infrastructure!



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):





GLIF Map 2011 - Global Lambda-Integrated Facility. Visualization by Robert Patterson, NCSA, University of Illinois at Urbana-Champaign. Data Collection by Maxine Brown, University of Illinois at Urbana-Champaign. Network Traces by JPCore.com, NCSA. Earth Texture: earthtooth.com - www.glif.org



GLIF 2011

**Visualization courtesy of Bob Patterson, NCSA
Data collection by Maxine Brown.**



We investigate:
complex networks!

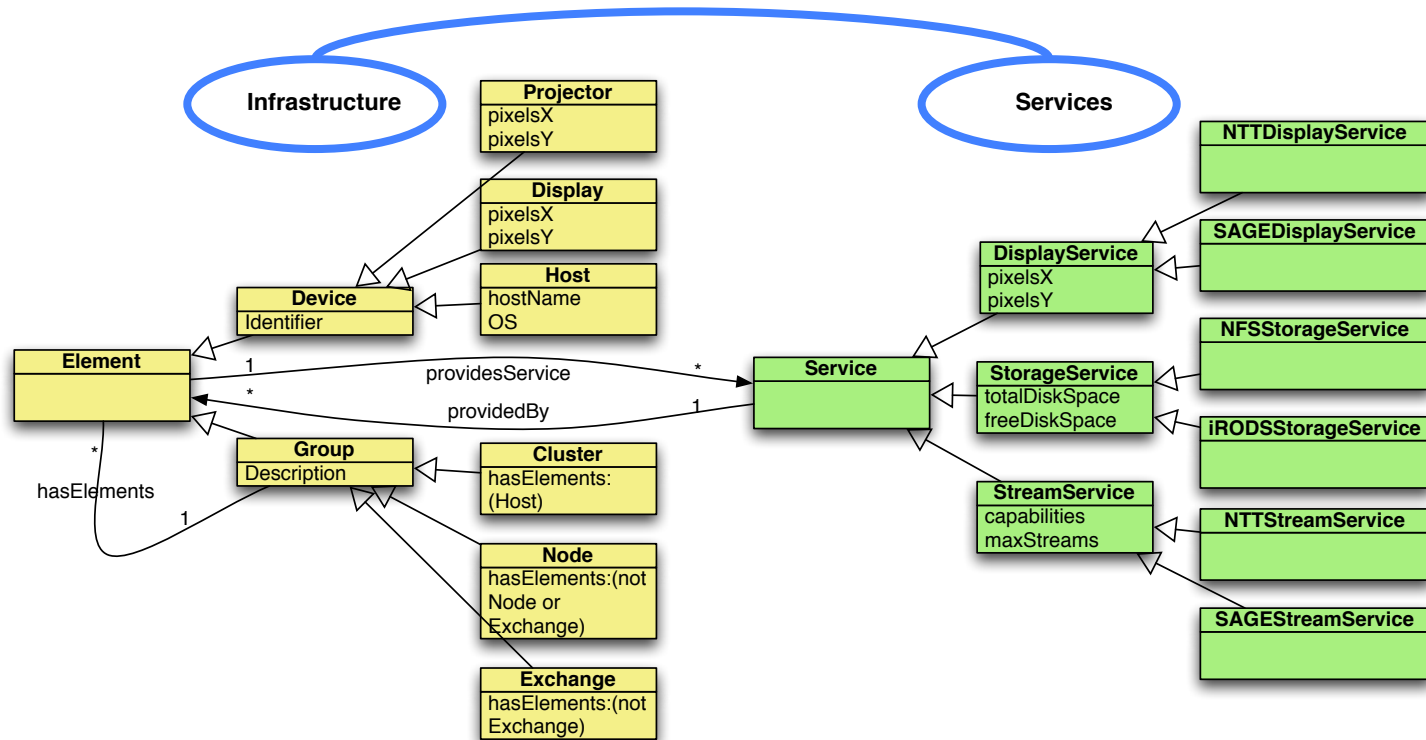


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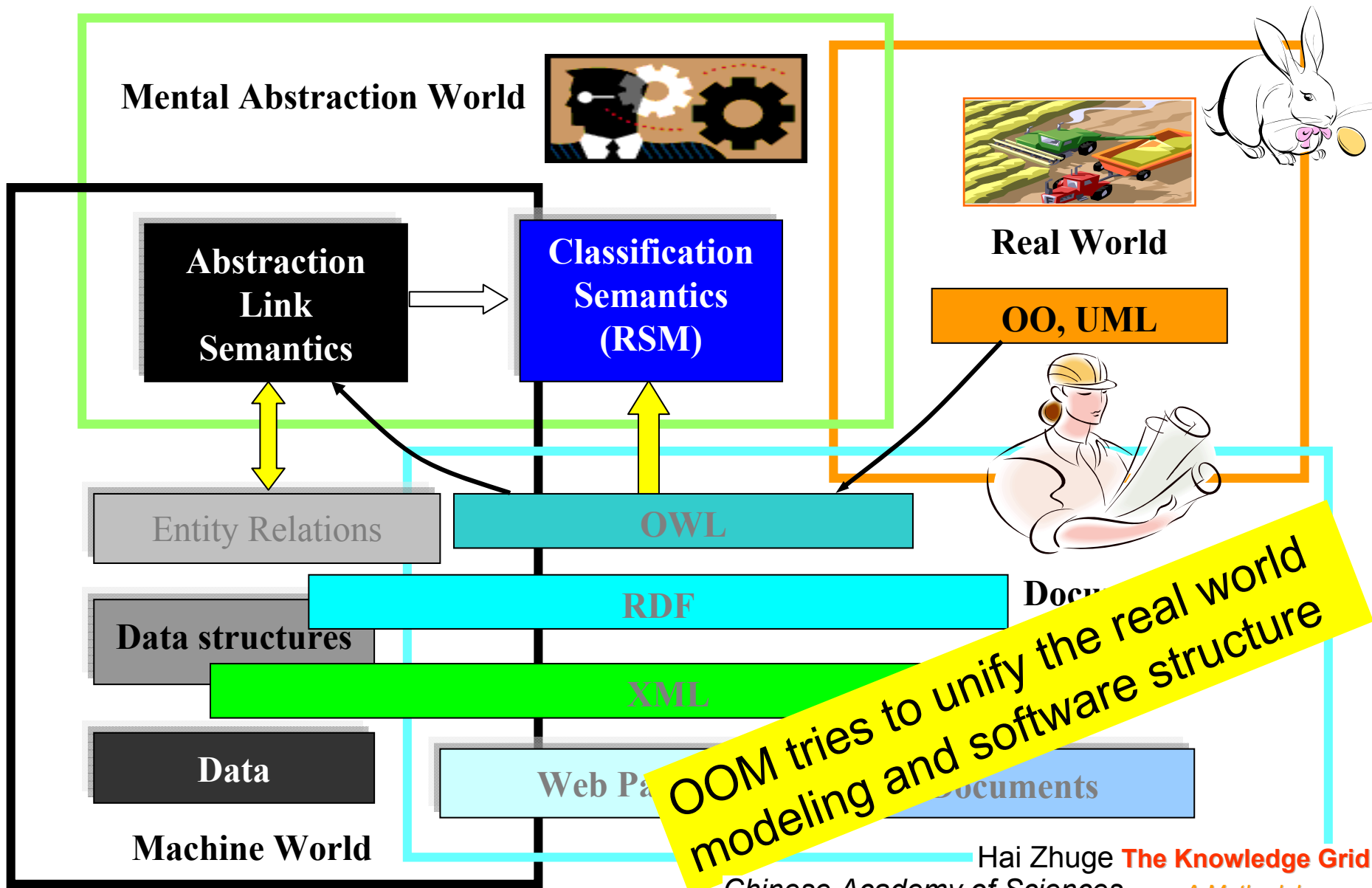


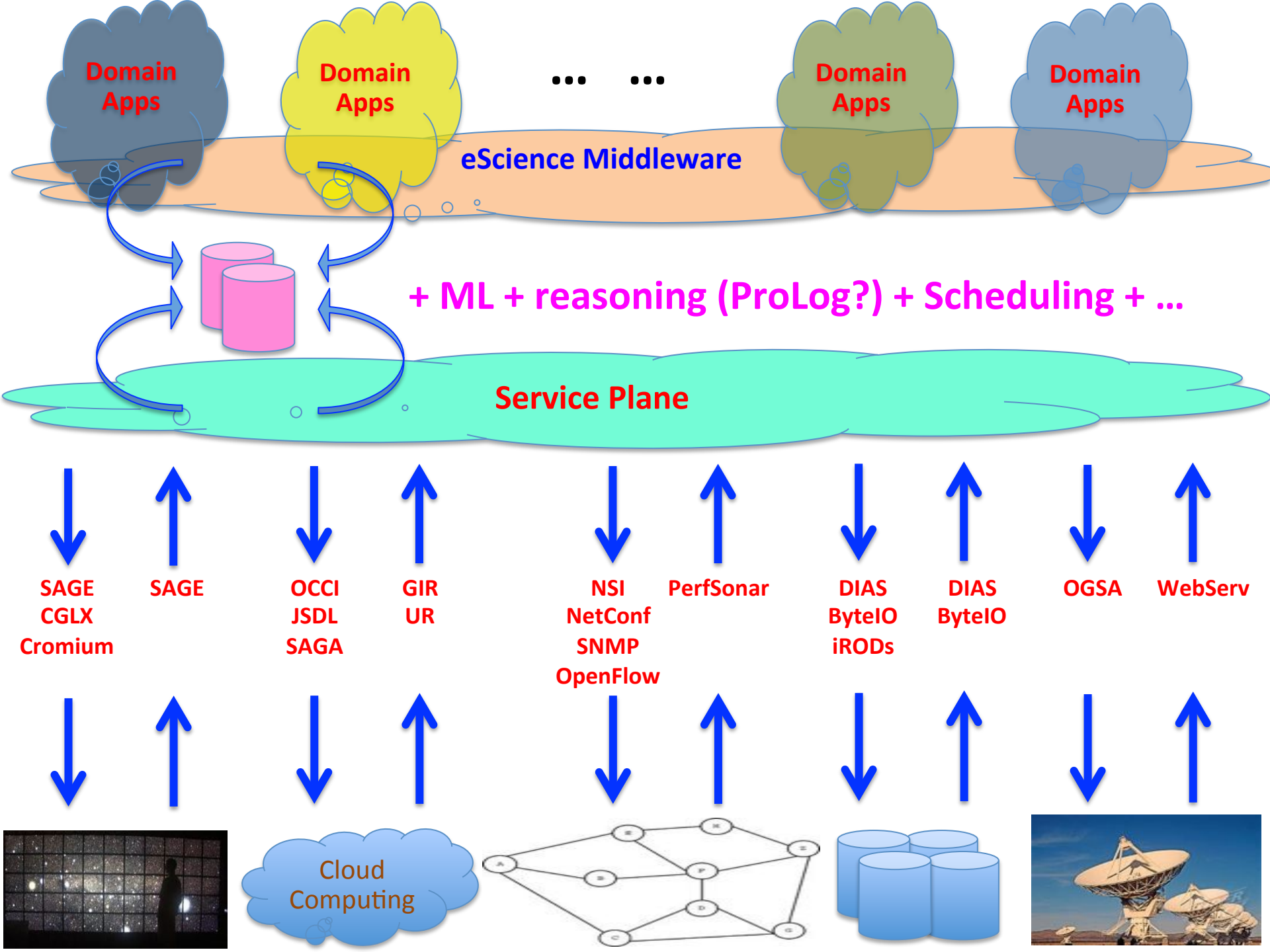
Information Modeling

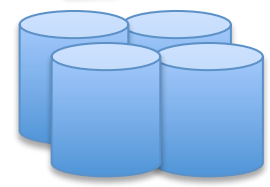
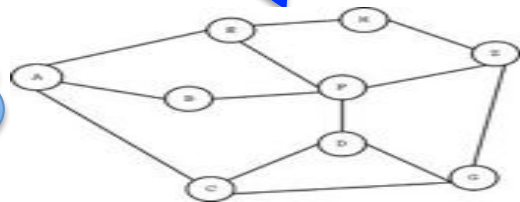
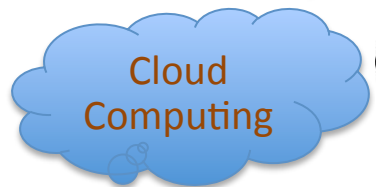
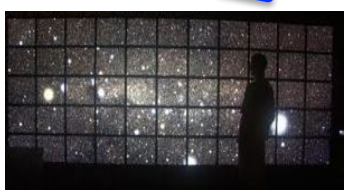
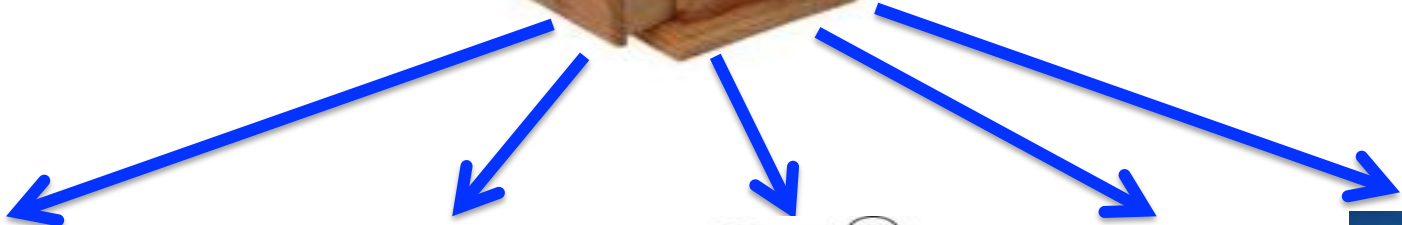
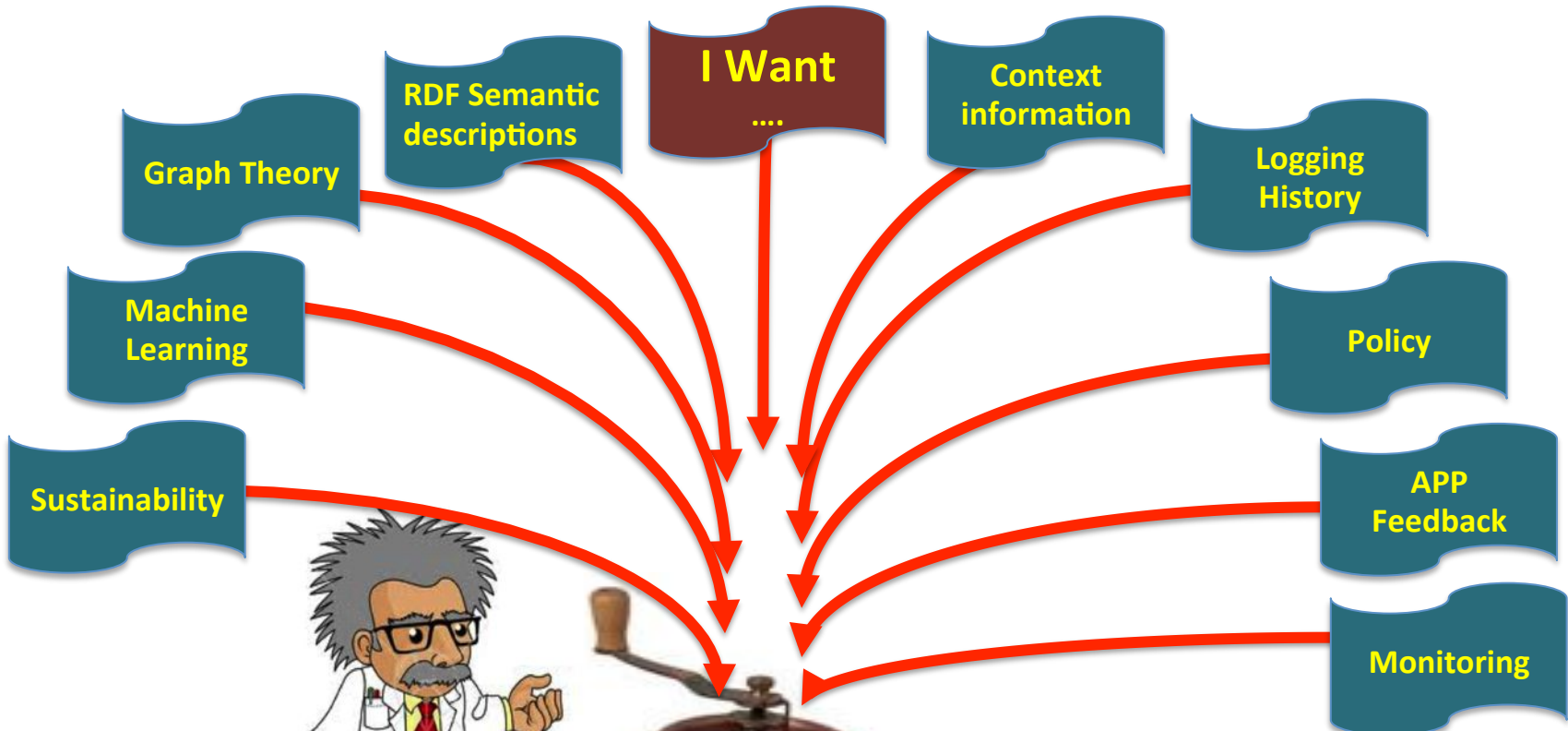
Define a common information model for **infrastructures** and **services**.
Base it on Semantic Web.



Semantics in Multiple Spaces







ECO-Scheduling



The Way Forward!

- Nowadays scientific computing and data is dwarfed by commercial & cloud, there is also no scientific water, scientific power.
 - Understand how to work with elastic clouds
 - Trust & Policy & Firewalling on VM/Cloud level
- Technology cycles are 3 – 5 year
 - Do not try to unify but prepare for diversity
 - Hybrid computing & networking
 - Compete on implementation & agree on interfaces and protocols
- Limitation on natural resources and disruptive events
 - Energy becomes big issue
 - Follow the sun
 - Avoid single points of failure (aka Amazon, Blackberry,
 - Better very loosely coupled than totally unified integrated...

Q & A

<http://ext.delaat.net/>

Slides thanks to:

- Paola Grosso
- Sponsors see slide 1. 😊
- SNE Team & friends, see below

