Is the Internet becoming the Computer

www.science.uva.nl/~delaat

Cees de Laat

GigaPort EU

University of Amsterdam

SARA

NCF

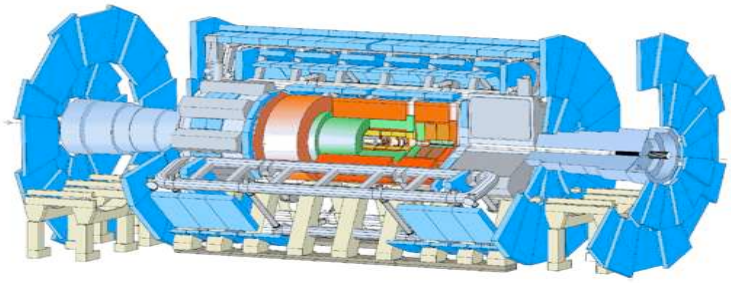
Talk contents

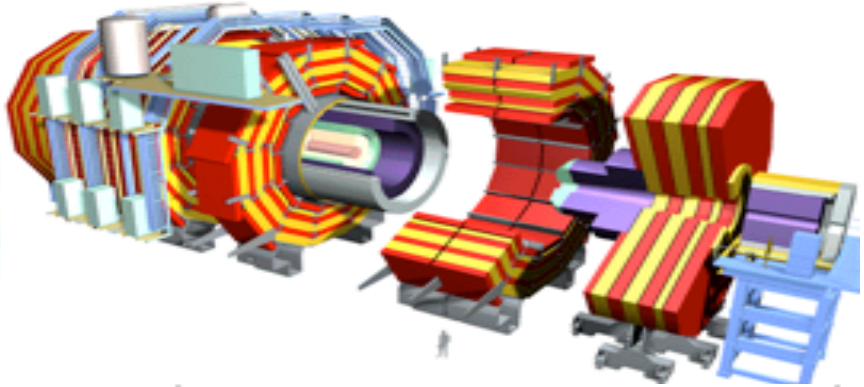
- Just wait 20 minutes

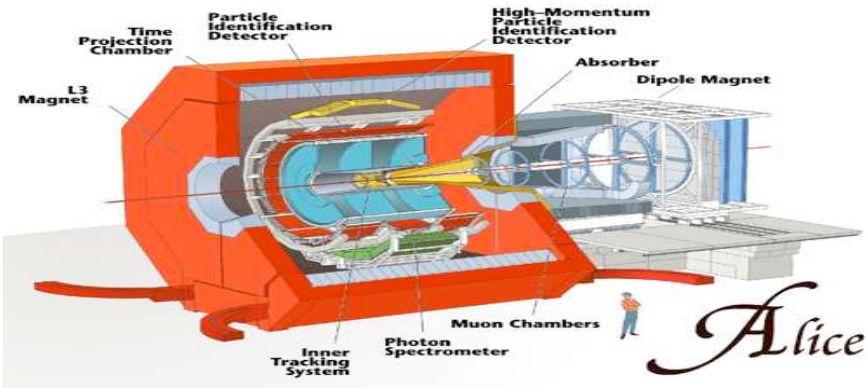
Four LHC Experiments: The Petabyte to Exabyte Challenge

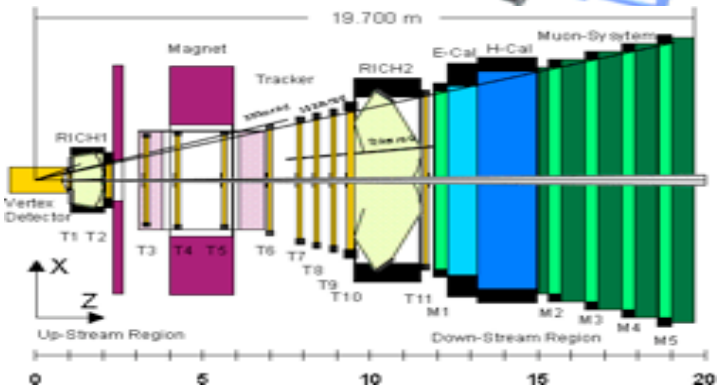
ATLAS, CMS, ALICE, LHCB

Higgs + New particles; Quark-Gluon Plasma; CP Violation







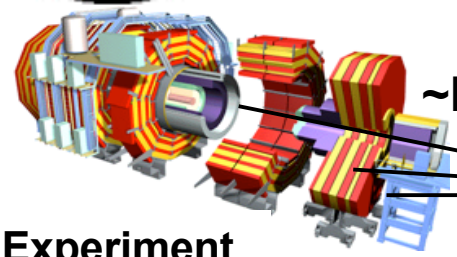


6000+ Physicists & Engineers; 60+ Countries; 250 Institutions

Tens of PB 2008; To 1 EB by ~2015

Hundreds of TFlops To PetaFlops

LHC Data Grid Hierarchy



Experiment

~PBytes/sec

Online System

~100-1500 MBytes/sec

CERN/Outside Resource Ratio ~1:2
Tier0/(Σ Tier1)/(Σ Tier2) ~1:1:1

Tier 0 +1

CERN Center
PBs of Disk;
Tape Robot

Tier 1

~10 Gbps

IN2P3 Center

RAL Center

INFN Center

FNAL Center

2.5-10 Gbps

~2.5-10 Gbps

Tier 2

Tier2 Center

Tier 3

Institute

Physics data cache

0.1 to 10 Gbps

Workstations

Tier 4

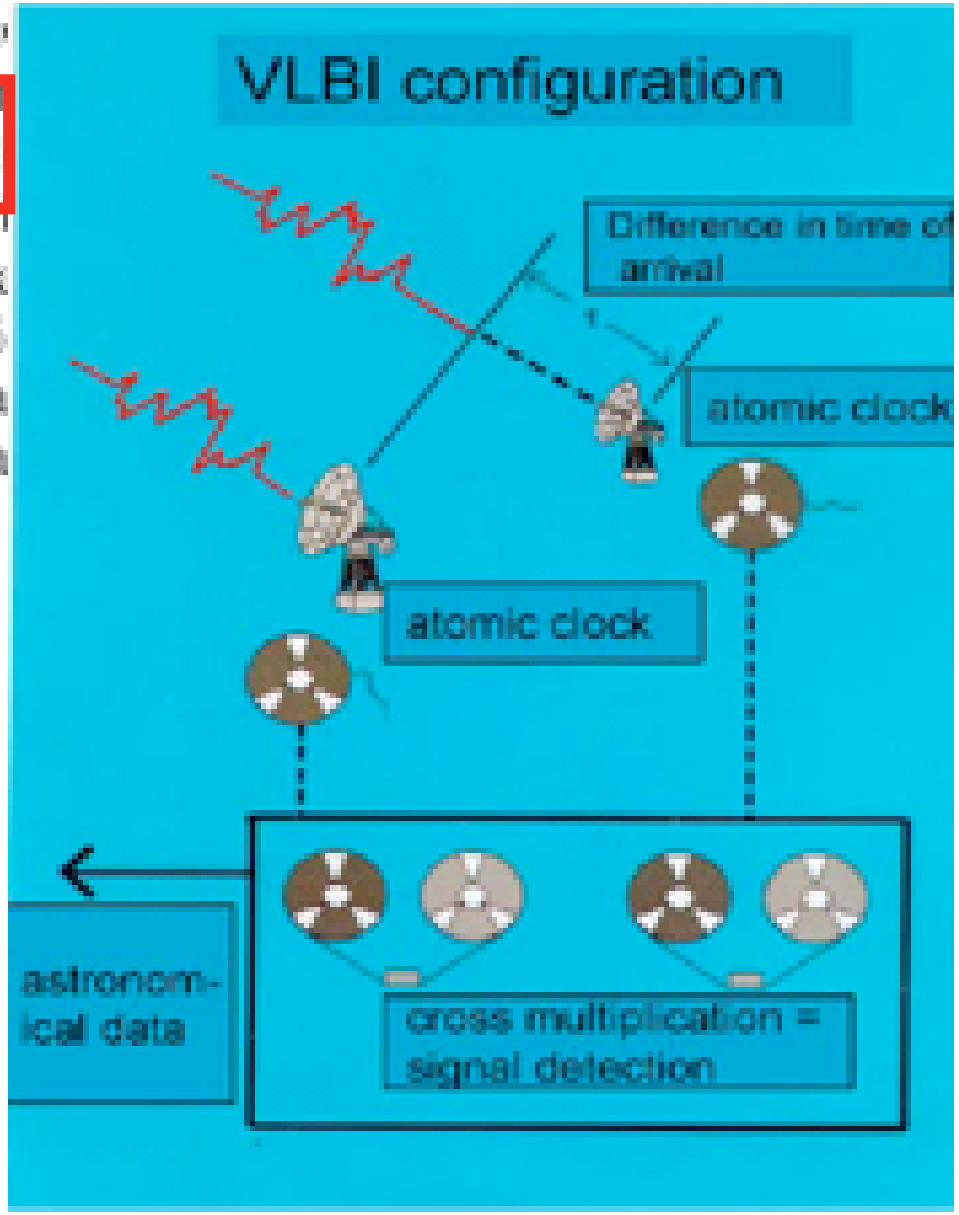
Tens of Petabytes by 2007-8.
An Exabyte ~5-7 Years later.

Emerging Vision: A Richly Structured, Global Dynamic System

VLBI

ger term VLBI is easily capable of generating many Gb of data per
The sensitivity of the VLBI array scales v
(data-rate) and there is a strong push to
. Rates of 8Gb/s or more are entirely feasibl
ider development. It is expected that paral
orrelator will remain the most efficient approa
s distributed processing may have an appli
lti-gigabit data streams will aggregate into la
or and the capacity of the final link to the da
tor.

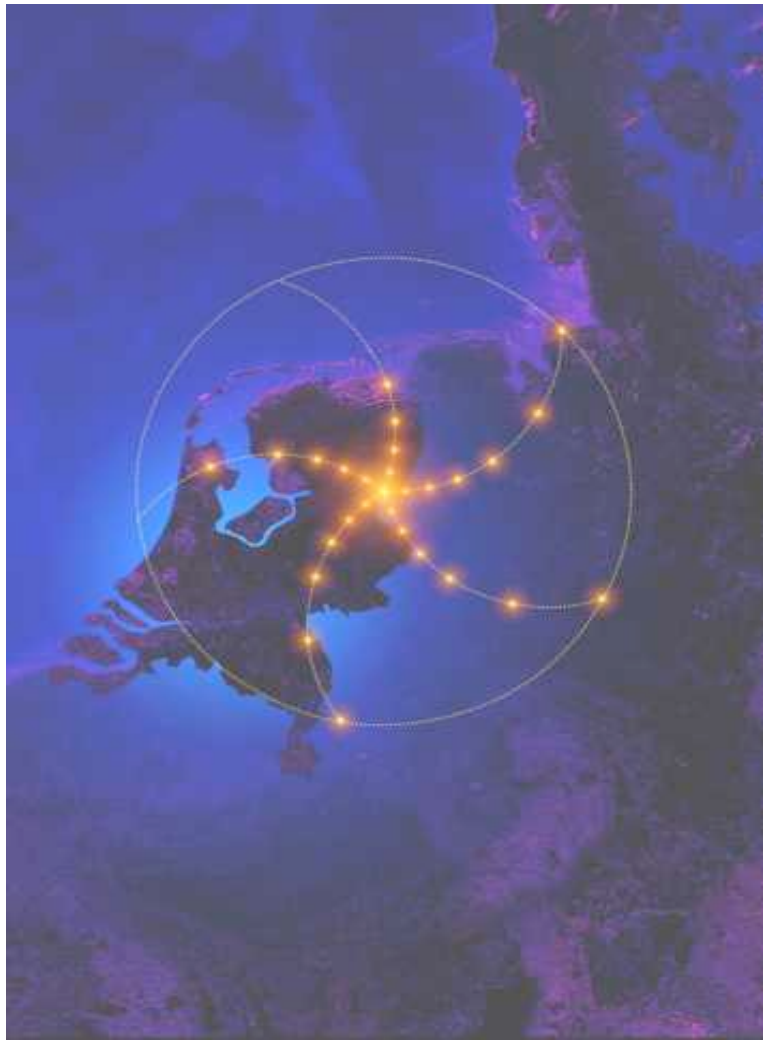
Westerbork Synthesis Radio Telescope - Netherlands



Lambdas as part of instruments

GigaPort

LOFAR



www.lofar.org

SURFnet

OptIPuter Project Goal: Scaling to 100 Million Pixels

- **JuxtaView (UIC EVL) for PerspecTile LCD Wall**
  - Digital Montage Viewer
  - 8000x3600 Pixel Resolution~30M Pixels
- **Display Is Powered By**
  - 16 PCs with Graphics Cards
  - 2 Gigabit Networking per PC

Source: Jason Leigh, EVL, UIC; USGS EROS

UCSD UCIrvine

it²

Grids

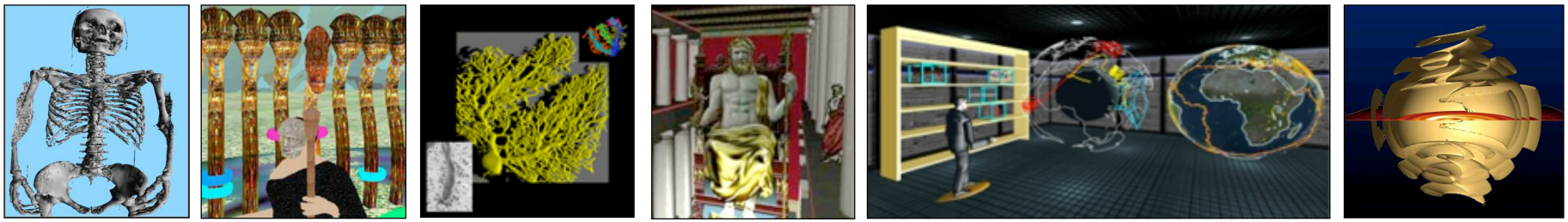
Showed you:

- Computational Grids
  - HEP and LOFAR analysis requires massive CPU capacity
- Data Grid
  - Storing and moving HEP, Bio and Health data sets is major challenge
- Instrumentation Grids
  - Several massive data sources are coming online
- Visualization Grids
  - Data object (TByte sized) inspection, anywhere, anytime

iGrid 2002

September 24-26, 2002, Amsterdam, The Netherlands

- 28 demonstrations from 16 countries: Australia, Canada, CERN, France, Finland, Germany, Greece, Italy, Japan, The Netherlands, Singapore, Spain, Sweden, Taiwan, United Kingdom, United States
- Applications demonstrated: art, bioinformatics, chemistry, cosmology, cultural heritage, education, high-definition media streaming, manufacturing, medicine, neuroscience, physics, tele-science

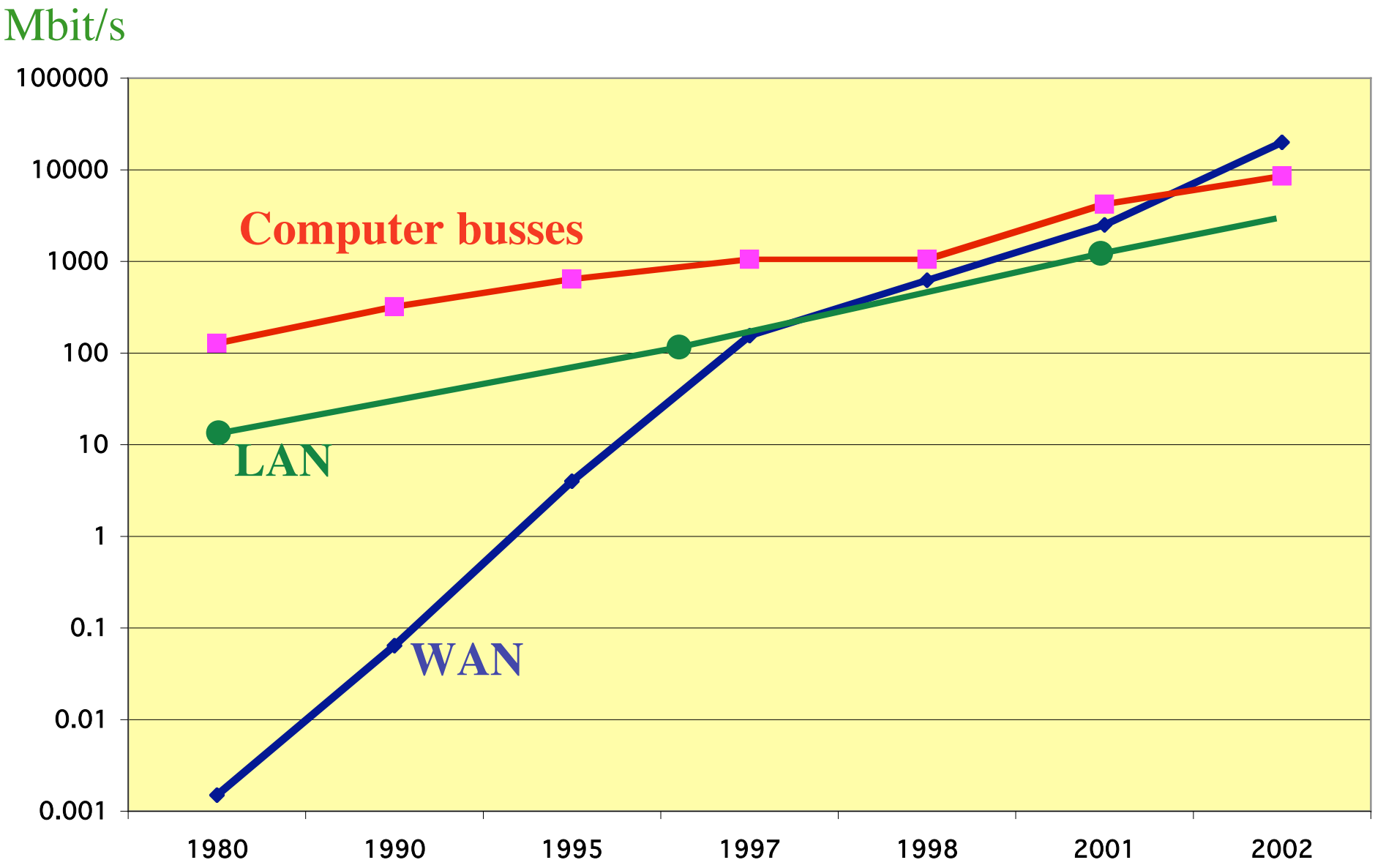


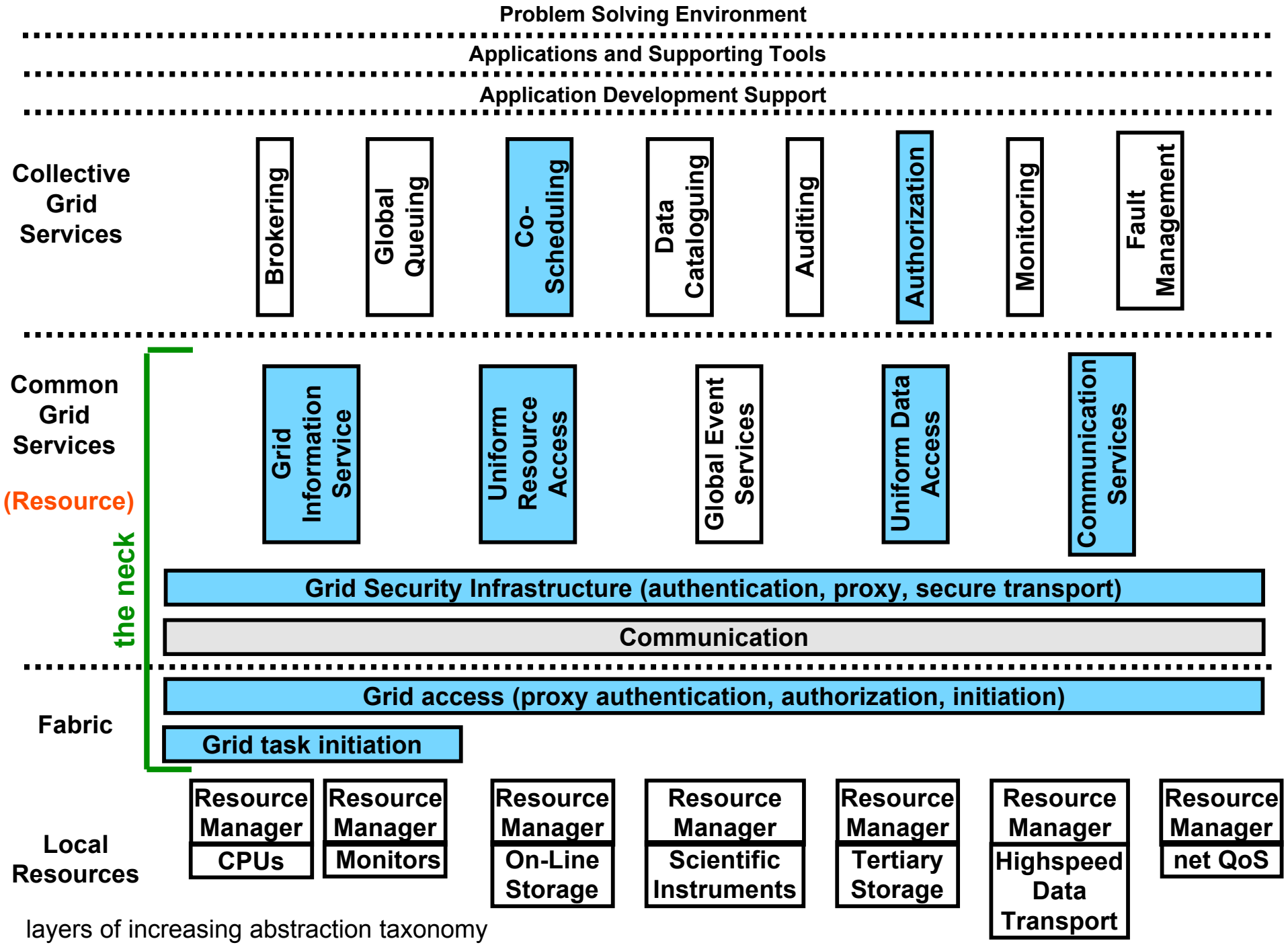
- Grid technologies demonstrated: Major emphasis on grid middleware, data management grids, data replication grids, visualization grids, data/visualization grids, computational grids, access grids, grid portals
- 25Gb transatlantic bandwidth (100Mb/attendee, 250x iGrid2000!)

www.igrid2002.org

Note: iGrid2005 @ San Diego sept 2005

Internal versus external bandwidth



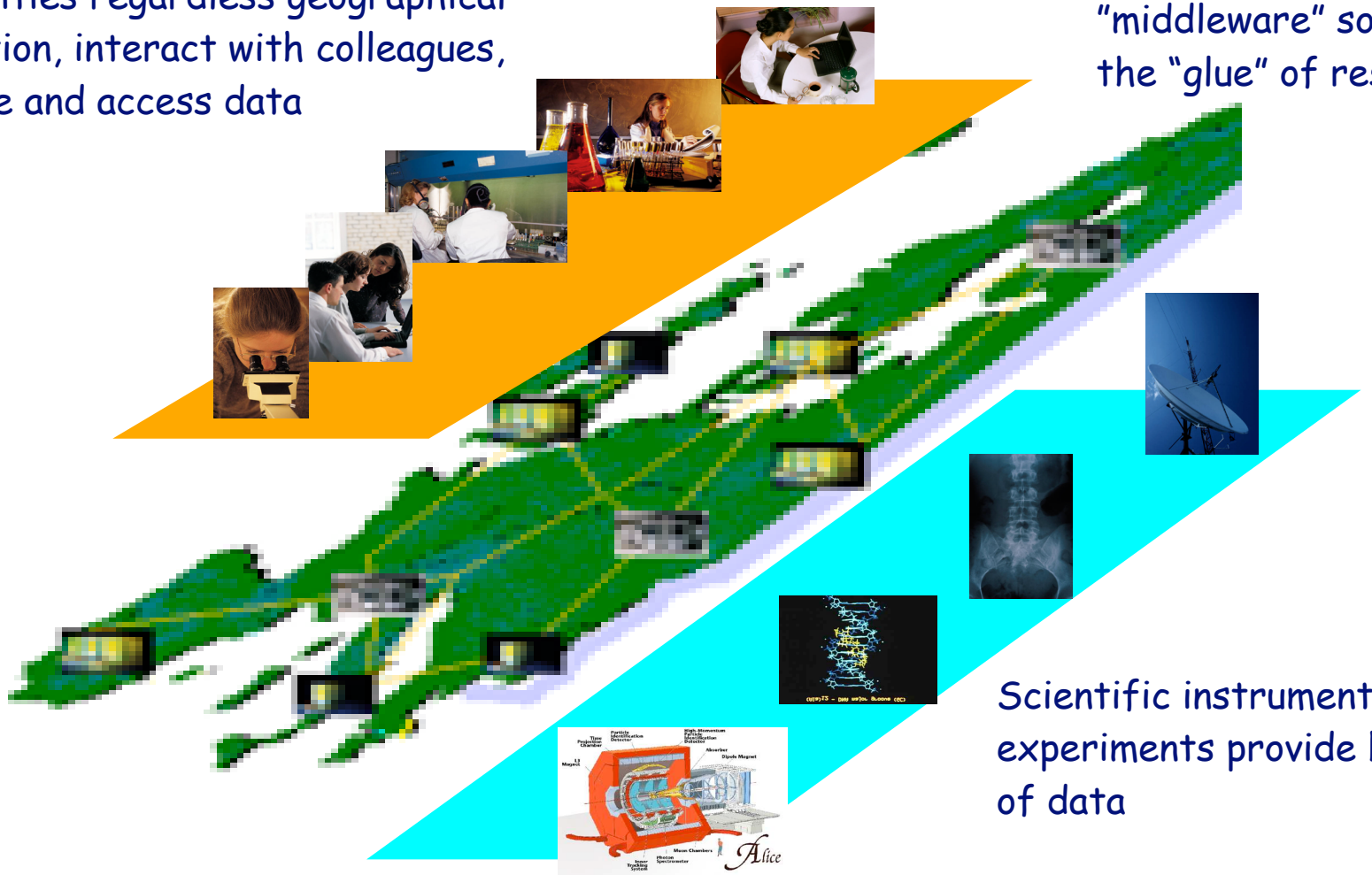


layers of increasing abstraction taxonomy

Grid - a Vision

Researchers perform their activities regardless geographical location, interact with colleagues, share and access data

The GRID: networked data processing centres and "middleware" software as the "glue" of resources.



Scientific instruments and experiments provide huge amounts of data

Ref: EDG

The END

(2 more ggf slides)

Partially complete list:

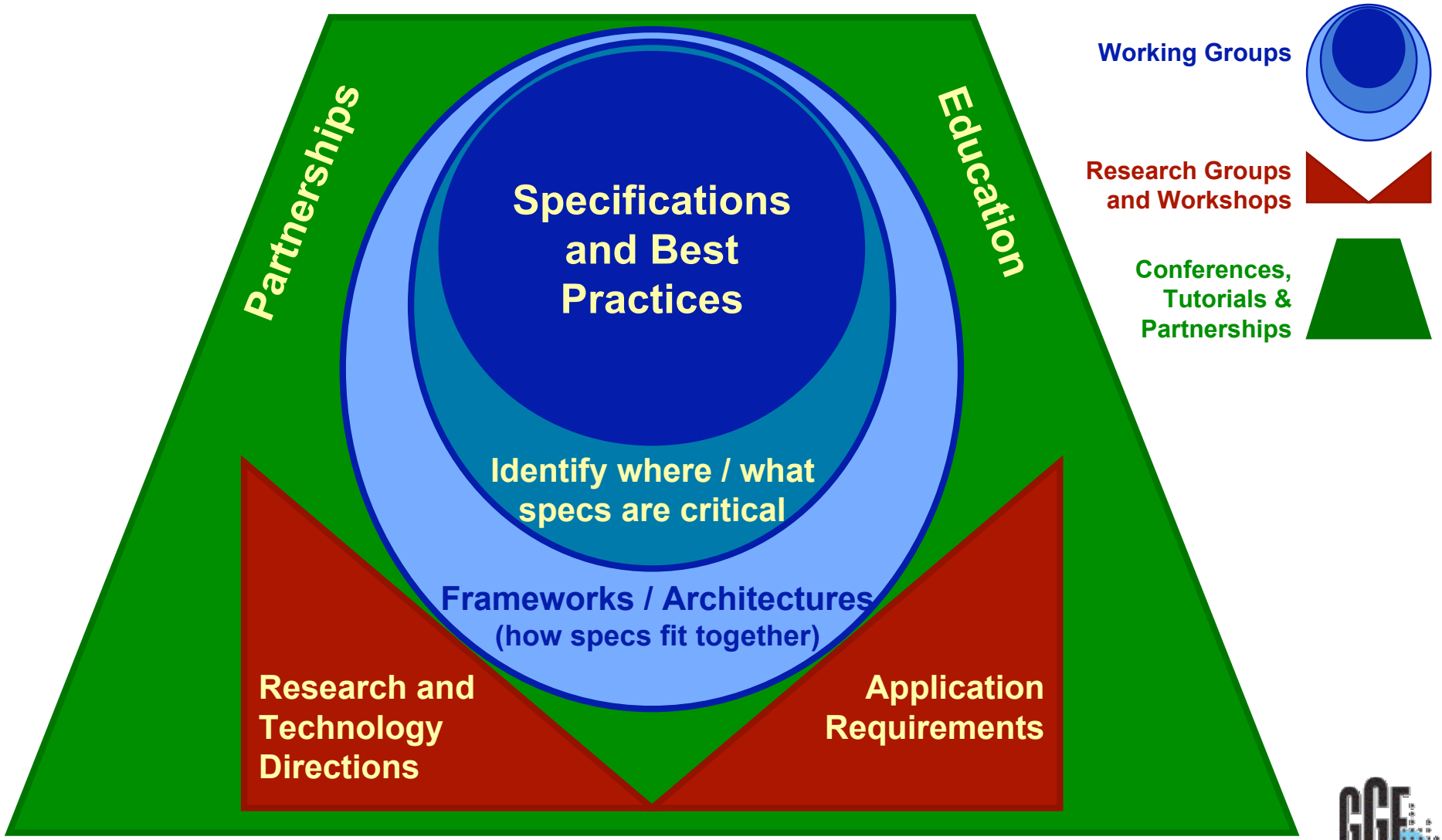
Caas
Chase
Cess
Kess
Case

GigaPort

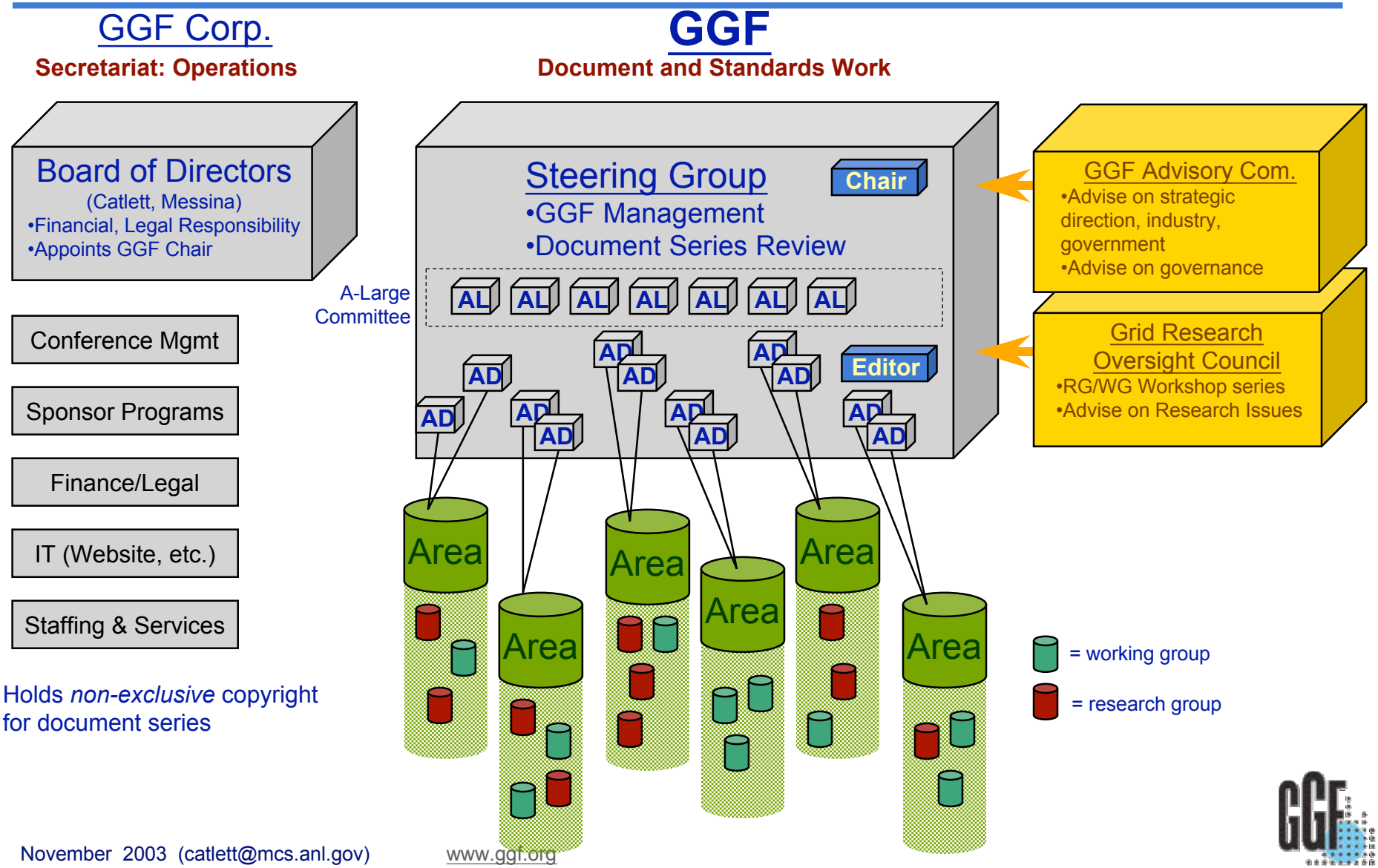
NWO/NCF

SURFnet

What is Global Grid Forum?



GGF Structure



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