4th Global Lambda Integrated Facility meeting

Nottingham 2-3 sept 2004

Cees de Laat

Many many thanks to our host UKERNA!

www.glif.is

Contents

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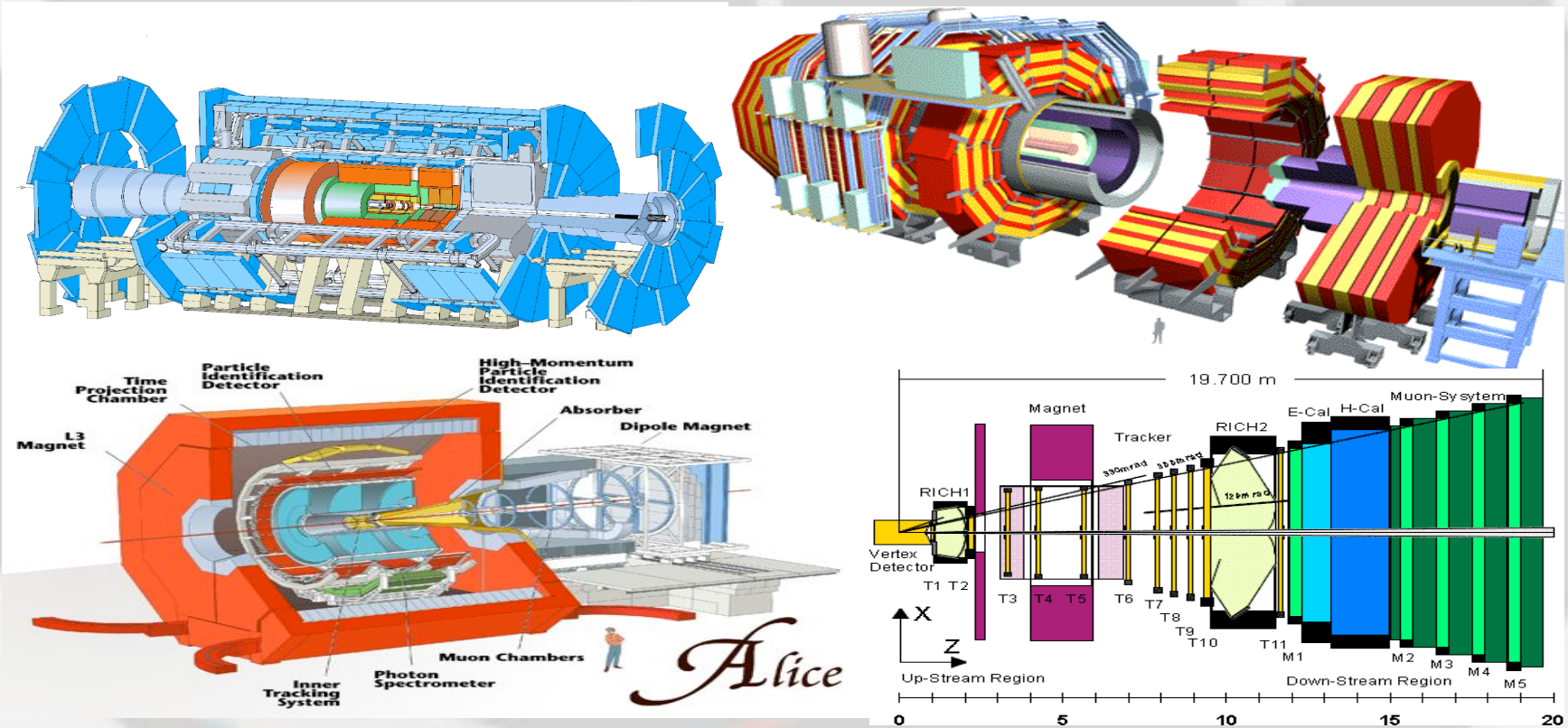
Four LHC Experiments: The Petabyte to Exabyte Challenge

- **ATLAS, CMS, ALICE, LHCB**



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

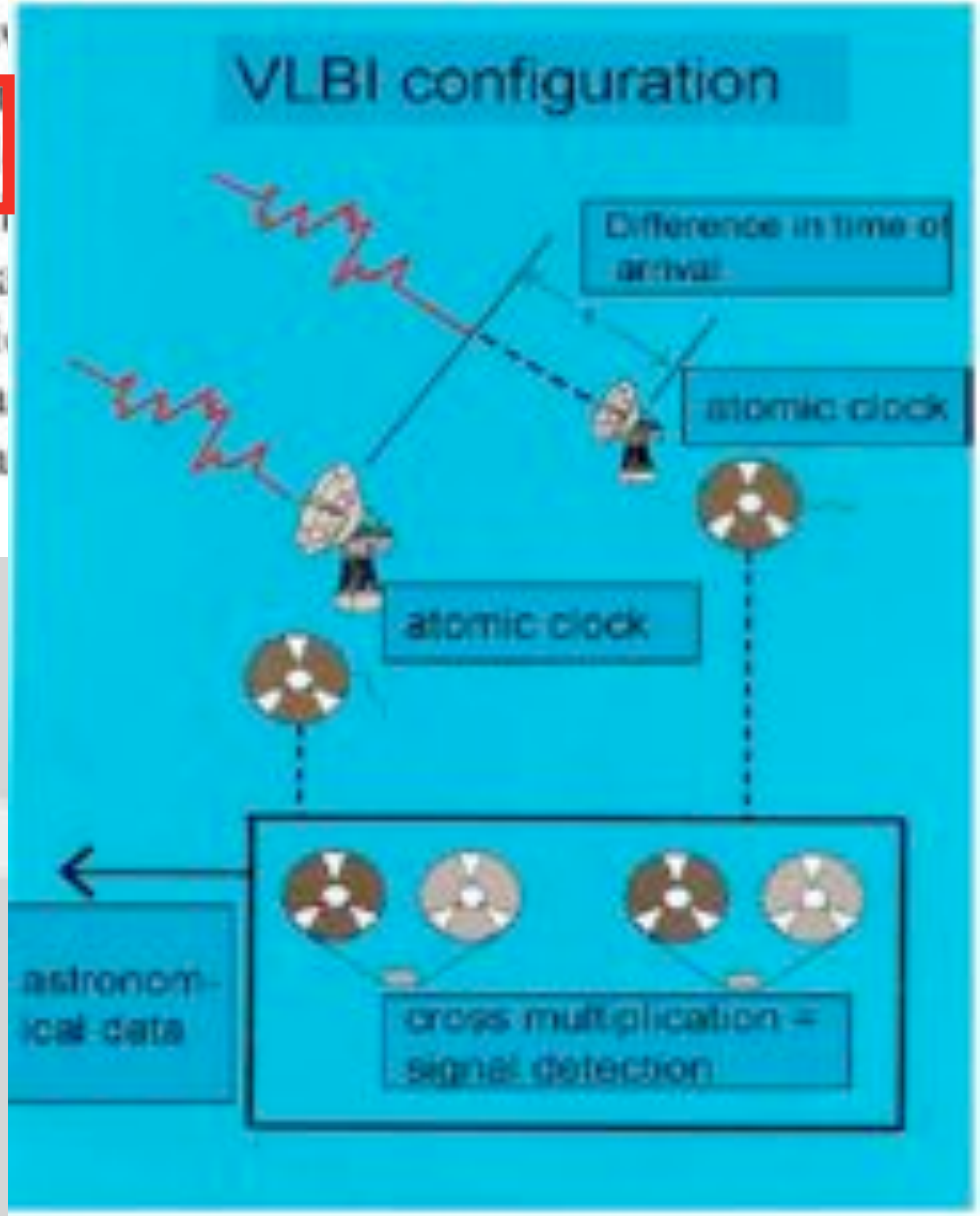
Tens of PB 2008; To 1 EB by ~2015

Hundreds of TFlops To PetaFlops

VLBI

he longer term VLBI is easily capable of generating many Gb of data per
scope. The sensitivity of the VLBI array scales w
dwidth (
data-rate) and there is a strong push to
dwidths. Rates of 8Gb/s or more are entirely feasibl
also under development. It is expected that paral
cated correlator will remain the most efficient approa
evolves distributed processing may have an appli
eral, multi-gigabit data streams will aggregate into la
correlator and the capacity of the final link to the da
ting factor.

Westerbork Synthesis Radio Telescope - Netherlands



Lambdas as part of instruments

www.lofar.org

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

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

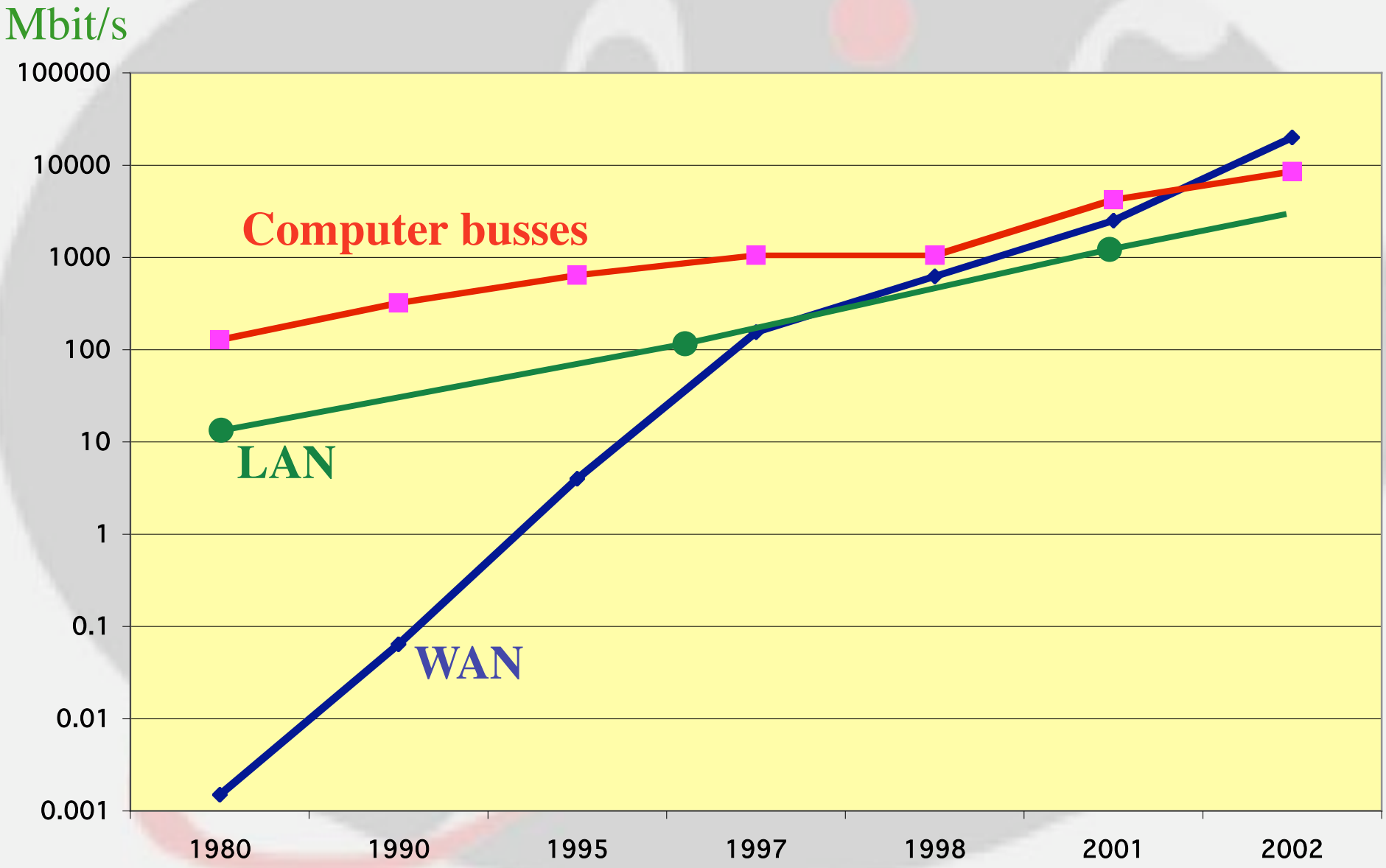
- 28 demonstrations from 16 countries: Australia, Canada, CERN, France, Finland, Germany, Greece, Italy, Japan, The Netherlands, Singapore, Spain, Sweden, Taiwan, United Kingdom, United States
- Applications demonstrated: art, bioinformatics, chemistry, cosmology, cultural heritage, education, high-definition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

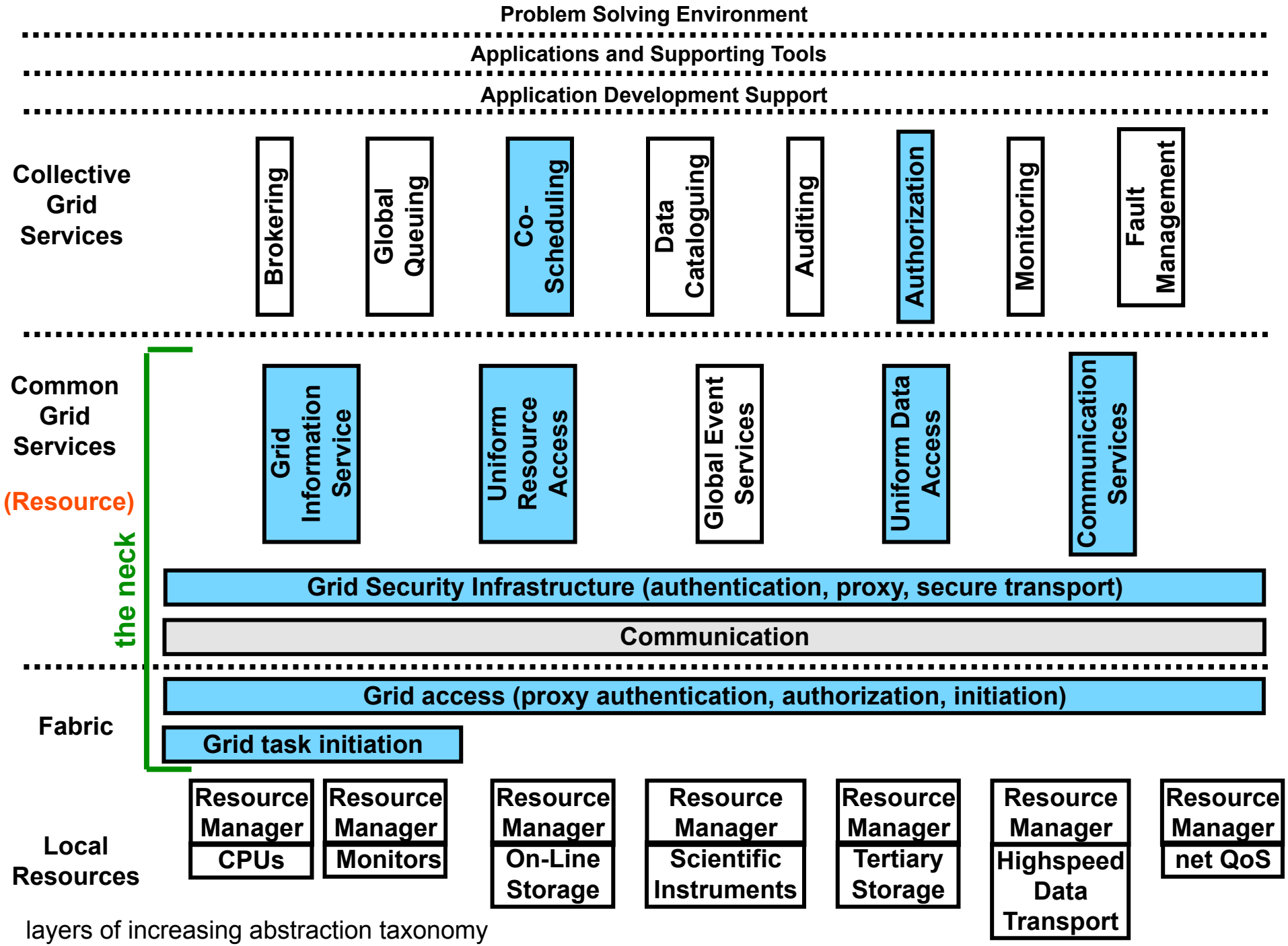
- Grid technologies demonstrated: Major emphasis on grid middleware, data management grids, data replication grids, visualization grids, data/visualization grids, computational grids, access grids, grid portals
- 25Gb transatlantic bandwidth (100Mb/attendee, 250x iGrid2000!)

www.igrid2002.org

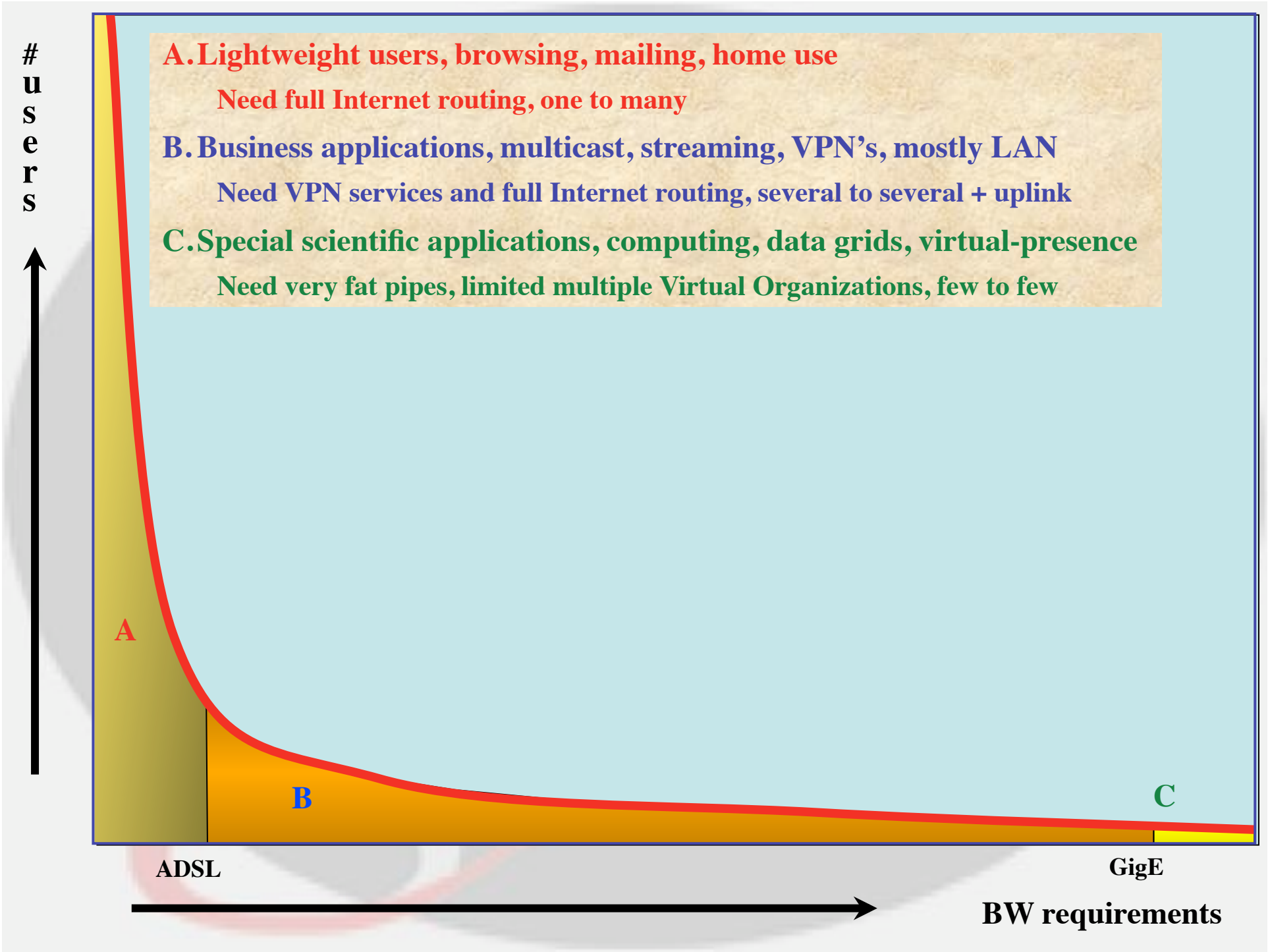
Note: iGrid2005 @ San Diego sept 2005

Internal versus external bandwidth





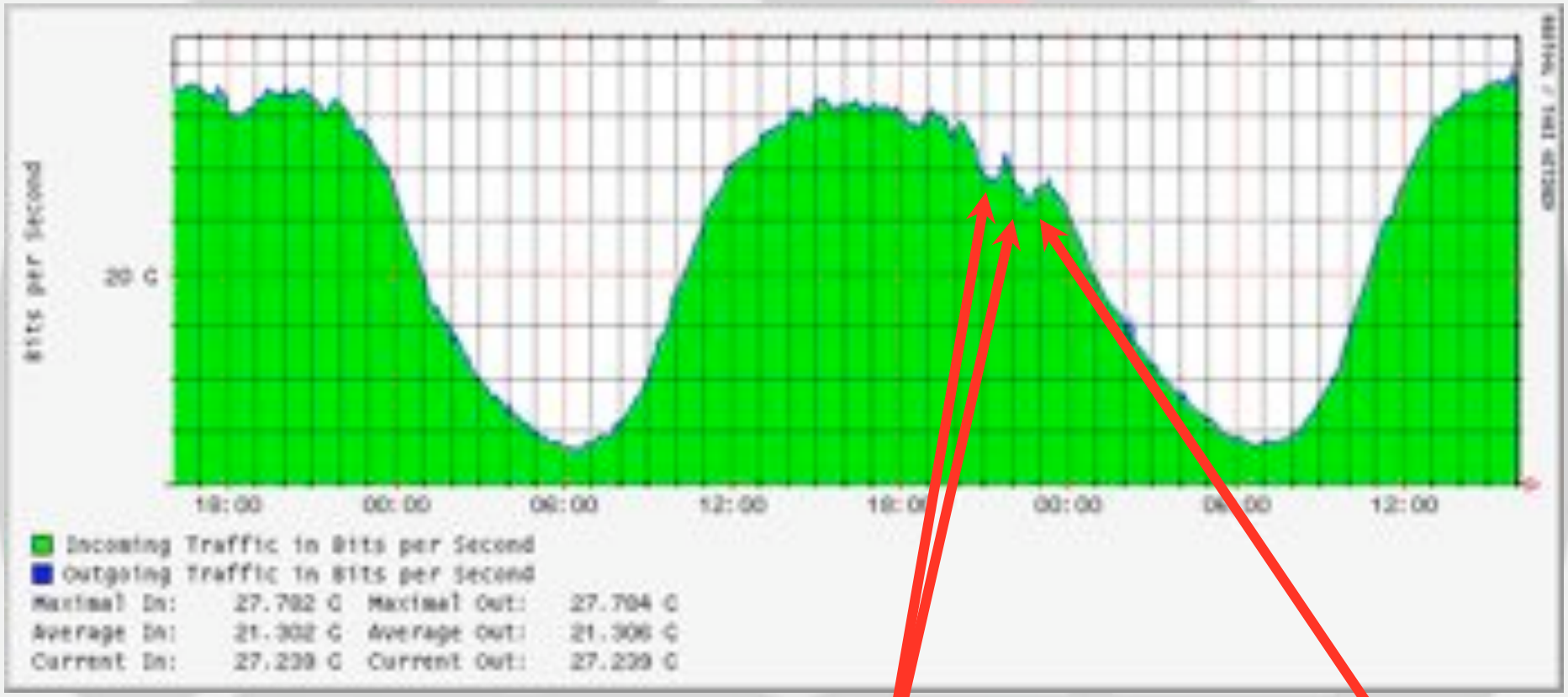
layers of increasing abstraction taxonomy


A. Lightweight users, browsing, mailing, home use
Need full Internet routing, one to many
B. Business applications, multicast, streaming, VPN's, mostly LAN
Need VPN services and full Internet routing, several to several + uplink
C. Special scientific applications, computing, data grids, virtual-presence
Need very fat pipes, limited multiple Virtual Organizations, few to few
users
A
B
C
ADSL
GigE
BW requirements

The Dutch Situation

- **Estimate A**
  - **17 M people, 6.4 M households, 25 % penetration of 0.5-2.0 Mb/s ADSL, 40 times under-provisioning ==> 20 Gb/s**

AMS-IX



June 19th 2004

Lost :-(

European championship football **Holland -- Czech Republic**

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- **Estimate A**
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- **Estimate B**
  - **SURFnet has 10 Gb/s to about 12 institutes and 0.1 to 1 Gb/s to 180 customers, estimate same for industry (overestimation) ==> 20-40 Gb/s**

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- **Estimate B**
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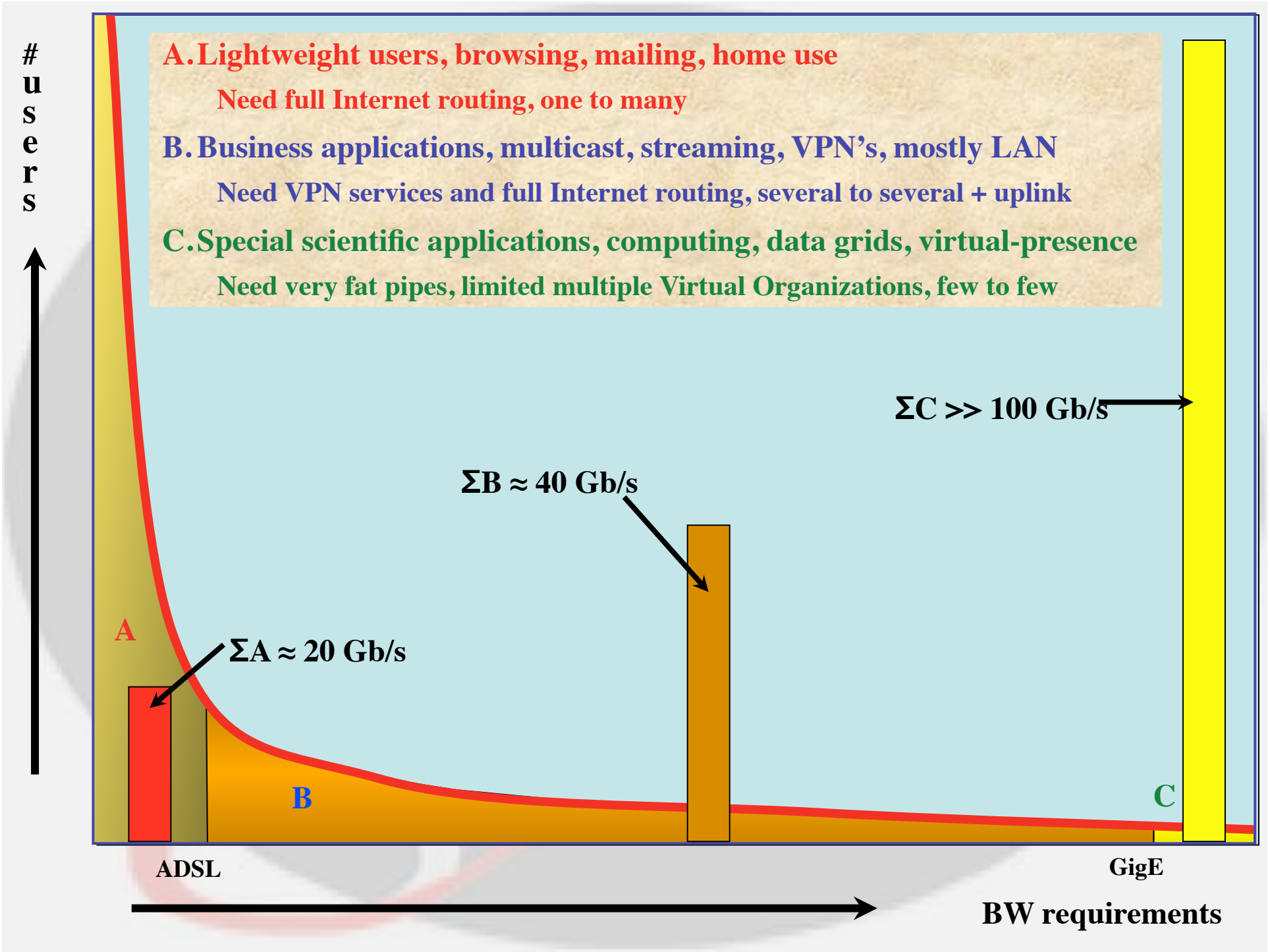
- **Estimate C**
  - **Leading HEF and ASTRO + rest ==> 80-120 Gb/s**
  - **LOFAR ==> ≈ 26 TBit/s**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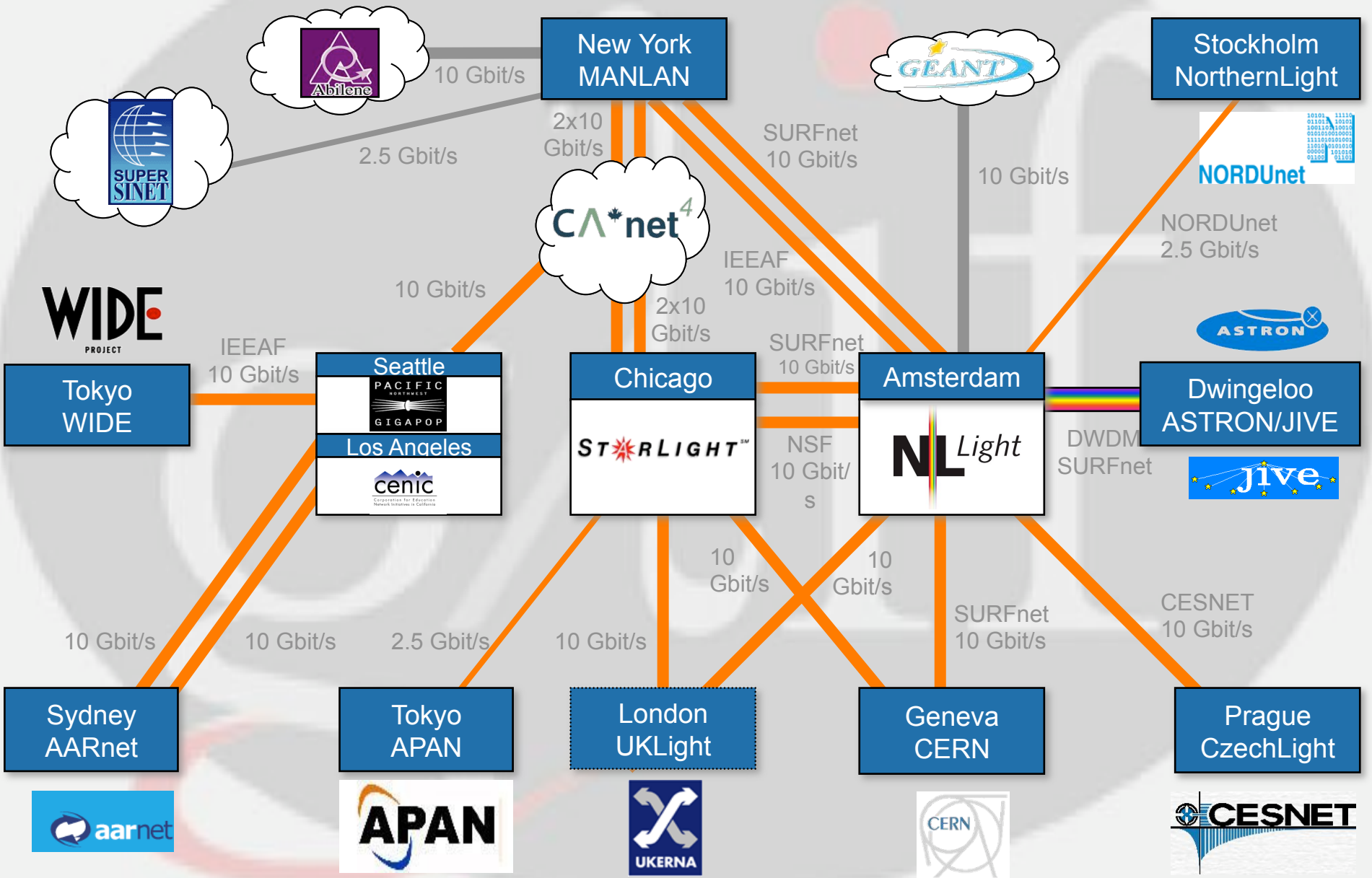
ΣC >> 100 Gb/s
ΣB ≈ 40 Gb/s
ΣA ≈ 20 Gb/s
A
B
C
ADSL
GigE
BW requirements

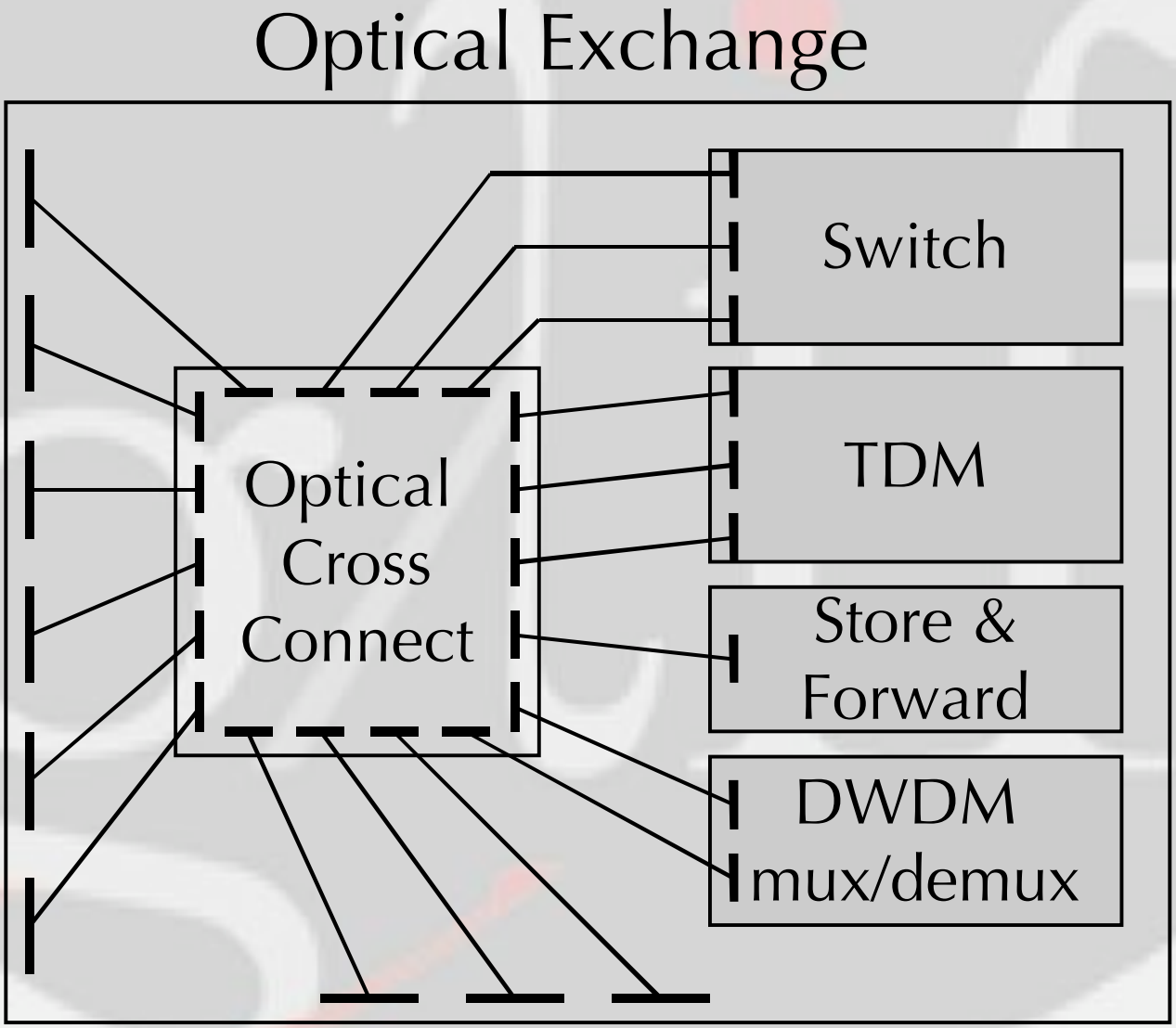
Services

SCALE / CLASS	2 Metro	20 National/ regional	200 World
A	Switching/ routing	Routing	ROUTER$
B	Switches + E-WANPHY VPN's	Switches + E-WANPHY (G)MPLS	ROUTER$
C	dark fiber DWDM MEMS switch	DWDM, TDM / SONET Lambda switching	Lambdas, VLAN's SONET Ethernet

Global Lambda Integrated Facility sept 2004



Optical Exchange as Black Box



http://carol.science.uva.nl/~delaat/articles/2004-2-opt-ex.pdf

History

- **Brainstorming in Antalya at Terena conf. 2001**
- **1th meeting at Terena offices 11-12 sep 2001**
  - **On invitation only (15) + public part**
  - **Thinking, SURFnet test lambda Starlight-Netherlight**
- **2nd meeting appended to iGrid 2002 in Amsterdam**
  - **Public part in track, on invitation only day (22)**
  - **Core testbed brainstorming, idea checks, seeds for Translight**
- **3th meeting Reykjavik, hosted by NORDUnet 2003**
  - **Grid/Lambda track in conference + this meeting (35!)**
  - **Brainstorm applications and showcases**
  - **Technology roadmap**
  - **GLIF established**

3th Lambda workshop @ NORDUnet 2003

GLIF - 4 meeting

- Invitation only
- Nottingham 3 September (+preparatory afternoon on 2 September)
- 60 participants
- Attendance from China, Japan, Netherlands, Switzerland, US, UK, Taiwan, Australia, Tsjech, Korea, Canada, Ireland, Russia, Belgium, Denmark
- www.glif.is

The main objectives of this year's (2004) meeting

GLIF Governance and policy

Our small-scale Lambda Workshop is now turning into a global activity. TransLight and similar projects contribute to the infrastructure part of GLIF. A good and well understood governance structure is key to the manageability and success of GLIF. Our prime goal is to decide upon and agree to the GLIF governance and infrastructure usage policy.

GLIF Lambda infrastructure and Lambda exchange implementations

A major function for previous Lambda Workshops was to get the network engineers together to discuss and agree on the topology, connectivity and interfaces of the Lambda facility. Technology developments need to be folded into the architecture and the expected outcome of this meeting is an agreed view on the interfaces and services of Lambda exchanges and a connectivity map of Lambdas for the next year, with a focus on iGrid 2005 and the emerging applications.

Persistent Applications

Key to the success of the GLIF effort is to connect the major applications to the Facility. We, therefore, need a list of prime applications to focus on and a roadmap to work with those applications to get them up to speed. The demonstrations at SC2004 and iGrid 2005 can be determined in this meeting.

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Control plane and grid integration

<WILL NOT MEET THIS TIME>

- The GLIF can only function if we agree on the interfaces and protocols that talk to each other in the control plane on the contributed Lambda resources. The main players in this field are already meeting, almost on a bi-monthly schedule. Although not essential, this GLIF meeting could also host a breakout session on control plane middleware.

Announcements

- **Emergency procedure, please read notes on wall by fire exit to attendees in Talbot suite**
- **Fire alarm test around Friday 3 pm -> ignore, any other time -> go for it**
- **Reception at Hart's Upstairs 7.30, dinner 8.00, is 10 minute walk, maps at Wendy's**
- **Breakfest from 7 am in Kings Carvery**
- **GLIF Friday starts 8.30 am in Talbot Suite**
- **Any issues with hotel, please contact Wendy.**

Last slide

- ***Special thanks to our host, UKERNA, for organizing this year's GLIF meeting and special Workshop dinner on Thursday evening. Thanks to the ON*VECTOR collaboration for hosting Friday's reception.***
- ***Personal thanks to you all***
- ***For help preparation phase to Wendy, Maxine, David, Peter, Kees, Erik-Jan, ..***