Esnet in Context

Department of Energy Advanced Scientific Computing Advisory Committee

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Outline

- ESnet review – summary
- Trends in National Research Networks

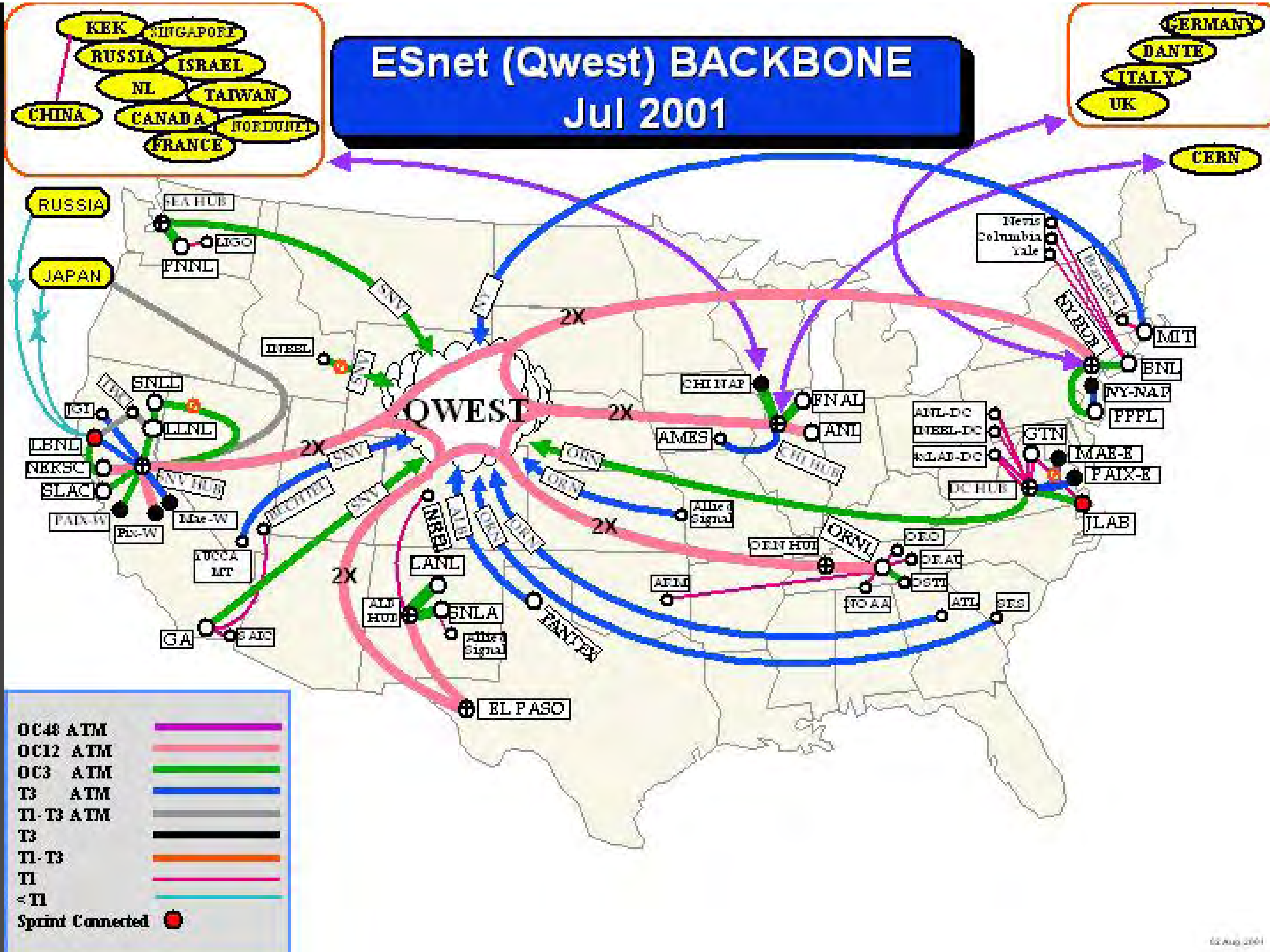
ESnet review

- 10-11 Sep 01, co-incident with ESSC meeting in Santa Fe
- Review committee –
  - R. Kendall, DoE Ames Lab
  - E. P. Love, Internet2
  - G. Strawn, NSF
  - V. White, Fermilab
  - W. Turnbull, NOAA
  - S. Wolff, Cisco

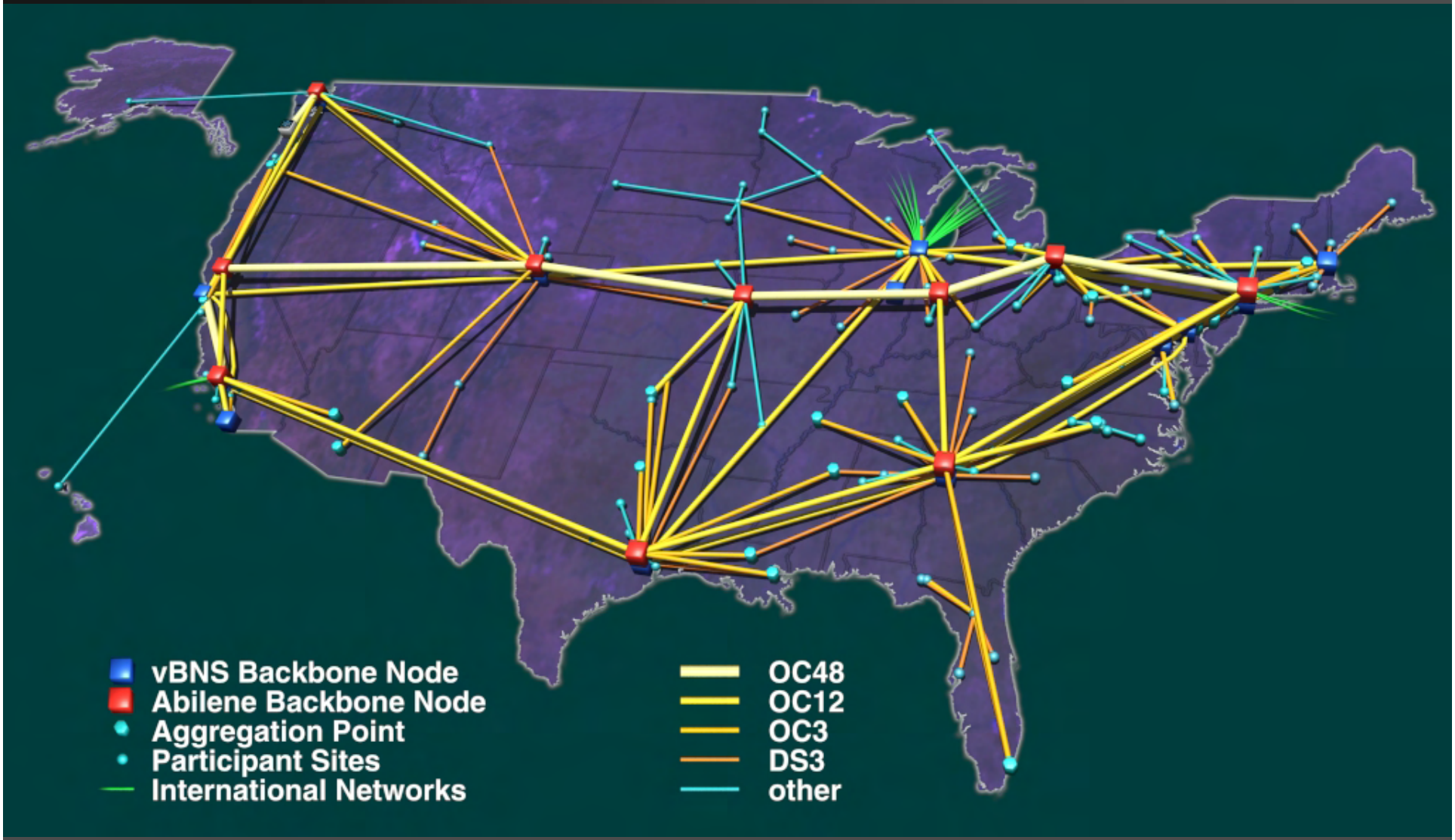
ESnet is a small ISP

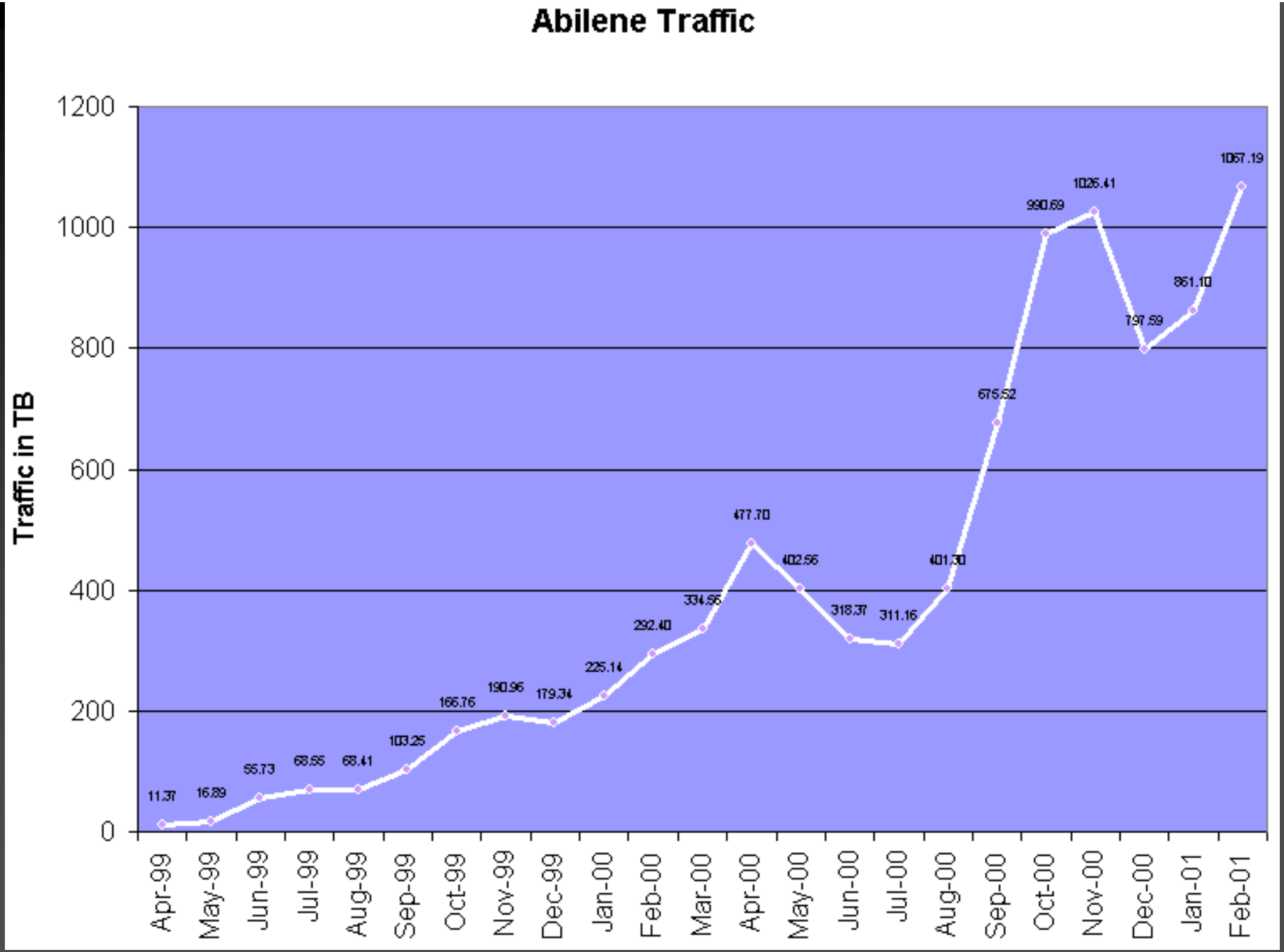
- Traffic volume, February 2001 –
  - ESnet – 45 TB
  - Abilene – 1057 TB
  - Uunet/Worldcom - ??
- New applications could add 1 Gb/s, 24x7
  - 1 Gb/s = 10.8 TB/day or about 328 TB/mo.

ESnet (Qwest) BACKBONE
Jul 2001



vBNS and Abilene




Abilene Traffic
Traffic in TB
1200
1000
800
600
400
200
0
11.37
16.89
55.73
68.55
68.41
103.25
166.76
190.96
179.34
225.14
292.40
334.55
477.70
402.55
318.37
311.16
401.30
675.52
990.69
1026.41
797.59
861.10
1067.19
Apr-99
May-99
Jun-99
Jul-99
Aug-99
Sep-99
Oct-99
Nov-99
Dec-99
Jan-00
Feb-00
Mar-00
Apr-00
May-00
Jun-00
Jul-00
Aug-00
Sep-00
Oct-00
Nov-00
Dec-00
Jan-01
Feb-01

ESnet oversight

- User governance (ESSC, ESCC) appropriate for historical growth patterns
- Not well constituted to cope with the approaching step increase in capacity requirements
- Fragmentation is (again) a possibility
- UCAID HENP Working Group

ESnet performance

- Connectivity is adequate for most current users
- Good management tools and user services
- Lean, cost-effective operation

ESnet planning

- User governance is
  - risk averse
  - not well constituted for a strategic view
- Special programs (e.g., biotech, SciDAC) need to plan networking requirements and budget for needed capacity

ESnet planning for new services & technologies

- No central knowledge of networking research
- Establishment of ESRSC a good step, but needs wider scope
- ESnet is hard to defend as a commodity ISP

NRN trends

NRN trends

- Fiber – ownership or IRU
  - 39 million miles of fiber in continental US
  - 20-35% lit
  - 2% in use (Source: Merrill Lynch)
  - Principal costs are trenching & terminating
  - Economic parameters are unclear
- IPv6
  - GEANT (EU)
  - WIDE (Japan)
  - NoF (UCAID)

NRN trends (cont.)

- Collaboration emerging as driver
  - Access Grid – “group-to-group”
  - UC CITRIS center
  - …but it’s not easy
- Adoption of “Grid” paradigm
- Storage networks
- Optical networks

Teleimmersion requirements

	Latency	Band width	Reliable	Multi cast	Security	Streaming	Dyn QoS
Control	< 30 ms	64 Kb/s	**Yes**	No	**High**	No	Low
Text	< 100 ms	64 Kb/s	**Yes**	No	Medium	No	Low
Audio	< 30 ms	Nx128 Kb/s	No	**Yes**	Medium	**Yes**	Medium
Video	< 100 ms	Nx5000 Kb/s	No	**Yes**	Low	**Yes**	Medium
Tracking	<10ms	Nx128 Kb/s	No	**Yes**	Low	**Yes**	Medium
Database	<100 ms	**> 1 Gb/s**	**Yes**	Maybe	Medium	No	**High**
Simulation	< 30 ms	**> 1 Gb/s**	Mixed	Maybe	Medium	Maybe	**High**
Haptic	**< 10 ms**	> 1 Mb/s	Mixed	Maybe	Low	Maybe	**High**
Rendering	< 30 ms	**> 1 Gb/s**	No	Maybe	Low	Maybe	Medium

Source: R. Stevens, ANL

(cf. also mini-essay by Valdis Kletnieks, VaTech)

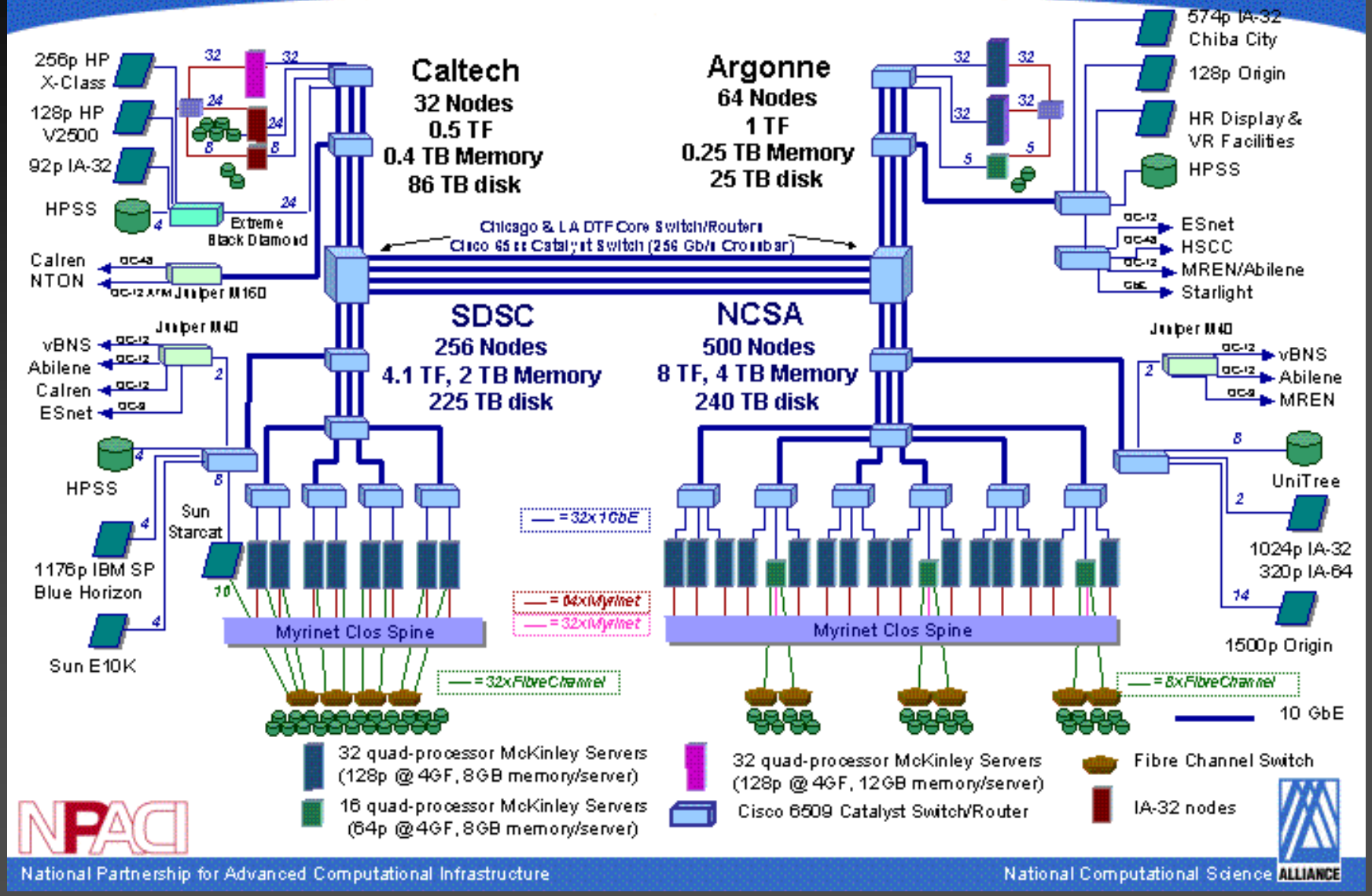
Example: CA*net 4

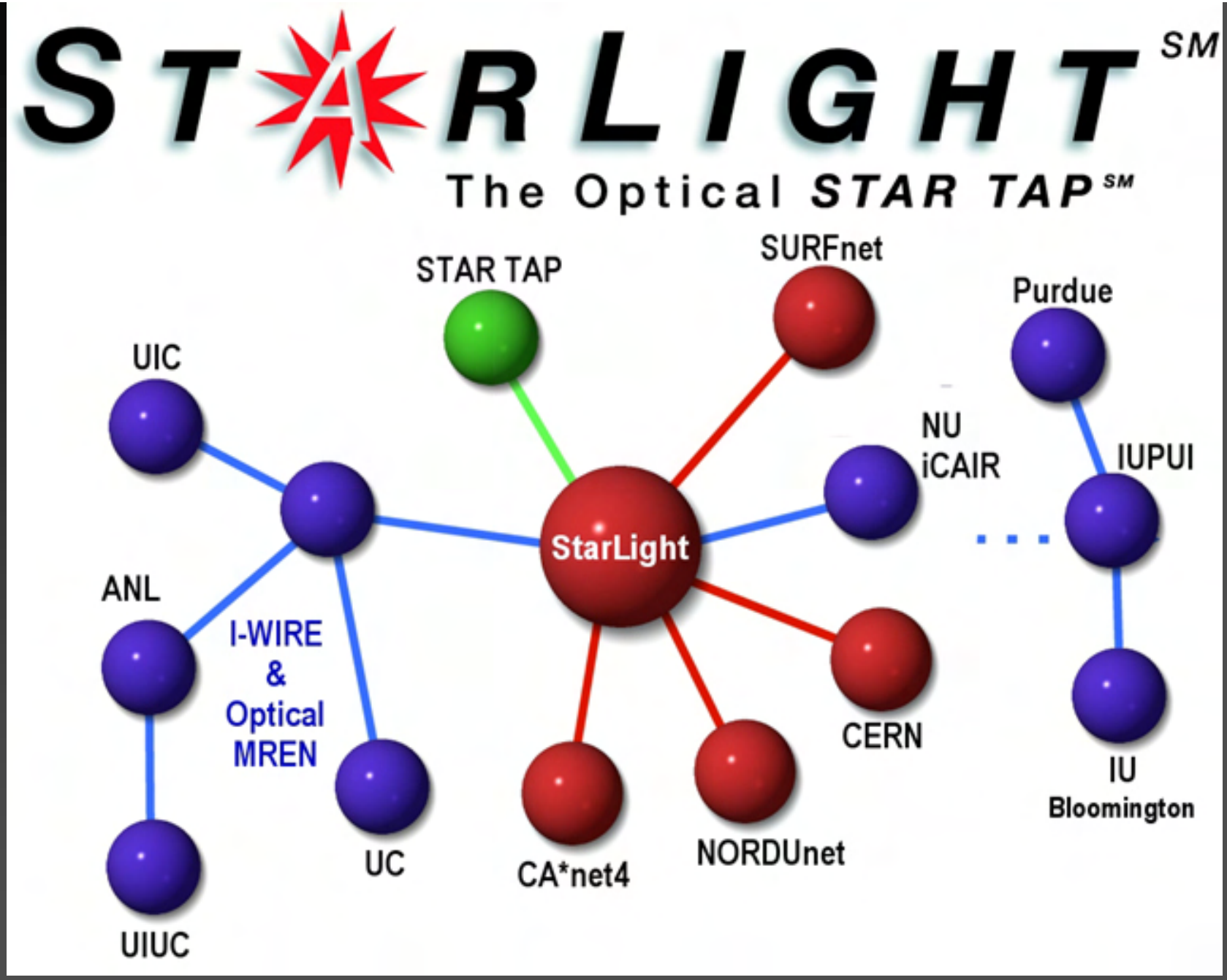
- Predicated on a commodity market in lambdas
- Postulates a transition from the network as a set of services to a set of owned objects
  - “Object-oriented networking”
- End-user control
- Full mesh among administrative domains (initially regional nets)
  - No backbone network
  - Links are owned/leased
- GMPLS, OBGP, UCP,…

Example: DTF / Teragrid

- $53m NSF funding
- backplane first, a network second
- Qwest fiber IL <-> CA, SONET framing
- 4 * OC192 ~ 40 Gb/s

Proposed 13.6 TF Linux TeraGrid

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The Optical STAR TAP SM
STAR TAP
SURFnet
Purdue
UIC
NU
iCAIR
IUPUI
StarLight
ANL
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