Networking Considerations For LHC

David Foster

Communication and Network Systems Group Leader

Information Technology Department

CERN – European Organization for Nuclear Research

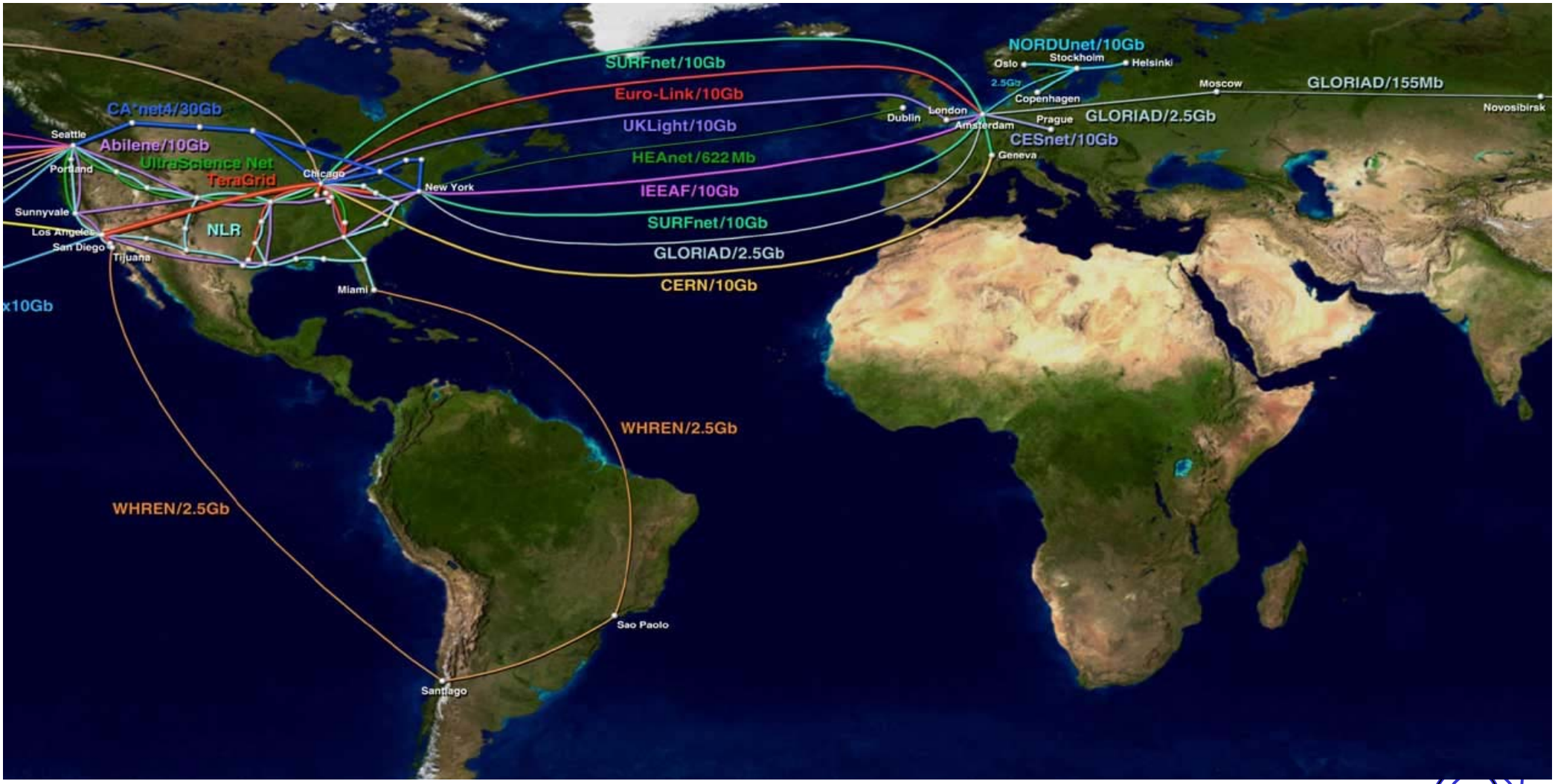
Geneva, Switzerland

david.foster@cern.ch

What we have – December 2004

- Commodity Internet Connectivity
  - Multiple redundant connections
- Multiple 10Gb/s connections
  - To Starlight/Chicago (and from there into the US via Abilene)
    - Paid by the consortium USLiC (large contribution from the DOE.
    - Allows us to perform 10Gbit tests to Fermilab
  - To Amsterdam (and into the SurfNET NREN)
    - Provided by SurfNet
    - Divided for the most part into 8x1Gb ethernets
  - To Geant
    - Geant-2 will have a pop at CERN that will provide level-2 ethernets at 10Gb/sec
    - Today we have Level-3 routed IP network with restrictions on the achievable end-end bandwidth due to design issues with the Junipers routers in Geant-1

Global Lambda Integrated Facility
Predicted Bandwidth for Scheduled Experiments, December 2004



www.glif.is

Visualization courtesy of
Bob Patterson, NCSA.

last update 23/11/2004 12:12

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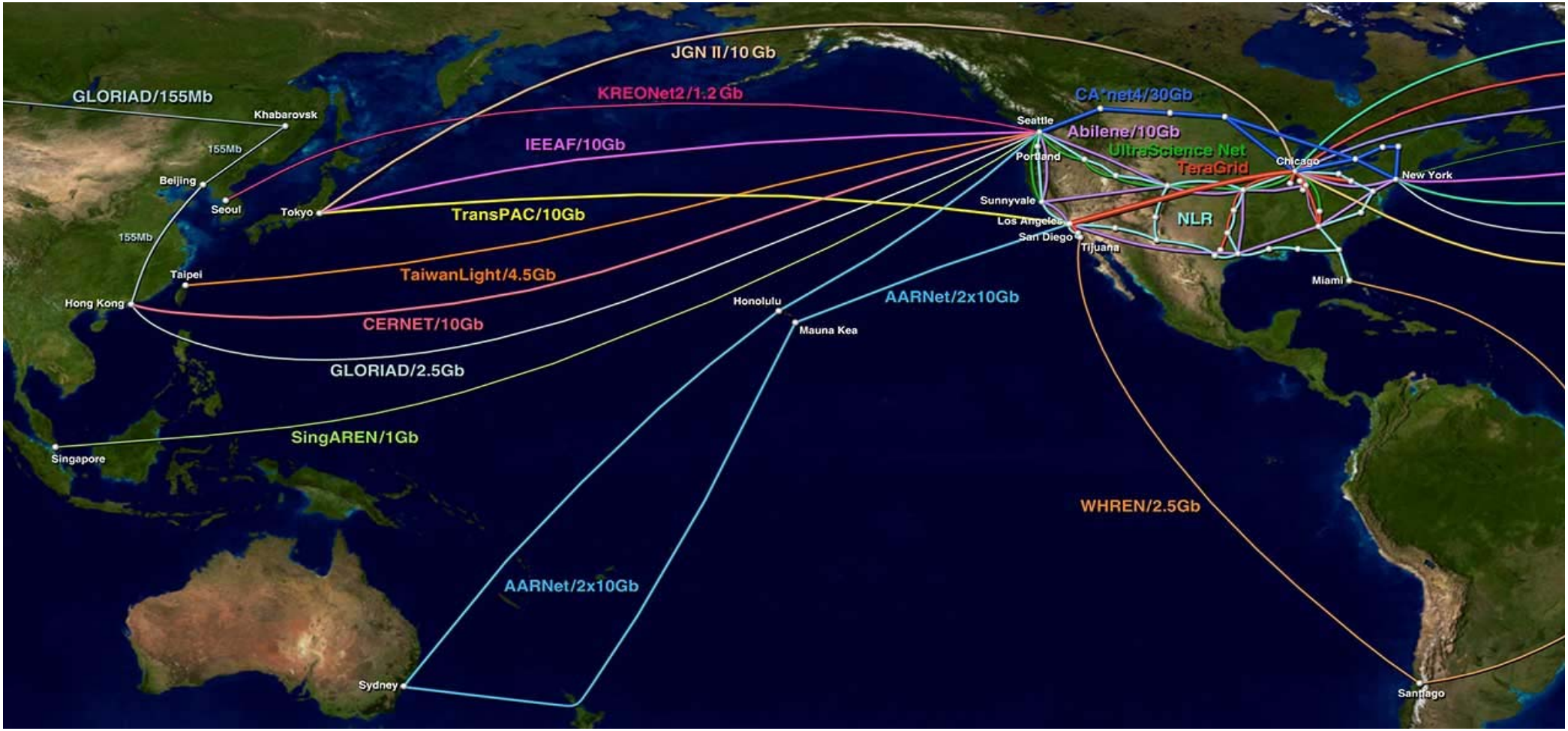

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Visualization courtesy of
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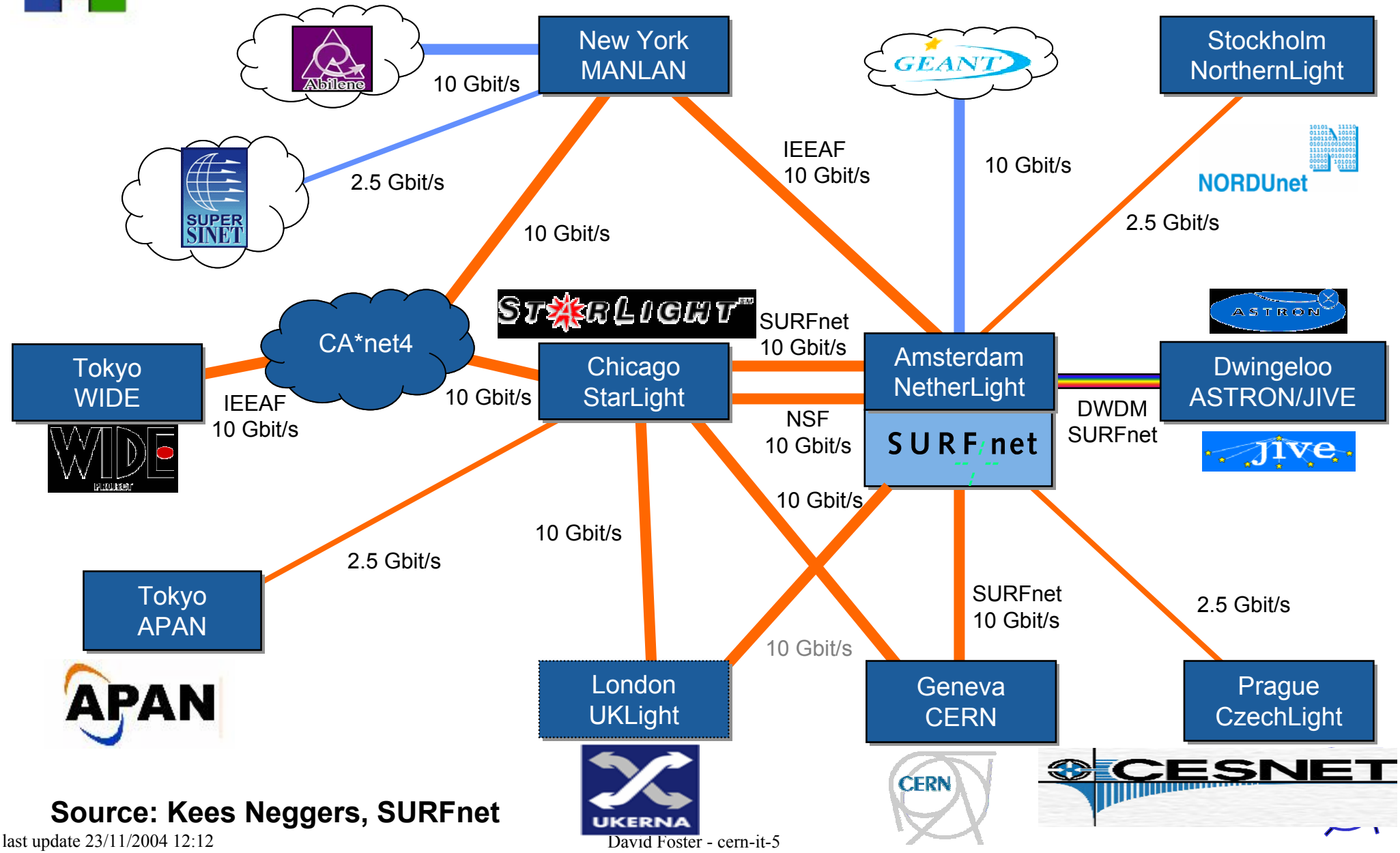
Global Participation: GLIF at StarLight



Source: Kees Neggers, SURFnet

What is the connectivity architecture for LHC 2004-2006?

- **Geant**
  - An EU Project, Managed by Dante spun off from Terena (an EU project) !
    - Geant-2 lifetime (4 years from 2004).
  - What Geant-2 will be able to deliver is not clear, yet.
  - Pop will be installed H1 2005, equipment, connectivity being selected now.
  - Requirements being passed to Dante through CERN-NREN-Dante meetings and EGEE SA2 via the Technical Network Liaison Committee (TNLC)
- **SurfNet**
  - Funded by the Dutch Government managed the GigaPort and NetherLight projects.
    - Well funded to 2008
  - Amsterdam is a major exchange point.
    - Optical switch project NetherLight
  - Will look at improving connectivity to Amsterdam to multiple wavelengths (dark fiber?)
- **US**
  - NSF and DOE both funding connectivity from [NY & Chicago] to [Amsterdam & CERN]
- **Any Direct Connections Requested by the T1's**
- **Will work with all parties to evolve connectivity.**

T1's, T2's and all that

- Not all T1 locations are completely clear.
  - "Distributed" T1's have no real meaning from a network SLA view.
- We have some idea of the T0-T1 bandwidth requirements.
  - Seems a good starting point to get 10Gb/sec end-end, CERN to the T1's. A bottom up analysis has been done as part of phase II planning.
  - But, is it clear to the T1's that they need to provision the connectivity?
    - European T1's need to negotiate with NRENs who in turn need a clear pricing model from Dante for GEANT-2.
    - Direct connections need to be provisioned from commercial providers
  - The end-end circuit has no single management responsibility (unlike commercial circuits). E.g. A T1 might connect to ESNet, Peer with Abeline and GEANT to a European NREN. Who does problem determination and followup?
- We have no real idea of T1-T1 or T1-T2 bandwidth.
  - A 200TB T2 disk cache, refreshed in 2 days would need a dedicated 10G link
  - Less than required connectivity will give slower than expected analysis but we don't want to be too far away.
  - Computing models at the end of 2004 may shed more light on this.

Risks and Uncertainties

- To provide a 10G link to each T1 is not difficult technically if we could pay for provisioned end-end circuits. Instead we will rely on transiting interconnected networks that have no overall end-end management.
  - ESNet initiative "ITECHS" and performance monitoring initiatives between GEANT and Abilene are steps in the right direction
  - CERN has started an end-end monitoring activity in CS Group.
- Some discussions recently indicate that centers may not yet understand their responsibility in providing the connectivity to CERN.
  - E.g. Atlas ideas around remote level-3 trigger farms.
  - GDB will have a working group to coordinate networking status with T1's and raise the visibility.
    - Should have a T0-T1 network workshop early 2005 in preparation for the TDR.
- US has many initiatives for European Connectivity but clearly identified production links and funding delivering data to Fermilab and Brookhaven has yet to appear.

Roadmap

- 2004
  - Service challenges start
- 2005
  - Q1 (January) Experiment requirements and computing models available
    - Translated into networking expectations agreed at T0-T1 workshop
    - Needs the participation of the T1's, NRENS and GEANT to create implementation plan.
  - Q2 Networking plans clarified as part of the TDR.
    - Understand the plans of the T1's, NRENS and GEANT which should be clarified as part of the MOU.
  - Q2 Will see the build up of GEANT-2 and end-end tests willl be made
  - Q4 Service challenges should reach "production levels".
  - Q4 End-end monitoring technologies and limitations should be known.
- 2006
  - Q4 Full end-end connectivity in place for all T1's.
  - Q4 Data transfers at production levels.