Global Terabit Research Network: Cyberinfrastructure for Global Science

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Global e-Science

- **Network-enabled world wide collaborative communities (grids) are rapidly forming in a broad range of areas – each can number in the 1000s**
- **These communities are based around a few expensive – sometimes unique – instruments or distributed complexes of sensors that produce vast amounts of data (high energy physics, astronomy, earth sciences, …)**
- **global communities carry out research based on this data using computation, storage and visualization facilities distributed world-wide**
- **All of this is global "cyberinfrastructure"**
- **The digital data of e-science can be shared with collaborators not just on campus, but across town, in the same state, nationally & ultimately internationally**
- **e-Science is becoming completely international – it knows no boundaries**

Global Cyberinfrastructure Components

- Huge hierarchical data storage facilities located worldwide
- Powerful computational arrays located worldwide to analyze data
- Software to make use of all of the above to extract information from data
- Support and management structure for hardware, software and applications

- **Global high-performance networks are the critical glue that connects these facilities together**

Global Cyberinfrastructure Network Requirements

- A single global backbone interconnecting global network access points (GNAPs) that provide peering within a country or region
- Global backbone speeds comparable to those at NRRENS, i.e. OC192 in 2002
- Coordinated global advanced service deployment (e.g. IPv6, multicast, QoS)
- Based on a stable carrier infrastructure or leased or owned fiber or wavelengths

Global Cyberinfrastructure Network Requirements (con't)

- Persistent, based on long-term (5-10 year) agreements with carriers, router vendors and optical transmission equipment vendors
- Scalable – e.g. OC768 by 2004, multiple wavelengths running striped OC768 by 2005, terabit/sec transmission by 2006
- Allows GNAPs to connect at OC48 and above. To scale up as backbone speeds scale up
- Provide a production service with 24x7x365 management through a global NOC

Global Terabit Research Network

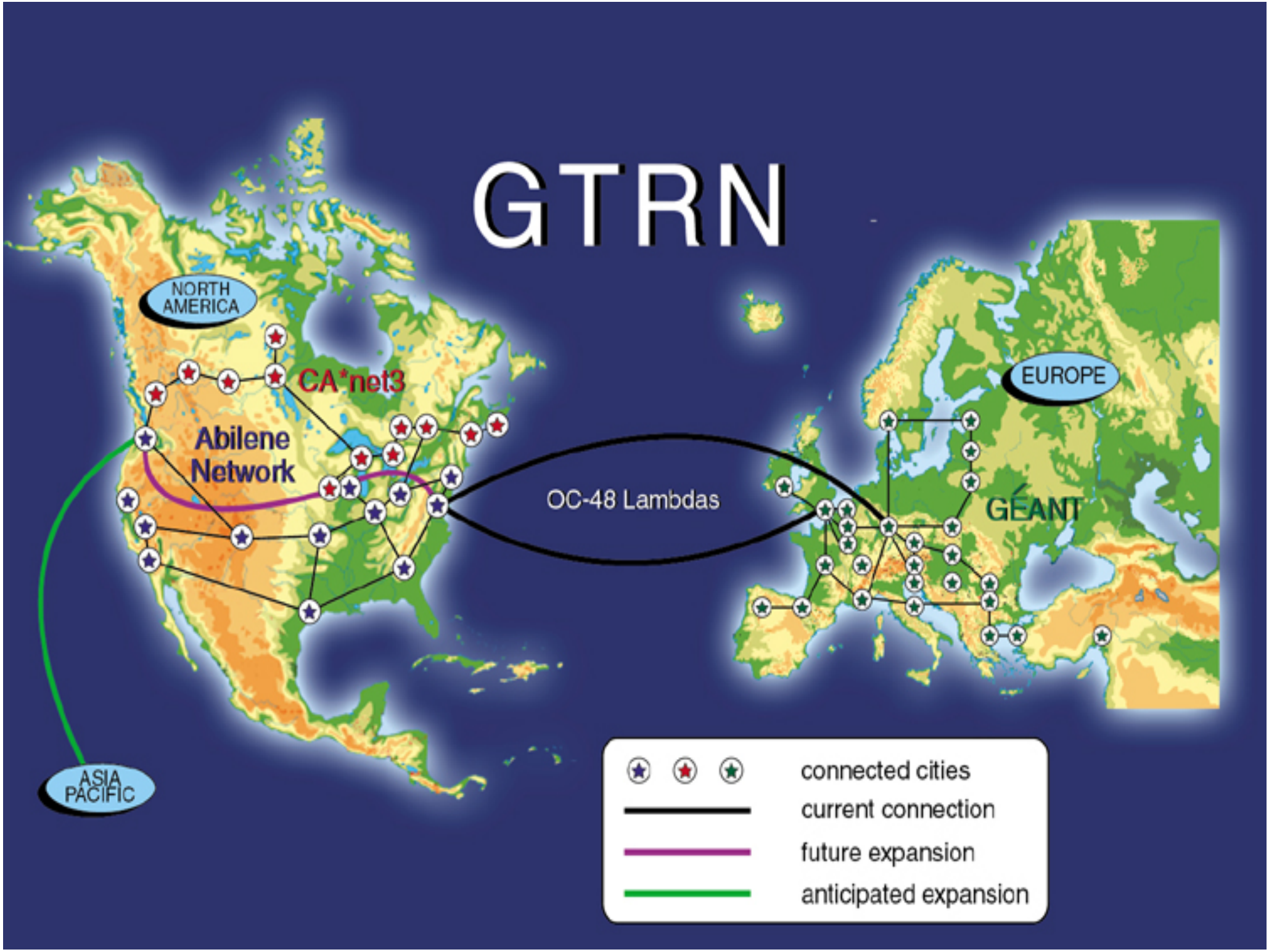
- A partnership to establish a true world-wide next generation Internet to interconnect national and multinational high speed research and education networks as a critical part of global cyberinfrastructure
- A coherent global solution that expands and enhances global cyber infrastructure for e-science
- Involves NREN-Consortium/Dante, Internet2, IU, CANARIE, StarTAP/Starlight & Pacific Wave
- Regionally based (initially Europe & North America; soon Asia Pacific,…)
- Announced 18 February 2002
- www.indiana.edu/~gtrn

A Global Partnership

- Initial Planning Group
  - Fernando Liello (European NREN Consortium)
  - Dai Davies (DANTE)
  - Michael A. McRobbie (Indiana University)
  - Steve Wallace (Indiana University)
  - Doug van Houweling (Internet2)
  - Heather Boyles (Internet2)
- Participating and Supporting Individuals (Organizations)
  - Bill St. Arnaud (CANARIE/CAnet*3)
  - Tom DeFanti (STAR TAP/Starlight)
  - Ron Johnson (Pacific Wave)

The Global Terabit Research Network

- A production service
- Currently connects the major R&E networks in Europe and North America
- 2 x OC-48 unprotected POS circuits
- Run as a single AS (AS21230)
- Second set of OC-48s planned
- Governed and managed internationally
- NOC services across the globe


GTRN
NORTH AMERICA
CA*net3
Abilene Network
OC-48 Lambdas
EUROPE
GÉANT
ASIA PACIFIC
connected cities
current connection
future expansion
anticipated expansion

The Global Terabit Research Network (con't)

- Anticipated additions in the next 60 days
  - GTRN AS at STAR TAP/Starlight
  - GTRN AS at Pacific Northwest GigaPop (PNG)
  - Tunneled capacity across Abilene to connect these points
  - Resulting GTRN topology: Europe, North America; Asia Pacific expected soon
  - Participation in New York layer two exchange point (Manhattan Landing)

GTRN Expansion

- Further deployment of GNAPs (e.g. in the Asia Pacific)
- Extension to Latin America via AMPATH starting with AS extension to Miami
- More formal global NOC services (e.g. GTRN weather map, seamless trouble reporting, etc.)

Questions?

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