

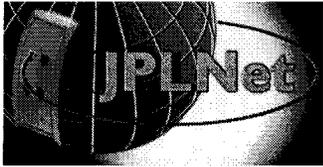
JPL

Campus Network

Advanced Services

December 4, 2000

Claudia de Luna



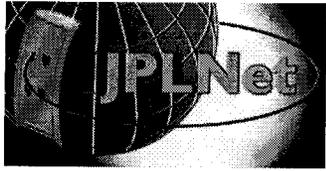
Agenda

- **Building Blocks**
- **State of the Network**
- **Advanced Services**
- **Future**
- **Case Studies**
- **Conclusions**

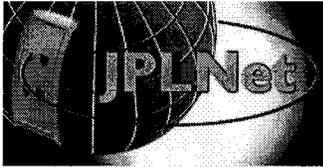


Building Blocks

- **Support**
 - Management
 - Direction
 - Funding
- **Centralization**
 - Economies of Scale
 - Operations
- **Infrastructure**
 - Cabling
 - Star Based Topology
 - Monitoring

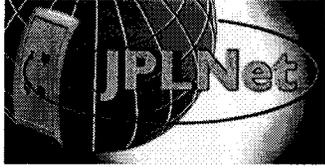


Network Subsystems



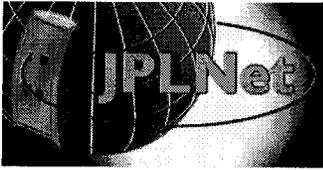
Current State of the Network

- **Fully Switched**
 - 10/100Mb/s to each desktop
 - Limited only by Network Interface Card (NIC) on system
 - 1000Mb/s for approved systems
- **Multi-Gigabit Core**
 - 18 Cisco 8540 L2/L3 switches interconnected via GigE
- **Management & Monitoring**
 - 900+ Network Devices monitored via Aprisma Spectrum
 - 14,000+ ports monitored via Concord Nethealth

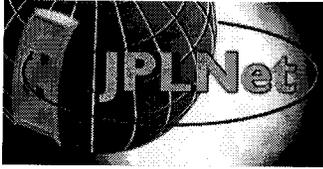


Current State of the Network (cont..)

- **Deterministic**
 - 2 Hops
 - Consistent Edge and Backbone Hardware
- **External Connectivity**
 - OC-12 (622Mb/s) to Internet 2 in California
 - T3 (45Mb/s) to commercial ISP
 - NASA Networks (OC-3)
 - 50Mb/s to Production Networks
 - 100Mb/s to Research Network

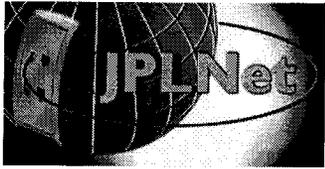


Network Topology



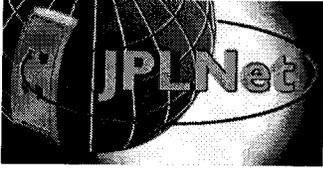
Advanced Services

- **Gigabit to the Desktop**
- **Tuning**
- **Measurement**
- **Multicast/Video**
- **Security**
- **Jumbo Frames**
- **IPv6**
- **Quality of Service**
- **Other?**



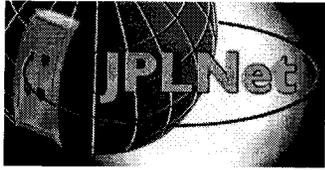
Gigabit to the Desktop

- **If a system meets:**
 - Minimum Hardware Criteria
 - Usage Justification
 - Current Port Utilization Criteria
- **A system gets:**
 - Fiber Drop (6strand MM)
 - 1000-Base-SX Port
 - 6509
 - 4003
 - 2948
 - Tuning Guidelines



Tuning

- **Duplexing**
- **TCP**
 - **White Paper & References**

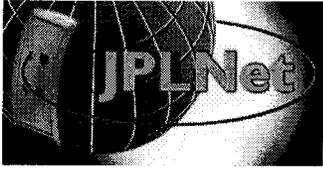


Measurement

- **Concord NetHealth**
- **Netsys Gigabit Ethernet RMON Probes**
- **Real Time performance Testing**
 - **Performance Testing System**
 - FreeBSD, Dual Processor, RAID
 - Anonymous FTP
 - ttcp (ttcp.jpl.nasa.gov), nttcp (nttcp.jpl.nasa.gov)
 - netperf (netperf.jpl.nasa.gov), iperf (iperf.jpl.nasa.gov)
 - endpoint (endpoint.jpl.nasa.gov) (NetIQ, formerly Ganymede)
 - Web page describing connectivity, TCP parameters, Contact Information
 - Internal reference, External reference



Measurement - Performance System



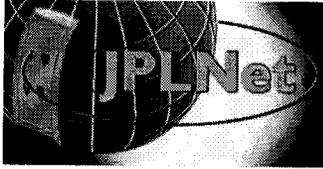
Multicast/Video

- **Campus Community**

- MPEG-1
- MPEG-2
- White Paper

- **External Community**

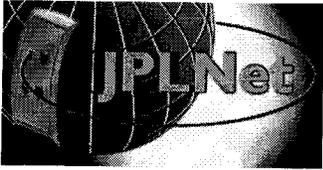
- What format?
- What data rates?
- Options?



Security

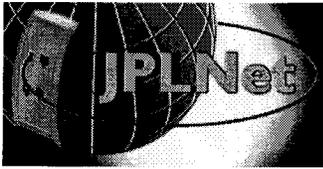
■ Firewall

- Support for OC-12/Gigabit Ethernet forwarding rates
- Appliance
- Research Networks
 - OC-48 to CalTech



Jumbo Frames

- **Localized**
- **Supercomputer Subnet(s)**
- **Cross Country?**
 - JPL/GSFC Aqua Testing

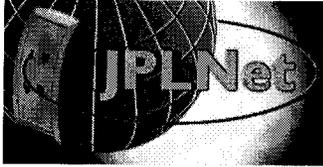


Case Study

Digital Sky Demo

■ NREN Gigabit Workshop

- Demonstrate large data set retrieval from 4 distinct geographic locations and real time rendering
 - Goddard Space Flight Center
 - California Institute of Technology
 - Jet Propulsion Lab
 - AMES Research Center



Case Study

Digital Sky Demo

■ Tools

- ping
- traceroute
- iperf, netperf, ttcp, NetIQ (Ganymede)

■ Issues

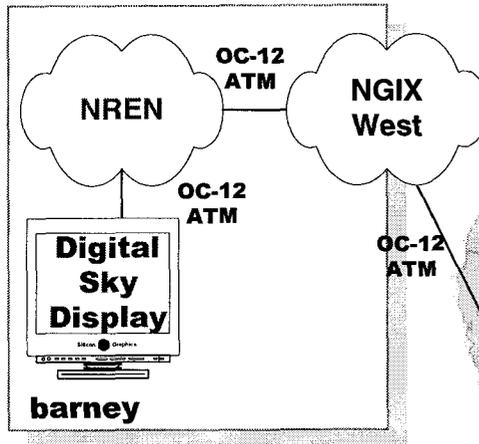
- Tools to measure throughput and packet loss
- Troubleshooting
- Contacts
- Test Points



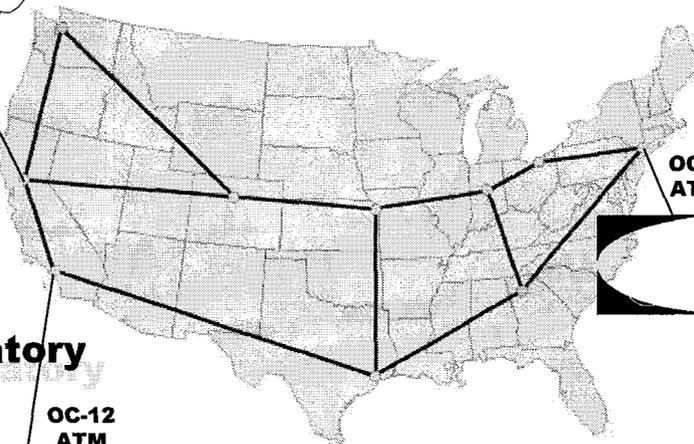
JPL Digital SKY Presentation NREN Gigabit Networking Workshop

August 15-16, 2000

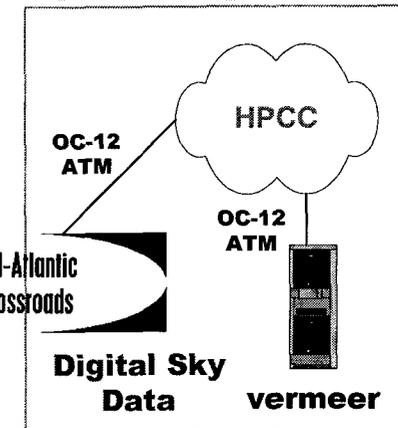
Ames Research Center



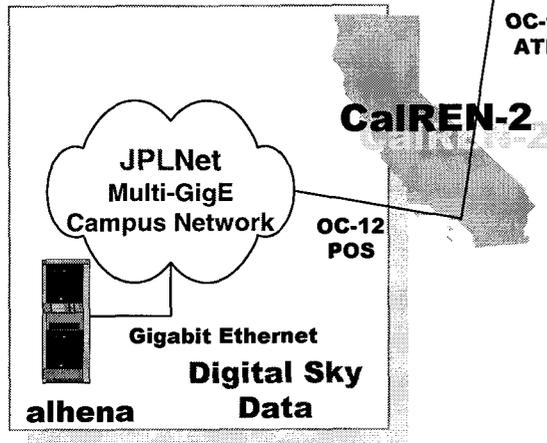
Abilene OC-48 Operational Backbone



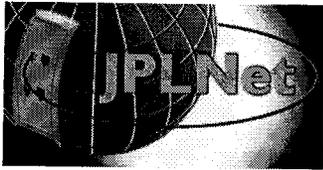
Goddard Space Flight Center



Jet Propulsion Laboratory



C. de Luna 2000-08-13
JPL-DigitalSkyPresentation.vsd



JPL Digital SKY Presentation NREN Gigabit Networking Workshop Contributions

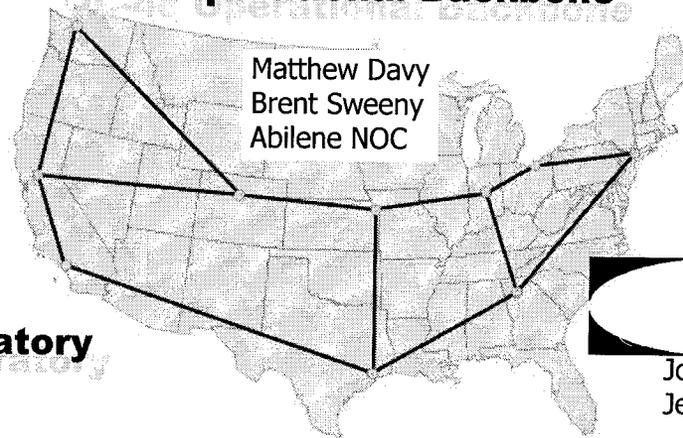
August 15-16, 2000

Ames Research Center

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Abilene OC-48 Operational Backbone

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CalREN-2

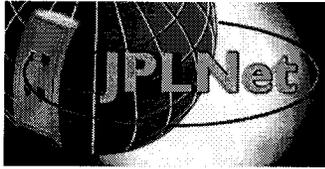
Brian Court
Erick Sizelove
CalREN-2 NOC

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All the people named here were directly involved in testing, troubleshooting, and optimizing the links that provide network connectivity for this demonstration.

It is certain that others were involved behind the scenes and just as certain that we cannot name them all here. This does not lessen their contribution nor our gratitude towards them.

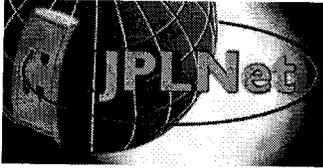
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JPL-Digital Sky Presentation-Participants.vsd



Case Study

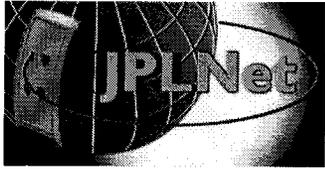
EOS Aqua Prototype

- **NASA's Earth Observing System (EOS) Aqua Spacecraft**
- **clock and data delivery over IP prototype**
 - 80Mb/s
 - From TRW to GSFC over Internet 2 infrastructure



Case Study

EOS Aqua Prototype



Case Study

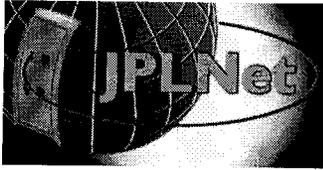
EOS Aqua Prototype

■ Tools

- ping
- Traceroute, pathchar
- iperf, netperf, ttcp, nttcp

■ Issues

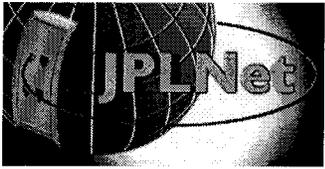
- Tools to measure throughput and packet loss
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- Test Points



Case Study

HiDef Demonstration

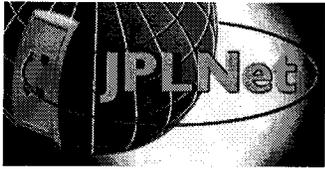
- **HiDef Virtual Co-location**
 - Vendor brought in special systems to packetize HiDef video
 - Requested 4 Gigabit Ethernet ports



Case Study

HiDef Demonstration

- diagram



Case Study

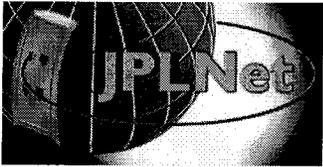
HiDef Demonstration

■ Tools

- Concord Nethealth and LiveTrend
- Cisco Works
- Network equipment interface statistics

■ Issues

- Tools to measure latency, jitter, packet loss, and throughput of network and network components
- Tools to measure end system relevant parameters
 - CPU
 - Bus
 - NIC
 - Memory
- Test Points



Future

■ **Advanced Services**

- IPV6
- Quality of Service
- Other
 - Self Tuning

■ **Advanced Measurement and Monitoring capabilities**

- TBD



Conclusions

- **What to measure?**
- **How to measure?**
- **Where to measure?**
- **All issues**
- **NLANR has made a good start a testing infrastructure**
- **Where do we go from here?**



Questions?