UltraScience Net: Overview, R&D, Status

JET-Net Half-Day Workshop

April 19, 2005

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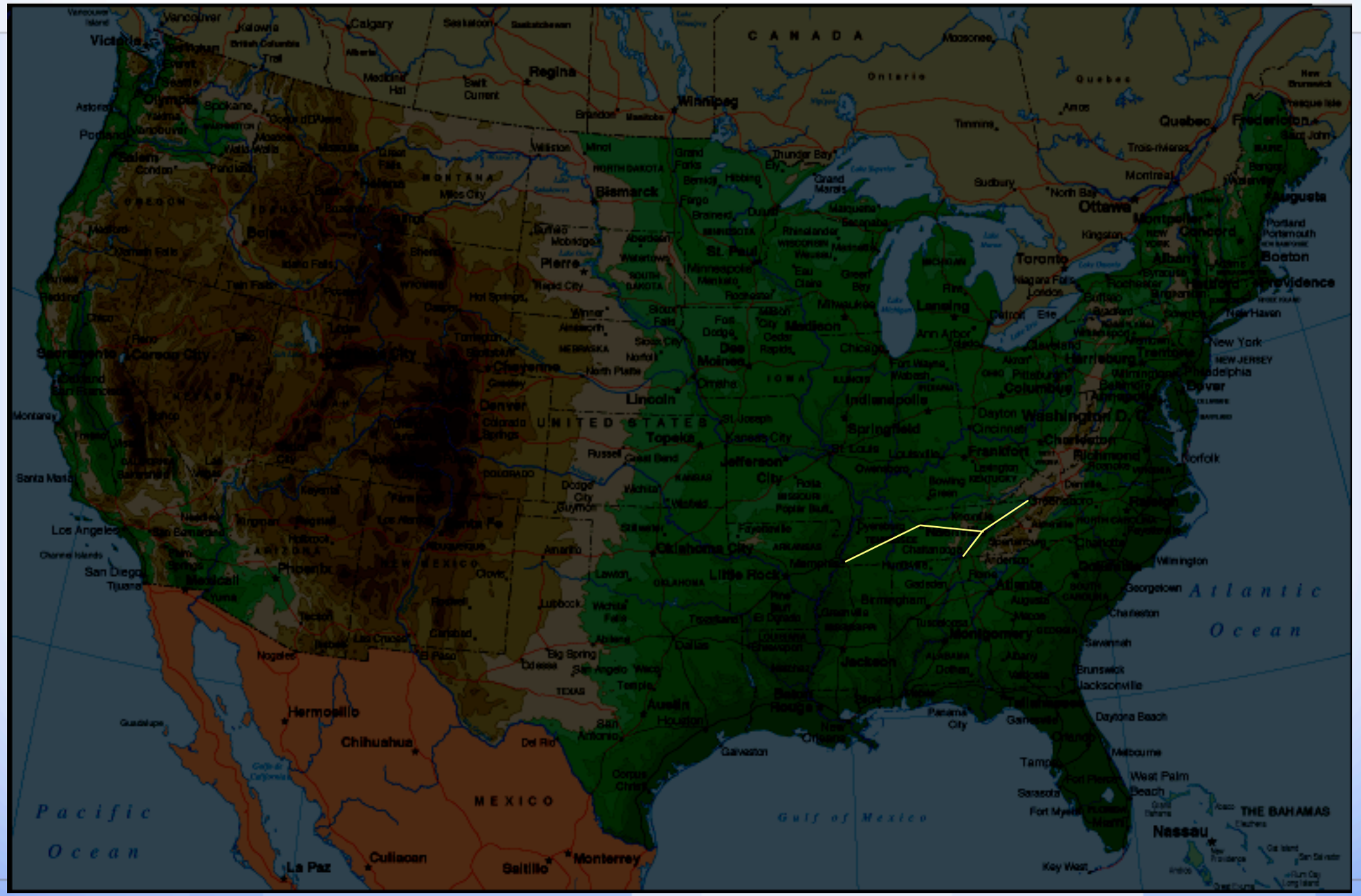
Outline -

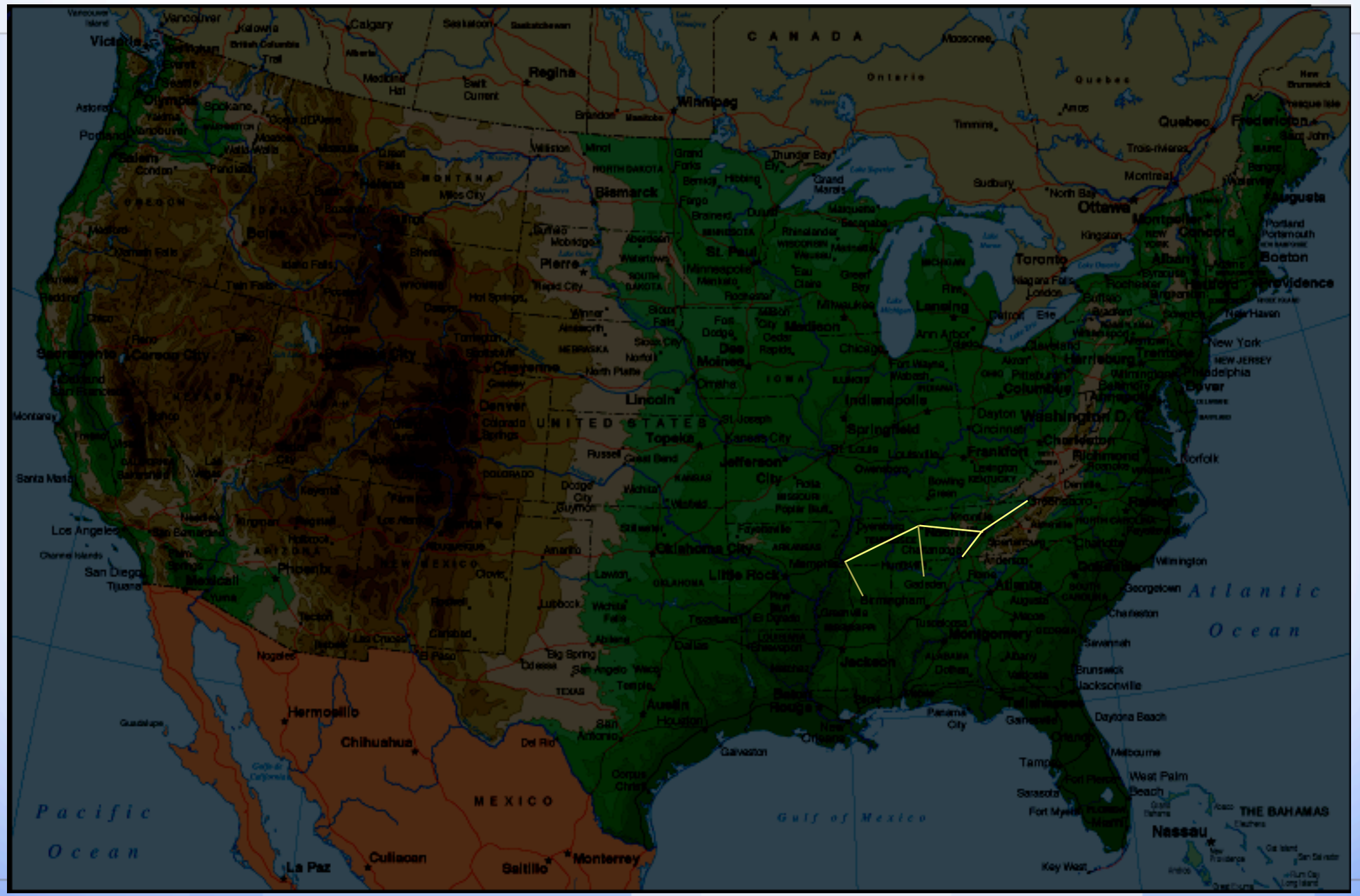
- Quick Review
  - What we're doing
  - Why
  - Vision for the future
- Status
  - Atlanta - Chicago
  - Knoxville - Nashville
  - UltraScience Net

What are we doing? We're building a network. We started with a blank slate...

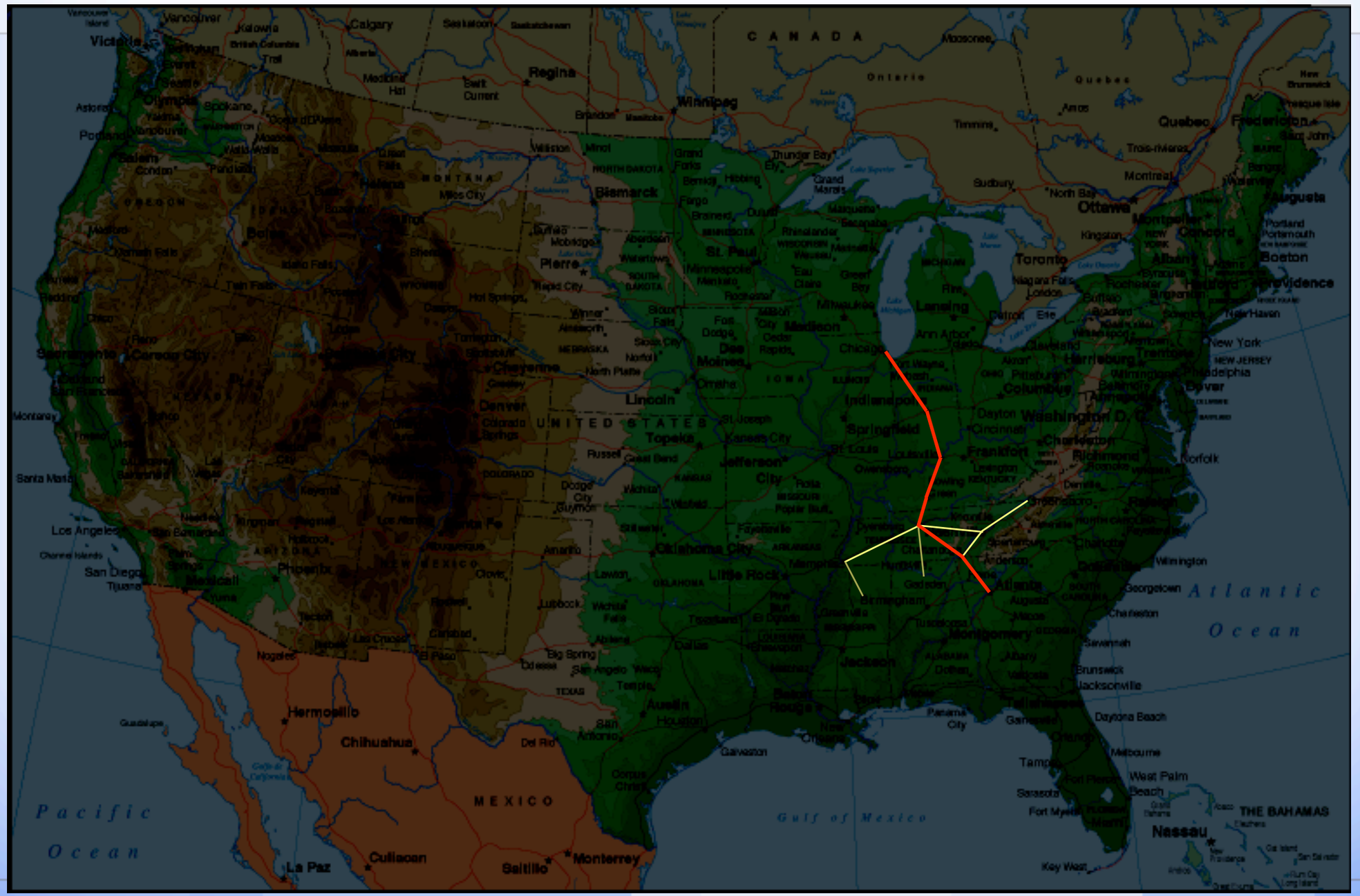
IRU with TVA: Chattanooga to Tri-Cities and Knoxville to Nashville to Memphis



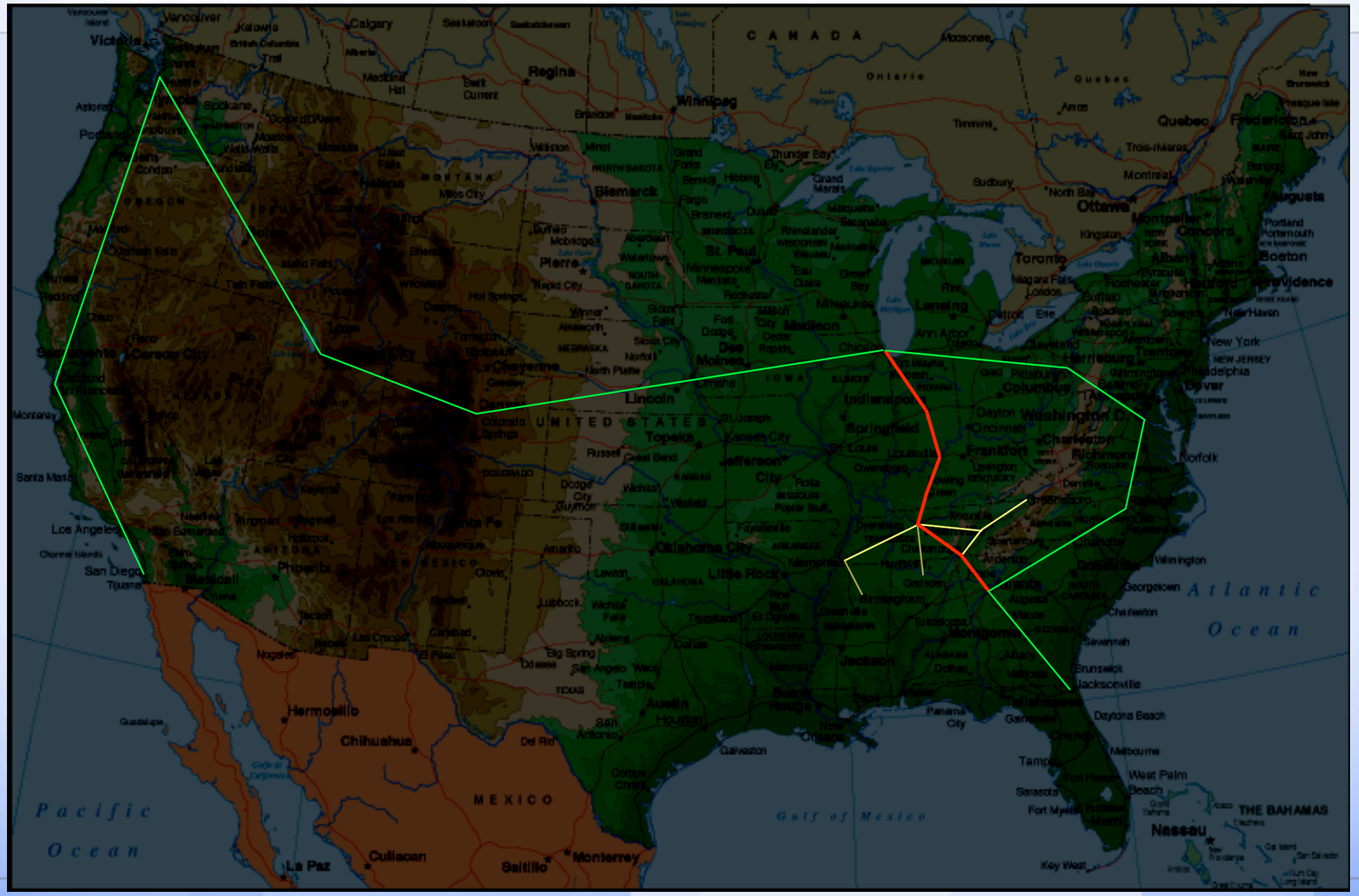
With stubs into Alabama and Mississippi



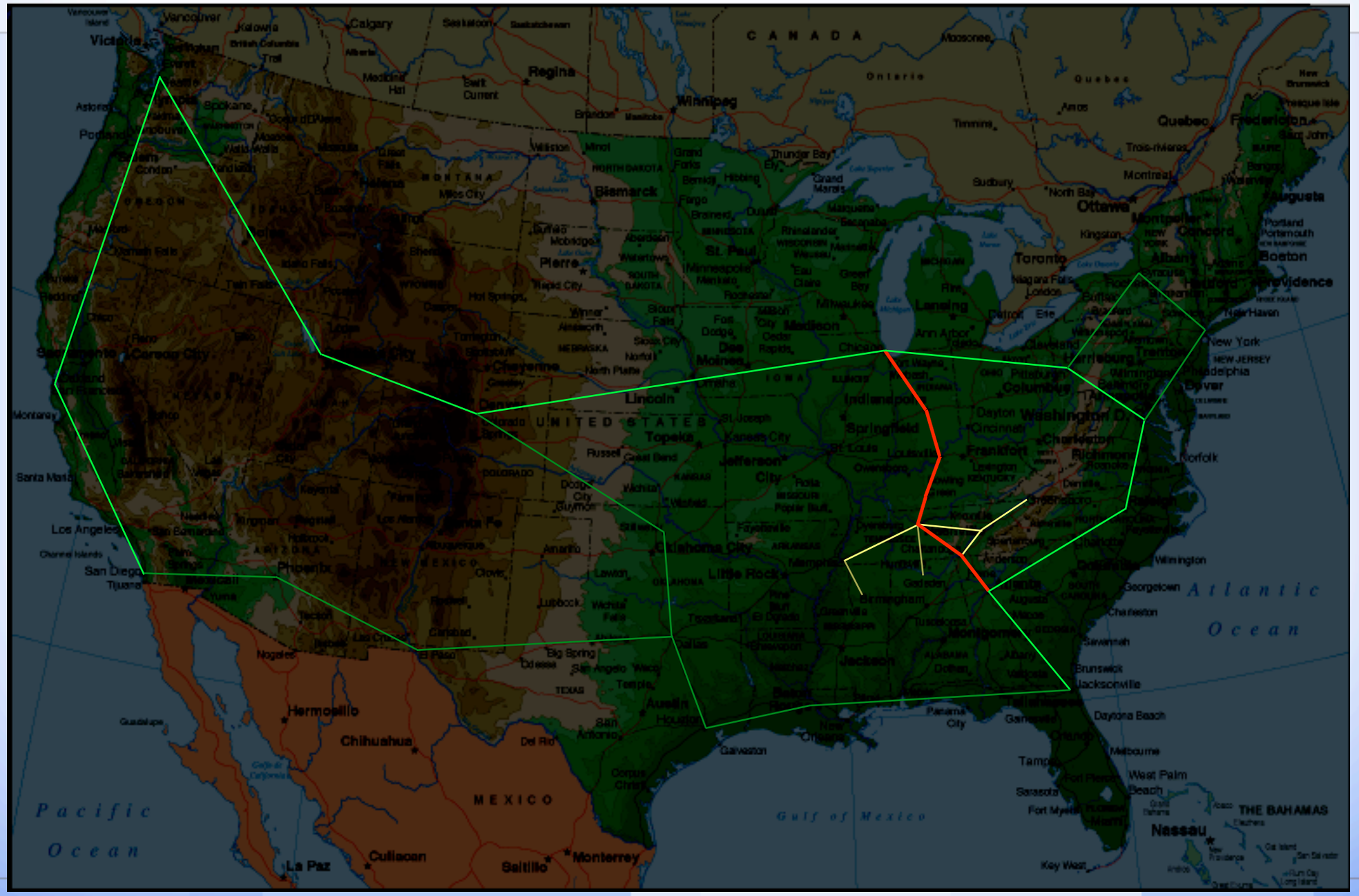
Another IRU with Qwest: Atlanta - Chicago



Arranged asset trade with NLR Charter-member prices on their infrastructure



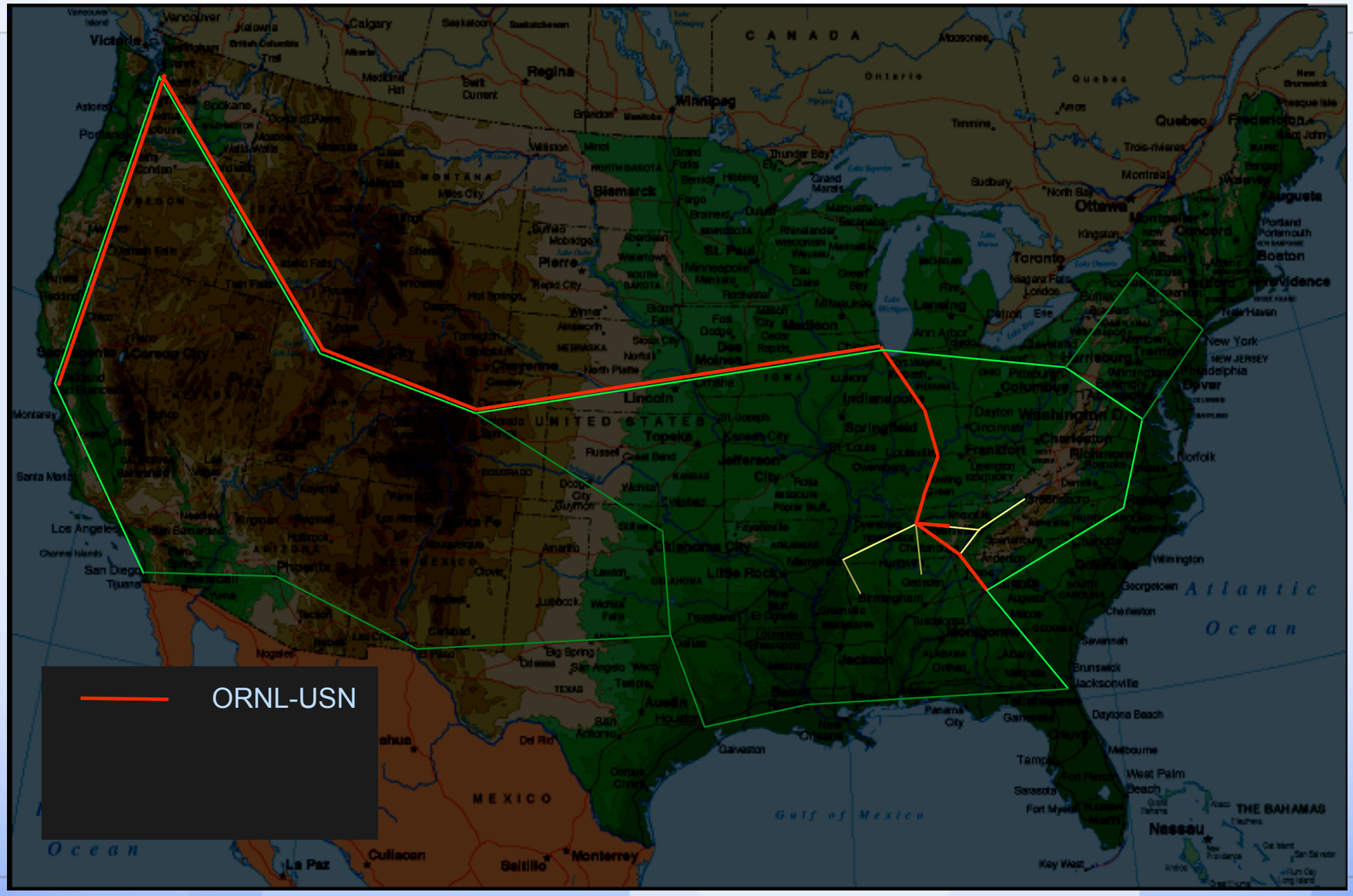
Which will look like this when finished



Infrastructure - Not a Network

- On it, we're building or adding to three research networks
  - DOE's UltraScience Network
  - NSF's CHEETAH (which will help us study inter-domain issues in switched circuits)
  - ORNL's connection to DOE's ESnet (which will bridge to operational status for Switched-Circuit techniques)

UltraScience Net: a reservation-based network


ORNL-USN
CANADA
UNITED STATES
MEXICO
Atlantic Ocean
Pacific Ocean
Gulf of Mexico
Vancouver
Calgary
Regina
Winnipeg
Thunder Bay
Sudbury
Ottawa
Montreal
Quebec
Toronto
Boston
New York
Washington D.C.
Chicago
Seattle
Portland
San Francisco
Los Angeles
San Diego
Las Vegas
Phoenix
Albuquerque
Denver
Salt Lake City
Boise
Spokane
Billings
Minneapolis
St. Paul
Bismarck
Pierre
Omaha
Kansas City
Oklahoma City
Dallas
Houston
Austin
San Antonio
Atlanta
Jacksonville
Miami
Nassau
THE BAHAMAS
Cleveland
Detroit
Pittsburgh
Columbus
Indianapolis
St. Louis
Memphis
Nashville
Charlotte
Raleigh
Norfolk
Philadelphia
Albany
Hartford
Providence
Portland
Augusta
Fredericton
Saint John
Halifax
Moncton
Charlottetown
Prince Rupert
Prince George
Edmonton
Saskatoon
Moose Jaw
Swift Current
Medicine Hat
Brandon
Thunder Bay
Sault Ste. Marie
Timmins
Moosonee
Amos
Trois-Rivières
Kingston
Niagara Falls
Lansing
Ann Arbor
Madison
Milwaukee
Green Bay
Minot
Grand Forks
Fargo
Bismarck
Aberdeen
Watertown
Rapid City
Sioux Falls
Fort Dodge
Des Moines
Cedar Rapids
Lincoln
Omaha
Topeka
Wichita
Jefferson City
Springfield
Little Rock
Jackson
Birmingham
Montgomery
Tallahassee
Tampa
Orlando
Miami
Key West
Fort Myers
Sarasota
Melbourne
Daytona Beach
Jacksonville
Savannah
Charleston
Wilmington
Georgetown
Greensboro
Roanoke
Harrisburg
Trenton
New Haven
Providence
Boston
Portland
Concord
Montpelier
Augusta
Bangor
Saint John
Fredericton
Quebec
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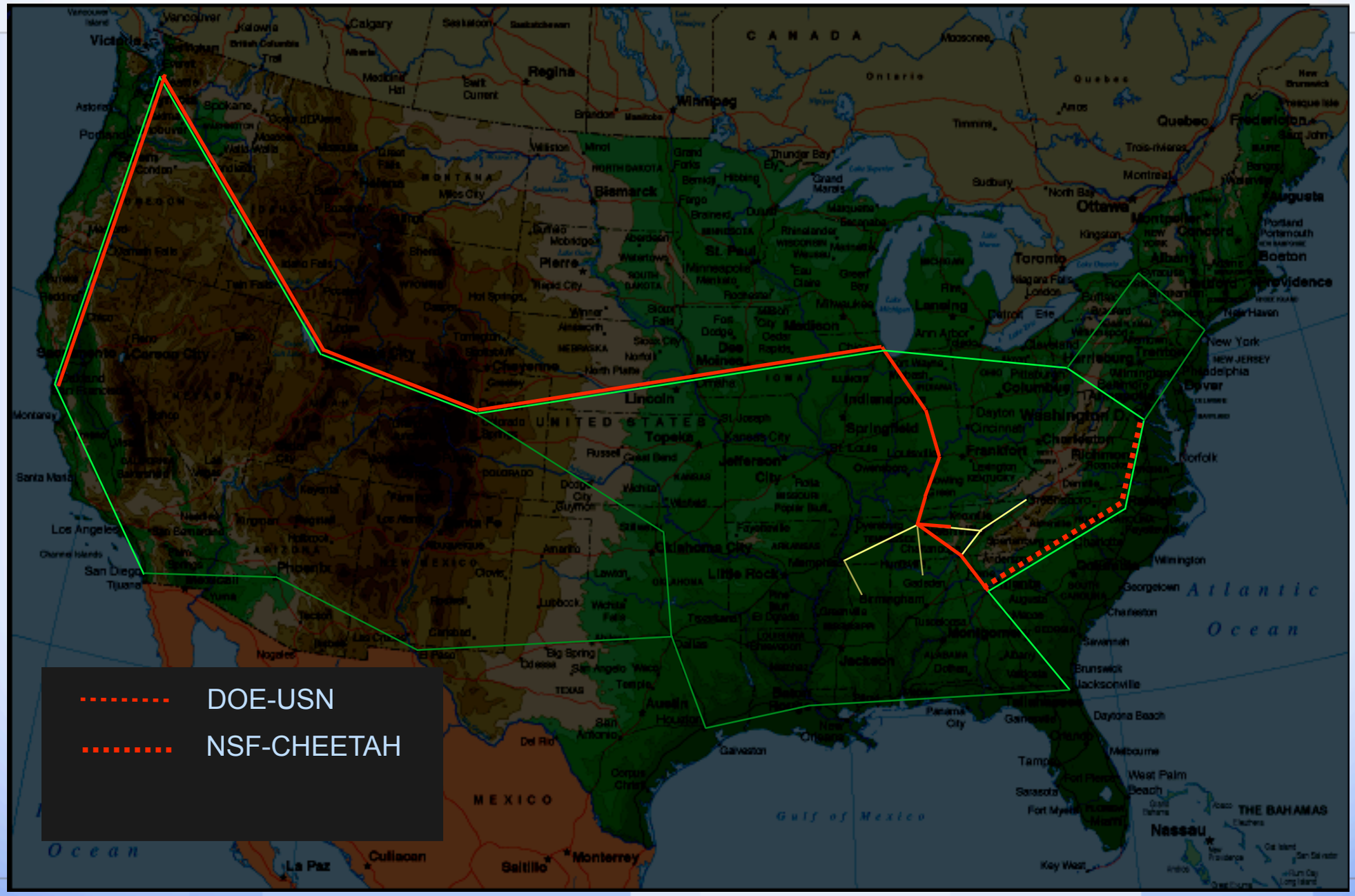
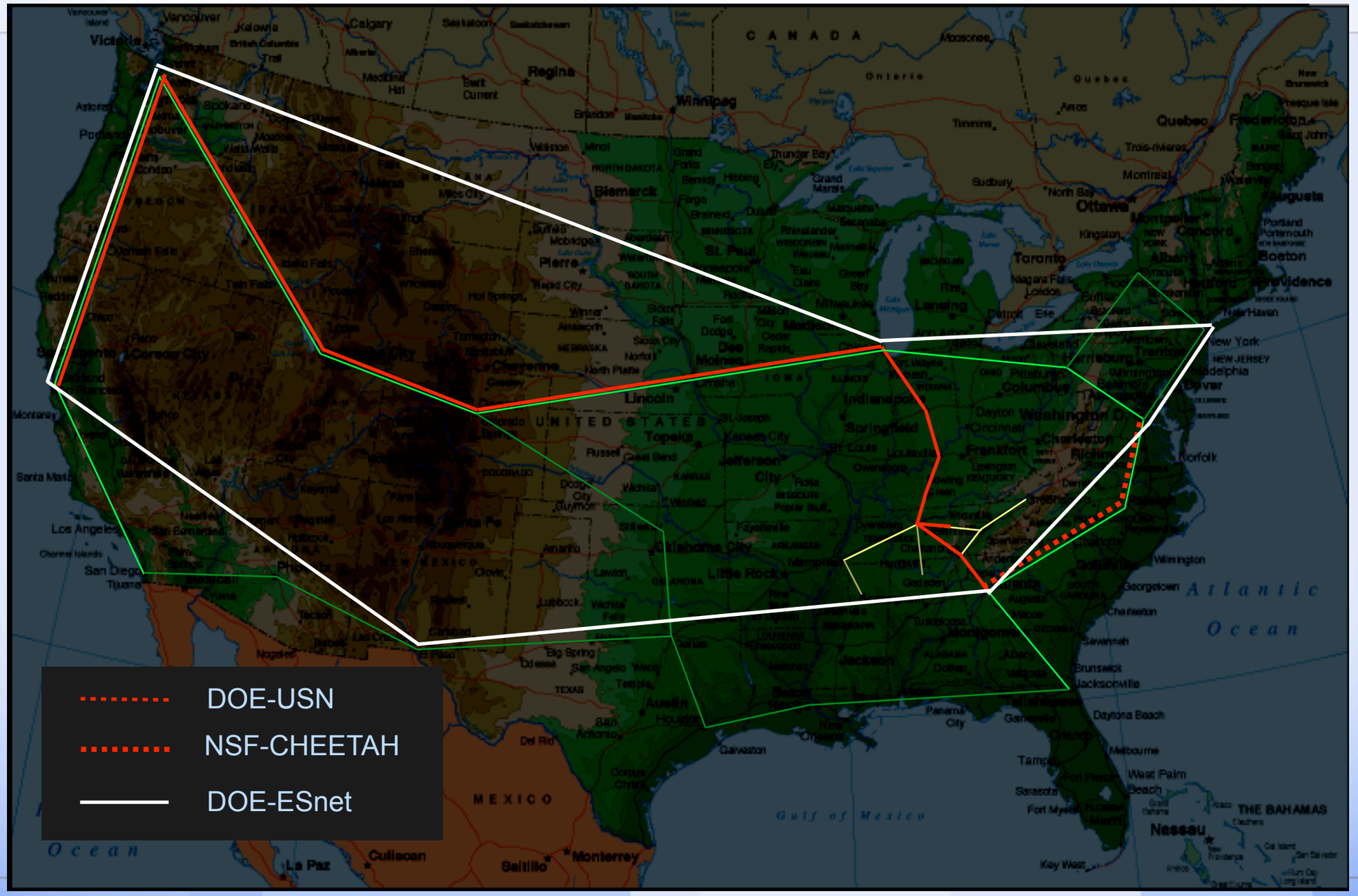
Pittsburgh
Columbus
Indianapolis
Chicago
Milwaukee
Madison
Green Bay
Minneapolis
St. Paul
Rochester
Eau Claire
Duluth
Grand Forks
Minot
Bismarck
Fargo
Grand Marais
Marquette
Escanaba
Rhinelander
Wausau
Aberdeen
Watertown
Pierre
Rapid City
Sioux Falls
Fort Dodge
Des Moines
Cedar Rapids
Omaha
Lincoln
Topeka
Kansas City
Wichita
Jefferson City
Springfield
St. Louis
Louisville
Cincinnati
Dayton
Columbus
Pittsburgh
Harrisburg
Trenton
Philadelphia
New York
New Haven
Providence
Boston
Portland

CHEETAH: an MPLS/GMPLS-based network



ESnet: DOE's production network (where we will use MPLS tunnels)



Questions to be answered

- MPLS/GMPLS vs. Scheduling and Reservation
- Inter-domain resource allocation, peering, and brokering
- Transitioning these techniques to operational networks

MPLS/GMPLS vs Reservation

- Scheduling and reservation come from a supercomputer, batch or grid-using community
  - Jobs run for days or weeks, resources scheduled in advance
  - File transfer time may only be known approximately
- MPLS comes from the telecom community
  - Pick-up-the-phone-and-dial; it connects, or it doesn't
  - Highly interactive, phone-call like model of computing

Inter-domain Issues

- UltraScience Net and CHEETAH join in Atlanta
  - CHEETAH's western end terminates at ORNL
  - Opportunity to experiment with technical, not policy issues
- Policy will have to be settled at or by JET

Transitioning to Production

- Use “off hours” capacity in ESnet
- Schedule MPLS partial-bandwidth tunnels
- Experiment with scheduling in an operational context
- Fortunately, ESnet is “in the family”

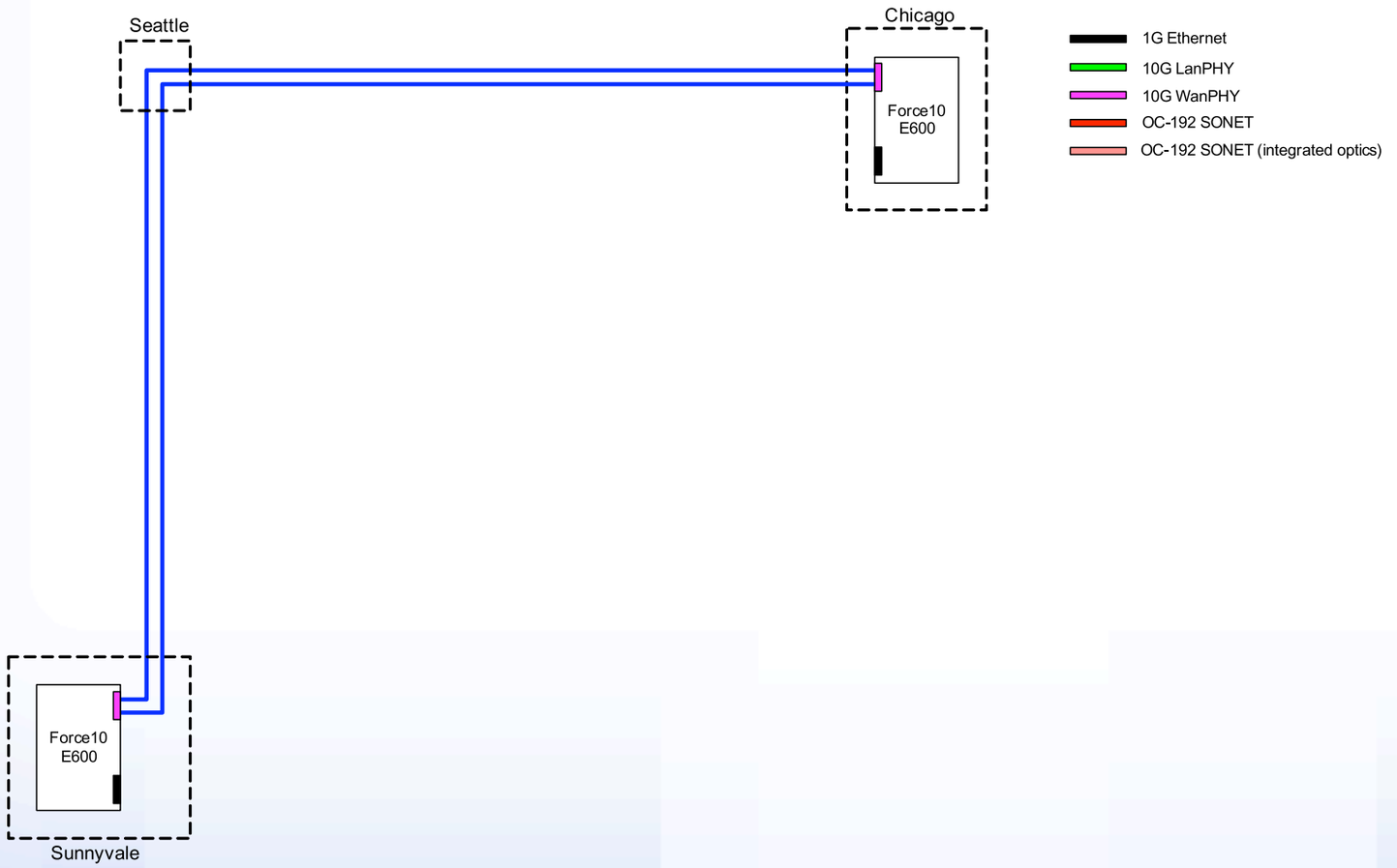
Current Status

- Chicago Sunnyvale is up and running
- The Atlanta-Chicago circuit is being built out now
  - Most hardware installs are complete, including ORNL
  - All hardware installs scheduled for completion by April 30
  - Test and Turn-up to be complete by mid-May
- Knoxville -Nashville following, roughly one month behind
  - Testing of TVA fiber found some problems…

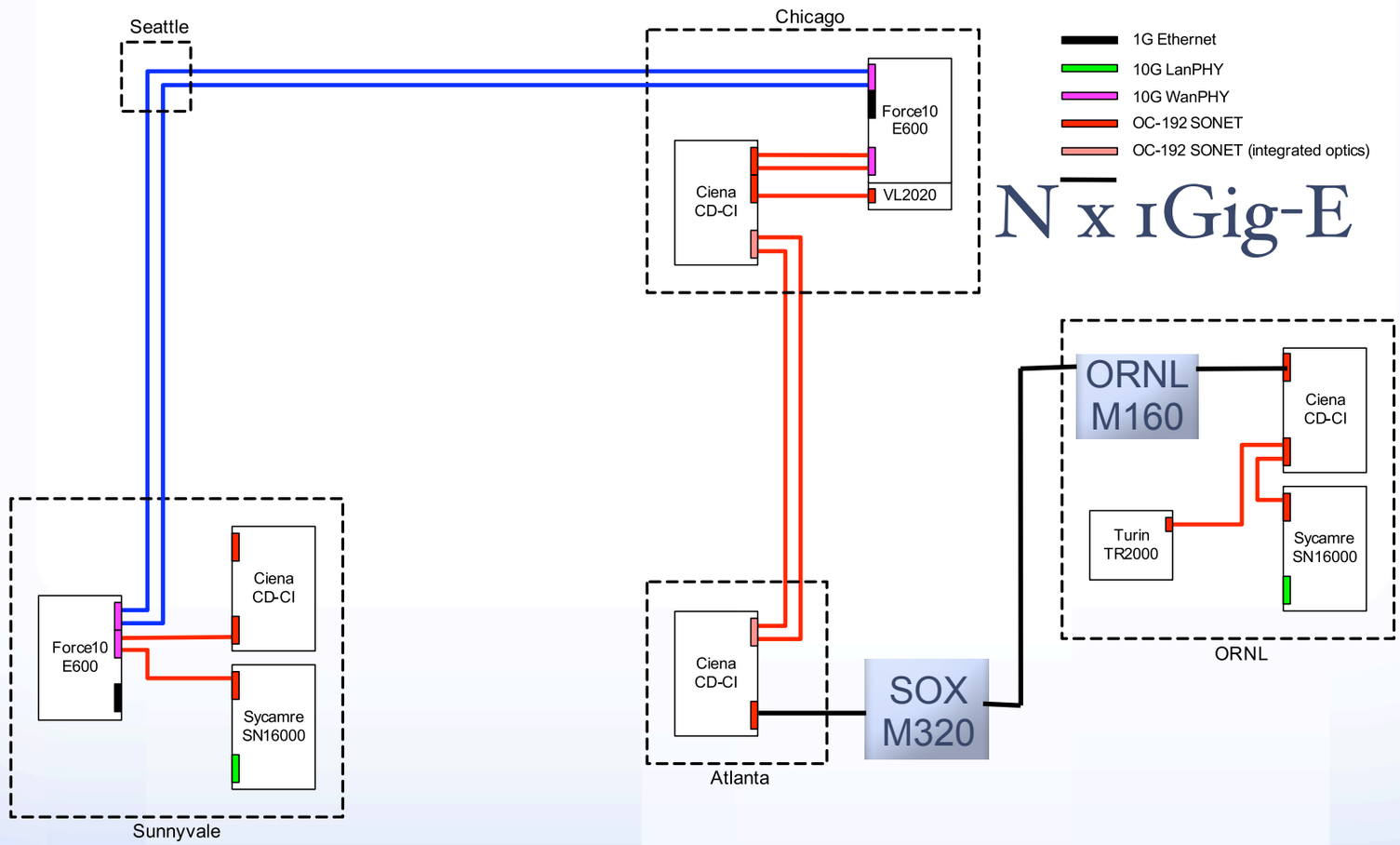
Chicago-Sunnyvale

- NLR providing 2 x 10Gbs circuits from Chicago to Sunnyvale
  - Initial transport is via 10Gig-Ethernet
  - Circuits up today
- Chicago layer-two switch installed six weeks ago (LAN-PHY)
- Sunnyvale switch installed last week
- Roll to SONET later (May-June?) when NLR brings up SONET lambdas (awaiting Cisco transceivers)

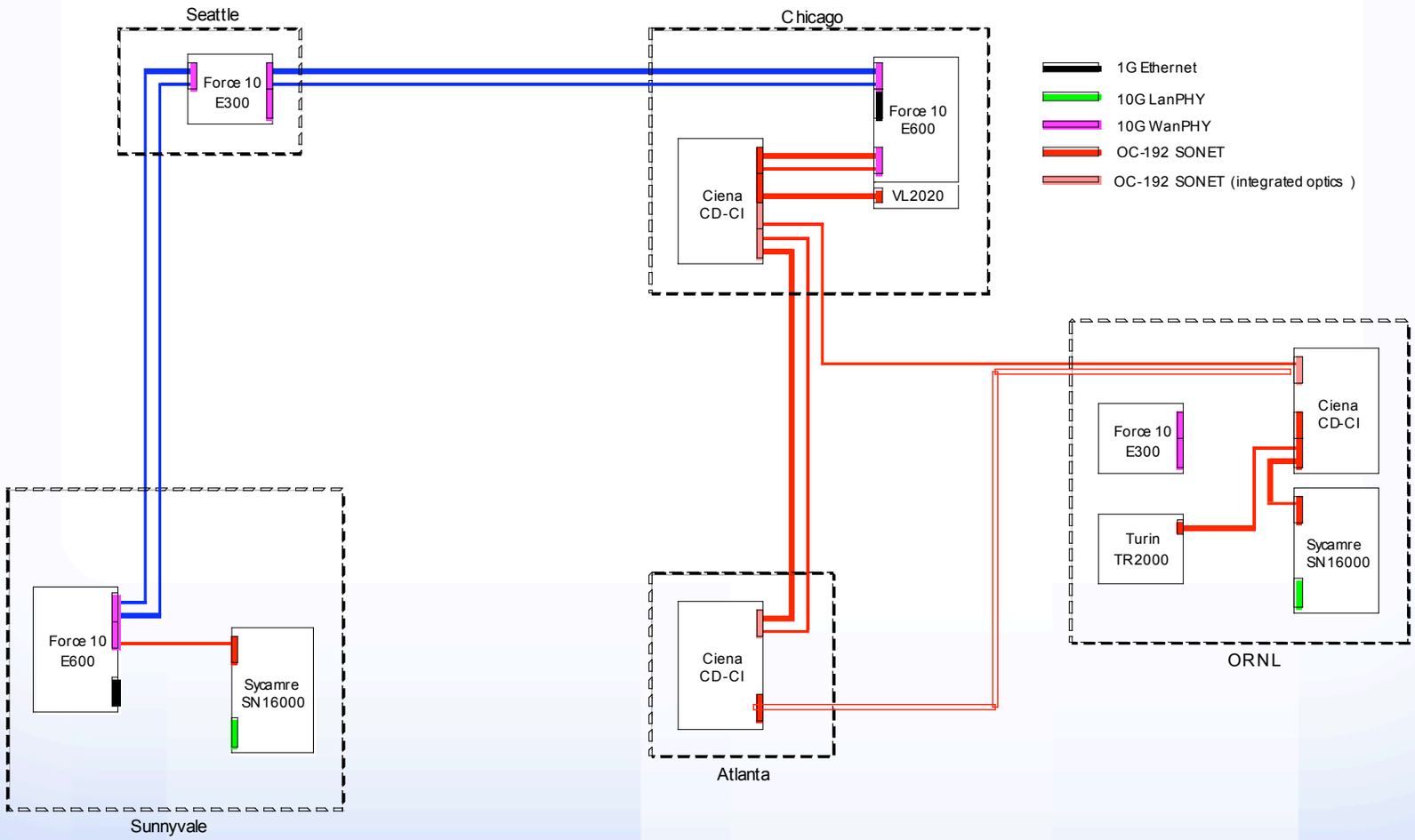
Phase-1 (April)



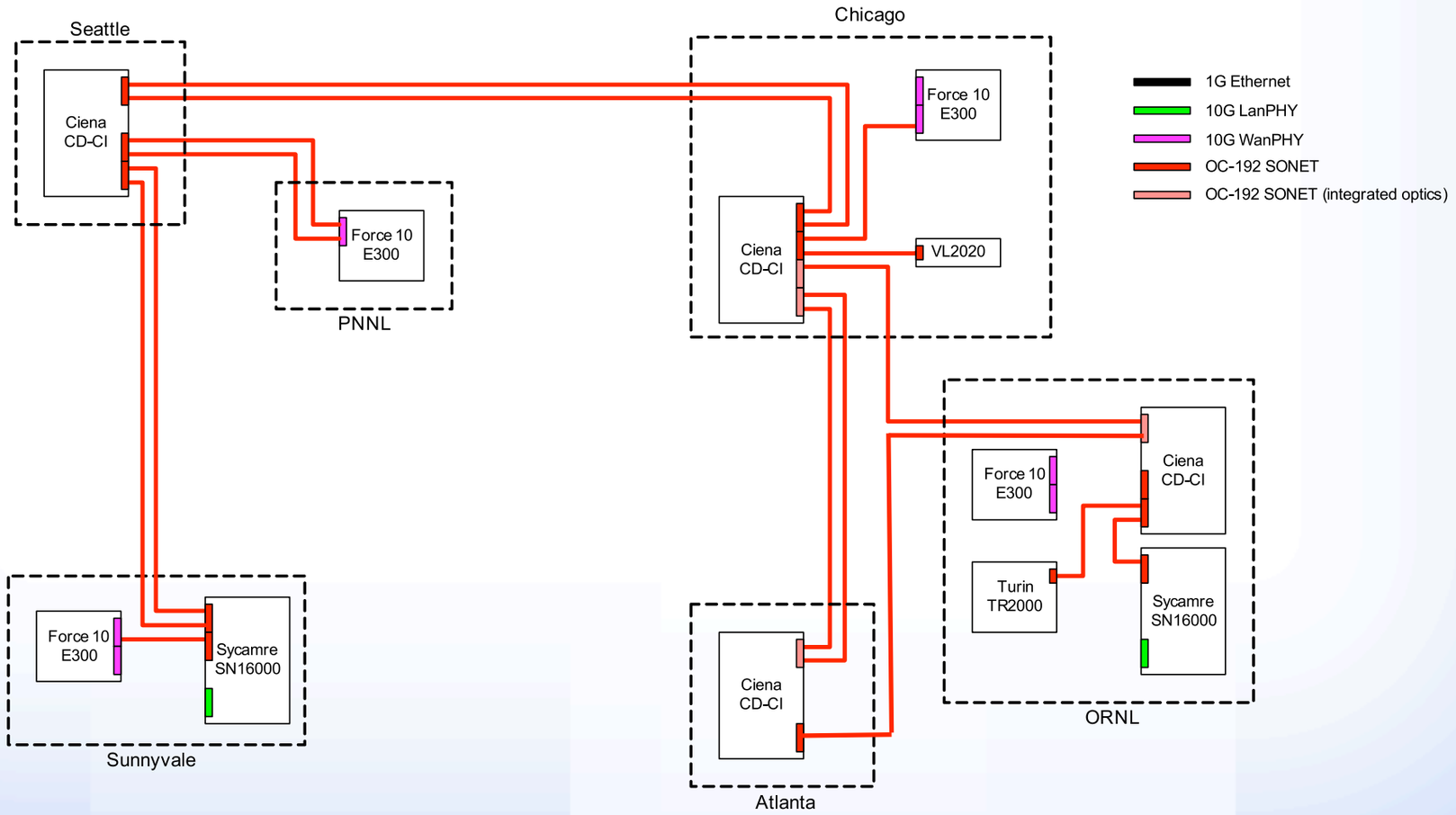
Phase-2 (April-May)



Phase-3 (May-June)



Phase-4 (June)


Seattle
Ciena
CD-CI
Force 10
E300
PNNL
Force 10
E300
Sycamre
SN16000
Sunnyvale
Chicago
Force 10
E300
Ciena
CD-CI
VL2020
Ciena
CD-CI
Atlanta
Force 10
E300
Ciena
CD-CI
Turin
TR2000
Sycamre
SN16000
ORNL
1G Ethernet
10G LanPHY
10G WanPHY
OC-192 SONET
OC-192 SONET (integrated optics)

Thank you

http://www.csm.ornl.gov/ultranet