

I-WIRE: One Example of a Regional Empowered Network Initiative

**JET Roadmap Workshop
Jefferson Lab Newport News, Virginia
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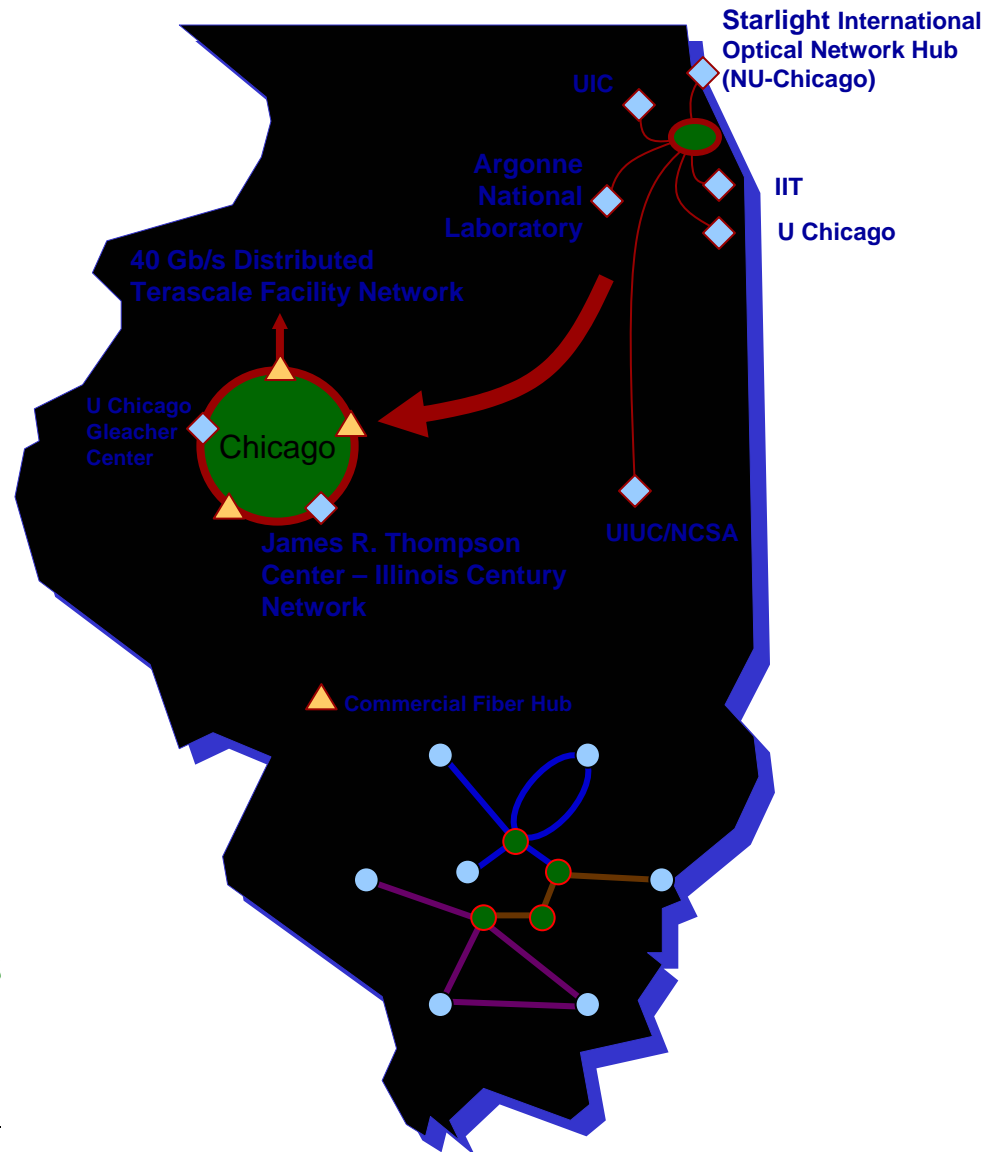
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For More Information see www.i-wire.org

I-WIRE (Illinois Wired/Wireless Infrastructure for Research and Education)

- State Funded Dark Fiber & Optical Infrastructure to support Networking and Applications Research
 - \$7M Total Funding (FY00-04)
 - Application Driven
 - Access Grid: Telepresence & Media
 - TeraGrid: Computational and Data Grids
 - New Technologies Proving Ground
 - Optical Network Technologies
 - Middleware and Computer Science Research
- Deliverables
 - A flexible infrastructure to support advanced applications and networking research



Background I-WIRE Objectives

- Original Charter (circa 1998)
 - Deploy dark fiber for research projects
 - NCSA, Argonne, UC Computation Institute, UIC Electronic Visualization Laboratory
- Results
 - Dark Fiber (20 year IRU) infrastructure to 11 sites (\$4M)
 - Additional sites included based on available fiber paths
 - \$3M for Chicago Metro area, \$1M for Urbana route
 - DWDM Transport Infrastructure (\$2.5M)
 - Linear segments to ANL, NCSA; Chicago metro ring
- Architecture: “Virtual Fiber Meet-Me-Room”
 - Land at any I-WIRE site, transport to any other I-WIRE site
 - Reach as many metro landing points as feasible
 - Have already established landing points in four locations
 - 111 N. Canal, NBC Tower, Doral Plaza, Starlight



I-WIRE Economics

- Up front cost of ~\$4M for fiber
 - 20-year IRU Fiber (existing fiber)
 - \$700 to \$5,000/strand-mile
 - New construction (for 'last mile')
 - \$30 to \$100/foot (\$160-530k/mile)
- Up front cost of ~\$2.5M for equipment
 - Additional sites \$50-75k
 - Additional channels ~\$25k/OC48, ~\$70k/10G
- Annual costs
 - fiber maintenance
 - equipment maintenance
 - staff effort

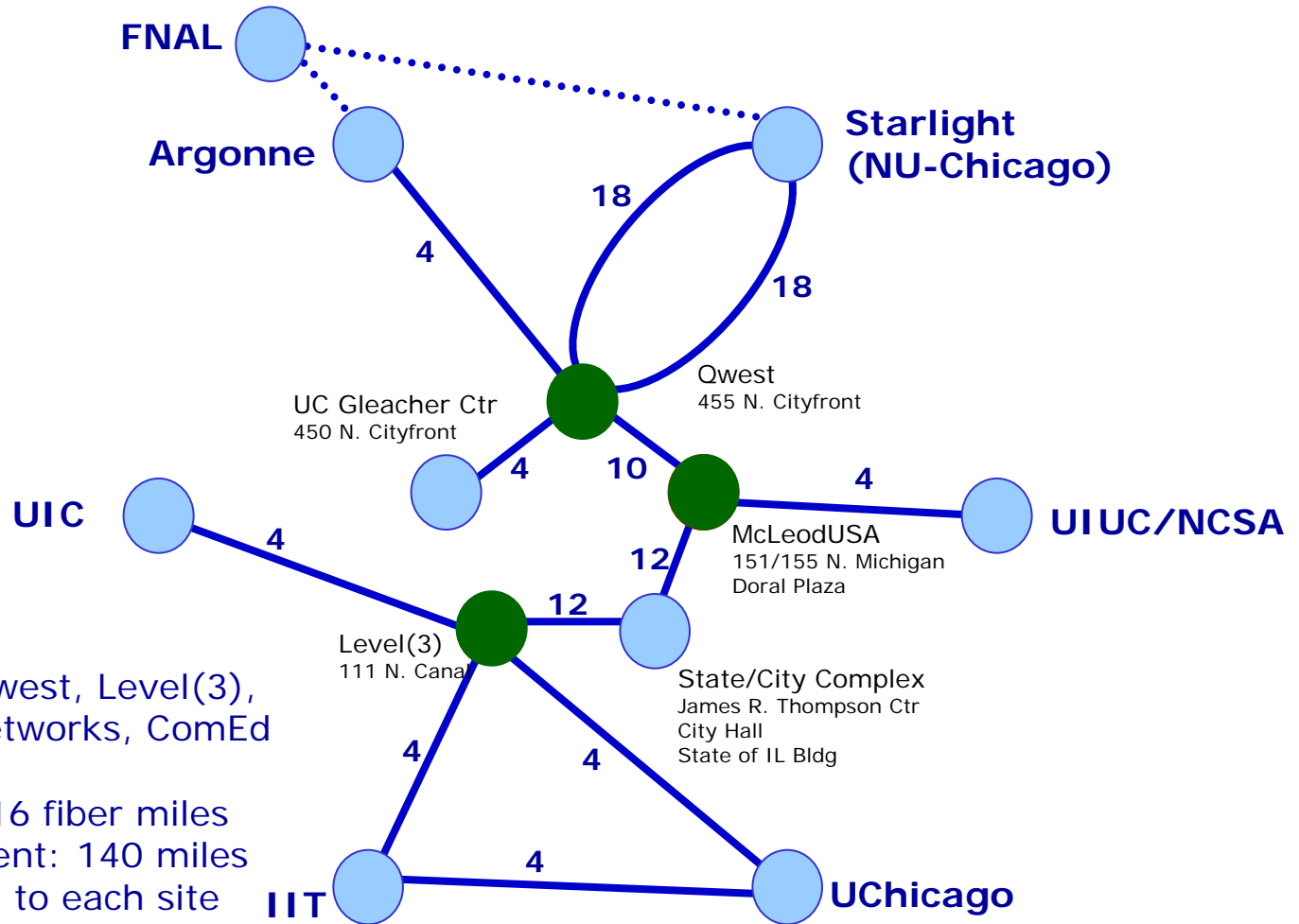


Current Status

- Ciena ONLINE Metro DWDM Systems in “Production”
 - TeraGrid Project
 - 3 x OC-192 NCSA-Starlight and ANL-Starlight
 - Optiputer Project (8GE UIC-EVL – Starlight)
 - DOT Project (planned OC-48, multiple I-WIRE sites)
- I-WIRE Support Plan
 - Next-Day maintenance
 - Redundancy for high-availability (L1 and/or L2)
- Creation of Cost-Recovery Vehicle
 - Fee Structure (base plus channel cost components)
 - Base System Maint + Engineering: Divided among participants
 - Channel Costs: Maintenance of channels used per institution
 - Recent numbers: \$1.3k/yr for OC48; \$5k/yr for OC-192



I-Wire Fiber Topology



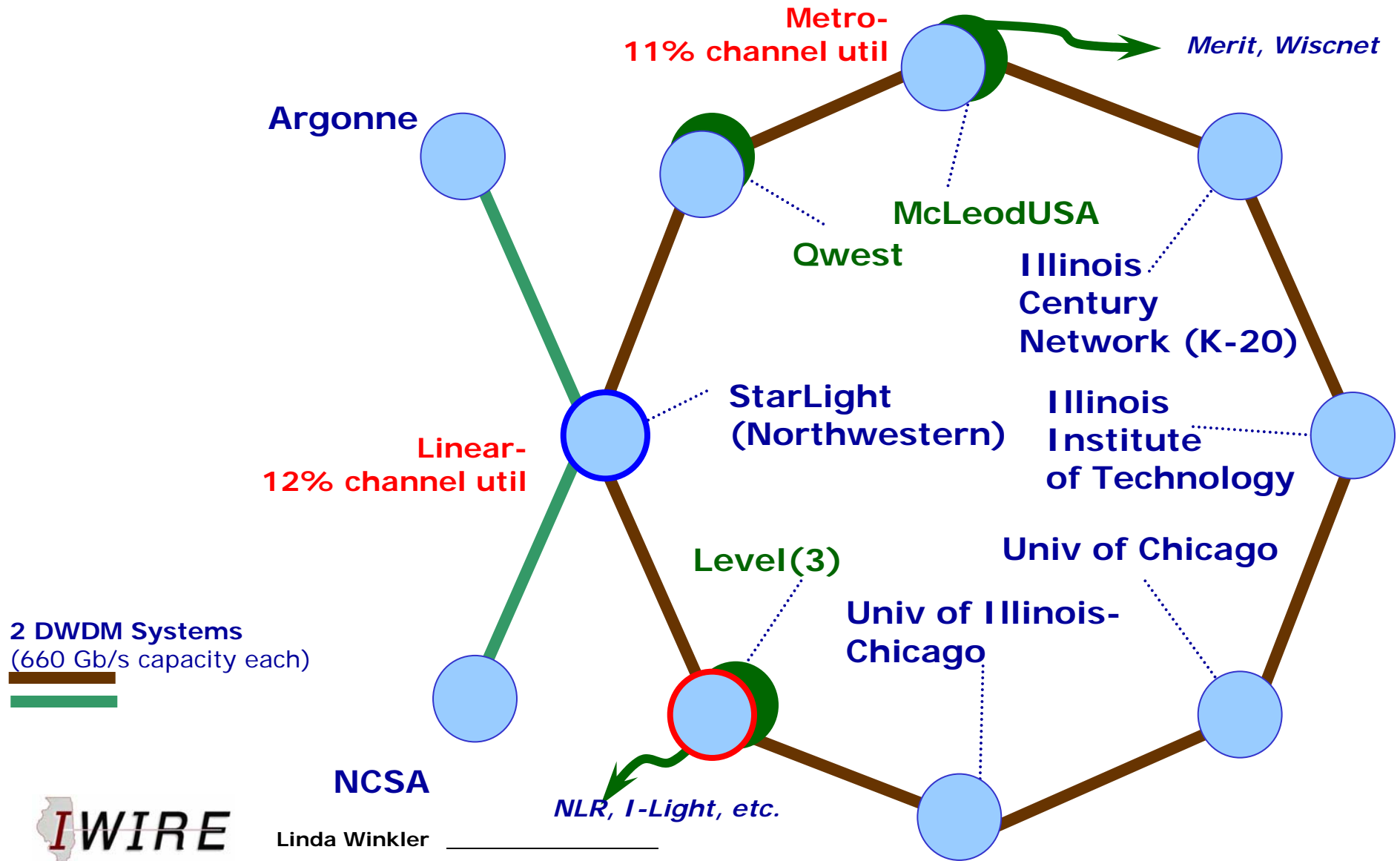
- Fiber Providers: Qwest, Level(3), McLeodUSA, 360Networks, ComEd
- 10 segments
- 190 route miles; 816 fiber miles
 - Longest segment: 140 miles
- 4 strands minimum to each site



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Numbers indicate fiber count (strands)

Status: I-WIRE Transport Systems



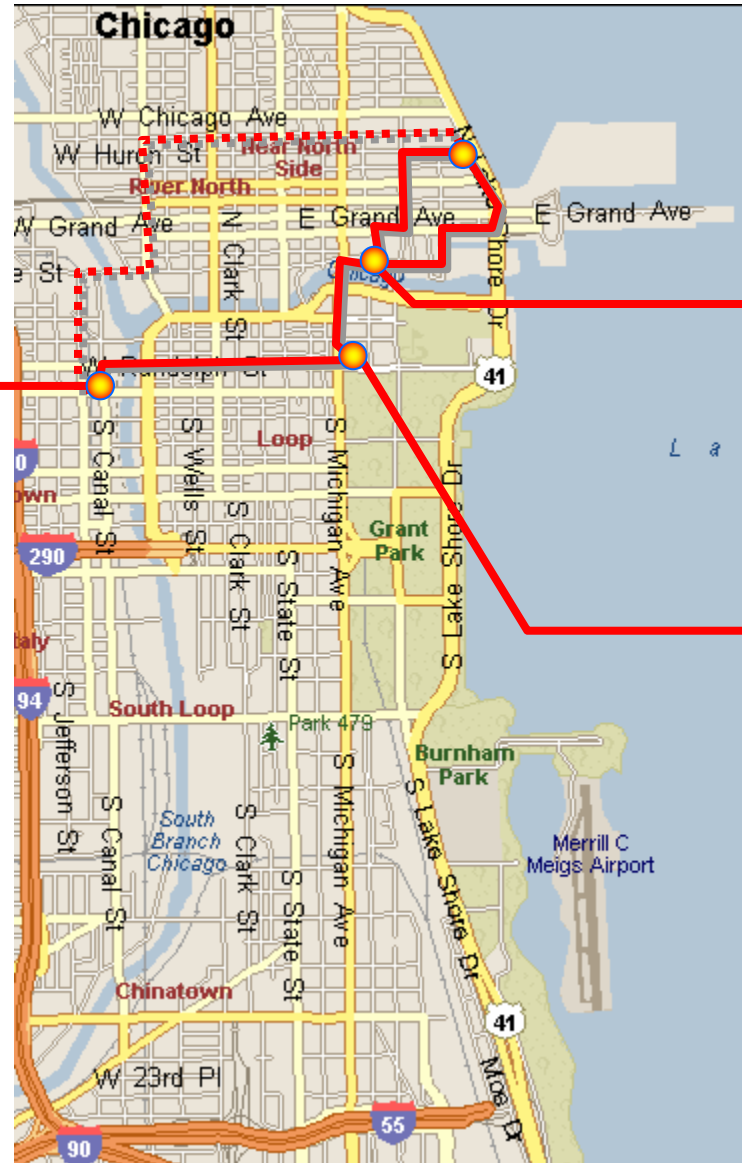
IWIRE Services

- Point-to-point circuits
 - All-rate (100M-2.5G)
 - OC48 (2.5G)
 - 10GE LAN PHY (10.125G)
 - OC192 (9.952G)
- Dark Fiber Services
- 99% uptime goal
- Channel capacity
- Channel utilization



I-WIRE Virtual Fiber Meet-Me-Room

Level(3)
NLR
UI-Chicago
U Chicago
IIT



Qwest
ESnet
Abilene
Argonne

Norlight
McLeodUSA
Michigan
Wisconsin
UIUC/NCSA

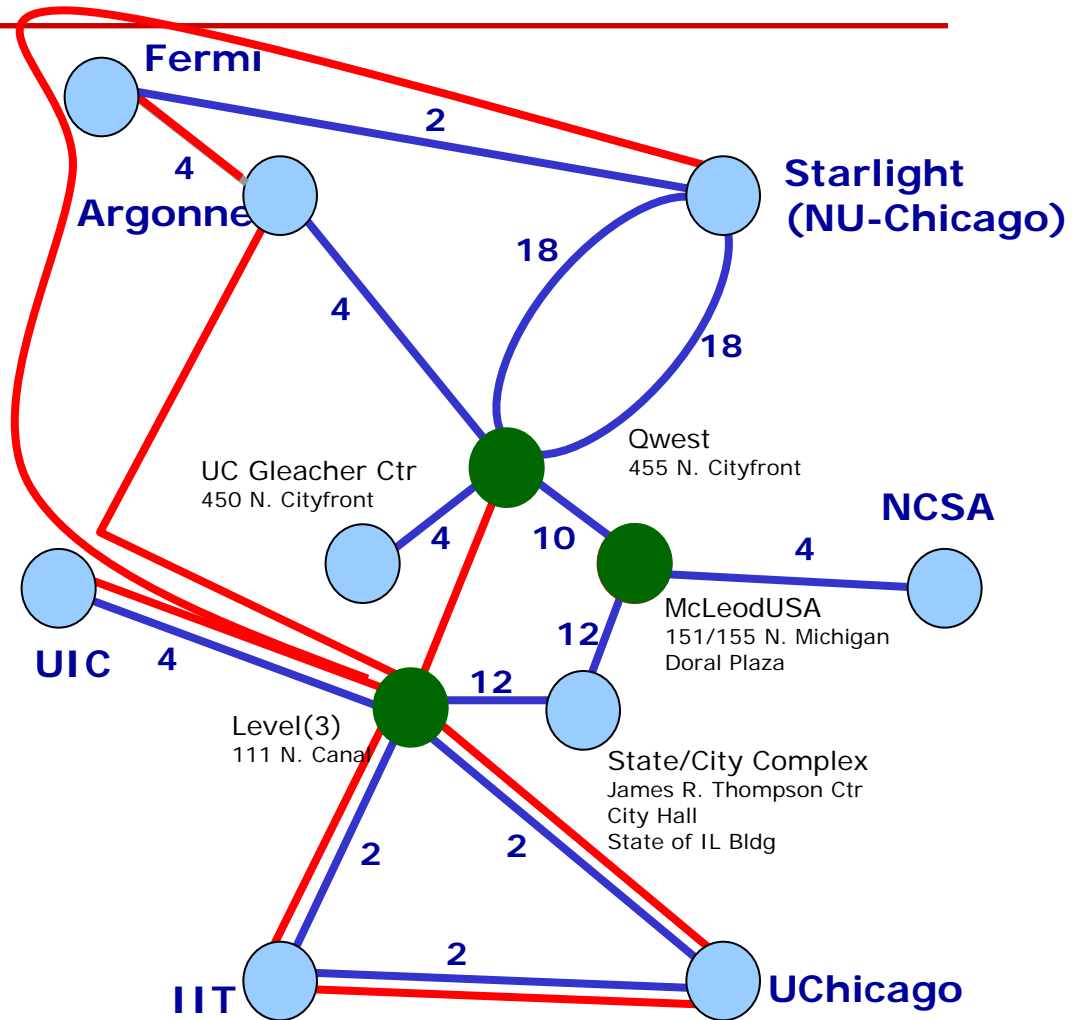


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I-Wire Fiber Topology Enhancements

FY04 I-WIRE funding Targets

- Adding Redundancy Fiber Path to Metro Ring
- Augmenting fiber to metro sites to allow for multiple experiments
- Expand to new sites
- Expand to new customers (DOE)



Numbers indicate fiber count in strands
 New fiber under investigation



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State of Technology

- State of DWDM Technology
 - Very mature stable, deployable, managable
- Collaborations
 - Need to work with vendors on control plane interoperabilty
 - Need to work with partners on encryption
- Technology projections
 - Dynamic provisioning
 - Topology discovery
 - Higher speed transmission remains difficult to harness on a single machine
 - Multiple stream application flows will continue dominate (Nx1GE => Nx10GE)

The Benefits

- Marginal cost to increase bandwidth
- Managable circuits (end points)
- Flexible architecture allows virtual organizations to create adhoc experimental infrastructures
- Deployment of high bandwidth circuits to markets underserved by traditional carriers