Recent Experience with GMPLS E-NNI

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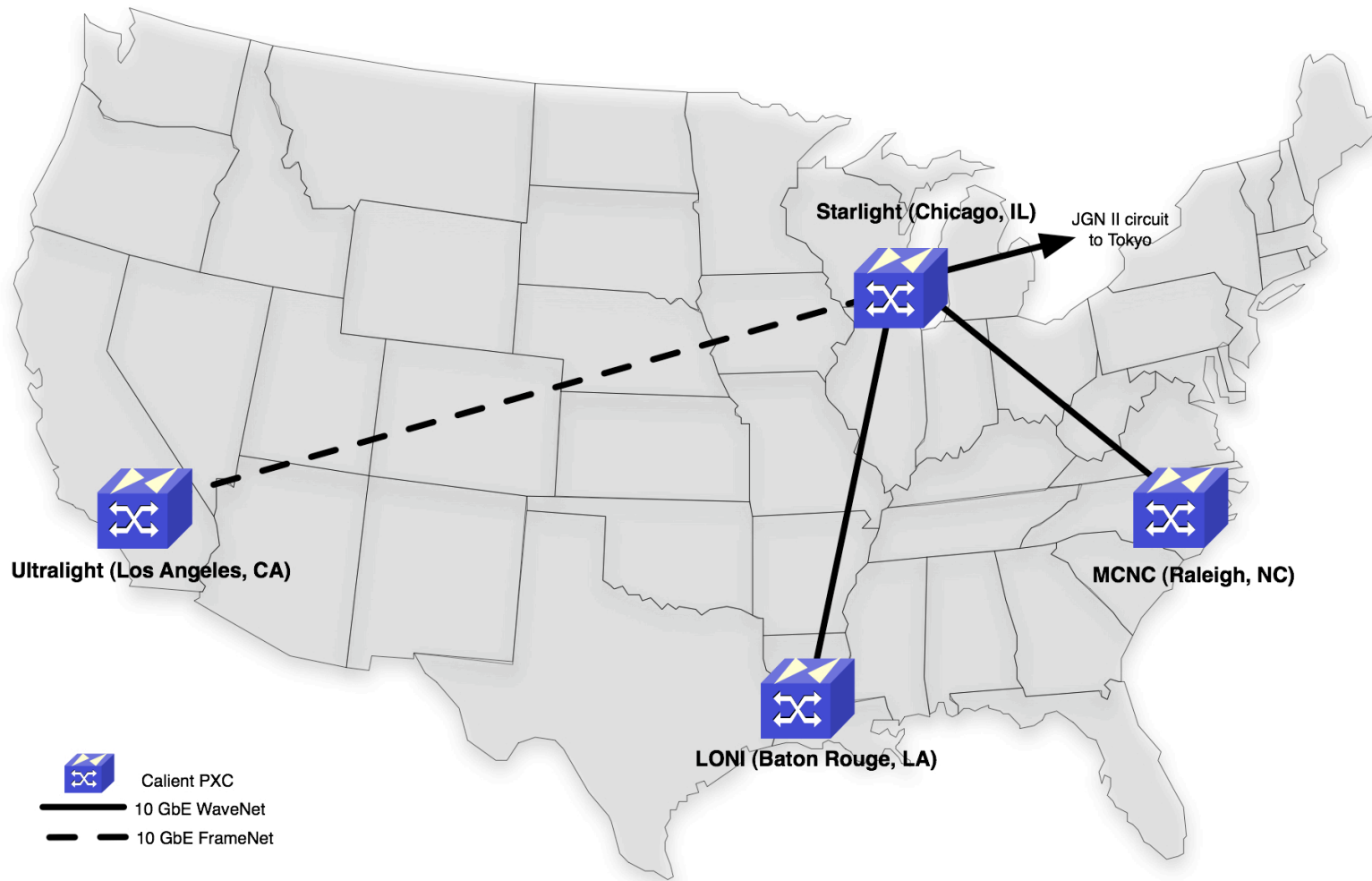**MCNC**

Outline

- Enlightened Testbed overview
- Three-domain testing and demo
- International control plane interconnections

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Enlightened Testbed Overview

- National footprint GMPLS-enabled optical testbed
- US Partner sites
  - Starlight (Chicago, IL)
  - Ultralight (Los Angeles, CA)
  - Louisiana Optical Network Initiative (Baton Rouge, LA)
  - MCNC (Raleigh, NC)
- Each site has administrative responsibility for local Calient OXC
- Testbed is cooperatively managed as a single domain
  - Single OSPF area
  - GMPLS control plane
- OXC at Starlight is configured as a border node
  - One international connection so far (to JGNII in Japan)
  - GMPLS E-NNI for interdomain signaling and routing

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Existing Enlightened topology
- Three locations connected to Chicago hub
- Data plane interconnections via NLR lambda and L2 services
- JGNII interconnection at Starlight

Starlight (Chicago, IL)

JGN II circuit
to Tokyo

Ultralight (Los Angeles, CA)

MCNC (Raleigh, NC)

LONI (Baton Rouge, LA)

Calient PXC

10 GbE WaveNet

10 GbE FrameNet

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Three-domain testing

- Tomo Otani reported on our interdomain testing efforts at the last GLIF meeting in Tokyo
  - Between Enlightened and JGN II (northern domain) testbeds
  - http://www.glif.is/meetings/2006/controlplane/otani-us-japan.pdf
- KDDI R& D Labs and MCNC extended the collaboration to include NTT and the JGN II southern domain
  - Demonstrated at the JGN II Symposium in Hiroshima January 2007
- End-to-end provisioning between tributary ports on Enlightened and JGN II southern domain.
  - Japan northern domain performed transit function
  - Japan southern domain used different vendor OXC
- Team members
  - KDDI Research: Shuichi Okamoto, Tomo Otani
  - NTT: Atsushi Taniguchi, Yasunori Sameshima
  - MCNC: John Moore

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GMPLS network

en λ IGHTened computing

GMPLS network

PXC

JGNⅡ

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ons Options Tests Admin View Help

SE-LW

01

LRF
10G

Start

730A

File Edit Tree Actions Selection View Format Window Help

	Events	Rates	
	1-01 XFP-3730A	1-01 XFP-3730A	Traffic(bps)
Tx Frames	275,061,860	0	0
Rx Frames	110,862,765	0	0

金沢

SmartWindow – ENNI-20061218-RA.prf

File Edit Actions Options Tests Admin View Help

1000Base-X GBIC

TX/INIT
RX/ERR
MGMT/PAUSE
LINK

01
Full
1Gb
Link
Stop

02
Full
1Gb
Link
Start

2

2

LAN-3311A

File Edit Tree Actions Selection View Format Window Help

	Events	Rates	
	2-01 LAN-3311A	2-01 LAN-3311A	Traffic(bps)
Tx Frames	70,869,499	9,764	78,112,000
Rx Frames	134,956,808	12,204	97,632,000

ローリー

堂島

JGNⅡ

Japan-U.S.
International line

バトンルージュ

martCounters – [Port Counters – 1A-01 LAN-3201A – (unt...

e Edit Tree Actions Selection View Format Window Help

	Events	Rates	
	1A-01 LAN-3201A	1A-01 LAN-3201A	Traffic(bps)
ames	349,987,118	12,206	97,648,000
ames	328,135,390	9,763	78,104,000

SmartCounters – [Port Counters – 1-01 LAN-3311A – (untitled...

File Edit Tree Actions Selection View Format Window Help

	Events	Rates	
	1-01 LAN-3311A	1-01 LAN-3311A	Traffic(bps)
Tx Frames	87,616	0	0
Rx Frames	42,497	0	0

61218-OSA-v8.5.prf

ests Admin View Help

1000Base-SX

TX/INIT
RX/ERR
MGMT/PAUSE
LINK

01
Full
1Gb
Link
Stop

01
Full
1Gb
Link

1

LAN-3201A   B

SmartWindow – ENNI-20061213-BR.prf

File Edit Actions Options Tests Admin View Help

1000Base-X GBIC

TX/INIT
RX/ERR
MGMT/PAUSE
LINK

01
Full
1Gb
Link
Start

02
Full
1Gb
Link
Start

1

1

LAN-3311A

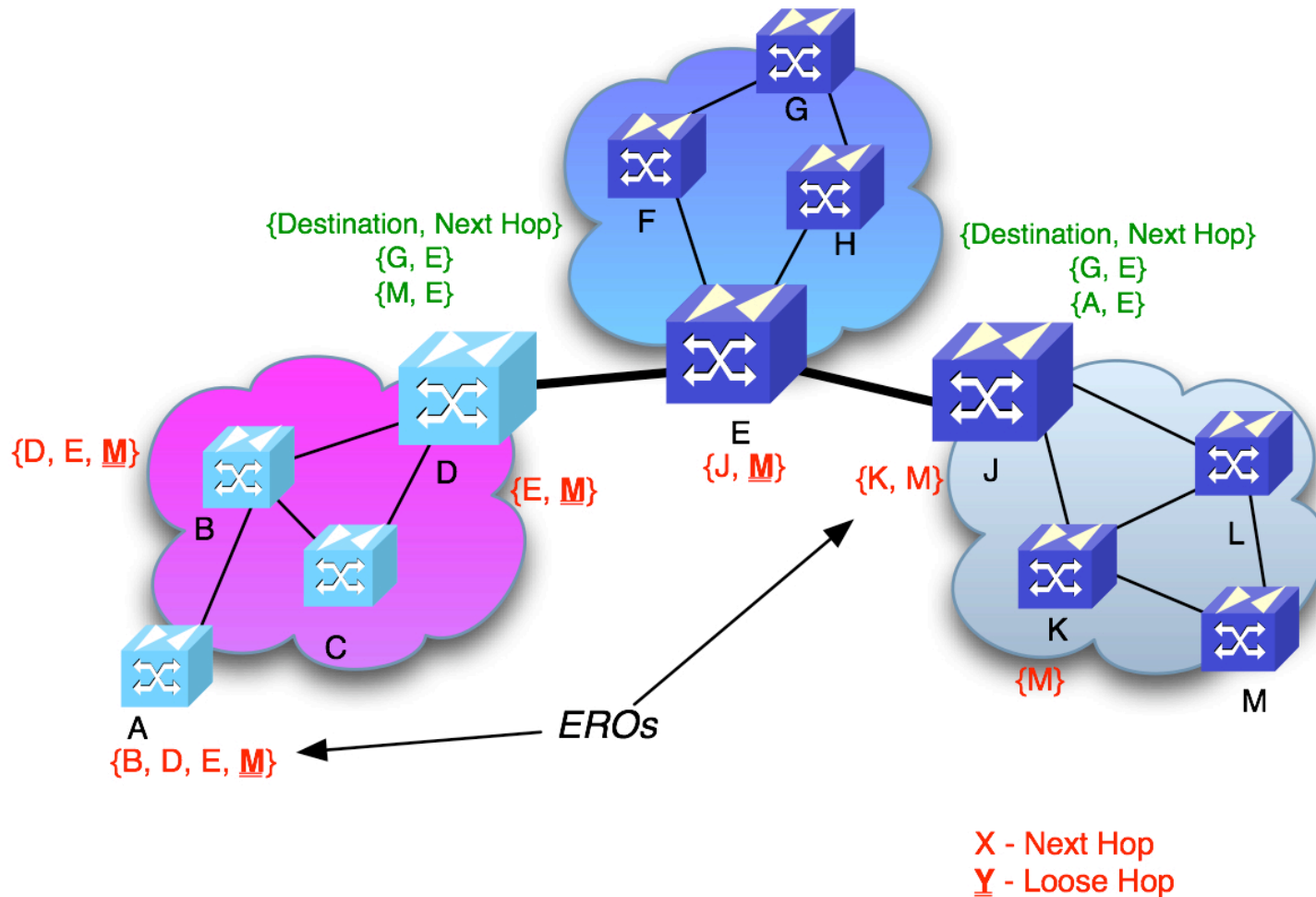LAN-3311A 1000Base-X GBIC Ethernet TeraMetrics Module   OnLine IP=130.39.196.45 Port=16385

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Routing & signaling

- Define control channel, OSPF-TE adjacency and TE link between border nodes (D, E, J)
- Static routes towards external domains defined at border nodes
- No topology information exchanged between domains
- RSVP-TE signaling with loose hops

{Destination, Next Hop}
{G, E}
{M, E}

{Destination, Next Hop}
{G, E}
{A, E}

{D, E, **M**}

{E, **M**}

E
{J, **M**}

{K, M}

J

{M}

A
{B, D, E, **M**}

EROs

X - Next Hop
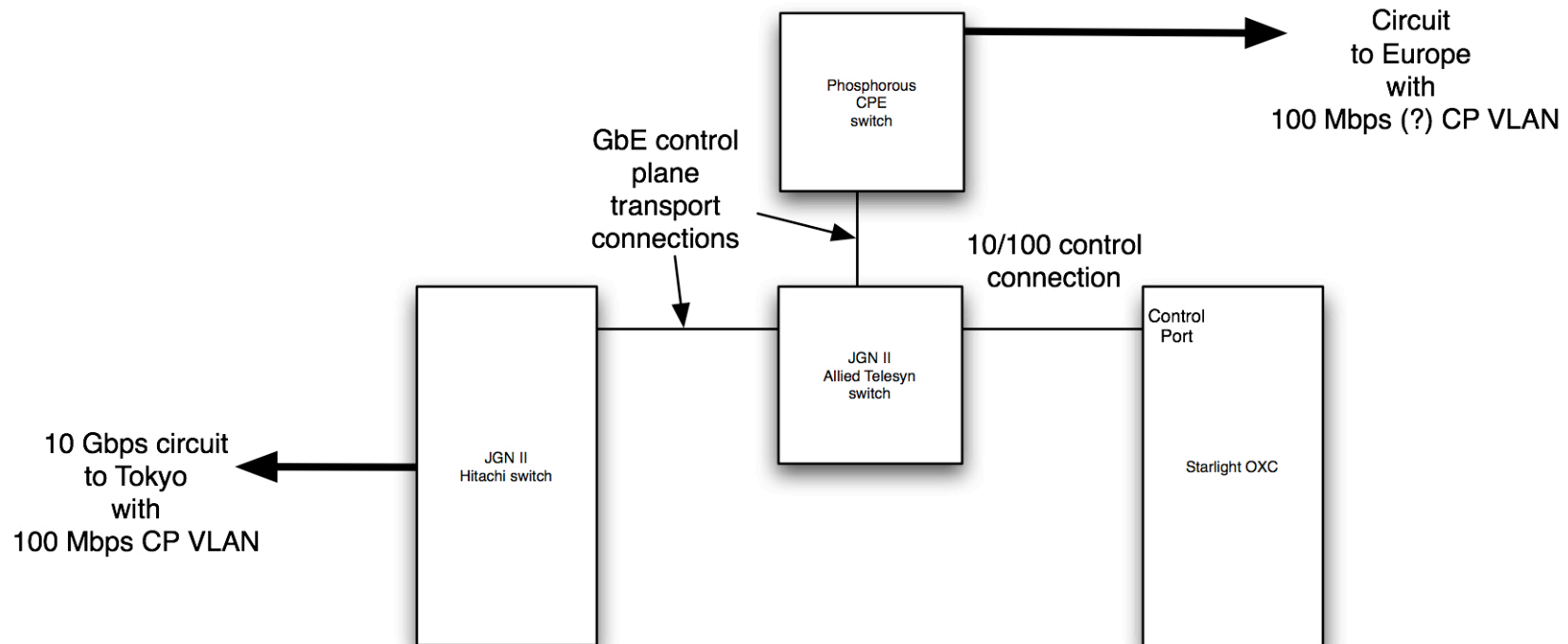**Y** - Loose Hop

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Current international connection

- Japan-US interconnection at Starlight
    - Data plane
        - Direct 10 GE connection from JGNII Ethernet switch (Hitachi GS4000) to Enlightened OXC
        - VLAN to Tokyo over JGNII transcontinental circuit
    - Control plane transport
        - Direct Fast Ethernet connection to small JGNII Ethernet switch (Allied Telesyn)
        - VLAN to Tokyo over JGNII transcontinental circuit
        - JGNII addressing for peering connection

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Additional international CP interconnection discussion
• Preliminary discussion with Phosphorous, JGN II and Enlightened
• Provision GE/FE CP VLAN on international circuit
• Interconnect at Starlight at small JGN II switch
• Allows protected CP interconnection
• CP traffic capture can be added to AT switch
• Data plane not shown…

Phosphorous
CPE
switch

Circuit
to Europe
with
100 Mbps (?) CP VLAN

GbE control
plane
transport
connections

10/100 control
connection

Control
Port

JGN II
Allied Telesyn
switch

10 Gbps circuit
to Tokyo
with
100 Mbps CP VLAN

JGN II
Hitachi switch

Starlight OXC

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Thanks!
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