Welcome

Dave Temkin and Betty Burke

February 4, 2013

NANOG 57

Thank You – Your Program Committee

- Philippe Couture
- Jim Cowie
- Greg Dendy (Vice Chair)
- Ryan Donnelly
- Chris Grundemann
- Greg Hankins
- Elisa Jasinska
- Anton Kapela
- Manish Karir
- Dani Roisman
- Michael Sinatra
- Tony Tauber
- Dave Temkin (Chair)
- John van Oppen

NANOG 57 Program

- 41 program submissions
- 26 accepted
- Short runway! (hat tip to Dave Meyer)

Program reminders

- Space
  - Break area in the main lobby area
- Speaking reminder
- Survey
  - Tell us how to make the program better
    - And please – tell us what you liked, too!

ARIN

- ARIN Helpdesk
  - Just outside the front door to this room
- ARIN Public Policy Consultation
  - Make yourself heard – mini-ARIN meeting here on-site
    - Tuesday afternoon track

Monday-Wednesday

- Rev 1.0
- We'll probably make some changes
  - Please fill out your surveys
- There's a reason for having peering on Wednesday afternoon…
- We'll regroup and release an updated schedule within 30 days of this meeting closing

Discussion Guidelines

- Some Simple Rules and Customs
  - Full and Free discussion, while maintaining respect for each other and the audience
  - Every person participating in the meeting is welcomed to ask questions
  - Use the microphone to speak, identify yourself with name and affiliation
  - Before you speak on the same topic twice, please let everyone else have their turn first
  - Keep comments brief so everyone has a chance to speak

NOGLab

- Transitioned from Development Committee to Program Committee
- Demonstrating technical excellence – new technologies, interesting applications of existing technology, etc.

Board Thank You

- Welcome to Orlando
- NANOG Committees
- Community Meeting
- Member Meeting
- Socials

Thanks to our Host, Connectivity, Premium and Infrastructure Sponsors!

Introductions

- CyrusOne
- tw telcom

Welcome to NANOG 57!

Josh Snowhorn
VP & GM of Interconnection
CyrusOne
snowhorn (@) cyrusone (dot) com

ABOUT CYRUSONE

GLOBAL. DATA CENTER FACILITIES. SOLUTIONS.

A Global Leader

- 24 high performance data centers worldwide
- Servicing 9 of top 20 Global Fortune companies
- Providing over 1 million sq.ft. of raised white floor space & several million sq ft of shell and approved FAR

Proven Financial Stability

- Recent IPO, now trading on the Nasdaq
- (NASDAQ: CONE)

World Class Facilities and Clients

- 90% of server environments are live production
- Top tier datacenters offering 100% SLA power

Exclusive Focus on Data Center Colocation

- Only build and operate datacenters
- Agnostic managed services
- Pure play colocation

Flexible Design

- Scalable, customized data center solutions engineered with Massively Modular technology

Personalized Service and Transparency

- High touch customer service delivered by data center experts
- Full transparency in communication, management and service delivery

PIONEERING DATACENTER DESIGN

BETTER FUNCTIONALITY AND AESTHETICS

A New Vision In Scale

- Building architectural feats with technologically forward equipment and systems
- Office suites
- Massively Modular™ white space, and suites

Maximizing Thermal Dynamics

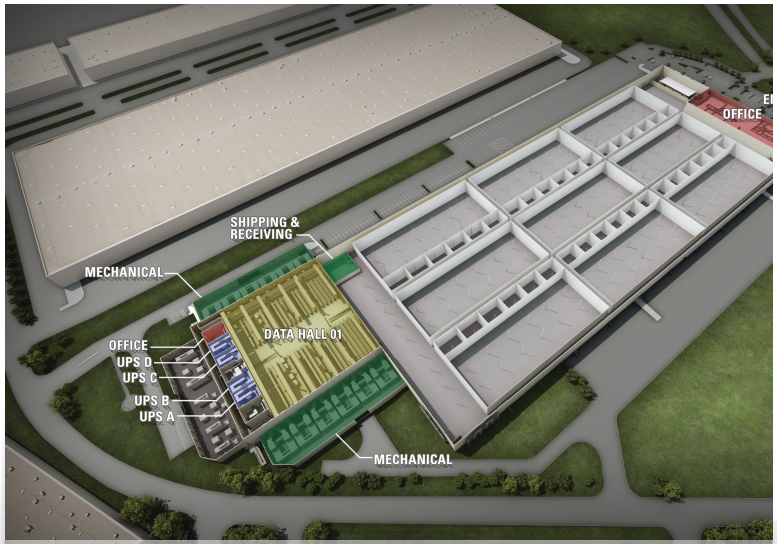
- Advanced indirect cooling techniques
- Utilizing full building capacity
- Added redundancies in power supply

MASSIVELY MODULAR™

INCREASING EFFICIENCY ONE POD AT A TIME

Being Massively Modular Lowers Costs

- Time/effort/money is spent up front on common platforms like land, building shell, network, fire protection, security
- Electrical and mechanical subsystems are remanufactured offsite
- Supply chain engineering is used to enable us to bring these electrical and mechanical subsystems onsite on a JIT basis



CYRUSONE INTERNET EXCHANGE

FREE PEERING PORTS

State Wide Internet Exchange

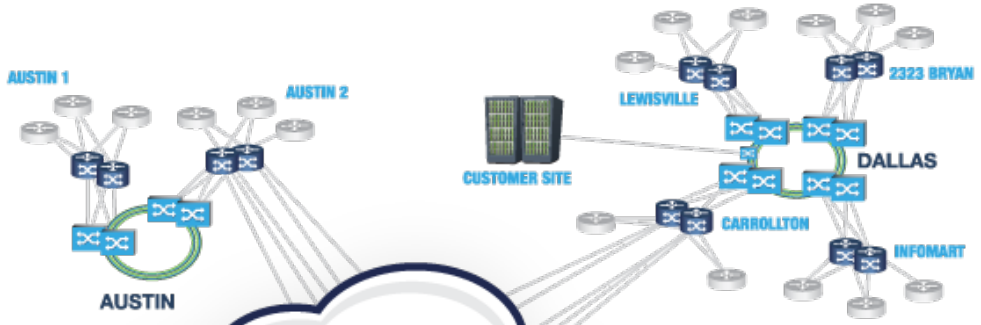
- Reduced latency city-to-city via multiple MPLS providers and wave capacity across the shortest paths available
- Ultra redundant FREE metro capacity using the latest Infinera optical technologies
- Massively scalable peering between metro buildings and city-to-city throughout Texas
- The first and only state-wide internet exchange for IP and seismic traffic in North America

INNOVATIVE FREE INTERNET EXCHANGE

STATEWIDE LAN

The Future of Datacenter Connectivity

- Reduces long-haul latency with Layer 1 p to p links
- Low latency free metro peering
- Enables peering and interconnection between sites across one giant LAN
- Peering in Houston, San Antonio and Austin for the first time



DALLAS

REMOTE CUSTOMER SITE

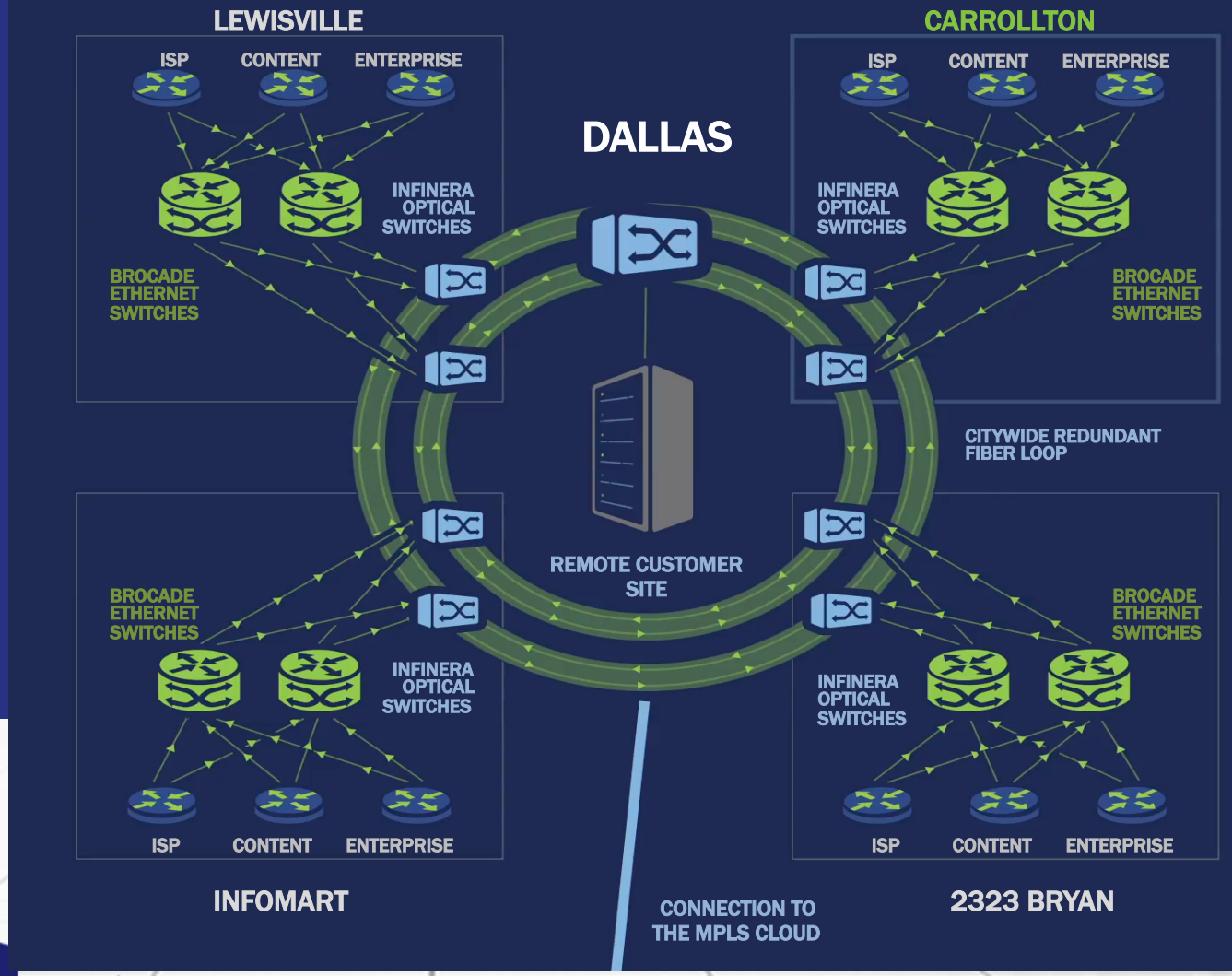
SITE TO SITE

OUT TO MPLS CLOUD

BROCADE FAILURE

INFINERA OPTICAL FAILURE

LOOP FAILURE



DALLAS

HOUSTON

REMOTE CUSTOMER SITE

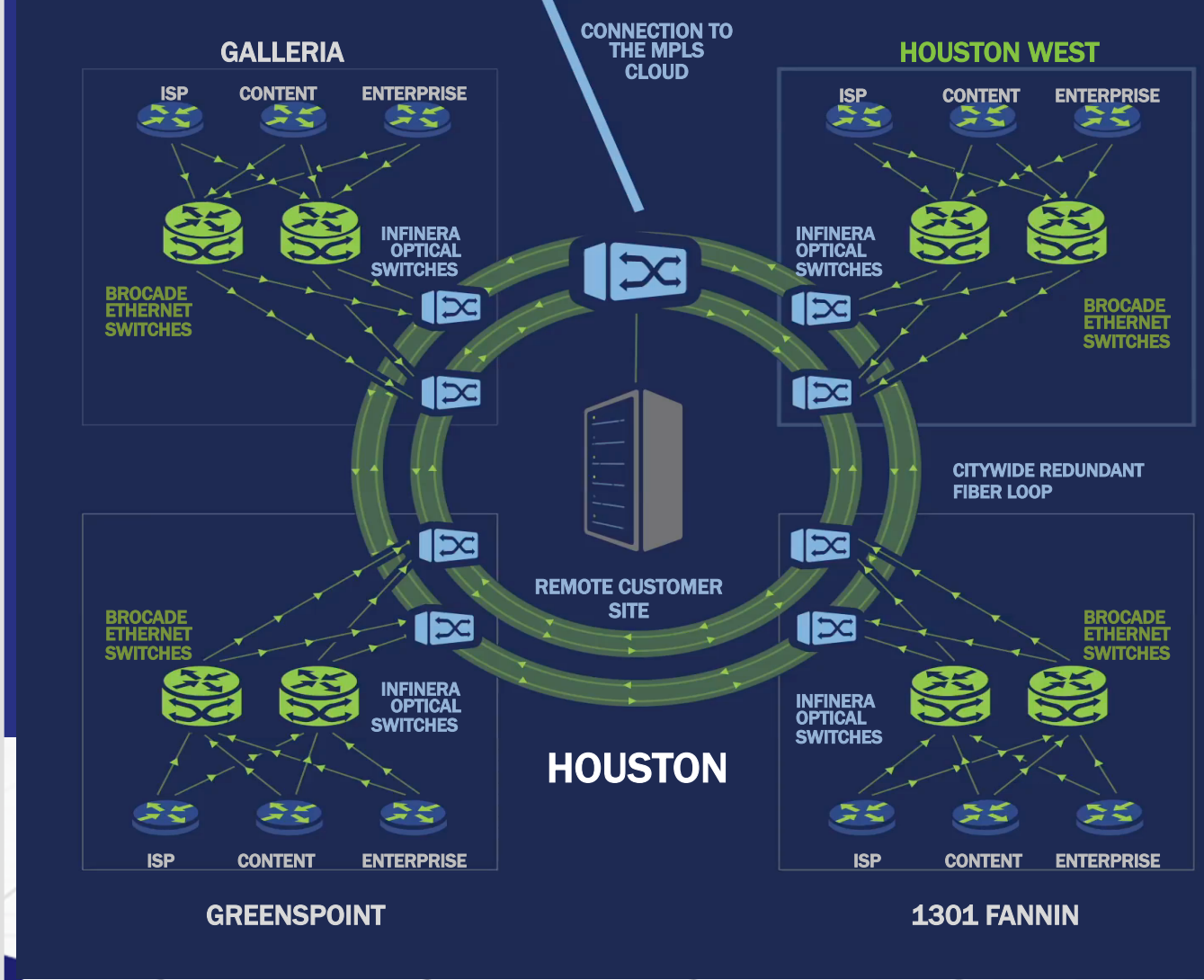
DATA CENTER SITE TO SITE

FIVE PROVIDER MPLS CLOUD OUT TO MPLS CLOUD

BROCADE FAILURE

INFINERA OPTICAL FAILURE

LOOP FAILURE



HOUSTON


SeaWorld
Orlando
GEEKS
GOING TO SEAWORLD
Sponsored by
CyrusOne
infinera
what THE NETWORK will be
VOYAGERS SMOKEHOUSE
THE SANDBAR
SEAPORT PIZZA
SEAPORT THEATER
MANTA
MANTA AQUARIUM
DOLPHIN NURSERY
THE SHOPS AT WATERFRONT
SEAFIRE INN RESTAURANT
BAYSIDE STADIUM
DOLPHIN THEATER
PELICAN PRESERVE
MEET FRANKLIN
GIFT SHOP
POLAR PARLOR ICE CREAM
CYPRESS BAKERY
SWEET SAILIN' CANDY SHOP
EMPORIUM GIFT SHOP
ENTRANCE & EXIT
BAYSIDE PATHWAY
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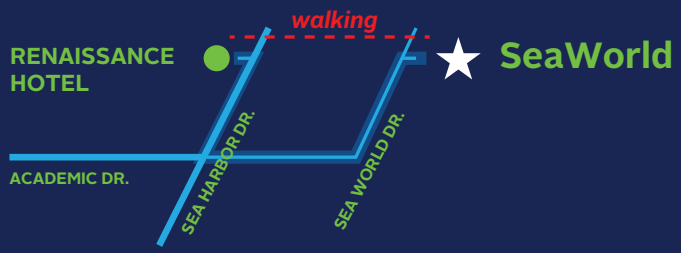
ORLANDO'S PREMIER EVENTS VENUE
CALL 407-363-2200
UNDERWATER VIEWING
COCONUT BAY TRADERS
SAND CASTLE TOYS AND TREATS
DIPPIN DOTS
RENTAL
KEY WEST AT SEAWORLD
DOLPHIN COVE
STINGRAY LAGOON
CAPTAIN PETE'S ISLAND EATS
GUEST SERVICES
RESERVATIONS
ATM

CyrusOne has rented the entire Key West Manta section of SeaWorld for an amazing NANOG 57 social event. Touch and feed the rays, view the aquarium, hang with the dolphins up-close and fly face-down from sky to sea on the 60 mph Manta mega-attraction coaster train. In other words, get ready for the most fun you've had since you the words "network" and "operators" were first used in the same sentence.



ENTERTAINMENT WILL INCLUDE:

Caribbean Trio
Tropical Bird Appearance
Color Stilt Walkers
Caricature Artists
Stingray Lagoon
Dolphin Underwater Viewing
Pelican Point
Gift Shop Open
Dolphin Spotlight Presentations at Dolphin Cove

SCHEDULE

TIME	**7:00 PM - 7:15 PM**
	Arrivals
LOCATION	*SeaWorld Orlando Group Gate*
TIME	**7:15 PM - 10:15 PM**
	Reception, Entertainment & Free Time
LOCATION	*Key West/Manta*
TIME	**10:15 PM - 10:30 PM**
	Departure
LOCATION	*Front Gate*

Open Bar & Dinner Included

CyrusOne Thanks You For Attending NANOG 57!

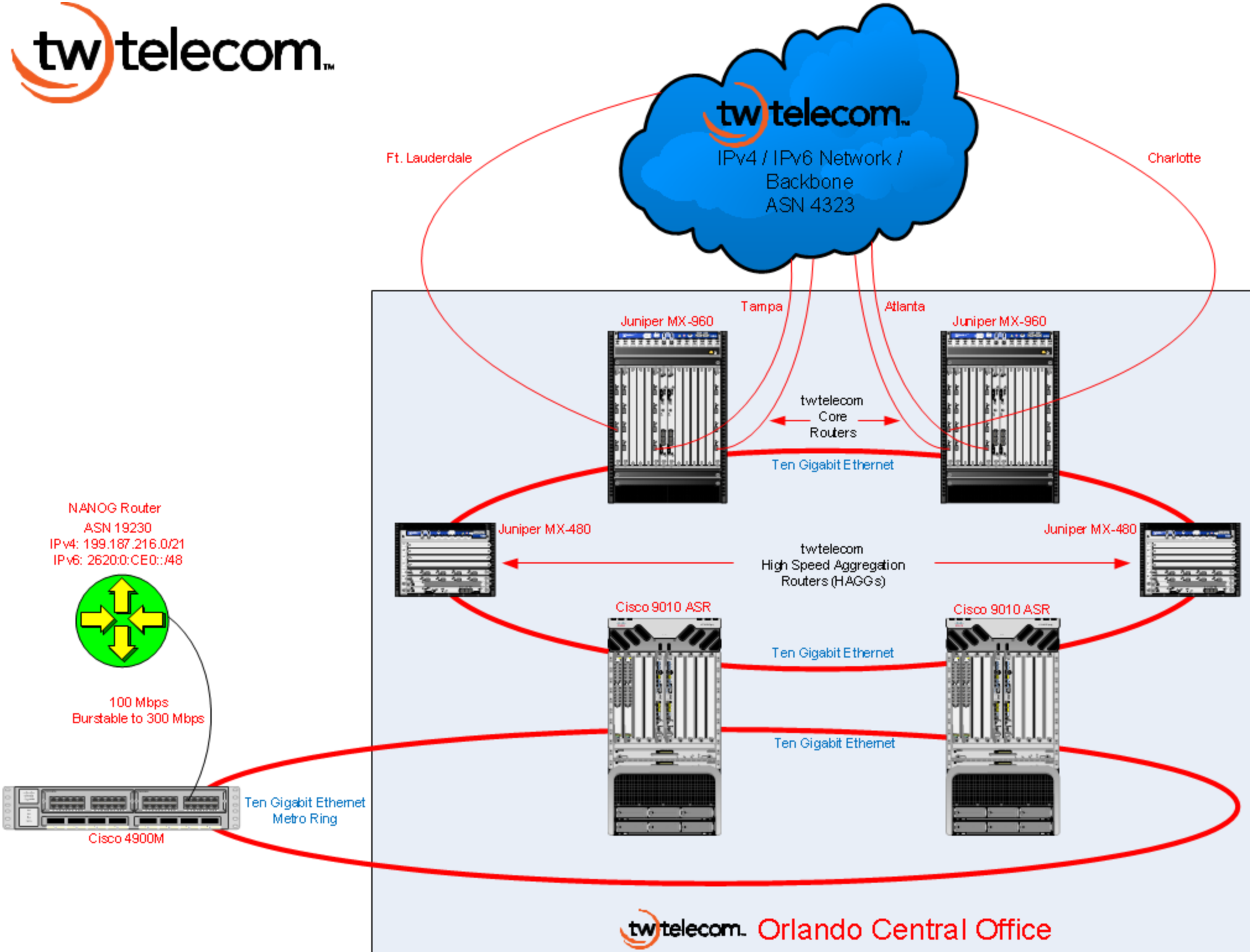
Have Fun!

NANOG57

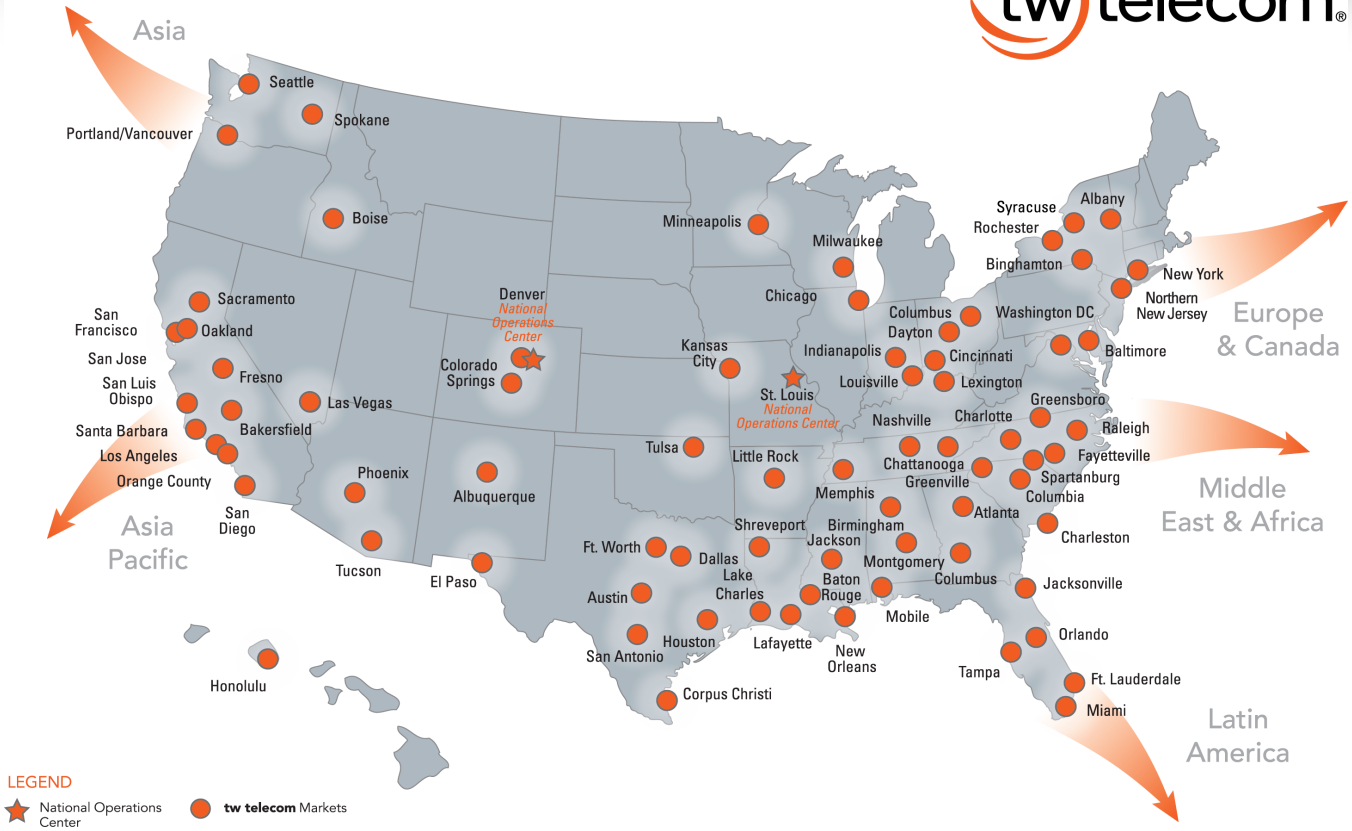
Connectivity Provider – tw telecom

Anthony Manns, Regional Engineering Manager

February 4, 2013


twtelecom
IPv4 / IPv6 Network /
Backbone
ASN 4323
Ft. Lauderdale
Charlotte
Tampa
Atlanta
Juniper MX-960
Juniper MX-960
twtelecom
Core
Routers
Ten Gigabit Ethernet
Juniper MX-480
Juniper MX-480
twtelecom
High Speed Aggregation
Routers (HAGGs)
Cisco 9010 ASR
Cisco 9010 ASR
Ten Gigabit Ethernet
Ten Gigabit Ethernet
NANOG Router
ASN 19230
IPv4: 199.187.216.0/21
IPv6: 2620:0:CE0::/48
100 Mbps
Burstable to 300 Mbps
Ten Gigabit Ethernet
Metro Ring
Cisco 4900M
twtelecom Orlando Central Office

A Unique Set of Network Assets



- Over **28,000 local and regional fiber route miles** across 75 markets
- Nearly **17,000 buildings** with fiber based services and connectivity
- National footprint interconnected with fiber and **10 Gig IP backbone**

Critical Differentiators

We operate our own fiber network

- Over 28,000 route miles of fiber – over 70% within the metro
- Ability to construct unique footprint, scale bandwidth, deliver robust array of network services

We offer a robust set of products and services

- Industry leadership position in Ethernet Services – metro and wide area

We strive for world class customer care

- Local management – sales & operations, coupled with 2 national operations centers create a unique coverage model

LIGHT READING'S LEADING LIGHTS 2012 WINNER

MEF 2012 CARRIER ETHERNET AWARDS Best Carrier Ethernet Business Application North America

tw telecom

IPv6 from tw telecom

tw telecom has been successfully implementing customer solutions with IPv6 since 2008

tw telecom uses a dual-stack arrangement, where both IPv4 and IPv6 traffic are handled across the same Internet circuit.

- A single direct network will be assigned a /64
  - */64 is size of today's IPv4 Internet – squared!*
- A network with a routed connection will receive a /56
- /48 available with documented support provided to ARIN.
- BGP is supported with Provider Independent space. These /48 netblocks may be requested directly from ARIN.

tw telecom - *one of the 10 most interconnected IP networks* ***WorldWide***

tw telecom

The Intelligent Network & Cloud Connectivity

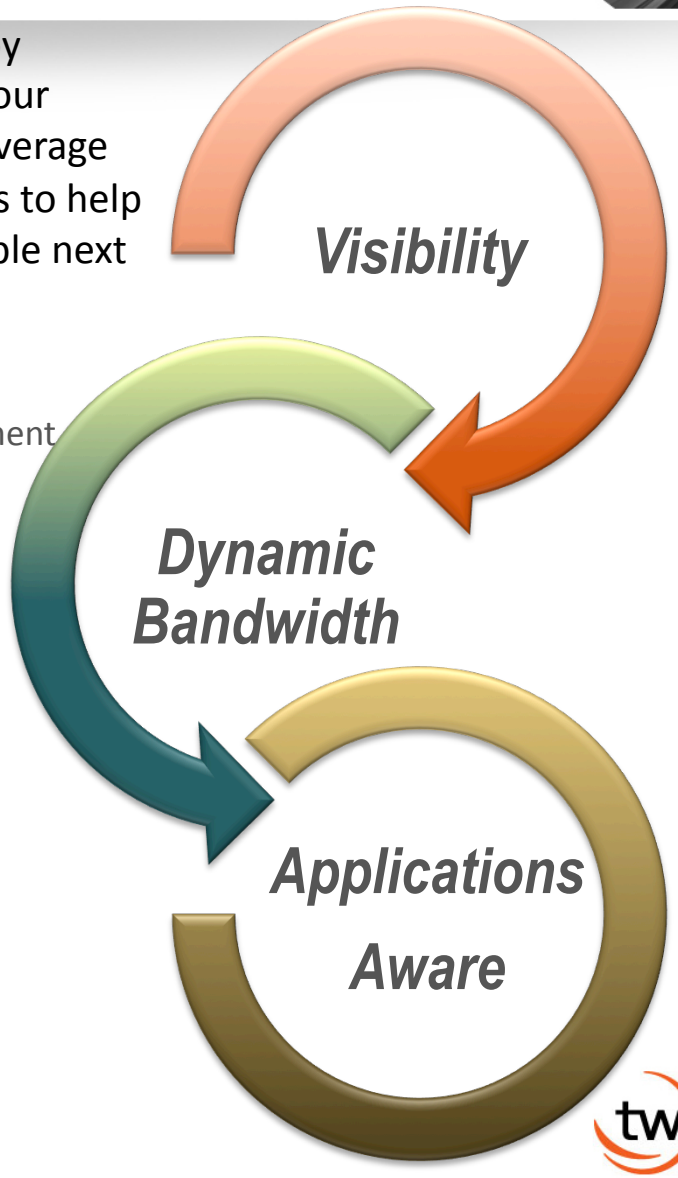
- Differentiate **tw telecom** from the competition by developing unique, value-added capabilities for our managed services and Ethernet solutions that leverage data center and application provider connections to help our customers solve business problems and enable next generation IT strategies.

- **Enhanced Management:**
  Granular visibility of performance metrics for each segment of a customer's network (Layer II & III)

- **Dynamic Bandwidth Capacity:**
  Ability to turn bandwidth up and down on-demand via MyPortal

- **Network Agreements with Cloud Providers:**
  Bypass the Internet with scalable, secure E-Line. Easy packaging and process

- **Application Monitoring and Control:**
  Network tools to prioritize applications and improve performance



twtelecom®

Thank You
www.twtelecom.com

NOGlab

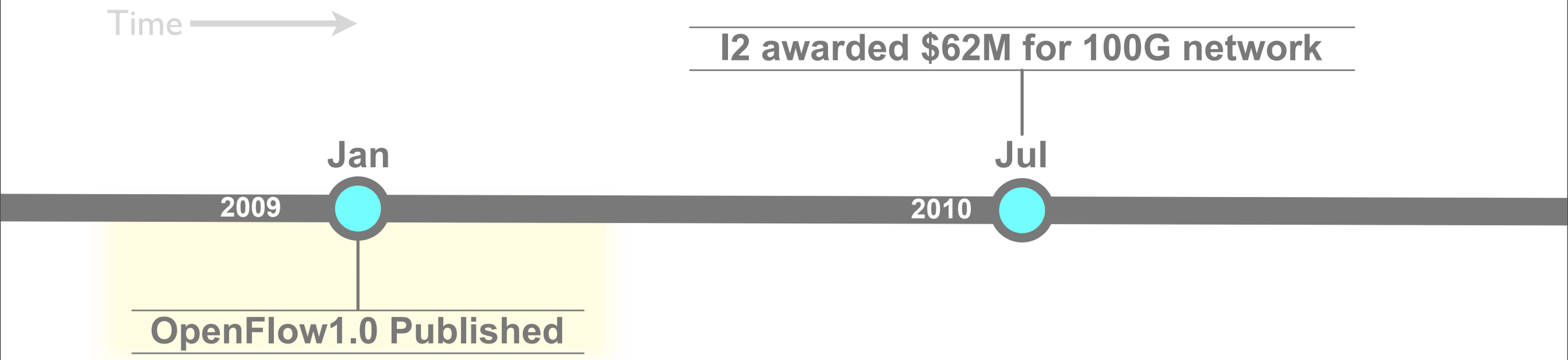
Customer controlled Layer2 Services with OpenFlow

Edward Balas
Indiana University GlobalNOC
ebalas@iu.edu

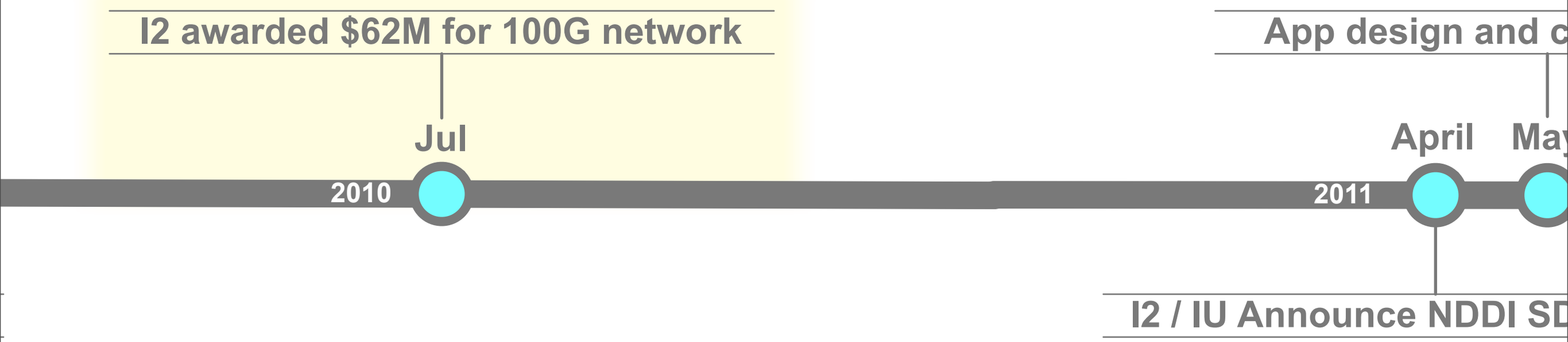
Executive Summary

- IU GlobalNOC and Internet2 collaborate
- 100G national OpenFlow network is the fruit
- customers provision virtual "circuits" across the network using UI / portal software called OE-SS
- other apps in the future
- come to the NOGLAB to see a multi-vendor demo

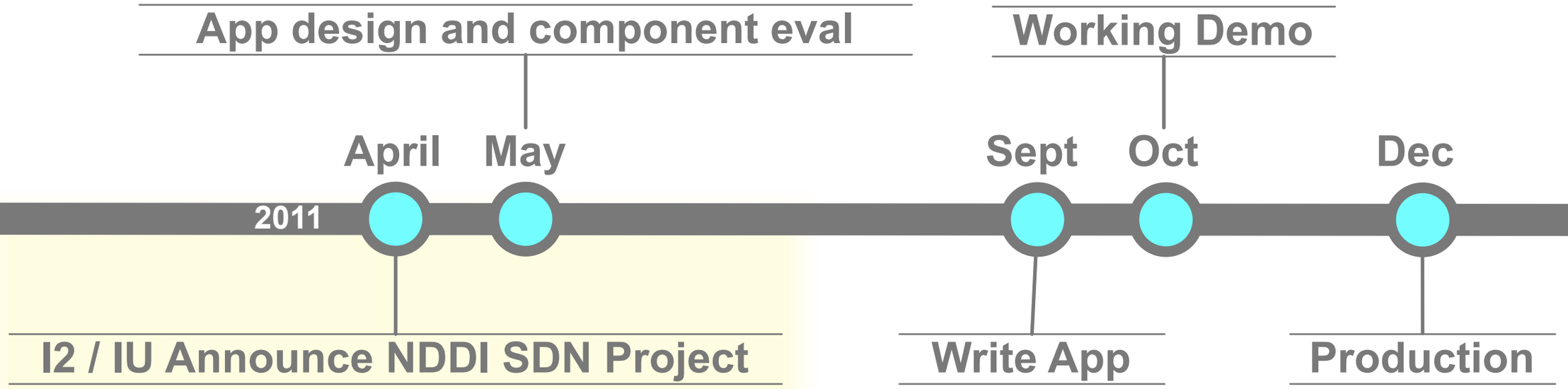
Brief History



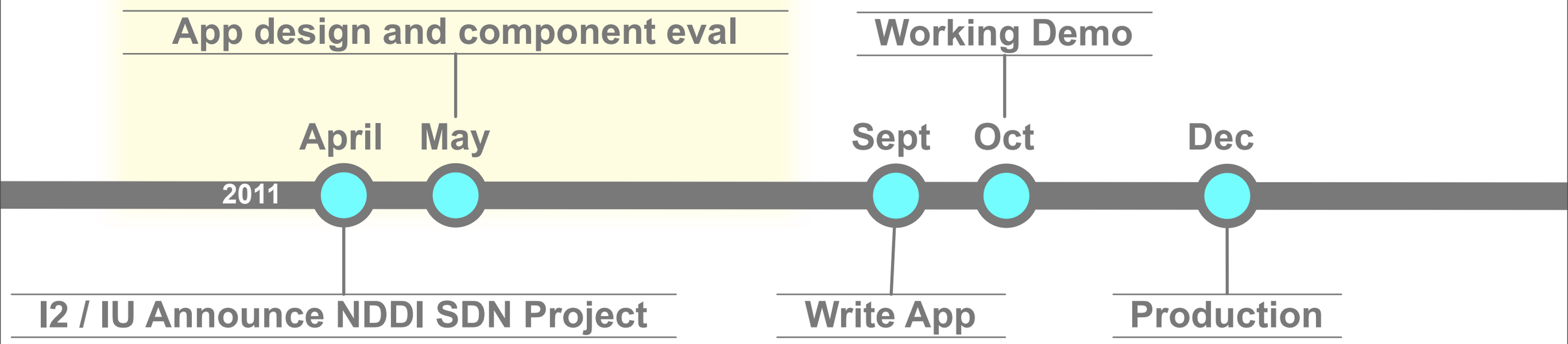
- separate Data Plane from Control Plane
- vendor neutral programatic access



- new Optical System:
  - 60 segments involving 328 elements
- 100G layer2 / layer3 refresh



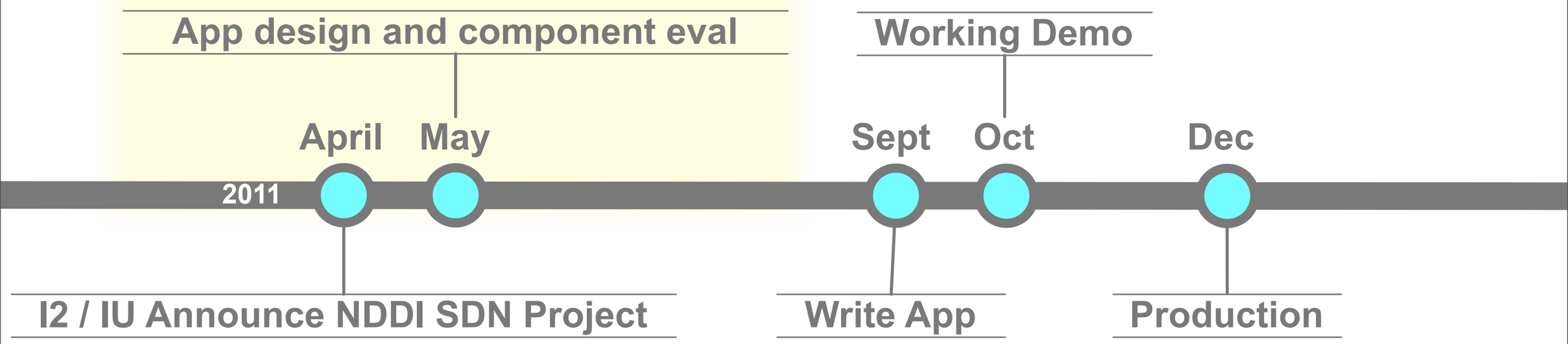
- create a Software Defined WAN
- support domain science
- support network research
- explore better ways to do things



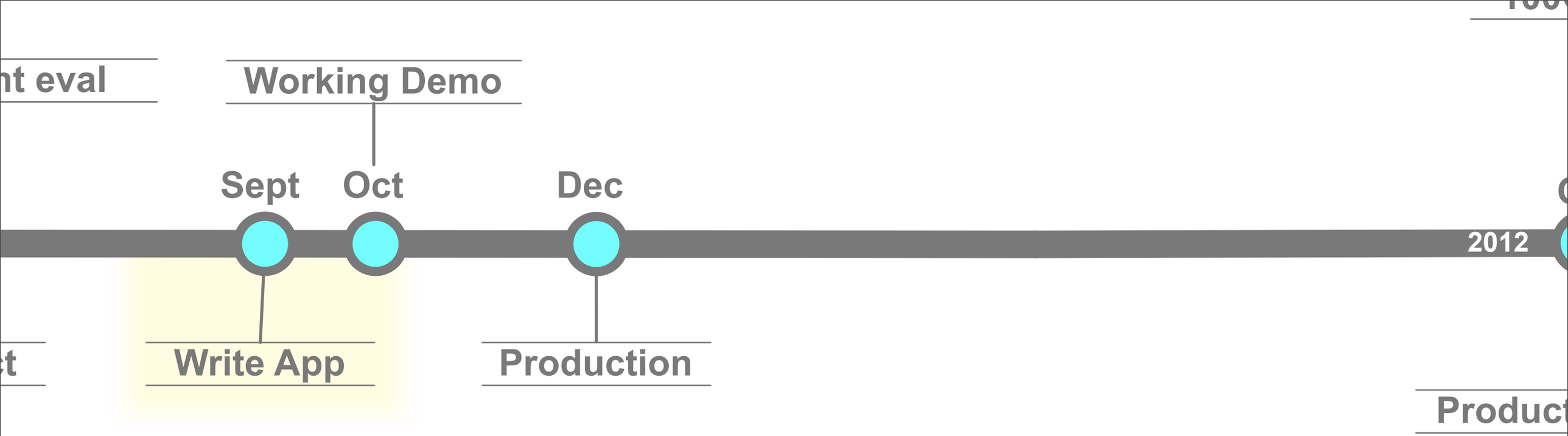
- pick an established use case
  - customer controlled VLANS
- focus on down stack risk

Open Exchange Software Suite (OE-SS)

- Open Source
- vlan translation
- backup paths
- sub-second* provisioning and failover
- integrated measurement and management
- high availability design

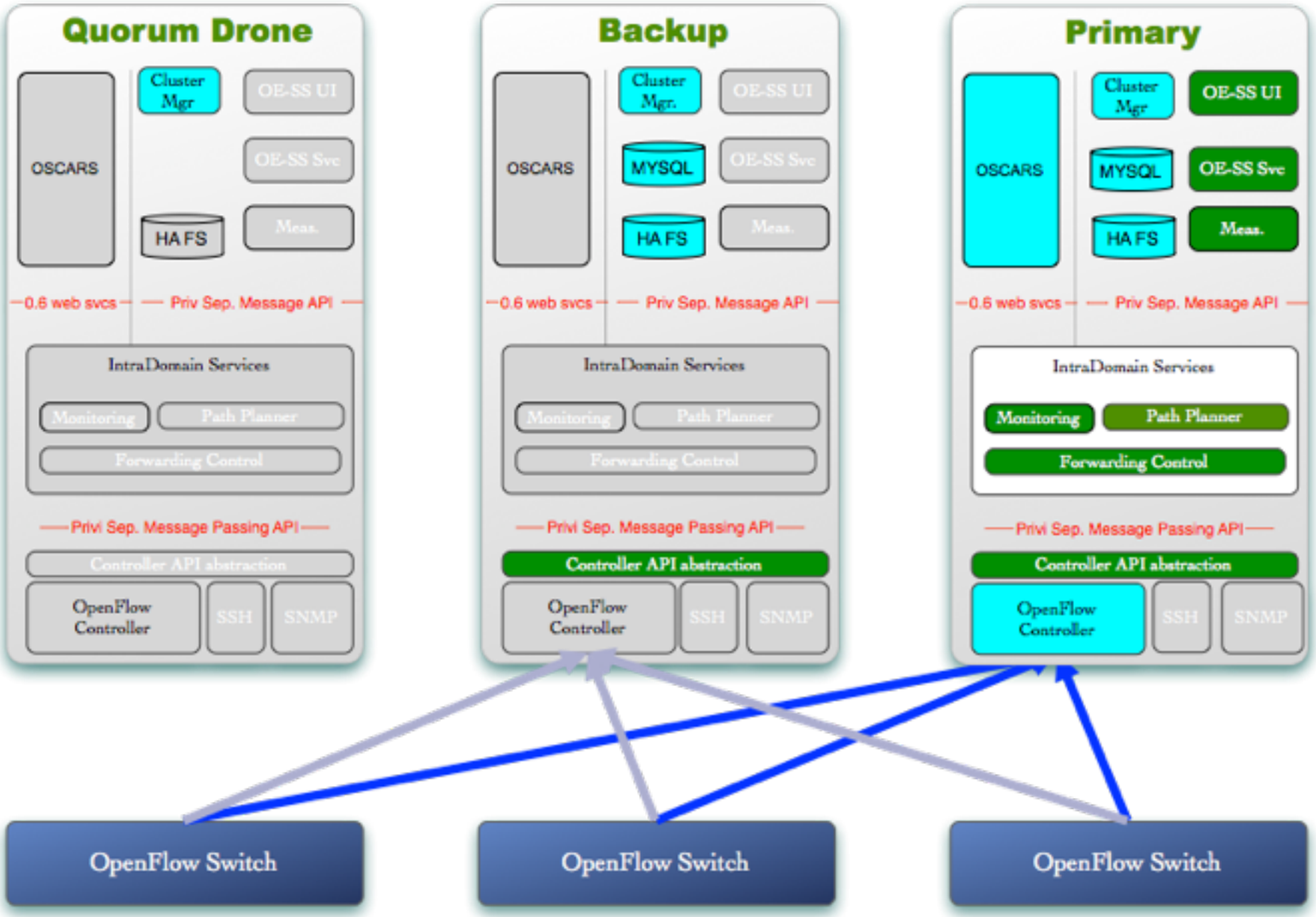


- use a 10G national network as baby step
- eval switches and controller
- sort out good, bad, and vapor



- NEC PF5820 10GE switches selected
- NOX controller, add abstraction, deploy centrally
- provide HA at application level

stack looks like this



OS³E The Open Science, Scholarship & Services Exchange

BETA

Feedback | Admin

Workgroups > Home > Details > Endpoints > **Primary Path** > Backup Path > Scheduling > Provisioning

Workgroup: GRNOC

Path

Choose a primary path from the map below by clicking on links between nodes.

Proceed to Step 4: Backup Path

Summary

Description
losa-salt test

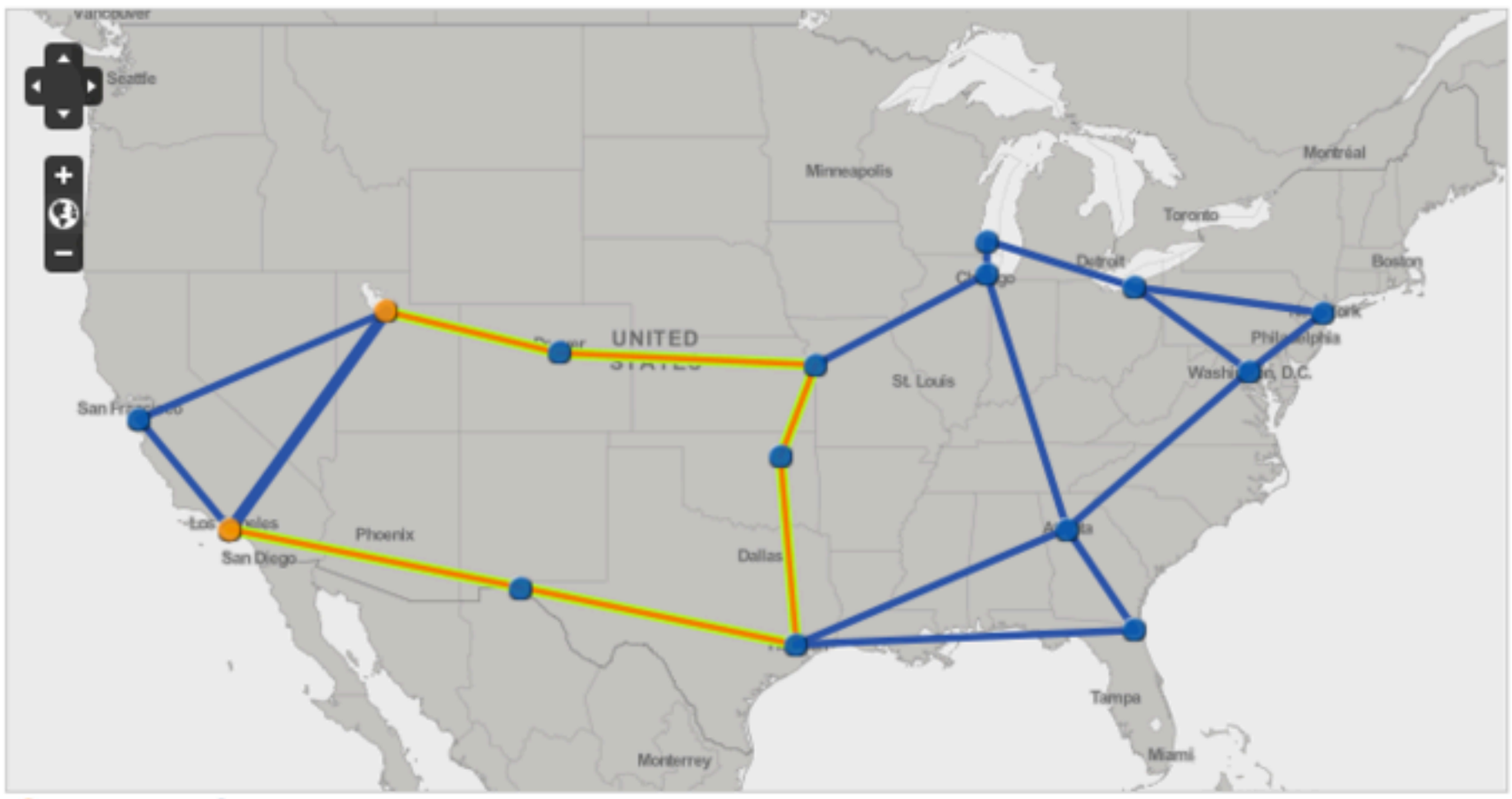
Bandwidth
0 Mbps

Type
Local

Status
active

Endpoints

Interface	VLAN
sdn-sw.losa.net.internet2.edu - e15/2	601
sdn-sw.salt.net.internet2.edu - e15/2	601



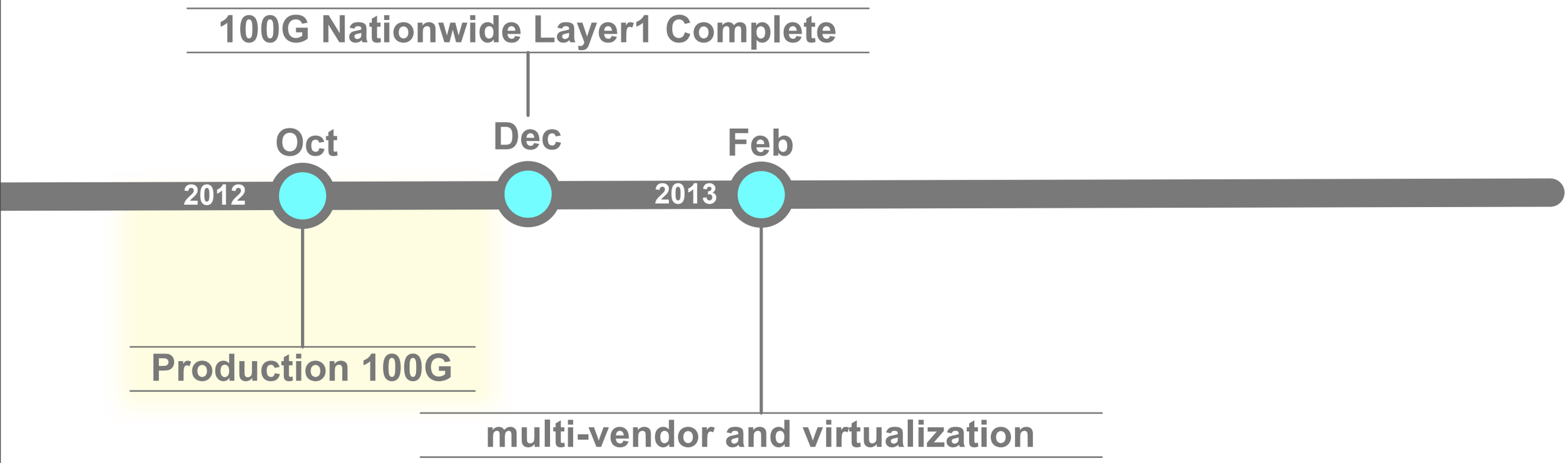
Primary Path
ELPA-LOSA-100GE
ELPA-HOUH-100GE
HOUH-TULS-100GE
TULS-KANS-100GE
DENV-SALT-100GE
KANS-DENV-100GE

Suggest Shortest Path

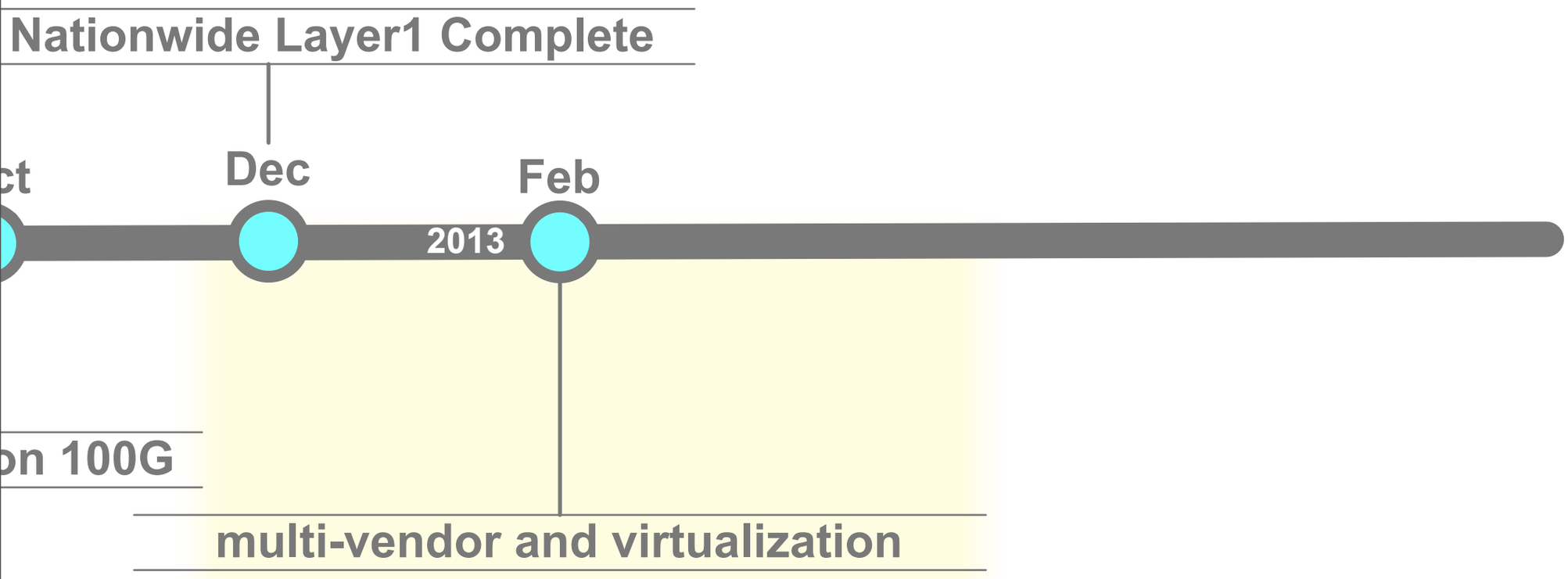

OS3E
The Open Science, Scholarship & Services Exchange
Vancouver
Seattle
Portland
Missoula
Minneapolis
Chicago
Buffalo
New York
Boston
Philadelphia
Cleveland
Pittsburgh
Ashburn
Washington DC
Salt Lake City
Sunnyvale
Denver
Kansas City
Indianapolis
Louisville
Raleigh
Los Angeles
Albuquerque
Nashville
Memphis
Atlanta
Tucson
El Paso
Dallas
Jackson
Jacksonville
Houston
Baton Rouge
Miami
INTERNET2
INDIANA UNIVERSITY
STANFORD UNIVERSITY

- Jenkins to automate builds and testing
- use mininet to test without hardware

- run on 5 node 10G WAN
- 24/7 monitoring, no risk adverse traffic
- evaluate operations procedures



- 10 month gap while we procure and deploy
- extensive testing/dialog with vendors
- 17 Brocades deployment complete



- Juniper goes into the network
- Using FlowVisor to slice the network
  - run multiple control planes in parallel
  - network multi-tenancy

Lab Setup

Two networks

- multi-vendor: Brocade, NEC, IBM, Dell
- OE-SS used to control
- point and click provision
- same experience, play in parallel

Hours

- Monday and Tuesday
  - 10:30am - Noon
  - 4:00pm - 6:00pm
- Wednesday
  - 10:30am - Noon

Check out demo

- interested in OpenFlow
- curious about our experiences or approach
- want to pontificate on the merit/evils of ...
- sitting too long and have parts going numb

Info

- ebalas@iu.edu
- http://code.google.com/p/nddi
- http://globalnoc.iu.edu/