

A Low Latency, Highly Available Wide Area Network (WAN)

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PEAKRELIABILITY
assuring the wide area view

Acknowledgement and Disclaimer

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WISP's Communication Needs

- Move synchrophasor data around the entire Western Interconnection among 19 parties (everyone with a phasor measurement unit (PMU) on their system)
- Low latency, high volume important

WISP's Communication Needs

- High availability, reliability, and cyber security:
 - Expect operators to use synchrophasor data to make operating decisions in near real time
 - Possible use of WAN for automated controls



WISP Specified:

- Redundant backbone
- Private, dedicated infrastructure
- 24/7 dedicated Network Operation Center (NOC)
- Centrally managed access by Peak Reliability
- Contract with each Participant for 'last mile' connection

WISP Specified (con't):

- One-way latency ≤ 30 ms average over 10 minutes between edge routers
- Jitter ≤ 2 ms average over 10 minutes
- Availability to Reliability Centers 99.997%
- Availability to single access participant 99.94%
- Encrypted transmission
- Capable of performance at high volume data transmission – 10X expected initial signal volume of 2100 measurements

WISP Selected Harris Corporation

- All WISP Participants connected to WAN
- All Participants are transmitting synchrophasor data to Peak Reliability, many are sharing data peer-to-peer
- WAN Performance has exceeded requirements
 - Average latency 19 ms (30 ms specified)
 - Average jitter 1.4 ms (2 ms specified)
 - Availability at Reliability Centers and Dual Access Participants has been 100 percent



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Integrated Network Solutions

- **Peak Reliability (formerly Western Electricity Coordinating Council)**

- Western Interconnection Synchrophasor Project (WISP) WAN



- **Department of Transportation**

- Federal Aviation Administration (FAA)
 - FAA Telecommunications Network (FTI) Contract
 - Dual Core “Red Core” Network Contract



- **Department of Defense**

- Defense Information Systems Agency (DISA)
 - DISN Access Transport Services (DATS) Contract



- **Private Industry**

- Harris Corporation
 - Harris Corporation Data/Voice Network



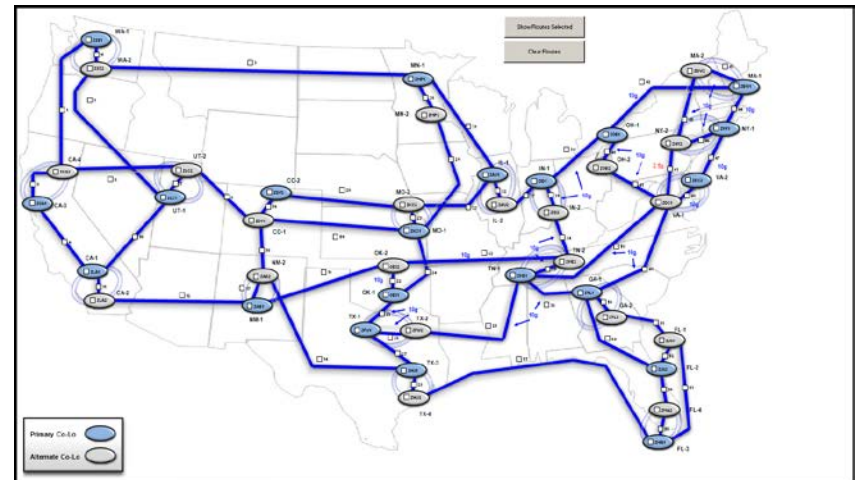
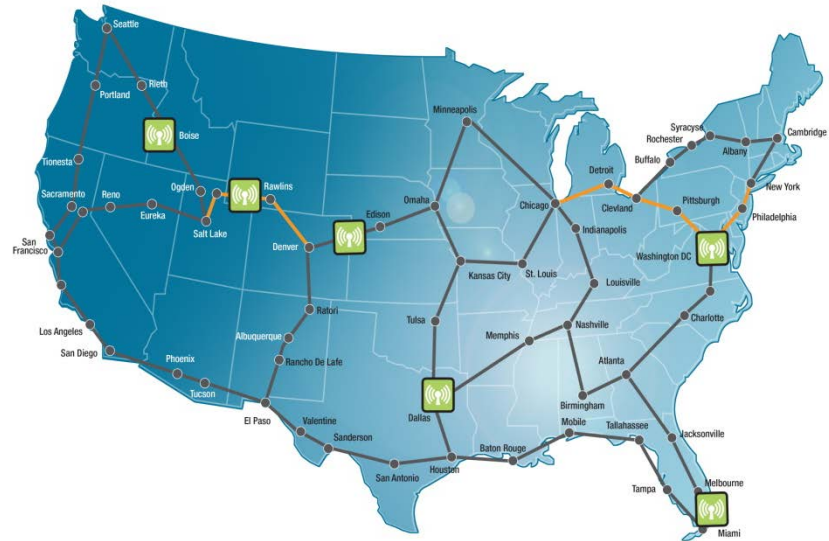
- **Healthcare**

- Health Management Associates (HMA)
 - Network Infrastructure Transition Contract



- **Harris Trusted Enterprise Network (HTEN)**

- A Nationwide, Terrestrial, High Capacity Backbone
 - Multi-Protocol Label Switched (MPLS) Wide Area Network (WAN)
 - > 15,000 Fiber Route Miles
 - 100 gigabits of capacity on each route
 - > 60 points of presence across the US
 - **Last mile access via local telecommunication providers**
- Designed to Transport Mission Critical Voice, Video, and Data Within a Private Environment
- Predicated on Four (4) Major Tenets:
 - Private/Secure
 - High Availability
 - High Throughput/Low Latency
 - Focused Customer Care





HTEN DIFFERENTIATORS



Private/Secure

- Separate PE Routers and Switching Equipment
- Defense in Depth Security Approach
- Private PE Routers and Separate VRF Tables
- No Direct Peering Points with the Public Internet
- Secure Gateway Services
- Multiple Layers of Security and Optional Security Services

High Availability

- Equipment Redundancy
- Physical and Logical Circuit Diversity
- 99.999% Availability

High Throughput/Low Latency

- Customized Routing Plans
- Deterministic Quality of Service (QoS)
- < 50ms of Latency (One Way) Across the U.S.

Customer Focused Care

- 24 x 7 x 365 Harris Operations Center
- 24 x 7 x 365 Security Operations Center
- Measures of Effectiveness (MOEs)
- Managed Service Network Solutions
- System Domain Focus

WISP WAN ARCHITECTURE

- **Private Optical Infrastructure**

- No internet connectivity
- Dedicated provisioning team
- Field Tech Force cleared via federal background check
- Allocated portion optical transport for PEAK purpose built WAN

- **Private MPLS CORE WECC Routers**

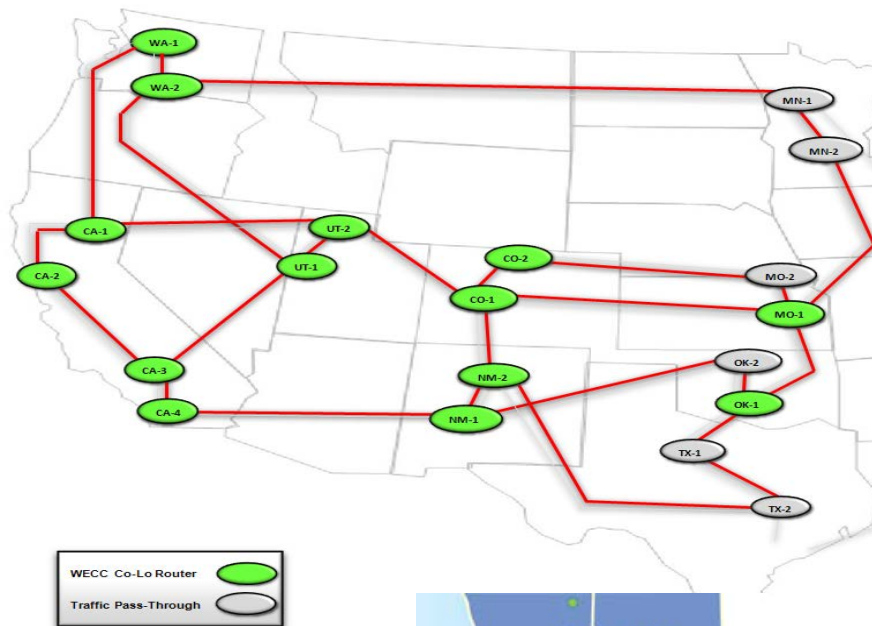
- Routers only used for WECC services
- Private IP address space for router management

- **Security Systems Guard the Infrastructure**

- Firewalls
- Anti-virus appliances
- Intrusion prevention systems
- 24 x 7 security operations control center
- Internal audits

- **Security Systems Guard the Data**

- Key Server
- GETVPN



WISP WAN SLA / METRICS

Service Level Category / Description	Monthly Performance Target based on 24/7 operation	Weighting Percentage
MPLS Core Network	100.00%	40%
Participating Entity with single access without diversity	100-99.95% 99.949-99.44% 99.43-98.89% 98.88-0.00%	0% 10% 30% 50%
Maximum MPLS Latency (one way)	30ms average per 10 minute period	10%
WAN MPLS Jitter.	2ms average per 10 minute period	10%
Unauthorized WAN Move/Add/Change.	100% change success rate	2%

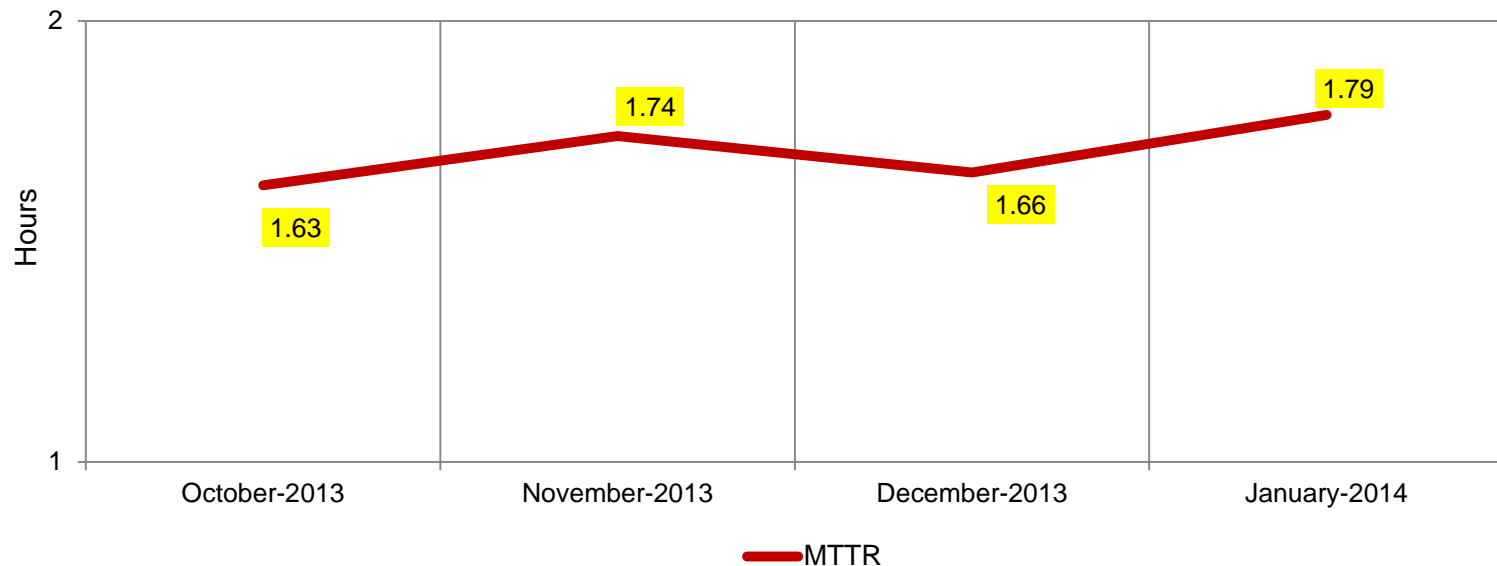
Performance Targets

Delivered Latency

UTILITY	LATENCY*	WITH GetVPN
1	21 ms	24 ms
2	18 ms	21 ms
3	11 ms	13 ms
4	19 ms	22 ms
5	20 ms	22 ms
6	22 ms	25 ms
7	18 ms	24 ms
* Latency Requirement <= 30 ms		



WISP WAN Mean Time to Repair (MTTR) 12-Month Average | Single-Access Facilities



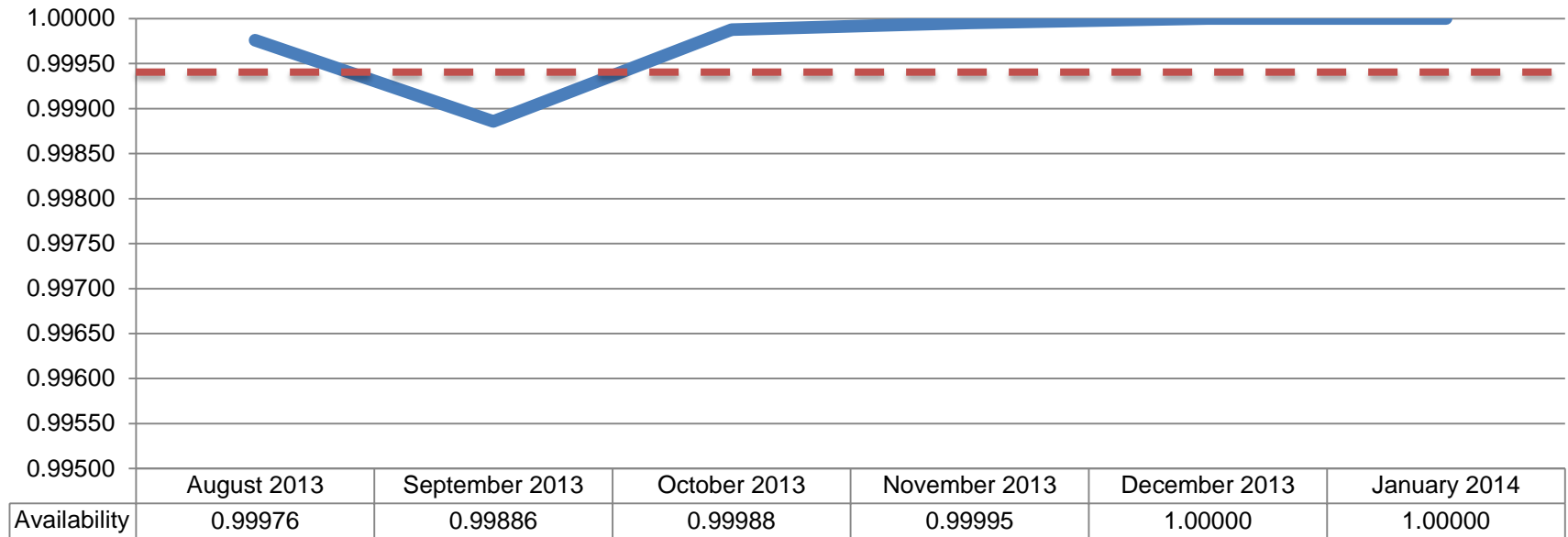
BACKGROUND

- Objective – rapid response to address and resolve network issues and outages
- Dual Access Facilities experienced 100% availability in 2013
- In 2013, there were 45 outage events with an average MTTR of 1.66 hour

$$\text{MTTR} = \frac{\text{Sum of Outage Time (over period)}}{\text{Sum of Outages (over period)}}$$



Service Availability Single-Access Facility



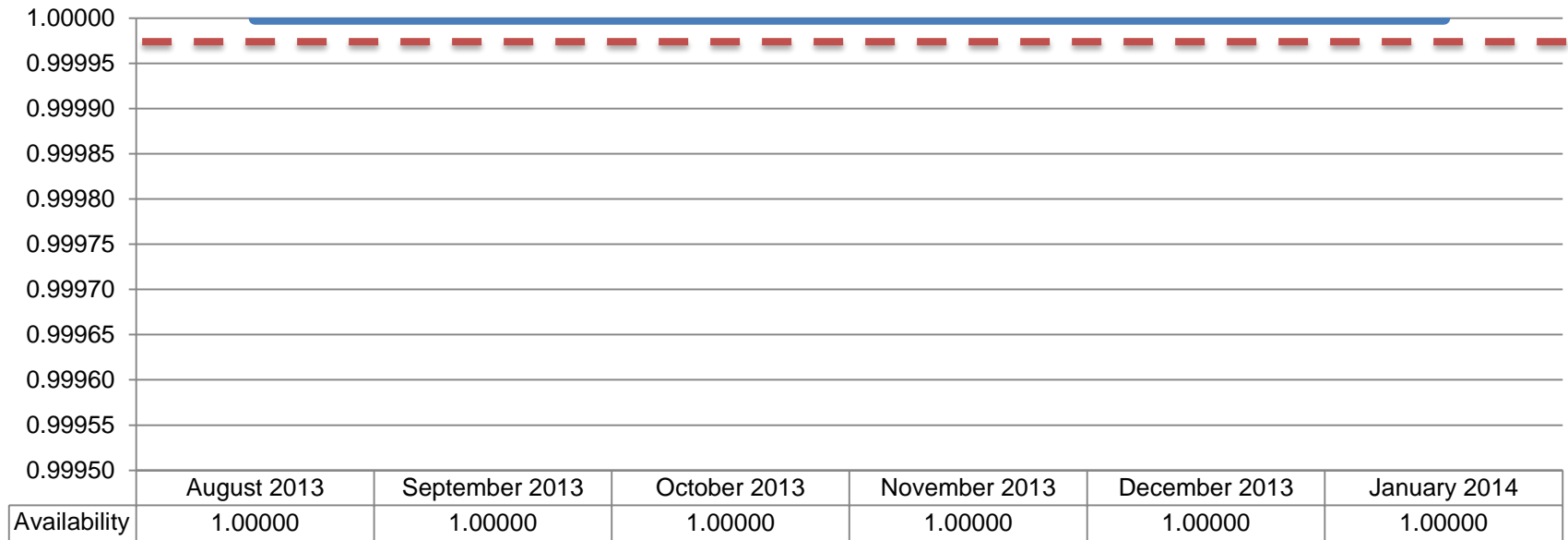
— — Required Availability

September 2013

- Telecommunications Partner maintenance scheduled as non-service affecting went awry. 5-hour outage incurred.



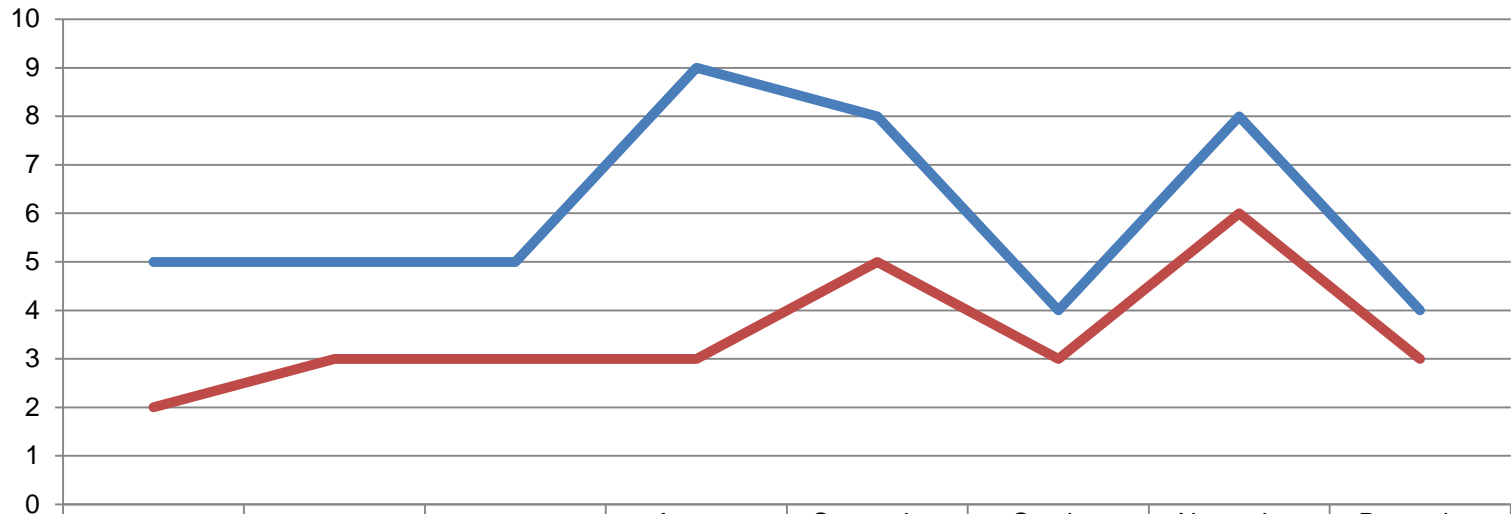
Service Availability Reliability Centers



— — Required Availability



Backbone Events



	May 2013	June 2013	July 2013	August 2013	September 2013	October 2013	November 2013	December 2013
Scheduled Outages	5	5	5	9	8	4	8	4
Unscheduled Outages	2	3	3	3	5	3	6	3

— Scheduled Outages — Unscheduled Outages

Background

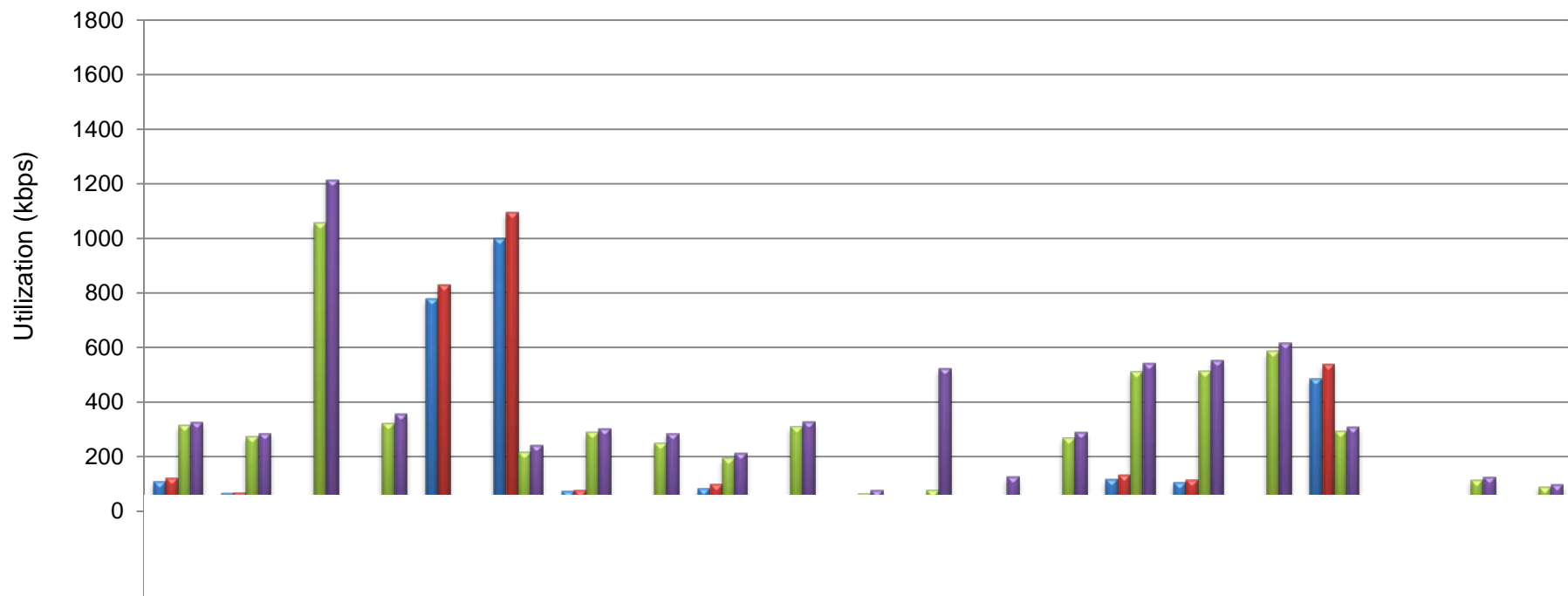
- 48 Scheduled Outages
- 28 Unscheduled Outages
- All WAN Point of Presence (POP) locations have a minimum of 3 routable paths
- **0 Impacts to Peak Reliability services**



Peak Reliability

Participating Entity Bandwidth Utilization (DS1)

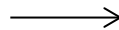
January 2014



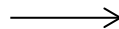
Average Receive kbps	111.54	64.9	1.78	1.93	780.34	1001.23	73.94	47	86.29	1.84	1.83	0.04	0.04	1.12	117.88	108.38	1.9	488.12	1.83	1.92	2.07
Peak Receive kbps	124.1	70.23	3.6	4.17	830.4	1095.71	79.1	51.18	100.13	3.51	3.16	1.31	1.3	2.94	133.88	116.6	3.99	538.35	3.64	3.78	4.63
Average Transmit kbps	314.29	272.41	1058.64	323.19	2.21	215.4	288.65	250.08	197.55	311.83	66.24	79.73	55.51	270.93	512.83	515.61	587.63	293.56	43.35	114.35	89.47
Peak Transmit kbps	329.45	287.97	1214.79	355.83	8.14	240.7	302.58	286.69	212.77	326.52	78.48	522.54	125.65	289.05	542.42	554.35	618.76	310.97	49.39	127.72	97.62
Configured	1536	1536	1536	1536	1536	1536	1536	1536	1536	1536	1536	1536	1536	1536	1536	1536	1536	1536	1536	1536	1536



- 1) Rate Limit VLAN #1
- 2) Size VLAN #1 to exceed expected Traffic



- 1) Rate Limit VLAN #2
- 2) Size VLAN #2 to exceed expected Traffic



- Virtual LANs (VLAN) create multiple layer-3 networks within a layer-2 network – mutually isolating packets
- Network backbone allocation can be expanded to handle increased traffic load

Upgrades

- Update router configuration, VLANs, CoS, etc. 10-15 business days
- Bandwidth increases 90-120 days
- Adding redundancy/diversity – new telco and equipment delivery – 90-180 days

New Sites

- 90-120 days

New Network

- Private Network establishment – 150-180 days ARO
- Site transition on-ramping - 180 days ARO



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Welcome to the Junos Pulse Secure Access Service

Web Bookmarks



[Remedy Ticketing System](#)



[WECC Orion Network Performance Monitoring](#)



[WECC Sharepoint Portal](#)

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Questions?



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