

More Bandwidth!

Part One: The Fever

November 4, 2011

HAVE A FEVER FOR MORE BANDWIDTH?

- 1 Discover resources to figure out bandwidth issues
- 2 Learn about mechanisms to resolve current bandwidth issues
- 3 Talk about activities both locally and nationally that are bringing More Bandwidth to all of Oklahoma

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GRNOC

GLOBAL RESEARCH NETWORK OPERATIONS CENTER

Suite of NOC Tools

- Product from years of managing Internet2, NLR and other regional and national networks
- Utilized as a software as a service



GlobalNOC
Global Research Network Operations Center

ALERTMON WALL

NOC Use

- Utilized by our support desk and engineers to quickly see the status of the network
- Resolution and ticket status can be recorded within Alertmon



NAGIOS

Availability

Service Name	Status	Availability
Service 1	OK	0.0000
Service 2	OK	0.0000
Service 3	OK	0.0000
Service 4	OK	0.0005
Service 5	OK	0.0000
Service 6	OK	0.0000
Service 7	OK	0.0000
Service 8	OK	0.0000
Service 9	OK	0.0000
Service 10	OK	0.0000
Service 11	OK	0.0000
Service 12	OK	0.0000
Service 13	OK	0.0000
Service 14	OK	0.0000
Service 15	OK	0.0000
Service 16	OK	0.0000
Service 17	OK	0.0000
Service 18	OK	0.0000
Service 19	OK	0.0000
Service 20	OK	0.0000

DOWN FOR EVERYONE OR JUST ME

Is google.com down for everyone or just me?

SNAPP

SNMP Network Analysis and Presentation Package

Metrics about the network are collected from most devices every 10 seconds



Inbound and Outbound:

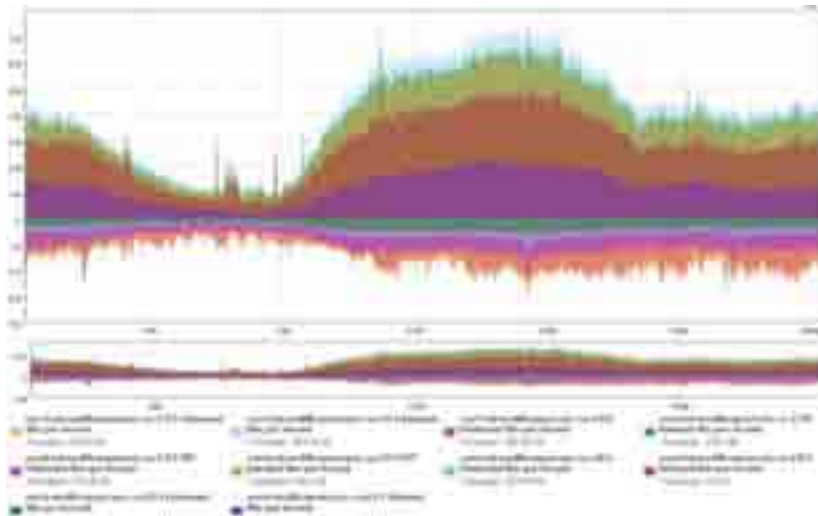
- Bits per second
- Packets per second
- Discards per second
- Errors per second
- 95th percentile use

SNAPP TRAFFIC GRAPHS

External Connectivity

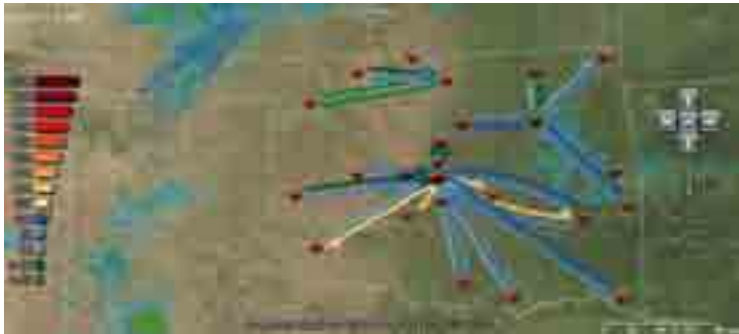


SNAPP STACKED GRAPHS



NETWORK ATLAS

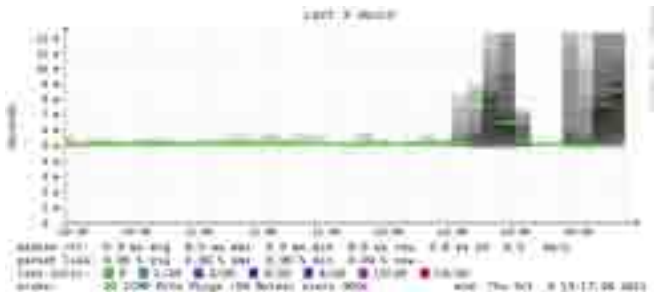
Combine availability, utilization and a touch of weather:



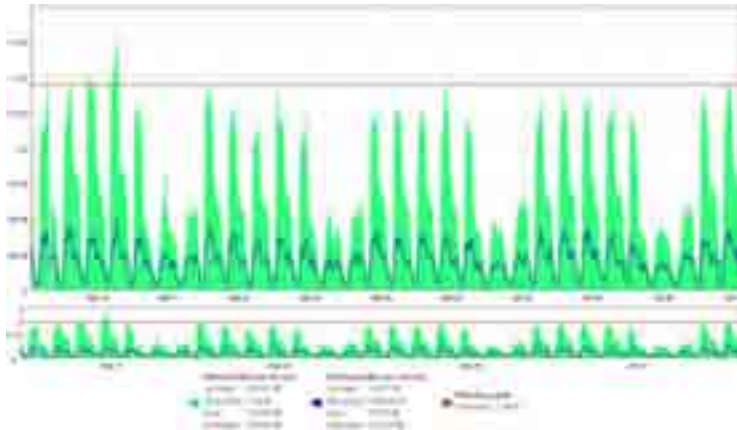
LATENCY

SmokePing

- SmokePing sends 20 “ping” packets every 5 minutes
- Timing of the 20 responses are recorded and visualized



INTERESTING LATENCY/BANDWIDTH ISSUE WITH CONTENT DELIVERY NETWORKS



IMPORTANCE DURING MAJOR EVENTS



NETFLOW DATA

- Input and output interface indices used by SNMP
- Timestamps for the flow start and finish time, in milliseconds since the last boot.
- Number of bytes and packets observed in the flow
- Layer 3 headers:
 - Source & destination IP addresses
 - Source and destination port numbers
 - IP protocol
 - Type of Service (ToS) value
 - In the case of TCP flows, the union of all TCP flags observed over the life of the flow.
- Layer 3 Routing information:
 - IP address of the immediate next-hop (not the BGP nexthop) along the route to the destination
 - Source & destination IP masks (prefix lengths in the CIDR notation)

NETFLOW ANALYSIS

Table: Port % Utilization on 10/11/11 during business hours

port	flows	octets	packets	Purpose
80	51.588	83.420	74.688	http
443	7.223	7.546	8.090	https
1935	0.067	3.515	3.032	flash
110	0.416	0.694	0.723	pop3
995	0.701	0.544	0.703	pop3-ssl
27030	0.013	0.430	0.353	Steam
2120	0.001	0.318	0.288	
43143	0.000	0.310	0.428	
554	0.001	0.285	0.254	rtsp
27600	0.001	0.206	0.415	
3016	0.001	0.197	0.297	
4070	0.004	0.110	0.097	
53	15.689	0.105	0.520	dns
143	0.068	0.102	0.244	imap
2908	0.000	0.092	0.132	
42159	0.000	0.089	0.076	
3306	0.002	0.084	0.113	
993	0.330	0.081	0.179	imap-ssl

PREFIX ANALYSIS

Table: Prefix % Utilization on 10/11/11 during business hours

Source Prefix	flows	octets	packets	IP owner
164.58.129.128/26	9.722	22.085	18.943	Akamai
74.125/16	0.176	8.949	7.212	Google
208.111.128/18	0.382	6.235	5.010	Limelight
206.32/14	0.067	3.865	3.087	
173.194/16	0.093	2.990	2.416	Google
204.87.64/18	0.037	2.822	3.538	OSF
216.151.153/24	0.006	2.587	2.050	
8/9	0.458	2.109	1.735	
209.84/16	0.022	1.883	1.505	
65.54.94/23	0.978	1.783	1.558	
164.58.240.16/28	1.602	1.728	2.111	
69.164/18	0.022	1.653	1.317	
199.101.132/22	0.004	1.530	1.210	
74.125.225/24	4.376	1.524	1.875	
68.142.64/18	0.026	1.409	1.166	
207.246.207/24	0.004	1.333	1.079	
65.112/12	0.242	1.315	1.126	

TYPE OF SERVICE

Table: ToS % Utilization on 10/11/11 during business hours

ToS	flows	octets	packets	Category	DSCP
0	98.662	98.937	98.070	Routine	none
128	0.007	0.334	0.499	Flash Override	cs4
32	0.257	0.189	0.177	Priority	cs1
96	0.013	0.177	0.146	Flash	cs3
160	0.020	0.096	0.406	CRITIC/ECP	cs5
8	0.138	0.091	0.133		
136	0.060	0.073	0.089		af41
184	0.008	0.033	0.247		ef
192	0.329	0.017	0.113	Internetwork Control	cs6
40	0.124	0.012	0.025		af11
88	0.073	0.008	0.016		af23
48	0.059	0.007	0.017		af12

CLASS OF SERVICE

- Support multiple categories of applications
 - 1 Real time traffic for video and voice
 - 2 Time sensitive business applications
 - 3 Best effort traffic that can tolerate delay or loss
 - 4 “Scavenger” service - traffic that you’d prefer above all else to be eligible for loss when under heavy congestion
- Allows very efficient use of available bandwidth

BANDWIDTH TESTING



A joint collaboration between ESnet, GEANT, Internet2 and RNP, PerfSonar performs quality and bandwidth tests between points on the network. Available in Oklahoma at <http://npad.onenet.net>

OCAN

Oklahoma's NTIA BTOP CCI Project to serve CAIs

ACRONYM SOUP

- NTIA - National Telecommunications and Information Administration (part of Department of Commerce)
- BTOP - Broadband Technology Opportunities Program
- CCI - Comprehensive Community Infrastructure
- CAI - Community Anchor Institutions (Schools, libraries, medical and healthcare providers, public safety entities, community colleges and other institutions of higher education, and other community support organizations and entities)
- OCAN - Oklahoma Community Anchor Network

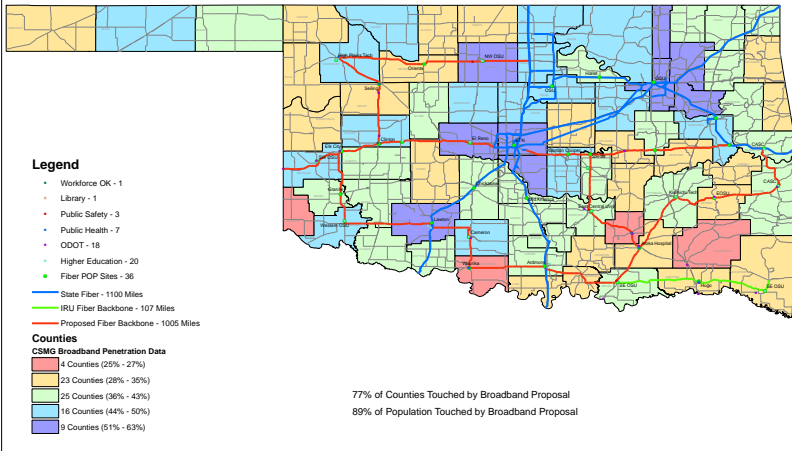
OCAN'S PURPOSE

- Build 1005 miles of fiber infrastructure for middle-mile services through a service area touching 35 counties
- Connect 32 Community Anchor Institutions (adding 55 more miles of fiber for last-mile connections)
- Provide lit and unlit facilities to improve broadband infrastructure and availability across the state.

Funded via **\$18,909,548** of state cash and in-kind match and a federal award of **\$73,998,268**

MAP OF OCAN

State of Oklahoma Map - Broadband Proposal for Fiber Backbone with Anchor Facilities and POP Sites



CAIs

Organization	City
CLEET	Ada
East Central University	Ada
Western Oklahoma State College	Altus
Ardmore Higher Education Center	Ardmore
Atoka Memorial Hospital	Atoka
Mary Hurley Hospital	Coalgate
Duncan Public Library	Duncan
Cameron University	Duncan
DPS-Highway Patrol Troop HQ	Durant
Southeastern OSU	Durant
Redlands Community College	El Reno

CAIs

Organization	City
Northern Oklahoma College	Enid
DPS-Highway Patrol Troop HQ	Enid
Northwestern OSU	Enid
Choctaw Hospital	Hugo
Southeastern OSU-McCurtain Co.	Idabel
Comanche Nation Tribal College	Lawton
Lawton Indian Hospital - Indian Health	Lawton
Cameron University	Lawton
Eastern Oklahoma State College	McAlester
Carl Albert State College	Poteau
Carl Albert State College	Sallisaw

CAIs

Organization

City

Southwestern OSU

Sayre

Seiling Municipal Hospital

Seiling

Seminole State College

Seminole

Connors College

Warner

Jefferson County Hospital

Waurika

Cheyenne and Arapaho Tribal College

Weatherford

Southwestern OSU

Weatherford

Eastern Oklahoma State College

Wilburton

Woodward Hospital

Woodward

Northwestern OSU

Woodward

CONNECTIVITY

For existing OneNet hubsites (19 of the 32 CAIs):

- Fiber looped through the institution
- Dual-attached to OneNet router at 10GigE and lambda ring provisioned to closest OneNet core site
- Will be working with the campuses on a number of technical requirements for the project

Remaining 13 CAIs will have a variety of connection types based on need

CURRENT STATUS

- FONSI received
- Engineering Design is nearly complete
- Interagency agreements are being finalized
- CPM (critical path method) for OCAN is headache inducing
- Several telecommunication provider partnerships are being considered

TIMELINE

- Establish remaining partnerships with telecommunications providers in coming weeks
- Final engineering and PS&E wrapping up now
- Construction is expected to begin December 2011/January 2012
- Completed phases will be lit and put in service throughout 2012 and 2013
- Last phase of construction due to complete before July 2013

PROJECT PARTNERS

- Office of State Finance – Funds Management
- Oklahoma Department of Transportation – Construction
- OneNet – Operations

OKLAHOMA DEPARTMENT OF LIBRARIES

BTOP AWARD

Given the sparse, remote nature of many of Oklahoma's rural counties, high-bandwidth applications like videoconferencing are an essential component to developing the state's economy, enhancing public safety efforts, and improving educational opportunities in tribal and economically distressed areas. The Oklahoma Department of Libraries proposes to upgrade public computer centers at 45 libraries in 44 counties across the state, establish 36 library-based videoconferencing systems, deploy 339 new workstations, and upgrade broadband connections for 42 sites. Participating libraries were selected based on local poverty levels, broadband penetration in their service areas, and cost-effectiveness, among other factors. Total Award: **\$2,333,250**

NetPotential2011

BROADBAND MAPPING GRANT

Great resources on OCAN and the State's Broadband Mapping Grant available at <http://ok.gov/broadband>



US UCAN

