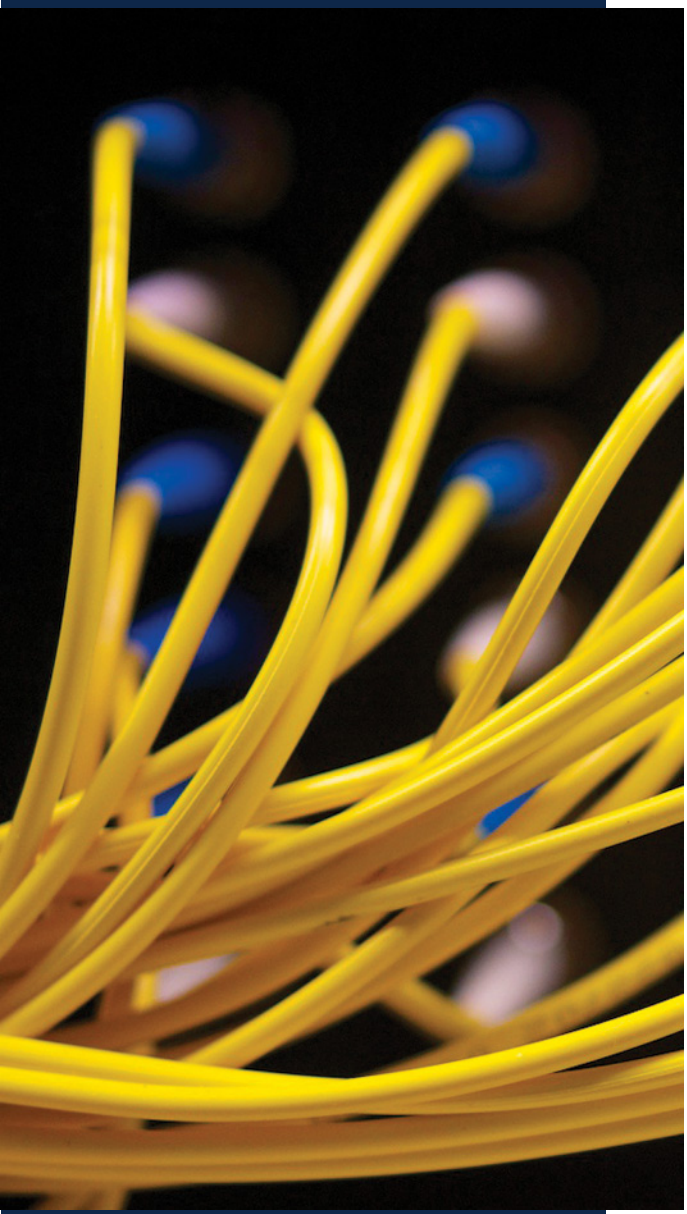
INFORMATION TECHNOLOGY SERVICES

NETWORKING BIANNUAL REPORT

UNC | INFORMATION TECHNOLOGY SERVICES

JUNE – DECEMBER 2022

NEWS AND **INFORMATION**



We are seeing many departments moving to off campus spaces. They often do this with no consideration for how they will connect back to campus. Please investigate your connectivity options back to campus with Networking BEFORE you sign the lease. These connections costs can be trivial in certain locations to over $2000 a month in others. Please educate your department leadership on this issue before it becomes a problem.

The Operations Center (formerly known as the Control Center) is now reporting to Networking. The Operations Center is led by Neil McKeeman. The Operations Center monitors systems, security, and networking services for the campus as well as many other functions. We are working on a major centralized monitoring initiative that is detailed in the major initiatives section of this report.

We are happy to announce that after 33 years of state service, Cindy Henshaw has decided to pursue retirement! She joined Networking with Jim Gogan and Mike Hawkins in 1996. Prior to that, she worked for HSL and the Department of City and Regional Planning.

We would like to welcome Richard Vo to our Network Deployment group. Richard Vo comes to the UNC Networking team from the State Lab of Public Health with DHHS. Prior to DHHS he spent 7 years with Blue Ridge Networks as a Network Engineer and then 8 years with Durham Public Schools as a Sr. Network Engineer. He has a BS Degree in Information Technology and has his Cisco CCNA.

Investigate connectivity options back to campus with Networking before you sign the lease.

RYAN TURNER
HEAD OF NETWORKING

We are still searching for a Wireless Architect. Expect to see a posting for this position soon.

We are currently recruiting and hiring a third Wireless Engineer.

We worked with our vendors in late summer to get significant quantities of switches and access points delivered to campus in an expedited manner. As highlighted in past reports, our normal orders were delayed by many months. By combining orders into a large order, we were able to gain priority and finally get the inventory we needed to properly life cycle across campus without delays. We expect this stock to last through the end of this FY. We are being told that a return to normalcy is expected by the summer for most of our equipment orders.

We are still being consumed by large campus capital projects. As soon as one ends, two or three more are announced. As you come to us with requests for things like additional wireless coverage or remote office connectivity, please understand that we are having to balance many different priorities and are working hard to complete requests on a timely basis.

Sincerely,
Ryan Turner
Head of Networking

KEY CAMPUS **METRICS**

KEY CAMPUS **METRICS**

WIRED

2,939
NUMBER OF SWITCHES

175,484
NUMBER OF PORTS

30 GBPS
PEAK UPLOAD RATE / OCT 23

20 GBPS
PEAK DOWNLOAD RATE / NOV 29

14 PB
TRAFFIC SENT TO INTERNET

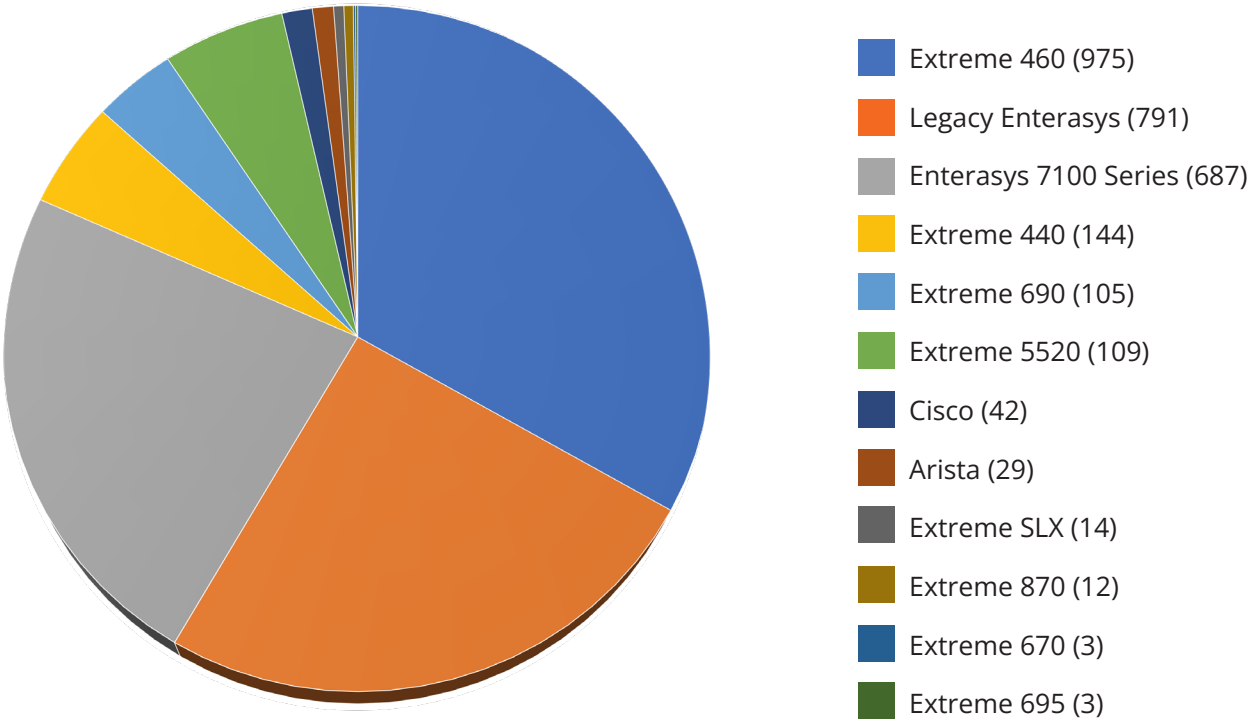
12 PB
TRAFFIC RECEIVED FROM INTERNET

86KW
POWER DELIVERED TO POE DEVICES

KEY CAMPUS **METRICS**

WIRED

SWITCH DISTRIBUTION — ENTIRE CAMPUS



We now have over 200 edge switches in inventory that will allow us to accelerate our life cycle in the next 6 months.

Our total installed switch count is increasing because we are life cycling G series switches which have up to 96 ports with a switch that has only 48.

More than 1/3 of our campus switch infrastructure is currently out of support. It will likely remain that way for several more years.

1,321 EXTREME XOS SWITCHES ON CAMPUS

EXPLANATION OF MAJOR MODEL TYPES

Cisco Nexus 7706
These chassis-based routers act as the core of our network and feature high density 40G/100G capabilities. These switches provide almost all core routing for campus and were part of our major core redesign in 2018. They also serve as the layer 3 core for ITS data centers, providing an aggregate of 400 Gbps from ITS Franklin and ITS Manning.

Arista
We used a variety of Arista switch models to provide high-density high-speed connections to ITS Research Computing as well as other research entities across campus.

Extreme 440
Compact low port count switch that is used in limited situations to provide port extensions to classrooms and conference rooms. This switch is installed as a 12 or 24 port count switch. It can be uplinked at 10 Gbps.

Extreme 460
One generation behind the current generation standard fixed format campus edge switch. Standard install is 48 ports of 1 Gbps connectivity with uplinks traditionally spec'd at 10 Gbps but will support 40 Gbps links.

Extreme 690
Our current generation of Building Entrance switch that is normally ordered with fiber connections to serve downstream edge switches at 10 Gbps. This is also the switch that is used for data center pods. Can support a multitude of uplinks speeds up to 100 Gbps.

Extreme 695
This will likely be our next generation of Building Entrance switch that will replace the 690. The switch has a different architecture with the ability to support 48 25Gbps links (an improvement from the 48 10Gbps of the 690).

Extreme 5520
Our current generation fixed format edge switch. Capable of significant multi-rate (2.5 Gbps or 5 Gbps) ports in addition to 802.3bt power in addition to unlinking at up to 50 Gbps.

Extreme SLX series
These high density 40G/100G switches are currently used as spine layer switches in the new data center design. They can support a high number of 100G ports, will support 400 Gbps in the future, and feature a deep packet buffer system that can eliminate packet drops from a congested network. They come in chassis and fixed format, and we will be considering this line for replacement of our current distribution tier 1 switches (S series).

Extreme 7100 series
Two generations behind currently supported edge switch. Fixed format switches that feature 1G to the desktop, 10G to the server, and 10G or 40G uplinks. This switch is no longer available for purchase and runs a network operating system that will eventually be deprecated by the manufacturer. Most will support 802.3at power over ethernet.

Enterasys Legacy
Consists of G3, K Series, S Series, and N series switches which are far beyond support and not adequate for modern networking needs. This equipment is being actively life cycled.

KEY CAMPUS **METRICS**

WIRELESS

ACCESS POINT DISTRIBUTION [ENTIRE CAMPUS]

- 225 (3175)
- 315 (3219)
- 515 (1672)
- 503h (851)
- 325 (812)
- 303h (386)
- 205h (369)
- 224 (276)
- 335 (89)
- 277 (49)
- 275 (46)
- 335 (72)
- 344 (4)
- 345 (6)
- 377 (9)

2,939
NUMBER OF SWITCHES

10,946
NUMBER OF APs ON CAMPUS

~47,000
PEAK CONCURRENT CONNECTIONS (SEPT 20)

iOS AT 35%
TOP ONBOARDED OS

We have nearly exhausted our inventory of 500 series APs which has been our standard AP for over 2 years. When the inventory is exhausted, we will be moving to 600 series APs.

We will be installing our first 600 series 6 GHz capable access points in the next few months. The Innovation Center will likely be the first location to receive these new APs.

Our deployment strategy for using the new 6 GHz spectrum has not been finalized.

All 200 series access points are now no longer supported by Aruba. Main campus no longer has any 200 series access points. However, Housing has several thousand that will take a few years to replace.

EXPLANATION OF MAJOR MODEL TYPES

AP-1XX – Aruba access points that feature 802.11n capabilities. Support for 100 series access points was ended in 2021.

AP-2XX – Aruba access points that feature wave 1 of 802.11ac capabilities. Aruba has set the end of support date for these access points as some time in 2023. We are currently life cycling 200 series across campus.

AP-3XX – Aruba access points that feature wave 2 of 802.11ac capabilities. Aruba has not set the end of support date for these access points, and we consider these still current generation.

AP-5XX – Current supported and installed model of access point which is Wi-Fi 6 certified.

AP-6XX – Upcoming generation of Wi-Fi 6 access points which have 6 6Ghz radios.

SERVICENOW **METRICS**

SERVICENOW **METRICS**

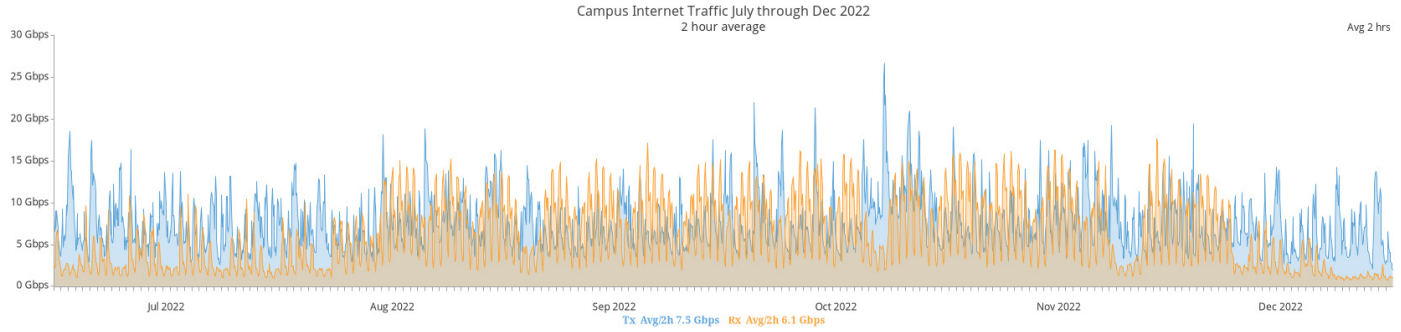
JULY — DECEMBER 2022

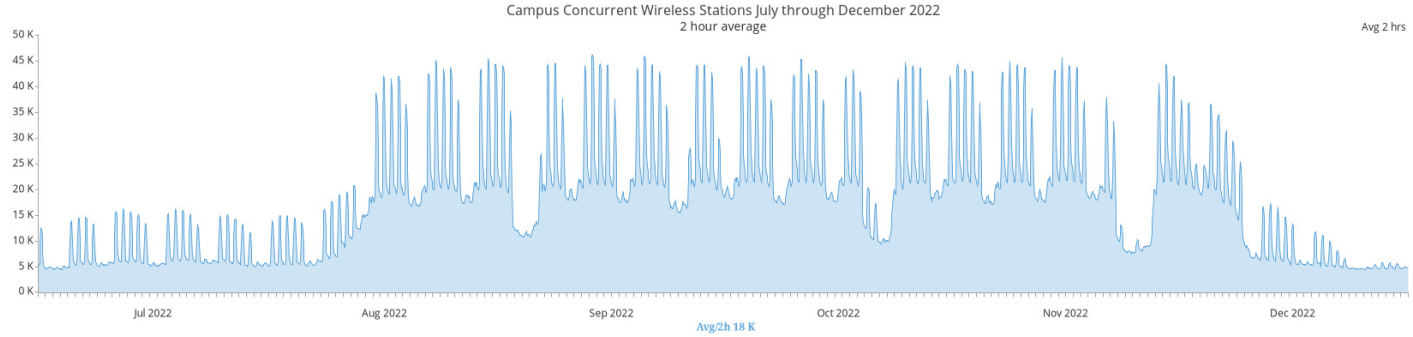
GROUP NAME	SERVICE REQUEST	INCIDENT	COUNT
IP Services	245	27	272
Deployment	396	299	695
Wireless	15	17	32
Operations / Engineering	287	75	362
Count	**943**	**418**	**1,361**

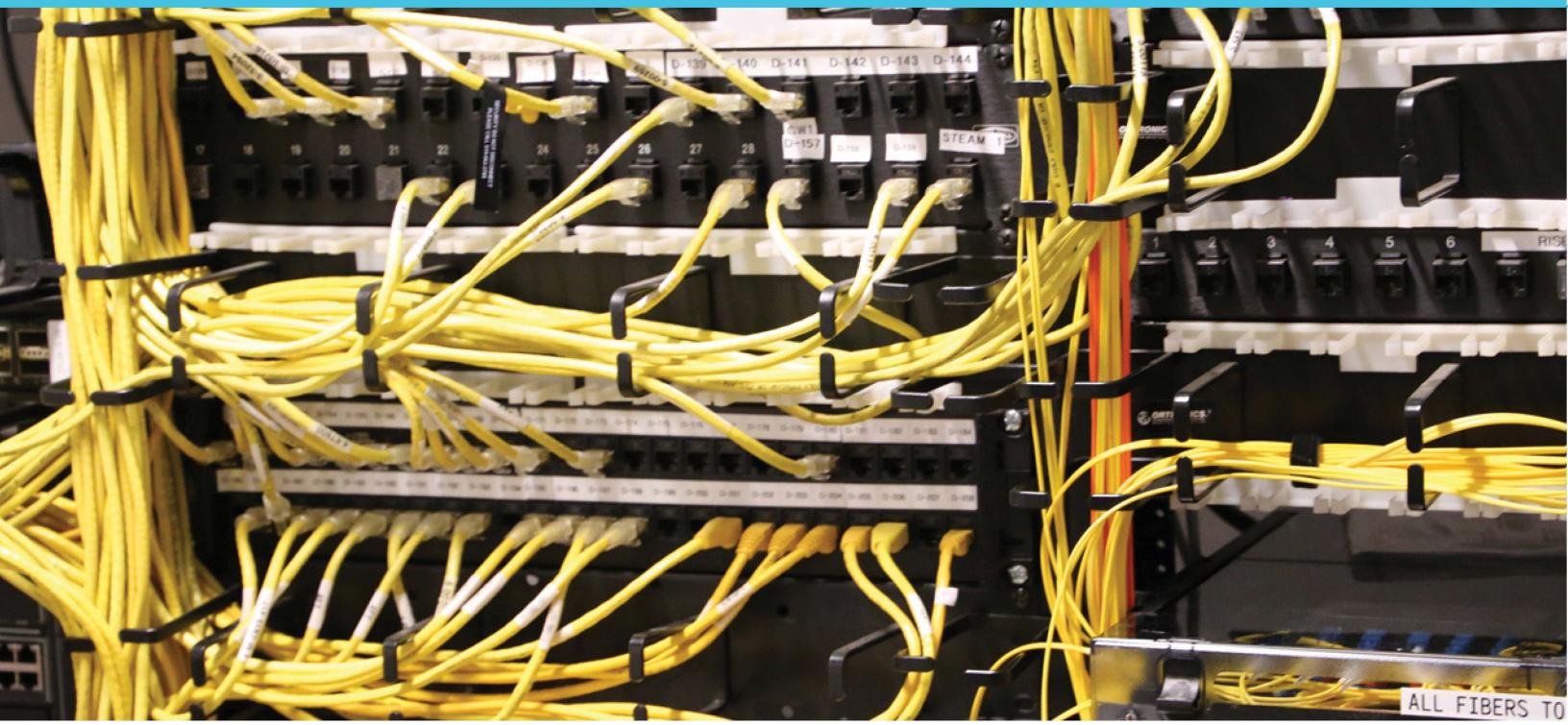
SERVICENOW **METRICS**

SERVICE GRAPHS

When you stretch a graph across 6 months on a fixed width, significant data averaging occurs. For all these individual data points, that is the average over a 2-hour period. That means that you could have a 30 Gbps spike in traffic, and it does not show averaged out over 4 hours. These graphs should be used to judge trends.



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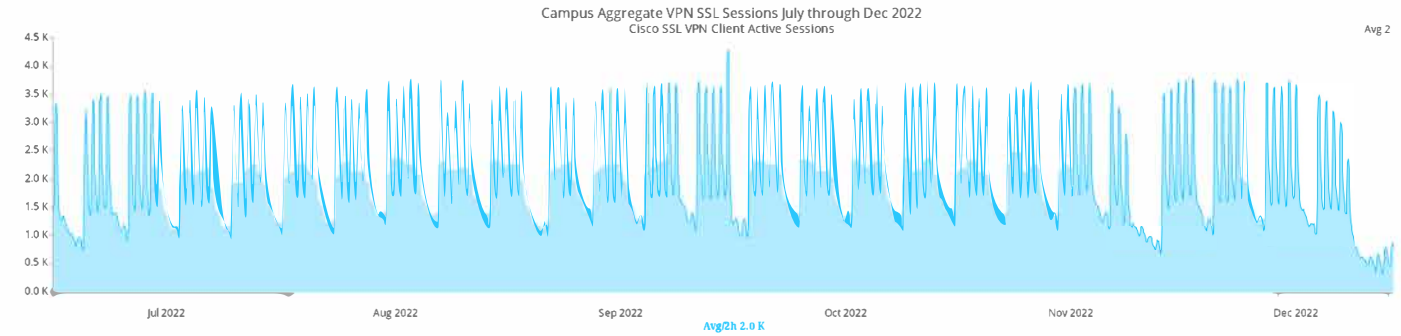
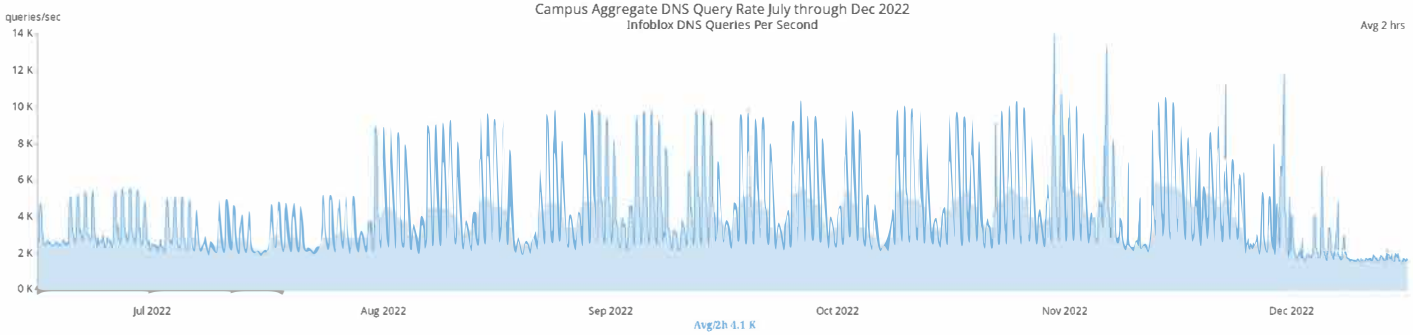
STEAM
ALL FIBERS TO


Campus Aggregate VPN SSL Sessions July through Dec 2022
Cisco SSL VPN Client Active Sessions
Avg 2
4.5 K
4.0 K
3.5 K
3.0 K
2.5 K
2.0 K
1.5 K
1.0 K
0.5 K
0.0 K
Jul 2022
Aug 2022
Sep 2022
Oct 2022
Nov 2022
Dec 2022
Avg/2h 2.0 K


Campus Aggregate DNS Query Rate July through Dec 2022
Infoblox DNS Queries Per Second
Avg 2 hrs
queries/sec
14 K
12 K
10 K
8 K
6 K
4 K
2 K
0 K
Jul 2022
Aug 2022
Sep 2022
Oct 2022
Nov 2022
Dec 2022
Avg/2h 4.1 K

MAJOR INITIATIVES REVIEW

SCHOOL OF BUSINESS CHARLOTTE

The Networking group continues to increase our scope to more sites around the state! In addition to the McColl expansion, the School of Business is opening up an executive education center in downtown Charlotte. Networking is working with the School of Business to equip this space with wired and wireless connectivity. This site will be tied back to campus with MCNC fiber.

6E access points allow for the use of new 6 Ghz frequency band which is the most significant change to wireless in over a decade.

F5 UPGRADE PROJECT

In early January, Sid Stafford and Frank Seesink worked with F5 to bring two new F5 appliances online. During the process, the Middleware F5 instance was moved off the legacy VIPRION chassis and onto the new platform. This freed up a lot of resources on the VIPRION chassis so we can allocate more resources to the other partitions (improving performance). Going forward, we are likely going to move development environments off of the expensive chassis and appliance platforms and onto virtualized platforms on the ITS UCS solution which should give us some more room to grow. However, VIPRION now has an end of support date in site and another hardware platform will be needed in the not distant future.

ARUBA OS UPGRADE

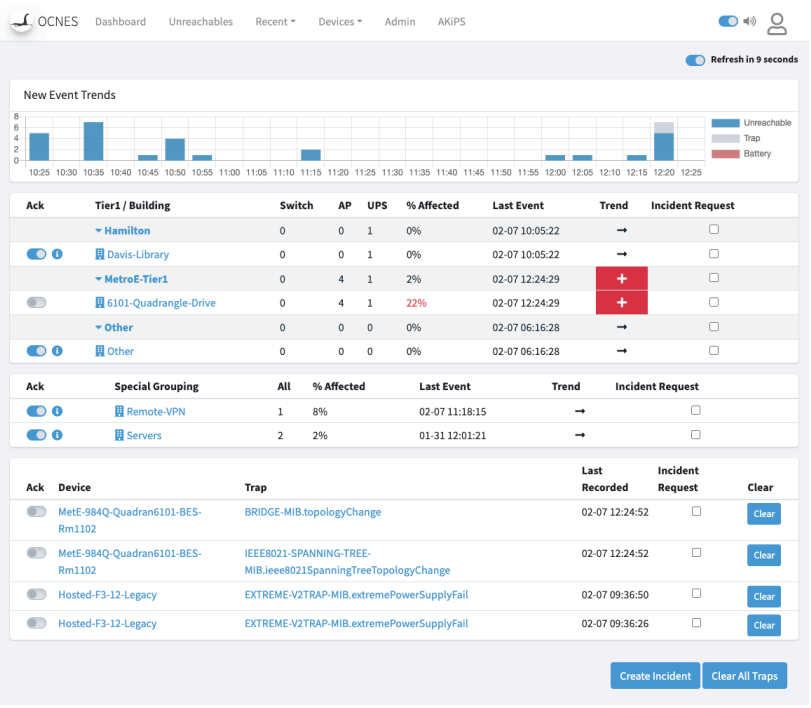
We have moved to Aruba OS 8.10 on all controllers across campus. This significant upgrade is the first code base that will support our new 6E capable access points across campus. Main campus will start to see the deployment of 6E capable APs within the next 6 months. 6E access points allow for the use of new 6 Ghz frequency band which is the most significant change to wireless in over a decade. Our 6E deployment strategy is not yet fully realized and will be detailed in upcoming reports.

SYSTEM OFFICE RALEIGH

The System Office has successfully moved its main presence from Chapel Hill to Raleigh. The Network Deployment group successfully deployed our networking stack in their new location in the Dillion Center. The System Office connects directly back to campus through an MCNC fiber connection.

UNC-GUEST CHANGES

Ever since UNC-Guest was a thing on UNC's campus, it has used publicly routed IP space. We have been periodically exceeding our capacity to supply the guest VLAN with IP addresses. We made the decision to NAT (Network Address Translation) the Guest network. All people connecting to the UNC-Guest SSID will receive a private IP address and be NATed through ITS Security infrastructure. We are debating turning on guest services throughout all of campus (excluding Housing). In the next few weeks will be turning off the captive portal page on UNC-Guest which we hope will dramatically improve the experience of our guests.



OCNES (OPERATION CENTER NETWORK EVENT SUMMARIZATION) TOOL DEVELOPMENT

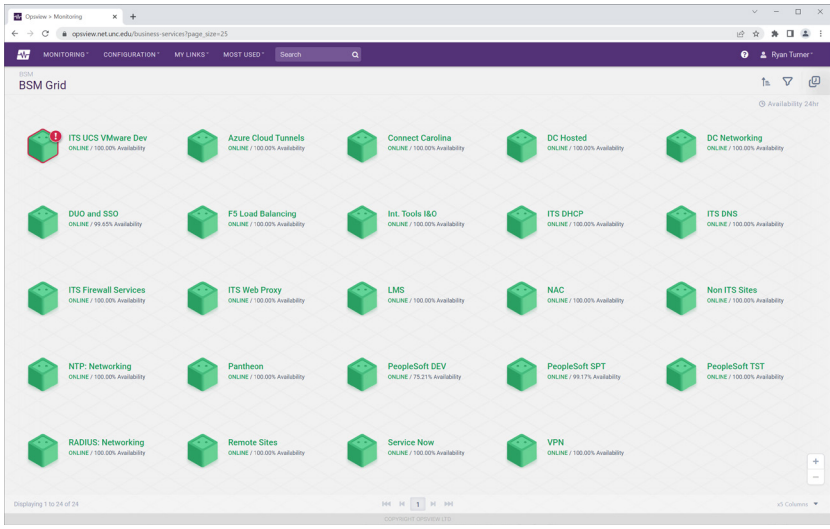
Will Whitaker leads the Networking DevOps team that produces in-house tools. They developed the OCNES tool which acts to summarize network events in a logical display, aiding in fault isolation and event resolution. This tool directly offset the need to continue a subscription to a very expensive NMS platform we have, and we expect this tool to be released as an open-source project. This tool will be presented nationally with the Network Managers Constituency Group with EDUCAUSE soon.

INNOVATION CENTER

This center will be an anchor of UNC and industry relationships, offering more than 20,000 square feet of shared space. Its development is being stewarded by Sheryl Waddell, Director of Economic Development and Innovation Hubs. This site will be connected directly to UNC's network thanks to the work of Chad Ray, Manager of the Transport Operations team. The networking team is providing significant data communication services to this building which will include the first deployment of 6E capable wireless.

CENTRALIZED NETWORK MONITORING PLATFORM

The Operations Center is going to have a much stronger role in monitoring business services for the University. We evaluated and have purchased a centralized monitoring platform called Opsview. We hope that this platform will significantly improve our response time and situational awareness of all the critical business services that ITS offers. This will include monitoring parts of the network in novel ways. The monitoring platform will include a web synthetic monitoring component that will track and alert on website interactions. We also expect this platform to automate the announcement of service degradation to the ITS Status webpage. The Networking DevOps group is currently coding integrations that will allow Opsview to talk directly to ServiceNow and ITSStatus. There will be presentations announced on the new capabilities once we have the platform matured.



ROPER HALL

This building has been delayed from its initially planned opening. However, the Networking group expects to begin provisioning equipment into this space within the next 30 days. There is a significant investment in data communications in this space with over 60 switches and 120+ access points. This building will have our most capable and large roll-out of stacked edge switches with at least 50 Gbps connectivity to each floor for high-end AV capabilities. Current construction can be seen here: https://app.oxblue.com/open/TAL/UNCMEB

LIFE CYCLE **UPDATE**

Life cycles are completed by the network deployment and wireless groups.

The following locations have received substantial new **switching** gear during the past 6 months:

Grounds Building

Lineberger CCC

South Building

Hamilton Hall

Hickerson House

The following locations have received substantial new **wireless** gear during the past 6 months:

Smith Building

Lineberger CCC

McCaskill Soccer

Carr Building

Knapp Sanders

208 W. Franklin

Glaxo

223 E. Franklin

Alumni Center

Campus Y

New West

Hickerson House

The following locations are being **targeted** for switch and wireless upgrades in the coming 6 months (subject to change):

Sitterson

Davie

Bynum

Steele

Marsico

Fetzer

Vance

Phillips

CRITICAL INCIDENTS REVIEW

AUGUST 25, 2022

Problems with DNS host

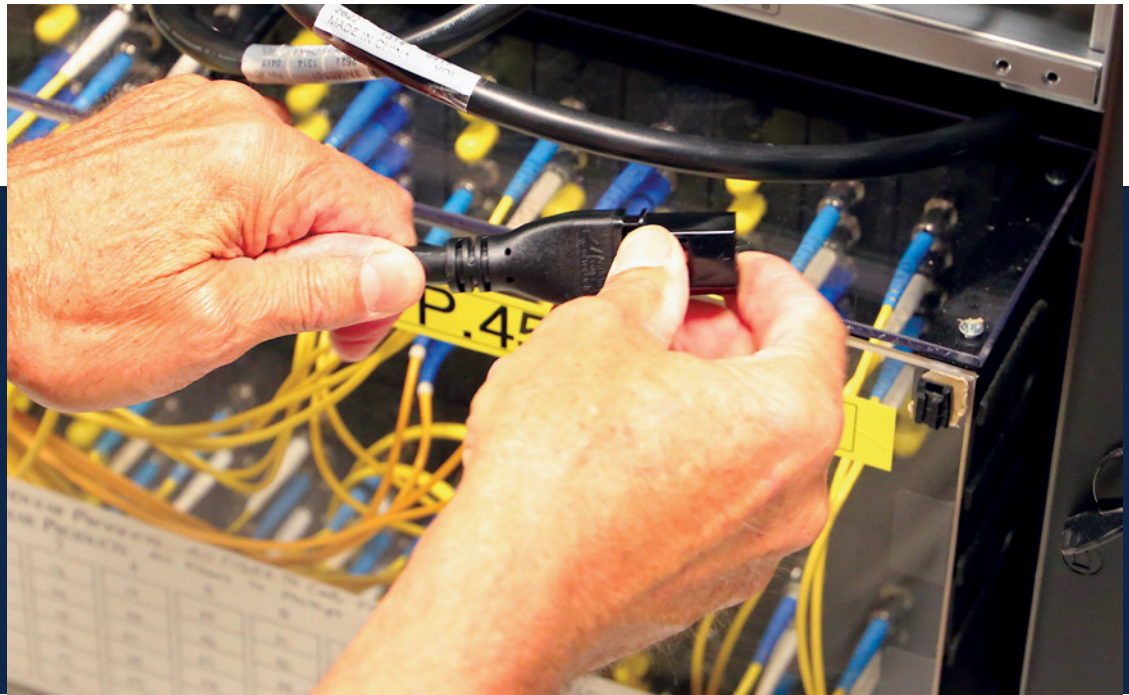
A problem with the underlying host that was running one of our Infoblox guest servers (for DNS) had storage issues. The affected host remained up 'enough' to remain part of our balanced anycast load balancing pool, and it resulted in some requests across campus being blackholed to the non-responsive guest. We have since altered our anycast approach so this condition will not result in traffic being blackholes in the future. The degraded service lasted from around 1:50PM to 2:01PM.

AUGUST 29, 2022

Line card failure in ITS Franklin

An SLX line card failure in ITS Franklin resulted in a partial failure of traffic going to the ITS Franklin DC. The problem was identified, and the line card was shut down. It would be replaced several weeks later during a scheduled change plan. The degraded service lasted from around 3:30PM to 4:30PM.

SEPTEMBER 13, 2022

F5 change (11800) failed

We attempted for a second time to integrate our new 11800 into our existing F5 cluster. This did not go as expected and affected numerous central IT services. The delay in restoring services was exacerbated by the way the problem manifested itself. After the second attempt, we contracted with F5 professional services to aid in the process. Months later, we ended up not integrating the 11800s into our existing cluster as intended, and instead brought them online as a standalone pair. The problem was recognized around 6:30 AM and was resolved around 7:20 AM.