



N-Wave News



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NOAA N-Wave

The N-Wave Enterprise Network Services Branch, under the NOAA Office of the Chief Information Officer, Service Delivery Division, supports both operations and research, enabling NOAA's mission of science, service and stewardship through highly available, secure, high-speed network transport and services.

Mission

N-Wave is committed to providing innovative networking capabilities with integrity, transparency and flexibility, to enable NOAA's missions through the implementation of:

- Quality, advanced high-speed connectivity both internally and externally to NOAA
- Portfolio of secure, flexible, available, high-bandwidth network services
- Retention and recruitment of exceptional operations and engineering staff.

Our Vision

To provide reliable, secure and sustainable enterprise network services for NOAA, which enables NOAA's mission of science, service and stewardship.

From the N-Wave Program Manager



Robert Sears

Publishing of this spring edition of the N-Wave newsletter should have coincided with the planned May 5-7 annual N-Wave Stakeholders Summit; however, due to the outbreak of COVID-19, all laid plans for calendar year 2020 have been impacted. As we all shelter in our homes, telework and deal with the multitude of challenges that have fallen upon us, it is N-Wave's mission to keep in touch with our stakeholders.

There has never been a more demanding time for the N-Wave team in our almost 10-year history, and the response has been steadfast and professional. I have not seen this team miss a step or curtail the customer experience amongst increased service demands ranging from Enterprise Remote Access VPN to Cloud Transport. The N-Wave team of federal staff, contractors and our science, research and education partners all take pride in ensuring the best possible customer experience.

Customer input and feedback play a key role in N-Wave's efforts to evaluate and continuously improve our services. N-Wave gathers that information throughout the year in multiple ways, but this year we expanded those efforts by conducting the first annual N-Wave Customer Feedback Survey in March.

We distributed the survey to 517 contacts – including technical staff, administrative staff, management and executive leadership – across all of

the organizations N-Wave currently serves, and the outputs of this survey were to have been presented at the May summit. Thank you to all who provided feedback regarding their experiences with N-Wave by taking the survey. We acknowledge that the timing was challenging, as our customers were dealing with their own unique situations surrounding COVID-19.

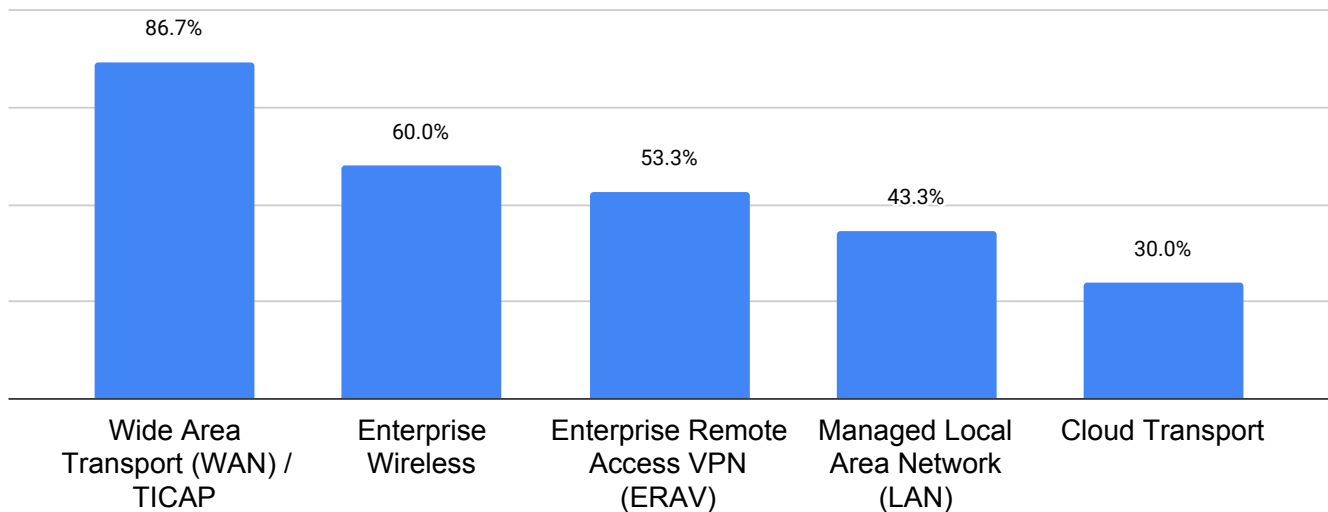
The survey responses we received offered new insight into the N-Wave customer experience—including the factors that influence decisions to deploy N-Wave services, overall level of benefit received from N-Wave, level of satisfaction with each of N-Wave’s network services (i.e., Cloud Transport, Enterprise Remote Access VPN, Enterprise Wireless, Managed LAN, Wide Area Transport / TICAP), and level of satisfaction with N-Wave’s network operations and resources (e.g., Tier 1 Service Desk, Tier 2-3 Engineering, customer-facing tools such as Atlas, COPE and SNAPP).

One of the questions we asked was “Which N-Wave services have you heard about?” The results showed that customer awareness of some

of our newer services is relatively low compared to our original service offering, Wide Area Transport. So we are taking some steps to increase awareness of the scope of our service catalog, including adding a recurring newsletter article to provide you the latest information regarding our newer services (see p. 12 regarding N-Wave’s Enterprise Services).

With takeaways regarding areas in which we are excelling and areas for improvement, all of the insight shared will guide N-Wave’s strategic planning efforts as we work to expand our network capabilities and service offerings to better support your missions. If you opted to self-identify when submitting the survey, we will be reaching out to you directly to discuss your needs and feedback in more detail.

A full brief, next steps and open discussion concerning the N-Wave Customer Feedback Survey will be conducted at the next N-Wave Stakeholders Summit (see p. 22)—where we can once again meet in person!



Survey results from the question, “Which N-Wave services have you heard about?” showed that customers are more familiar with N-Wave’s first service offering, Wide Area Transport, than they are with N-Wave’s newer services.

Commerce Headquarters Connects to N-Wave, Bringing New Possibilities for Agency-Wide Collaboration

N-Wave has nearly completed its year-long effort to provide the Herbert C. Hoover Building (HCHB) in Washington, D.C., with wide area network transport and Trusted Internet Connection (TIC) services. Final cutover work has been interrupted by COVID-19, but plans are being made to accommodate the migration during the remote-working constraints.

Connecting the Department of Commerce (DOC) headquarters to N-Wave will have a transformative effect on both N-Wave and the DOC in general, replacing legacy inter-agency connectivity, enabling higher-speed throughput, expanding the use of existing NOAA security services and opening possibilities for future department-wide optimizations.

For N-Wave, HCHB represents the largest single site on the network. Since its construction in 1932, HCHB has been one of the largest buildings in the District of Columbia. Today, it is the third largest federal building in the metro region, behind only the Pentagon and the Ronald Reagan Building. HCHB covers more than 8 acres—3 city blocks. It has more than 5,000 windows, 1.5 million face bricks, nearly 100 acres of plastering, and 25 tons of bronze hardware. One lap inside the building around the outside corridors is 1/2 mile.

Technical Scope of Connecting HCHB

HCHB will be another aggregation site on the N-Wave network, connected with dual 10 gigabits per second (gbps) circuits back to the N-Wave core. Initially MPLS services will deliver two instances of virtual routing and forwarding (VRF), one for internet access and one for private connectivity to the DOC Azure environment. The internet connectivity will sit behind NOAA's TICAP, where N-Wave will announce HCHB's public IPv4 and IPv6 routes to the internet. The



cloud connectivity will traverse N-Wave's Cloud Brokerage Network to connect to Azure, making it appear as an extension of the HCHB premises.

Both the internet and Azure connectivity will replace commercial services. Previously internet connectivity was limited to 300 megabits per second (mbps). This will be increased to 1 gbps on N-Wave, limited by the interconnection from the HCHB premises equipment to the N-Wave aggregation routers. The cloud connectivity will be 200 mbps based on the Azure SKU in use by HCHB. It can easily be upgraded up to multi-gigabit speeds when needed.

N-Wave is using a pair of Juniper MX204 routers as its on-site aggregation devices, with a pair of Juniper EX4600s switches behind the MX204s serving as a local N-Wave campus core to increase port density. HCHB physically connects to both of these core switches with a pair of their own routers that previously connected to the commercial service provider. Border Gateway Protocol is used as the routing protocol between N-Wave and the customer to enable dynamic routing and make the connectivity fault-tolerant and self-healing.

New Possibilities for Future Agency-Wide Optimizations

Once the final steps in connecting HCHB to N-Wave are completed, many other connectivity options are possible via access to N-Wave's nationwide transport infrastructure. Most immediately relevant, any other customer or potential customer within the building will be able to access private N-Wave routing capabilities simply by connecting to the N-Wave switches and a private VRF. Longer term, N-Wave will have taken another step towards replacing legacy MPLS services interconnecting sister bureaus across DOC with its own service. N-Wave will ultimately be able to provide higher speeds at a lower cost

and with more reliability to interconnect all of DOC. This could include connectivity to enterprise-wide services such as the DOC intranet and Enterprise Continuous Monitoring Operations, commonly referred to as ECMO.

Over the past year, N-Wave engineers have worked very closely with the HCHB NOC team to understand the details of the local network and to collaboratively develop the connectivity solution for HCHB. This work performed together with this important customer site forms the basis for a strong relationship as N-Wave offers services to other DOC bureaus within the building and into these new service areas.



Credit: NOAA OAR 2014 Photo Contest.

N-Wave Delivers Services to Support NOAA's New Enterprise Data Center



Credit: NOAA OCIO.

NOAA recently celebrated the opening of its new Enterprise Data Center (EDC) in Ashburn, VA. This achievement contributes to the agency's data center consolidation initiative to reduce IT operations costs and risk. It also has enabled the ongoing renovation and re-stacking efforts at the NOAA Silver Spring Metro Center campus in Silver Spring, MD.

Collaborating for Success

Close collaboration among teams within the NOAA Office of the CIO – including the Enterprise Data Center team, High Performance Computing and Communications, and N-Wave – led to the successful deployment of the new data center. The teams have been working together to develop, deliver and support network and data center services that enable OCIO operations and Line Office missions.

Mid-Atlantic Crossroads (MAX) – a valued, long-time NOAA partner in the science, research and education network community – also played a key role. MAX is one of N-Wave's infrastructure partners and the provider for the current TICAP colocation and TICAP peering services in the D.C. metro. For the NOAA EDC-Ashburn, MAX worked on behalf of NOAA to contract for and manage the relationship with Zayo for the Tier III zColo facility where the data center is located.

Extending N-Wave Services into the New Data Center

From the physical cable plant to wide-area connectivity, N-Wave engineers designed and deployed the network services that are critical to EDC-Ashburn.

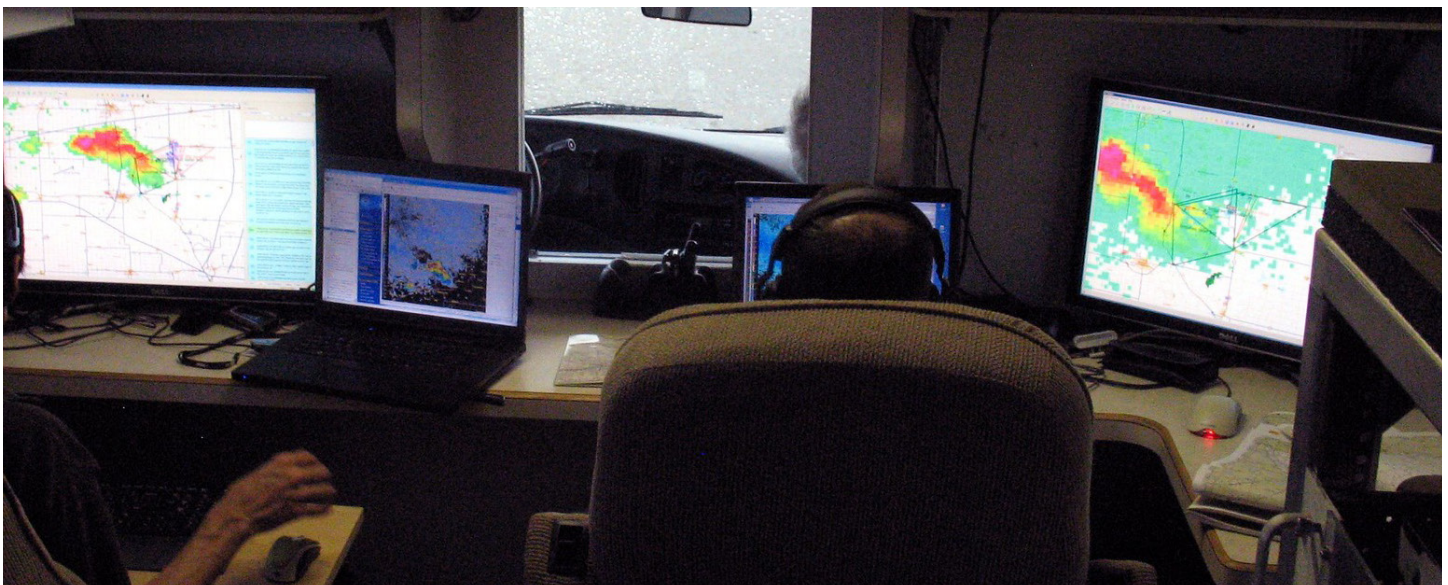
- **Standardized Cable Plant** – To facilitate and optimize physical connectivity between customer racks and the N-Wave network, engineers designed a structured cabling plant for the data center. The cable plant includes six pairs of single mode fiber and six Cat6A copper connections from each customer rack to the N-Wave Meet-Me Rack. This allows each rack to be able to connect to any other rack via copper or single mode fiber. N-Wave manages this infrastructure and ensures inventory availability to augment it as needed.
- **WAN Services and Redundant Backbone Connectivity** – N-Wave is the wide-area network provider for EDC-Ashburn, with diverse 10 gigabit per second connectivity to the N-Wave backbone at College Park, MD, and McLean, VA. N-Wave plans to upgrade these to 100 gbps connections by the end of September 2020. As the WAN service provider, N-Wave is also able to offer TIC-compliant internet access, customer private routing through virtual routing and forwarding (VRF), Cloud access transport and NOAA-wide connectivity solutions for data center customers.
- **Redundant Aggregation and Switching** – N-Wave provides diverse, redundant connectivity out of the data center and a redundant switching distribution layer at

EDC-Ashburn, allowing customers to have full diversity starting at their devices.

- **High-Capacity Connectivity** – N-Wave provides customers at EDC-Ashburn with physical handoffs at 1, 10 and 40 gbps. N-Wave offers multiple ways to connect, from a Layer 3 handoff to a fully managed LAN solution.
- **Managed LAN as a Service** – N-Wave offers its Managed Local Area Network service to customers at EDC-Ashburn. N-Wave can provide networking starting at the WAN all the way to the access port on the customer device, working with customers to design, deploy and manage a solution that meets their LAN needs.

Preparing for Customer Migrations

In preparation for customer migrations into the new data center, N-Wave has been heavily involved in gathering requirements. This includes gaining in-depth knowledge of each customer’s current networking environment and anticipated needs, along with identifying the devices, port configurations and migration scheduling considerations necessary for a smooth transition.



Credit: NOAA National Severe Storms Laboratory.

Future of the NOAA Networking Committee

Much has changed in the NOAA networking landscape since the agency formed its NOAA Networking Committee (NNC) in 2011. With members representing each Line Office, the NNC's primary mission was "the establishment of a common NOAA network infrastructure through planning, management and deployment of network resources."

NOAA and the NNC have fulfilled much of that original mission—establishing N-Wave as a common NOAA backbone network, delivering OMB-mandated Trusted Internet Connections through TICAP and the X-Wave peering infrastructure, and developing new network services like NOAA Enterprise Wireless to meet the needs of the agency.

What remains from the NNC's original scope is the need for a technical forum to provide direction for NOAA's Enterprise IT networks, technical guidance and policy recommendations to the CIO Council, and support and technical coordination for NOAA-wide development projects. The NNC recently sought guidance from the NOAA CIO Council regarding whether the committee should continue its efforts in these areas or if a new direction was needed.

New Direction

The NOAA CIO Council recently agreed to a proposal that will pause the committee's work indefinitely. In lieu of the NNC, the networking community within NOAA will shift focus toward other engagement and strategic collaboration opportunities:

- **Annual N-Wave Stakeholders Summit Meeting** – This annual event is part of N-Wave's continuous efforts to engage stakeholders in strategic network capacity planning, provide updates on federal government initiatives, and share N-Wave's latest capabilities and services.
- **Annual NOAA Joint Technical Interchange Meeting** – This new annual meeting will be modeled after Internet2's and ESnet's Joint Techs meetings, which were last held in 2013. Network engineers across all of NOAA will gather for intra-NOAA technical discussions and deep dives into timely topics.
- **Quarterly Status Briefings to CIO Council** – In place of monthly NNC meetings, the NOAA CIO Council will now directly receive quarterly briefings regarding N-Wave, Enterprise Infrastructure Solutions and other network-related initiatives.
- **Ad Hoc Network Initiative Working Groups** – Based on outcomes from quarterly CIO Council briefings, NOAA's Infrastructure Operations Coordination Committee (IOCC) will form ad hoc working groups to address specific network needs and new initiatives such as IPv6.
- **Other Outreach** – N-Wave will continue other outreach efforts, including its weekly Change Management and Engineering Review Board Meeting, customer experience feedback surveys, biannual N-Wave newsletters and pre-briefs on emerging network services.



Credit: NOAA/PIFSC/HMSRP.

As N-Wave Evolves and Expands, So Does Its Test Lab

As N-Wave evolves and expands, its test lab plays an increasingly important role in assisting with the lifecycle of the network. From prototyping new architectures and testing new services to providing a testbed for engineers to cultivate new skills, the test lab delivers value to N-Wave and its customers.

Delivering Value Across All Phases of the 'Plan, Build and Manage' Lifecycle

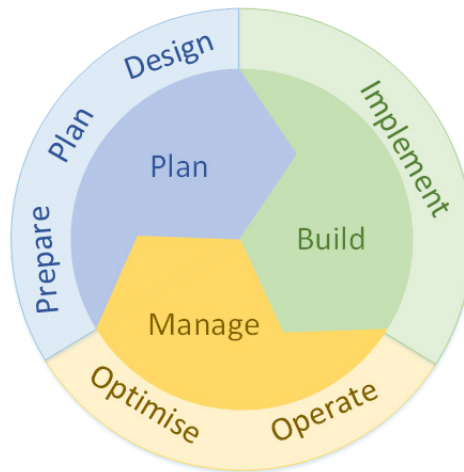
Testing is traditionally thought to take place during the build section of the "plan, build and manage" lifecycle. During the implementation phase of the build section in particular, a testbed can be used to evaluate the new components of the network design, uncover any potential problems and prove out the detailed low-level design. This lifecycle can be used both for the evolution of the network, as well as for adding new services that utilize the underlying network.

The lab can also be leveraged in other phases of the lifecycle. For example, network testing in the lab can be implemented during the planning phase to evaluate the readiness of the current network for a new technology deployment. Additionally, changes to the network – such as code upgrades during the operation phase or traffic engineering during the optimization phase – can be tested in the lab prior to production rollout to validate the changes.

Leveraging Virtualization in the Lab

Virtualization has been revolutionary in the information technology arena, and the N-Wave lab has embraced it through the use of Emulated Virtual Environment (EVE-NG) software. EVE-NG allows N-Wave to virtually deploy network components such as switches, routers, firewalls

and load balancers from a variety of vendors. EVE-NG provides a great training resource for N-Wave's next generation of talented network engineers. This virtual environment affords junior network engineers an opportunity to learn operating systems syntax and rapidly set up test environments without any need to procure and deploy costly hardware. The ability to build a test network without the need to buy new equipment also greatly benefits N-Wave and its customers through cost and time savings.



Prototyping New Architectures, Testing New Services and Platforms

The N-Wave lab is also being used to prototype the possibility of new architectures. One such example is centered on the NOAA Trusted Internet Connection (TIC) architecture, seeking more efficient ways to accommodate ever-increasing bandwidth demands. N-Wave engineer Jason Iannone conceived an

idea to collapse the current border router and aggregation routers into a single physical router chassis. This concept would reduce cost and allow the TIC peering infrastructure, X-Wave, to easily use N-Wave for transport services to interconnect the X-Wave devices. Engineers continue to model this architecture in the lab to prove the feasibility of the concept design.

As N-Wave expands its portfolio through the addition of service offerings such as NOAA Enterprise Wireless and the Managed LAN service, those components are being modeled in the N-Wave lab. These additions to the lab will allow service changes and modifications to be tested prior to deployment in production.

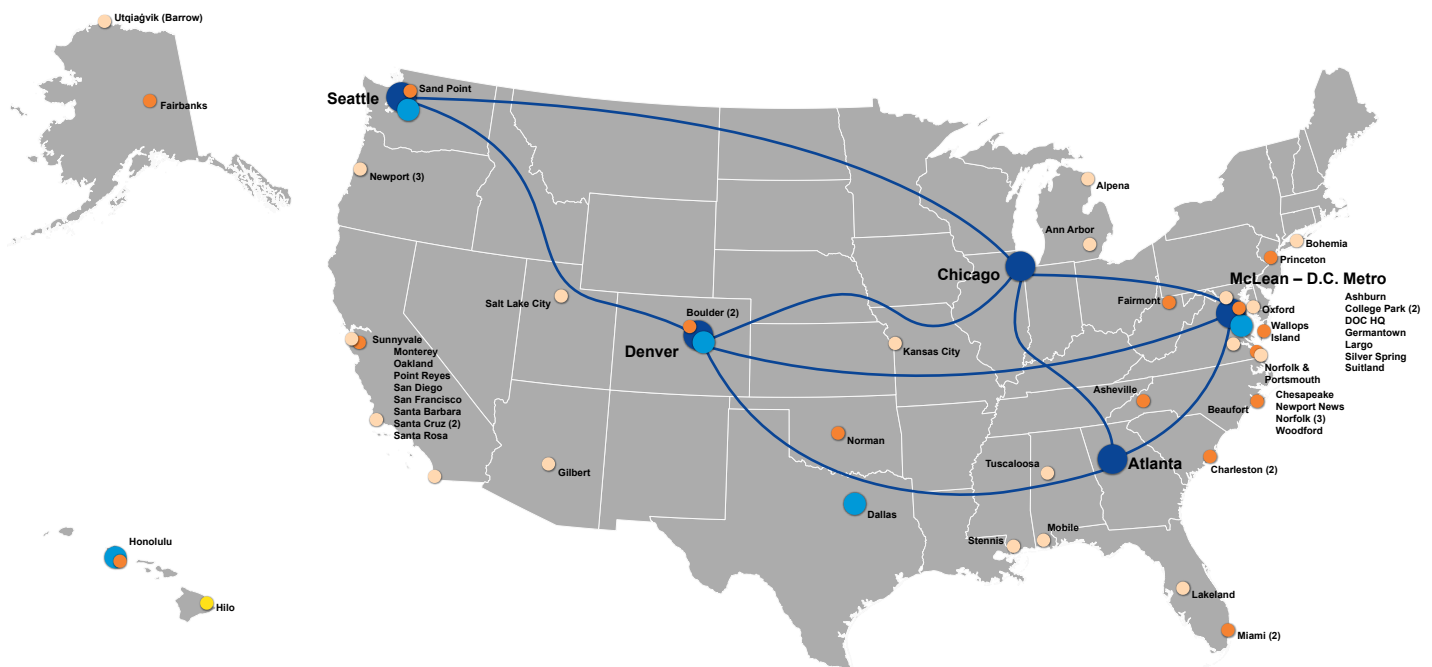
Engineers are also testing new hardware and software platforms in the N-Wave lab. As

hardware within the network reaches end-of-life, newer platforms need to be tested to ensure interoperability with the current infrastructure. Additionally, N-Wave is moving toward network automation to provide configuration consistency, simplify management and reduce errors, all of which result in a more stable network. Testing automation technology in the N-Wave lab before releasing it on the production network is critical for ensuring there are no unintended consequences.

Enabling the Advantages of a Structured Design Lifecycle

A structured design lifecycle offers many advantages to N-Wave, all of which are enabled

through use of the N-Wave lab. One of the advantages is lowering the total cost of network ownership while adding new technologies to an existing network, training staff, managing network performance and maintaining the network. Another is improving agility, which allows N-Wave to respond rapidly to changing operational needs. A final advantage of following a structured design lifecycle is increased availability and planned deployments that minimize the risk of downtime, as sound planning for day-to-day operations helps speed problem resolution. N-Wave's strategic use of the lab to realize these advantages and future benefits will keep N-Wave current with the latest technologies and capabilities.



- Network Core
- TICAP & VPN Concentrator Site
- Aggregation Site(s)
- VPN Backhaul Site
- Participant Site(s)

Network Changes and New Participants (October 1, 2019 – March 31, 2020)

Thunder Bay National Marine Sanctuary – Alpena, MI

N-Wave completed the installation to provide connectivity for the Office of National Marine Sanctuaries (ONMS) location in Alpena. This 100 mbps circuit is provided in partnership with Merit, Michigan’s regional research and education network.

NOAA Enterprise Data Center (EDC) – Ashburn, VA

N-Wave provisioned connectivity for EDC-Ashburn, located in the new zColo data center, via diverse, 10 gbps circuits.

NESDIS NOAA Center for Satellite Applications and Research (STAR) – College Park, MD

N-Wave migrated STAR from a legacy Silver Spring NOC infrastructure onto a dedicated, 20 gbps connection over the D.C. metro DWDM infrastructure, which was recently extended to the NOAA Center for Weather and Climate Prediction (NCWCP) in College Park. STAR previously relied on a 10 gbps connection that it shared with the National Weather Service.

Operational Secure Ingest System (OSIS) – College Park, MD

N-Wave provisioned a second 10 gbps Direct Connect to Amazon Web Services for OSIS.

Joint Polar Satellite System (JPSS) Common Ground System Operational Traffic Backup – Fairmont, WV, and Suitland, MD

N-Wave deployed a 1 gbps Layer 2 VPN circuit between NOAA’s Consolidated Backup facility in Fairmont and the NOAA Satellite Operations Facility (NSOF) in Suitland. The new connection provides redundancy for an existing AT&T circuit.

JPSS Common Ground System – Gilbert, AZ

N-Wave provisioned and tested a new 500 mbps link from the Northrop Grumman facility in Gilbert to N-Wave’s core node in Denver, CO, providing connectivity to Riverdale, MD, and NSOF. This connection supports JPSS-2 spacecraft instrumentation checkout activities.

NOAA Acquisition and Grants Office – Kansas City, MO

N-Wave migrated the NOAA Acquisition and Grants Office’s Eastern Acquisition Division, which is located in the Richard Bolling Federal Building in Kansas City, off a legacy MPLS connection and onto a 1 gbps N-Wave circuit.

Pacific Marine Environmental Laboratory (PMEL), the Alaska Fisheries Science Center (AFSC) and the Northwest Fisheries Science Center (NWFSC) – Newport, OR

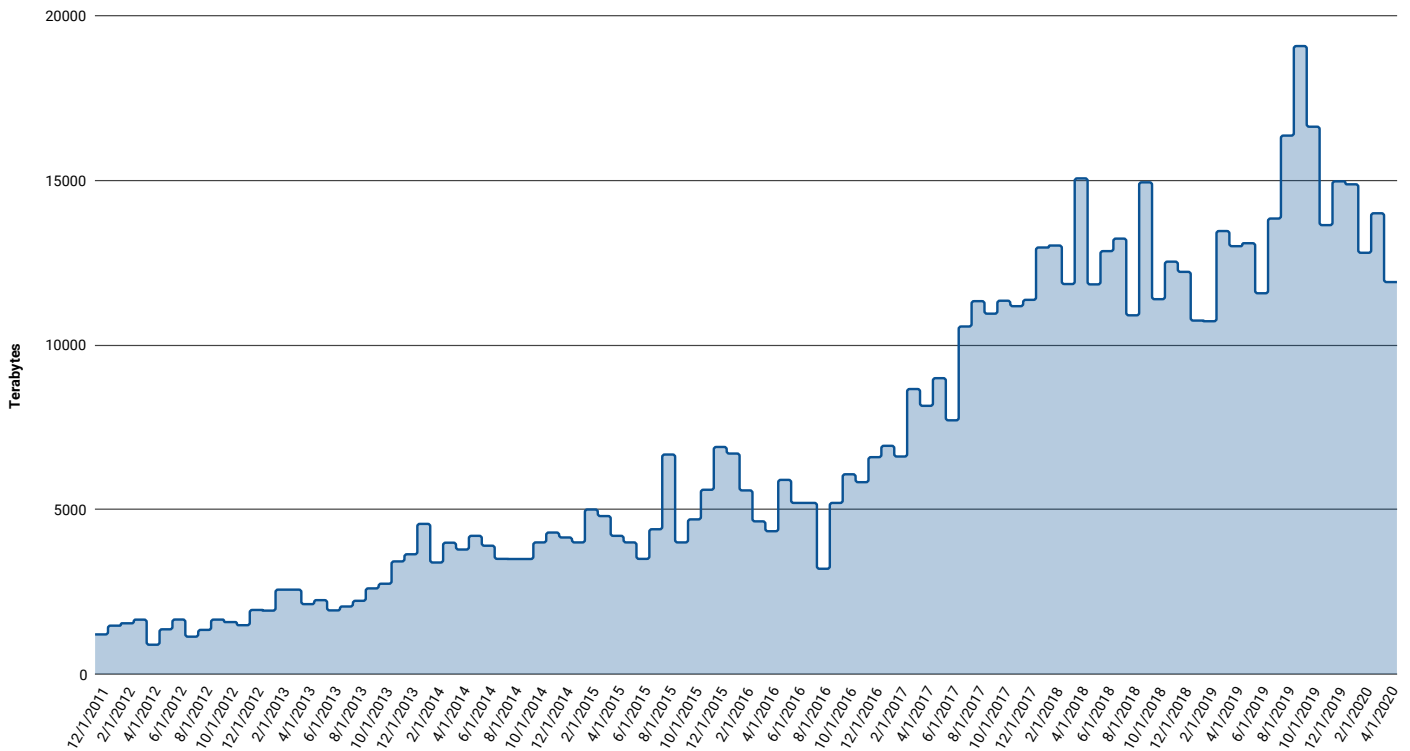
Building on dark fiber installed last year between the Office of Marine and Aviation Operations’ Marine Operations Center-Pacific (MOC-P) and Oregon State University’s Hatfield Marine Science Center (HMSC), N-Wave engineers connected the PMEL, AFSC and NWFSC facilities in HMSC to N-Wave over the existing 1 gbps circuit supporting MOC-P.

GOES-IO (Indian Ocean) – Seattle, WA

N-Wave deployed a TICAP peering connection in Seattle for a 20 mbps terrestrial circuit from Dongara, Australia, to support a legacy GOES satellite that was recently repositioned over the Indian Ocean. The downlink station in Dongara sends satellite imagery, telemetry, and command and control dataflows back to the Wallops Command and Data Acquisition Station (WCDAS) in Wallops Island, VA, and to NSOF.

N-Wave Network Performance Metrics

Network Traffic (December 2011 – March 2020)



While the overall trend has flattened, N-Wave continues to see traffic spikes as the NOAA Research and Development High Performance Computing System (R&D HPCS) expands and develops new partnerships. R&D HPCS's newest supercomputer in Starkville, MS, went into use in Q4 of FY19 and continues to send an increasing amount of traffic as it ramps up.

Following N-Wave's recently completed 100 gigabits per second upgrades, traffic levels are expected to rise as N-Wave continues to work with NOAA's Line Offices to upgrade the capacity of their connections to the backbone, thus enabling them to further leverage the national infrastructure. As of this publication, peak traffic reached 19.08 petabytes in September 2019.



Credit: NOAA.

N-Wave Enterprise Services Updates (October 2019 - March 2020)

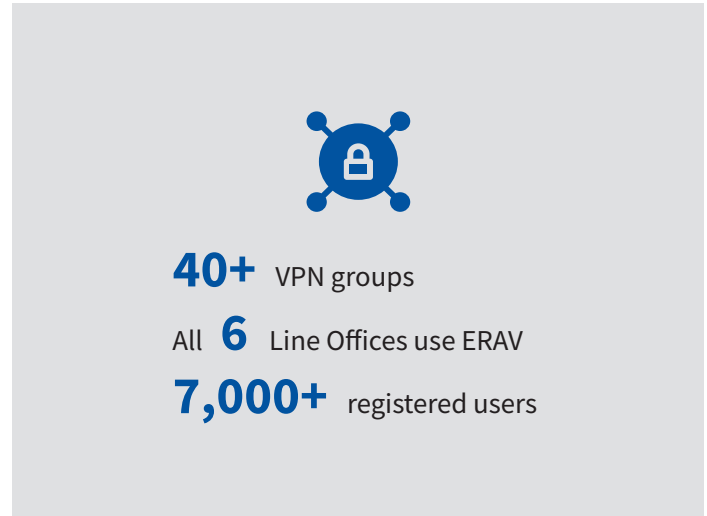
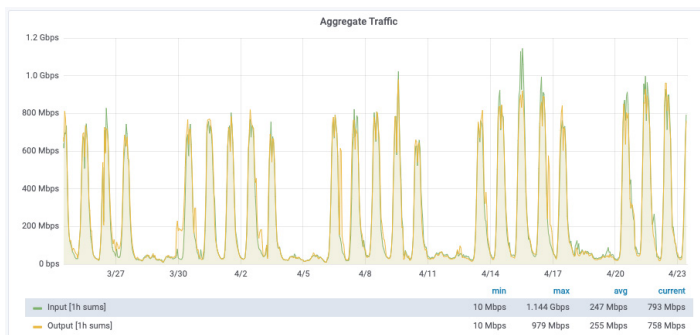
Enterprise Remote Access VPN (ERAV)

In response to COVID-19, ERAV has been the mechanism for N-Wave customers to continue to complete their missions while teleworking.

The ERAV service hardware and firewall licenses currently can support 10,000 users, with 8 gigabits per second (gbps) of available Secure Sockets Layer (SSL) bandwidth across the nodes in Denver and Washington, D.C. On the horizon, N-Wave will perform a major expansion of ERAV capabilities to support NOAA-wide use (20,000+ users) and up 50 gbps of available SSL bandwidth. This expansion is made possible through the [CARES Act](#) supplemental funding.

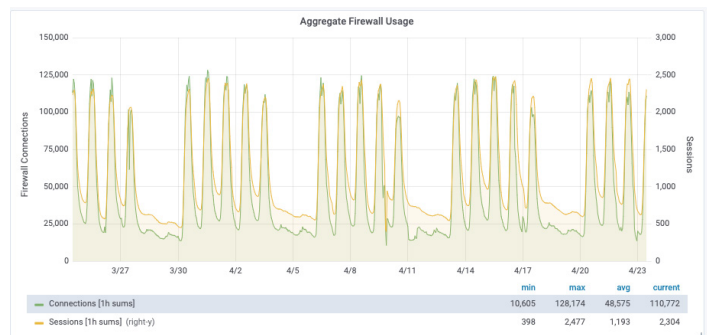
Customer migrations to N-Wave's ERAV service continue to move forward, with only a few groups remaining on the legacy VPN system. As customers move to ERAV, their users benefit from increased bandwidth and service redundancy.

With the Department of Defense anticipated to roll out changes to CAC certificates in July, N-Wave is prepared to support the new 16-digit UPNs in the identity certificates for ERAV. Engineers have already conducted testing with some Line Offices (LO).



Findings include:

- Old 10-digit UPNs will continue to work with ERAV until current CACs expire, but newly issued CACs will only have the 16-digit UPN.
- For LOs that use Active Directory for ERAV authorization, LO VPN administrators will need to deploy a new AnyConnect profile on user devices.
- For LOs that use N-Wave's database for authorization, N-Wave engineers will create user accounts using the 16-digit UPNs and then will coordinate with LOs to eventually remove the 10-digit accounts. LO VPN administrators will also need to deploy a new AnyConnect profile on user devices.



Aggregate traffic and concurrent sessions for N-Wave's VPN services. With a major shift to telework in response to COVID-19, these services are now key mechanisms for providing access to NOAA and DOC internal resources.

Enterprise Wireless

NOAA Enterprise Wireless continues to expand nationwide across the NOAA landscape. N-Wave engineers have deployed 953 access points at sites from Alaska to Florida and from California to North Carolina, with multiple locations in between.

Engineers are currently working to configure and deploy core wireless equipment at the NOAA Inouye Regional Center (IRC) data center in Hawaii. Core equipment in Denver, CO, and College Park, MD, will continue to support service deployments across CONUS, while the IRC will benefit from dedicated core equipment in support of its campus WiFi. Regardless of where they onboard, wireless users will be able to easily roam between Hawaii and CONUS sites.

As the service expands to new locations, users continue to benefit from a growing list of sites at which they can seamlessly connect to WiFi, reducing IT overhead and providing a better customer experience. Customers can also submit tickets for conference accounts to support WiFi access at large and small gatherings.

Recently customers have asked to connect Google Meet hardware to WiFi using MAC address authentication in support of their conference rooms. This has been successful with those devices working well using NOAA Enterprise Wireless.



20+ service locations spanning the U.S.

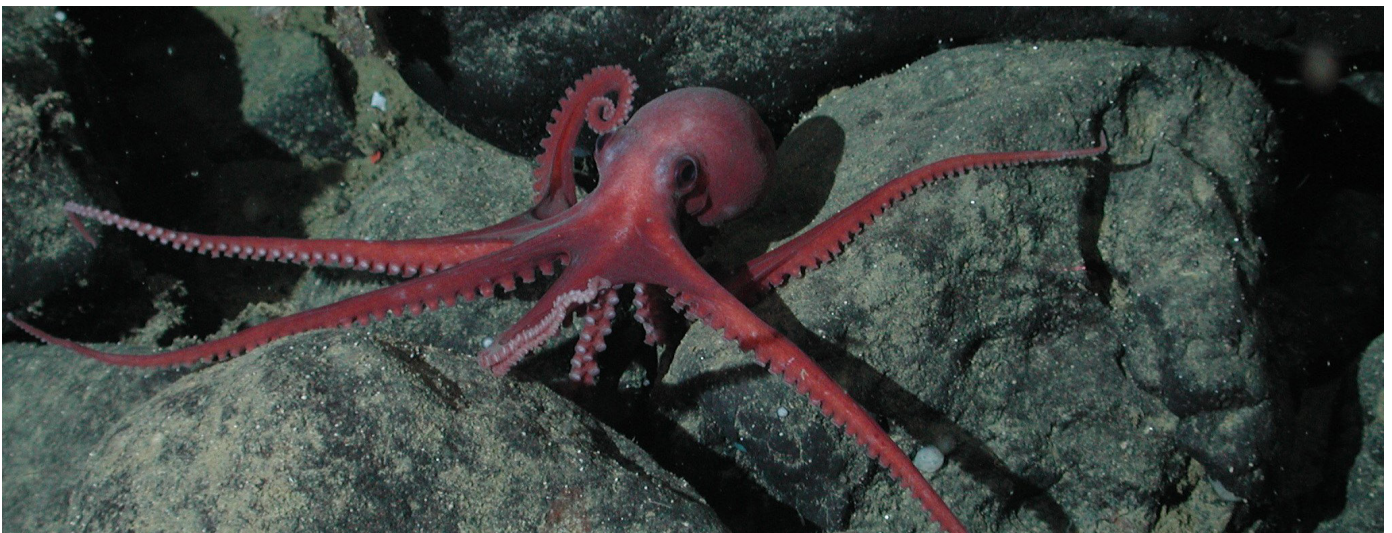
12 states with service locations

950+ wireless access points

New Enterprise Wireless Locations

The following Enterprise Wireless service locations were added between October 2019 and March 2020:

- National Geodetic Survey Testing and Training Center – Woodford, VA
- NOAA OCIO Corporate Services – Kansas City, MO
- OMAO HQ – Silver Spring, MD
- SSMC Remaining Spaces in Buildings 2 and 3 for 100% coverage at SSMC (see p. 15) – Silver Spring, MD
- Thunder Bay National Marine Sanctuary – Alpena, MI



Credit: NOAA/Monterey Bay Aquarium Research Institute.

Managed LAN

The service provides full LAN management down to the access port, with N-Wave taking care of all configuration, management and patching of the switches. The FISMA system boundary exists at the access port, so the customer is only responsible for end devices that plug into the switches. This reduces the scope of a customer's Assessment and Authorization, or A&A, because the network exists within N-Wave's system boundary.

Depending on the networking needs of tenants at a given site, N-Wave can deploy a single switching architecture that supports NOAA Enterprise Wireless and multiple customer LANs using logical separation. This frees up rack space, lowers power and cooling needs, and reduces management overhead. This service provides a single point-of-entry through N-Wave's Service Desk for 24x7 Tier 1 support, along with expert troubleshooting from a centrally managed and geographically dispersed



6+ Managed LAN deployments since the service was launched in 2019

14+ additional sites use a form of the Managed LAN service in support of NOAA Enterprise Wireless

190+ switches deployed

team of N-Wave Tier 2 and 3 network engineers. Networks large and small also benefit from robust configuration management, monitoring, alerting and diagnostic tools, with end-to-end visibility for network troubleshooting.

Customers who are interested in any of these service offerings, or would like additional information, can submit the new service request form:

<https://sn-tools.grnoc.iu.edu/new-noaa-request/>



Credit: NOAA/NMFS/OPR.

NOAA Enterprise Wireless Provides 100% Coverage at SSMC

NOAA employees and guests at the Silver Spring Metro Center (SSMC) now benefit from campus-wide WiFi coverage offered by a single solution—NOAA Enterprise Wireless.

N-Wave engineers recently completed a project to supplement SSMC's existing WiFi coverage, adding 320 access points (AP) and 17 switches. This was a major undertaking accomplished through the dedication and efficiency of engineers who continued to support other N-Wave network services while performing a major equipment installation.

Now with a total of 589 APs across the SSMC campus, NOAA Enterprise Wireless covers all NOAA spaces at SSMC and offers users the same connectivity experience campus-wide and at other sites with the service.

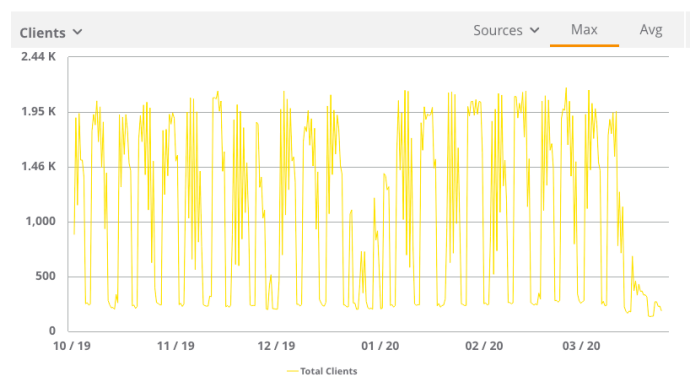
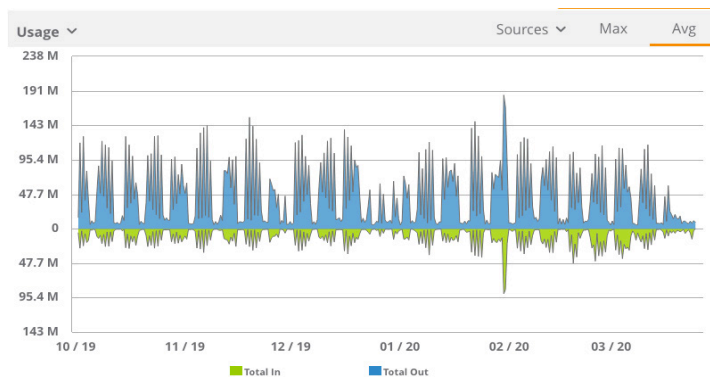
This marks the first time SSMC has offered a single wireless solution to the entire campus. The benefits include:

- Seamless campus-wide mobility for NOAA employees, not requiring re-authentication.
- WiFi conference accounts that provide guest



connectivity for events can span multiple SSMC buildings and multiple sites. A single conference account created for a large event can be used anywhere across NOAA where the Enterprise Wireless service is deployed.

- Improved WiFi connectivity in conference rooms, allowing some internet-only networks to be turned down.
- Single point of entry for opening wireless support tickets, which reduces IT overhead and user frustration.



Current WiFi client and usage metrics reflect the situation surrounding the COVID-19 outbreak, with mass telework being performed across NOAA. When NOAA returns to full on-site operations, employees and guests at SSMC will benefit from the WiFi coverage provided by the 589 access points across the four campus buildings.

N-Wave Security Updates and New Initiatives

Assessment and Authorization Takeaways

N-Wave continues to see rapid growth in both its customer base and service catalog, further enabling NOAA's mission. However, this pace brings new security challenges that must be continually monitored and managed through a robust security program.

One way we address these challenges is through an extensive audit and penetration test as part of N-Wave's yearly Assessment and Authorization (A&A) process, conducted by skilled and objective third parties. The N-Wave security team takes this process seriously and looks to maximize value each year by uncovering real gaps and areas for improvement.

This year, as a result of A&A outcomes, the team formulated major projects around improving configuration management. One of these projects surrounds the development, auditing and enforcement of secure baseline configurations across the entire N-Wave network infrastructure. Once complete, the result will be a much more uniform security posture across all network and management devices.

Another project involves enhanced configuration management of staff workstations and laptops used to manage the N-Wave infrastructure. Improving the security protections and management of these devices will have a tangible effect on the stability and supportability of the N-Wave network infrastructure that serves NOAA's diverse missions.

ICDs / IP Attribution

As NOAA's enterprise network transport provider, N-Wave assumes a unique responsibility for the accounting and tracking of Internet Protocol (IP) addressing used by its NOAA customers. This puts us in a critical partnership with NOAA's Cyber Security Division, who must quickly attribute malicious and adversarial network traffic to individual NOAA FISMA systems. NOAA Cyber must often work with N-Wave to perform such IP attribution, so that the responsible system owner can take appropriate action.

Keeping IP attribution up to date is a huge effort for a large and dynamic network such as N-Wave, especially given historical decentralization of these efforts. The establishment of NOAA's Trusted Internet Connections and integration with the N-Wave backbone set the stage for NOAA-wide interconnectivity and utilization of a centralized enterprise network. This is a large project that will continue to evolve, but one recent effort to improve accuracy of IP attribution involves Interface Control Documents (ICDs). These documents describe the technical details of the interconnections between N-Wave and its NOAA customers and clearly define demarcation points.

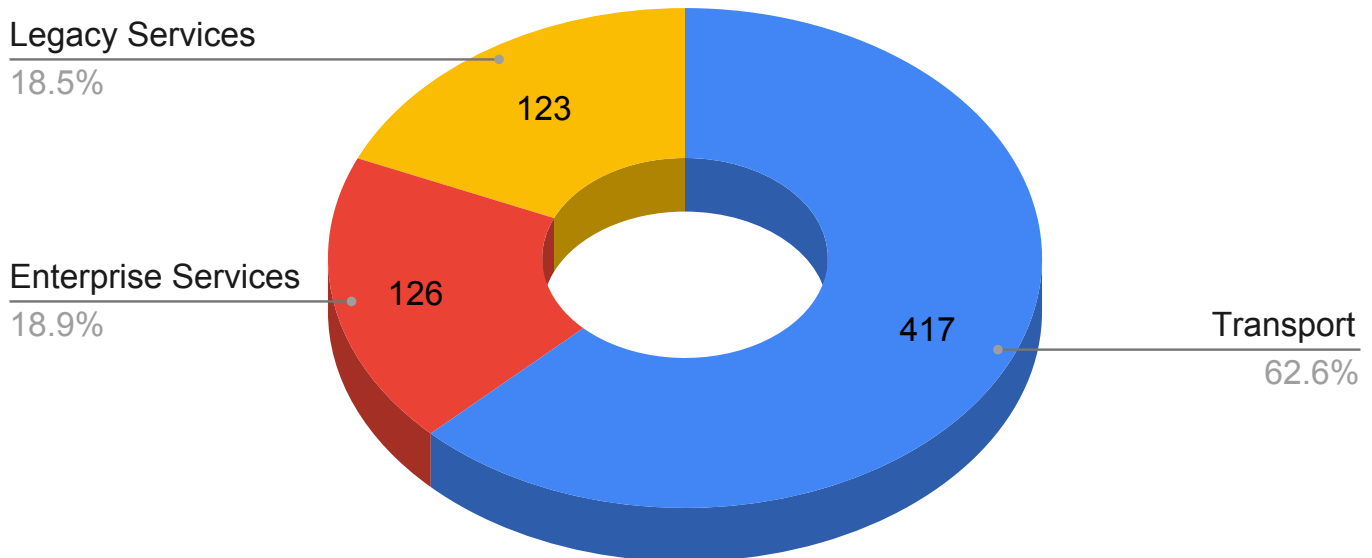
ICDs have always been an important component of N-Wave's engineering efforts, but we have recently put a renewed emphasis on them – now requiring signatures from System Owners and Information System Security Officers from both sides. These signatures provide critical acknowledgment of responsibility for the corresponding IP address space. After obtaining signatures, N-Wave then passes these ICDs to Cyber's Enterprise Security Services for updated IP attribution. Through efforts such as these, we can continue to improve the accuracy of the IP attribution data and in doing so improve NOAA's ability to respond rapidly and effectively to security incidents.

Network Operations Center Metrics and Updates

The N-Wave Network Operations Center (NOC) provides support 24 hours a day, 365 days a year. Support metrics gathered from October 2019 through March 2020 indicate that the N-Wave NOC opened 11,046 tickets. That number encompasses all incidents, service requests, change and maintenance events, and customer

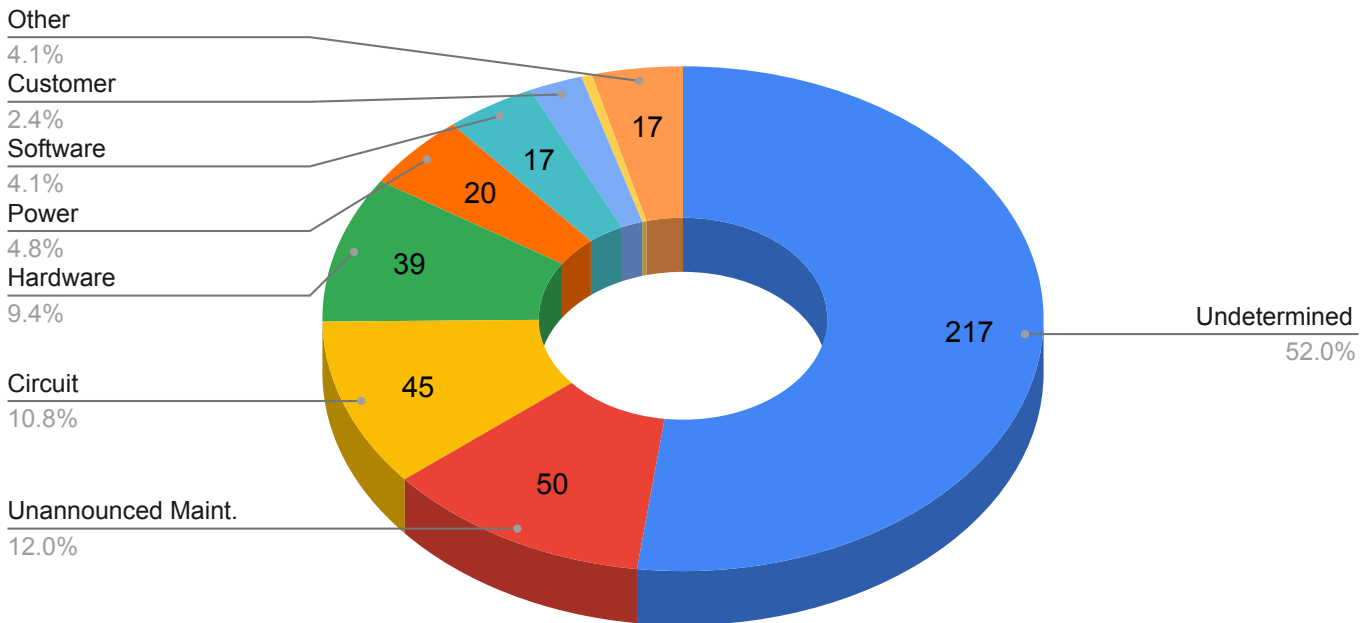
communication records, such as individual phone calls and incoming and outgoing email correspondence of the NOC. Service requests (22%) and communication records (68%) make up the bulk of those tickets, while incidents and changes account for only 10% of tickets.

Incidents by Service



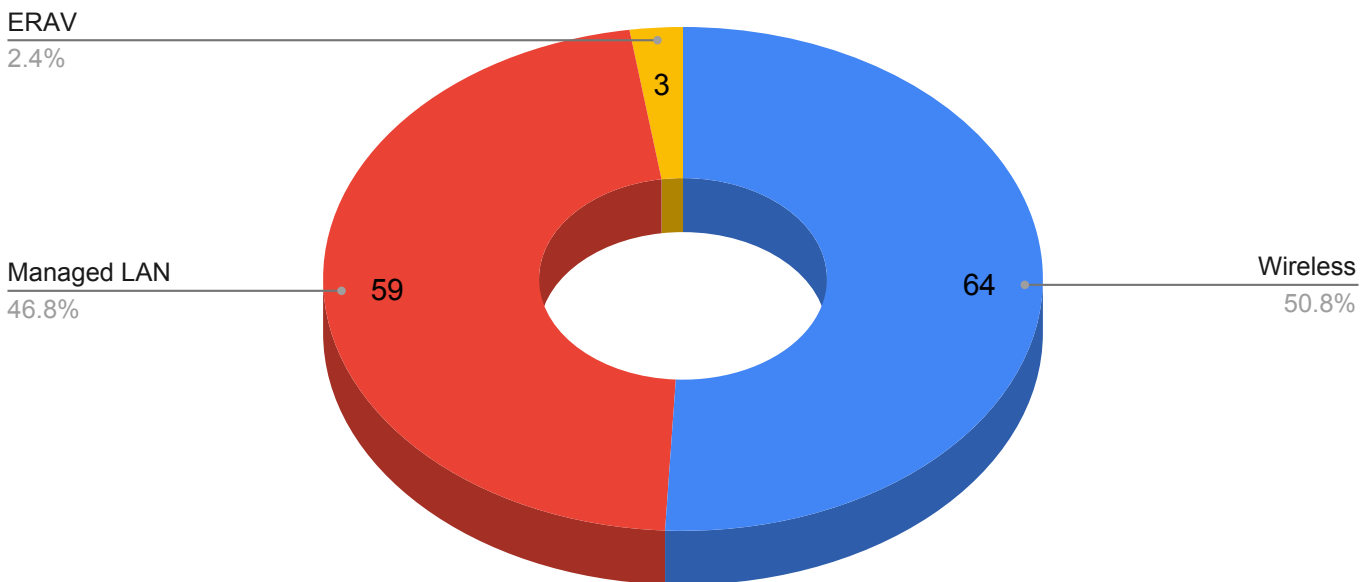
This shows the high-level breakdown of incidents by service, namely Transport, Enterprise Services and Silver Spring's Legacy Services. As Legacy Services continue to migrate into N-Wave's Enterprise Services portfolio, the NOC expects the number of Legacy Services incidents will decrease, while the portion of Enterprise Services incidents will grow.

Transport Incidents by Category



This is a high-level breakdown of the 417 Transport incidents. Undetermined incidents mostly comprise very brief observed outages for which a vendor is not able to determine the cause. Unannounced maintenance events typically occur when customers or providers do not announce the maintenance to N-Wave. As a result, the NOC is unable to notify the community and instead has to treat the event as an incident separate from standard maintenance events. Circuit incidents are outages caused by fiber damage, bumped fiber, vandalism or cut fiber.

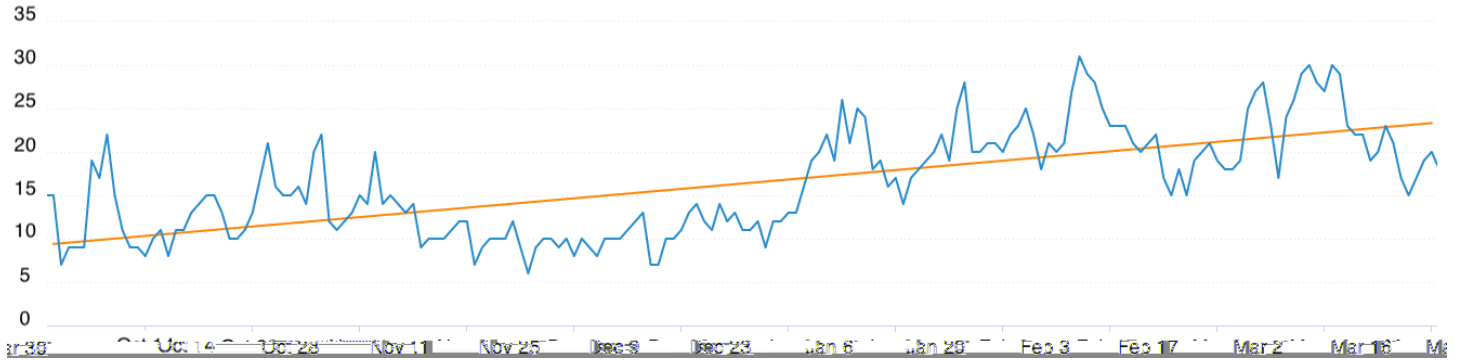
Enterprise Services Incidents by Category



This represents 126 incidents related to N-Wave Enterprise Services. NOAA Enterprise Wireless and Managed Local Area Networks (LAN) are the most widely deployed services, accounting for more than 97% of Enterprise Services incidents. Since the recent launch of the Enterprise Remote Access VPN (ERAV) service, few incidents have been reported.

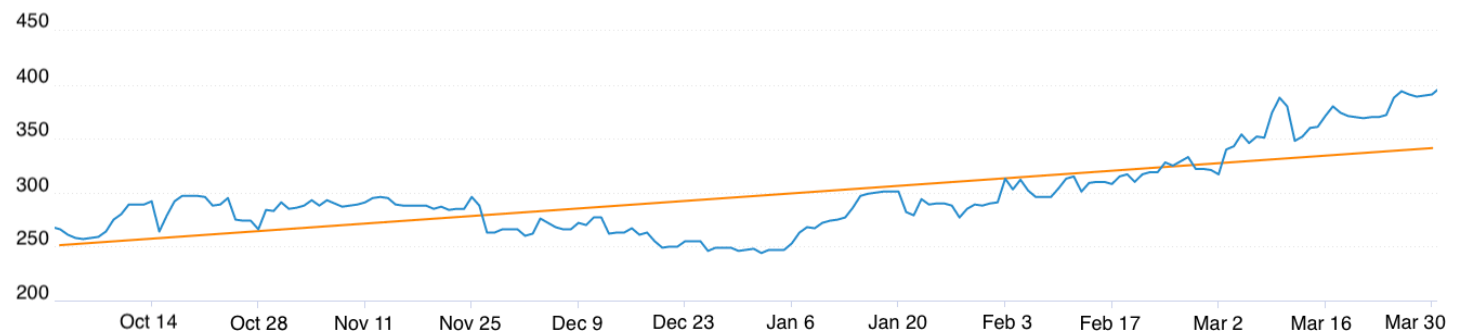
Trends in Incidents and Requests

Active Incidents



The Active Incidents metric shows the trend of all incidents active on any given day. The dip from late November 2019 to early January 2020 marked the holiday season, followed by an upward trend as business resumed post-holidays.

Active Requests



The Active Requests metric shows the trend of all catalog tasks active on any given day. The line reflects the overall rate of growth in active requests as N-Wave extends its services to new sites and customers, with a significant jump in March due in part to an influx of requests for VPN services to accommodate mass teleworking across NOAA in light of COVID-19.

N-Wave Welcomes New Staff



With the integration of the NOAA Boulder Network Operations Center (BNOC) into N-Wave, Tom Carey now supports the Department of Commerce Boulder campus under the Office of the Executive Director and is beginning in the role of the N-Wave federal manager of the transport team. In his new role with N-Wave, he is responsible for managing transport services and providing technical oversight from service request to service delivery. N-Wave anticipates Tom will fully transition out of his campus role and into the N-Wave team beginning FY21. Tom has worked in NOAA since 2004, most recently as the manager of the BNOC. Before that he was the IT Operations lead for the National Centers for Environmental Information (NCEI) in Boulder. He has a bachelor's degree in computer science from the University of Colorado.

Sean Gambarani has been hired as a network engineer with N-Wave, providing support for N-Wave services. He is currently focused on the National Centers for Coastal Ocean Science (NCCOS) campus LAN migration project. Sean joined N-Wave in November 2019 and is based in Charleston, SC. He previously worked as a network engineer for an IT service management company in Falls Church, VA. He has a bachelor's degree in information technology from George Mason University.



Daniel Hurley has been hired as an N-Wave network engineer. His current focus is providing support for the Enterprise Wireless and Managed LAN services, including two upcoming customer migration projects in Fairmont, WV, and Sand Point, WA. He is also working on developing training materials and standard operating procedures documentation for the N-Wave services team. Daniel joined N-Wave in August 2019 and is based in Seattle, WA. Prior to that, he was employed as a network engineer for a software development company. He has a bachelor's degree in information technology with a security emphasis from Western Governors University.

Logan Smith has joined N-Wave as a cyber security analyst, supporting the program's security posture. His role includes security incident response, IP address attribution, account management, vulnerability scanning remediation, and the annual Assessment and Authorization process. He joined the team in December 2019 and is based in Boulder. Logan has an associate's degree in cybersecurity and cloud computing from Front Range Community College. His background includes serving as a Tier 1 IT service desk technician and IT project manager assistant at the college.





Paul Tjihe has been hired as a network engineer with the N-Wave services team. He provides support for the National Ocean Service, with a focus on projects and migrations to N-Wave Enterprise Services. He joined the team in March 2020, and is based in Silver Spring, MD. Paul previously worked as a network specialist consultant for the State of Michigan Department of Technology. He has a network engineering diploma in networking and telecommunications from Montplaisir University in Tunisia, and he has a Cisco Certified Internetwork Expert (CCIE) certification.

With the integration of the BNOB into N-Wave, Eugene Tsuno provides support to both the Boulder campus and N-Wave projects as a network and systems engineer. He currently provides dedicated support for the transition of legacy BNOB services into N-Wave and is working on an Infoblox IP address management project. He transitioned to the N-Wave team in January 2020 and is based in Boulder. Eugene worked for the NOAA BNOB since 2007. Before that he worked as a systems engineer for a mobile client software and network solutions company. He has a bachelor's degree in computer science from the University of California, Berkeley.



Zachary Wilson, also previously with the BNOB, has transitioned to the N-Wave team as a systems engineer. He primarily assists with device setup and maintenance, including preparing devices for testing in the N-Wave test lab. He transitioned to the N-Wave team in January 2020 and is based in Boulder. Before joining N-Wave, Zachary provided audiovisual and system administration support for the BNOB and records keeping support for NOAA's Earth System Research Laboratory. He has a bachelor's degree in physics with a minor in computer science from the University of Colorado Boulder.



Credit: NOAA/NMFS/OPR.

Upcoming N-Wave Outreach Events

Next N-Wave Stakeholders Summit

The N-Wave Stakeholders and Science Engagement Summit is a yearly gathering of NOAA's leaders, campus technology coordinators, data producers, data managers, information security officers, network engineers, researchers, scientists, and system administrators, along with N-Wave's partners from the scientific, research and education networking community. Those who attend – in person or virtually – have an opportunity to learn about:

- Current and future uses of NOAA's networks where increased data flows will drive capacity planning for network backbones and the TICAPs
- Expansion of current programs and new initiatives from:
 - NOAA Line and Staff Offices
 - Other federal government agencies
 - International partnerships
- N-Wave's new services and future plans
- New networking technologies and their possible application to better support NOAA's missions

The May 2020 N-Wave Stakeholders Summit was canceled due to the situation surrounding the COVID-19 outbreak. N-Wave initially asked its stakeholder community to save the dates for a rescheduled, face-to-face event in September 2020. After careful consideration of the current situation and the uncertainties of the next few months, N-Wave has decided to reprogram the summit for 2021. The event is now scheduled for February 23-25 at the Silver Spring Sheraton Hotel in Silver Spring, MD.

New NOAA Joint Technical Interchange Meeting

This is a new annual series of technical workshops for Line and Staff Office engineers—from the junior level through senior network engineers, network administrators and others who are involved with the technical direction of NOAA's networks.

The NOAA Joint Technical Interchange (JTI) meetings are designed so that each session will provide opportunities to share technical updates from Line and Staff Offices and N-Wave's partners, provide a forum for informal discussions between all participants and dive deeper into technical topics.

The inaugural meeting is scheduled December 2-3, 2020, and will be hosted from the David Skaggs Research Center in Boulder, CO, with plans for an engaging virtual experience and face-to-face participation. N-Wave anticipates the program will include discussions surrounding NOAA IP address management and a deep dive into IPv6 in light of the expected upcoming revisions to the OMB mandates.

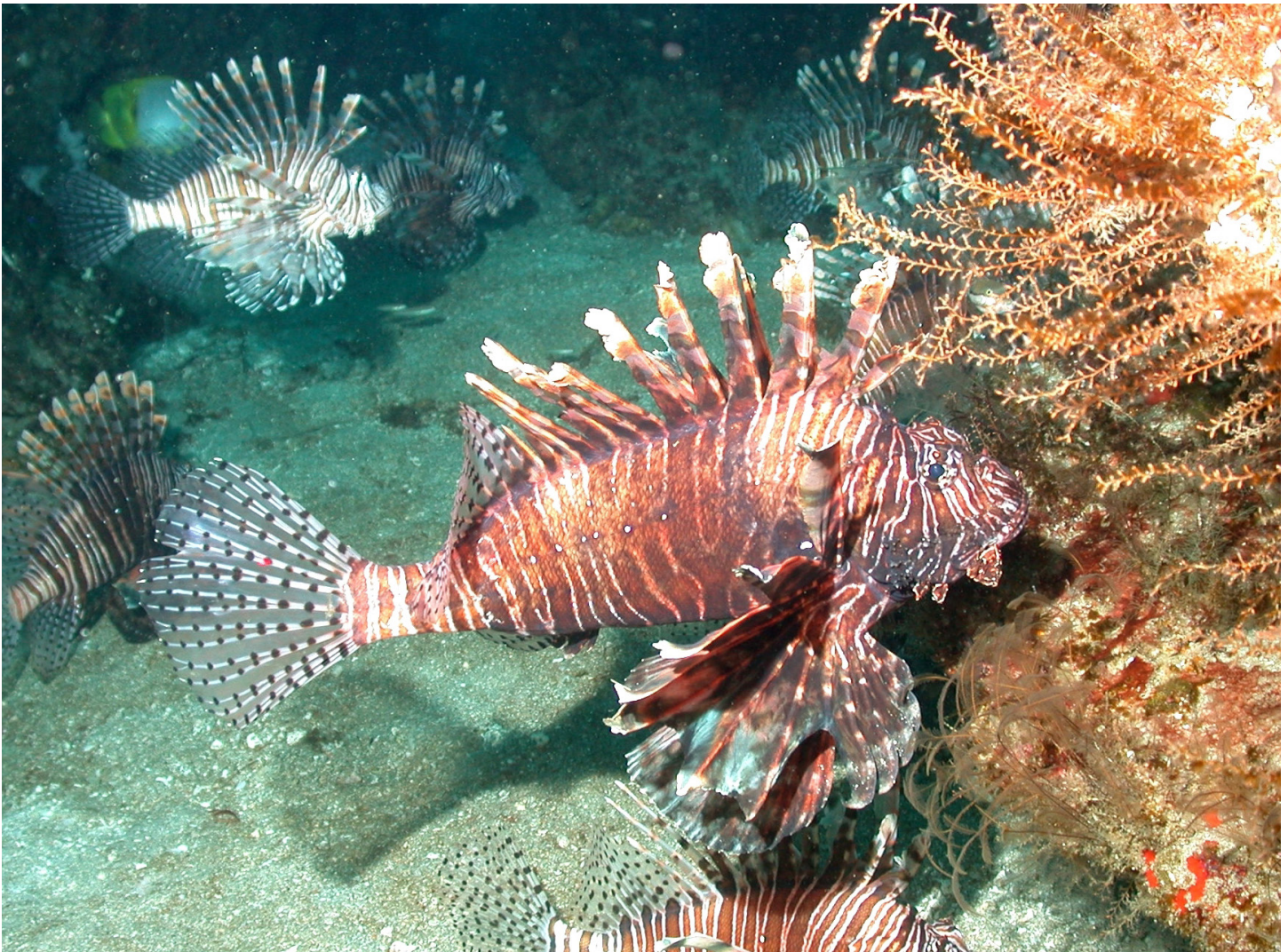
More Information

More information about N-Wave outreach events is available at: <https://noc.nwave.noaa.gov/nwave/public/events.html>

We will continue to post updated information to the site as we monitor travel advisories and other health and safety guidance surrounding COVID-19.



The banner features the N-Wave logo on the left, which includes the text "n-wave" in a stylized blue font and "NOAA ENTERPRISE NETWORK" below it. To the right, the text "STAKEHOLDERS and science engagement SUMMIT" is displayed in a bold, blue, sans-serif font. At the bottom left, the dates "February 23-25, 2021" and location "Silver Spring, MD" are listed. On the bottom right, the NOAA logo is visible.



Credit: NOAA Teacher at Sea Program.

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