ISSUE
19
May
2022

N-Wave News

About N-Wave

N-Wave delivers stable, secure, high-speed network services to enable the vast missions of its stakeholder community within the federal government.

Our national network infrastructure extends across the contiguous U.S., Alaska and Hawaii—reaching remote field sites, major campuses, data centers and supercomputing facilities. Combined with our scalable cloud solutions, robust catalog of enterprise managed services and advanced network operations, N-Wave supports all stakeholder missions with integrity, transparency and flexibility, and employs a unique partnership approach to provide the best customer experience.

The N-Wave Program Office operates under the Office of the Chief Information Officer within the National Oceanic and Atmospheric Administration. N-Wave is NOAA's network service provider and has expanded to serve other federal government agencies.

in this edition:

From the N-Wave Program Manager	P. 1
Customer Survey Feedback Results	P. 3
A Winning Partnership Combination in California	P. 4
N-Wave Makes Strides Toward IPv6 Transition	P. 6
Security update and New Initiatives	P. 8
Updates on Automating the N-Wave Network for Scalability	P. 9
Network Changes and New Participants	P. 10
New Notification Subscription Portal	P. 11
N-Wave Enterprise Services Updates	P. 12
N-Wave Network Performance Metrics	P. 14
Alaska Progress Update	P. 15
N-Wave Map	P. 16
Network Operations Center Metrics and Updates	P. 17
Research To Operations - N-Wave Lab Update	P. 19
N-Wave Joint Engineering and Technical Interchange (JETI) Meetings	P. 20
N-Wave Stakeholders Summit	P. 21
A Really Interesting, Very Short-lived Network - SCinet	P. 22
N-Wave Welcomes New Staff	P. 23
N-Wave Outreach Events	P. 25

From the N-Wave Director

Robert Sears

A common definition of a service provider is "an individual or entity that provides services to another party. The relationship is typically governed by a service agreement." This definition describes an expected service provider to customer dynamic which can create either an arm's length approach or more transactional relationship between provider and customer.

N-Wave operates much like a private sector business with a fully defined service catalog, cost model and associated levels of service, while working within the same federal parameters of its customer base (federal acquisitions, FISMA, annual appropriations, and federal hiring to name a few) that many providers do not. This sets the stage for a much greater understanding of customer mission requirements and the need for transparent and direct partnerships.

N-Wave is built upon partners within the science, research and education community. We leverage regional and national optical infrastructures and other transport services from partners depicted in the image below. These partners provide great visibility into their individual networks allowing N-Wave to engineer and deploy its nationwide infrastructure. These are true partnerships as the sharing of design, topology, operation, management and near- and long-term strategic plans ensures N-Wave has great transparency into the status of its underlying partners' infrastructures, availability of new services, upgrades and enhancements.

N-Wave is Built on Partnerships with the R&E Community

The term customer does not do justice to the relationship established between N-Wave and its service subscribers. When N-Wave team members engage, be it for new service requests, changes, troubleshooting or business-related items, the exchange is interactive and geared towards the understanding of customer missions. Our teams collaborate and share information across multiple technical, administrative and even programmatic areas to ensure delivery of a subscribed service or services. Our approach extends beyond the technical delivery point, which is where many provider relationships end, with both N-Wave and the subscribing program discussing the end goal and collaboratively seeking the most optimal approach. The relationship that really exists is not customer and provider but mission, and mission-enabler.

One last testament to our mission-enabling service position is the vast array of ancillary support the N-Wave team provides beyond the service level agreement. Our Joint Technical and Engineering Interchange (JETI) holds multiple events designed to provide opportunities to exchange technical updates across NOAA Line and Staff Offices, DOC Bureaus and N-Wave's network partners. Workshops, training and technical crosstalk's are geared towards the technical practitioners across our community and provide a wealth of resources. The N-Wave annual stakeholders meeting provides a range of topics across technical, management and administrative disciplines while the newly developed DOC/NOAA IPv6 Transition Coordination Team is targeting a very specific technical goal. All these events are designed to provide additional value to the wide range of missions within the N-Wave community, anchored in enabling partnerships and collaboration.

Customer Feedback Survey Results

In January 2022, N-Wave solicited feedback from its stakeholders to determine how its broad catalog of provided services are perceived. N-Wave is always looking for areas to enhance or improve its offerings and customer input and feedback play a key role in that effort. This survey also guides N-Wave's strategic planning efforts, as we work to expand our network capabilities and service offerings to better support our customer's missions. Overall, the survey responses help us to continue strengthening the collaborative relationships we have with each customer.

The following are examples of the responses received:

How do you feel about the amount of benefit provided by N-Wave overall?	83% responded with N-Wave providing a "Very High" or "Substantial" benefit
Which N-Wave services have you heard about? (i.e., WAN/TICAP, Enterprise Wireless, ERAV, LAN, Cloud Transport)	WAN/TICAP and ERAV were the most heard about with Cloud Transport being the option customers have heard least about
How satisfied are you with N-Wave services? (i.e., WAN/TICAP, Enterprise Wireless, ERAV, LAN, Cloud Transport)	All categories showed a "Very Satisfied" response with WAN/TICAP, ERAV and LAN leading the way, each having over a 50% increase compared to previous years
On a scale of 1 to 10, how likely are you to recommend N-Wave to another organization?	74% of respondents gave a "9-Likely" or a "10-Very Likely"
What other feedback, comments or unmet needs should N-Wave address?	The need for affordable cloud transport upgrades and more assistance with both LAN management and design were responses to this question. N-Wave is working to resolve these items, as we continue to look toward better optimization and enhancements to offer stakeholders.
Respondent Testimonials	N-Wave appreciates the complimentary responses about its staff and services. We strive to provide the best customer experience. Examples of responses provided include: • Tony Zhang provides superb responses and Adam Nemethy is a rockstar. • N-Wave has always provided great service. • The assigned points of contacts to our organization have been a huge asset. • N-Wave has been extremely helpful in providing network support and exploring how to assist with other issues.

A Winning Partnership Combination in California

Microsoft founder, Bill Gates, is once quoted as saying, "Our success has really been based on partnerships from the very beginning." N-Wave wholeheartedly believes in this concept and has experienced a similar journey when it comes to its existing partnerships.

Partnerships are N-Wave's most important asset and they help the program continue to offer high quality, highly scalable networking solutions and services to its federal agency and scientific, research and education partners across the country.

One such partnership has led to multiple opportunities for N-Wave's growth and expansion across the state of California. NOAA is a longtime member of the Front Range Gigapop (FRGP) with the initial relationship established to support the David Skaggs Research Center, in Boulder, CO. FRGP is a consortium of universities, research organizations, nonprofit corporations, government agencies, cities, counties, states and K-12 schools that cooperate to share wide-area networking (WAN) services. These WAN services include Internet2, intra-FRGP, commodity internet, caching and peering connectivity. The FRGP is one of several academic Regional Optical Networks (RONs) in the United States.

The Western Regional Network (WRN) is a multi-state partnership to provide advanced, robust high-speed networking for research, education and related uses. WRN is a collaboration of the Pacific Northwest Gigapop (PNWGP) in Washington (who is also a direct partner with N-Wave), FRGP in Colorado and Wyoming, the University of New Mexico on behalf of the State of New Mexico, the Corporation for Education Network Initiatives in California (CENIC), and the University of Hawaii. WRN serves the following states: Alaska, California, Colorado, Hawaii, Idaho, Montana, New Mexico, Oregon, Washington, Wyoming, with a fiber/terminus/pop at StarLight in Chicago. A member of any WRN partner is treated by the others as their member. This in turn allows N-Wave to work with the other WRN members for local networking partnerships.

Western Regional Network

Credit: CENIC

Through WRN, NOAA's N-Wave program and the FRGP began engineering efforts over six years ago with CENIC to support NOAA sites in California. This nonprofit organization operates the California Research and Education Network, a high-capacity network designed to meet the unique requirements of over 20 million users, including the vast majority of K-20 students together with educators, researchers and others at vital public-serving institutions. CENIC's Charter Associates are part of the world's largest education system; they include the California K-12 system, California Community Colleges, the California State University system, California's public libraries, the University of California system, Stanford, Caltech, USC, and the Naval Postgraduate School. At its node in Tijuana, Baja CA. - BN., CENIC connects with the University Corporation for International Development (CUDI), the Mexican research and education network.

This partnership led to N-Wave's ability to offer a much more affordable networking service for several of NOAA's offices in California than it had been able to do in the past. As several sites were interested in connectivity at the same time, N-Wave was also able to take advantage of economies of scale with more effective connectivity and cost efficient methods of network service. Specifically, the N-Wave network engineers worked together with CENIC and developed an aggregation site in Sunnyvale, CA, with diverse high bandwidth connections to the N-Wave core nodes in Denver, CO, and Seattle, WA. Customers would connect to the aggregation site via lower bandwidth connections. With the help of the WRN member partners, N-Wave was able to procure diverse 10G connections to its two core nodes.

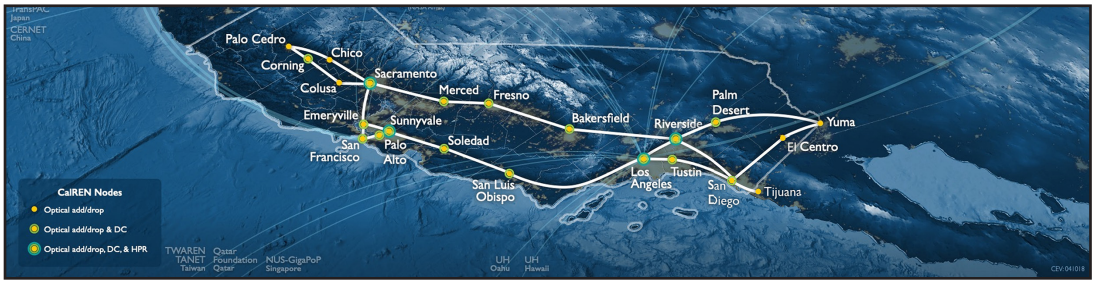
These connections allowed NOAA to build out in areas where no affordable existing connectivity existed while also allowing sites to easily move to higher bandwidth connections as needed. The aggregation design also allowed the multiple NOAA locations to pay for their own connectivity to the collector site but share in the cost of the aggregation service. The other benefit to this design was as the number of customers who joined the California aggregation site increased, the shared cost decreased for every NOAA customer at the aggregation facility. By virtue of using the aggregation facility, each site had a more robust connection to N-Wave than it could have had individually.

Today, N-Wave connects nine NOAA sites in California through this unique partnership, including:

- The Office of Marine Aviation and Operations
- Several Office of National Marine Sanctuaries sites
- The National Marine Fisheries Service Southwest Fisheries Science Center's sites
- The National Ocean Service's Office of Coastal Management

Innovation is key to a thriving partnership and this one is a particularly good one that has allowed N-Wave to enable NOAA scientists and researchers to expand their abilities, grow the accuracy of forecasting and predictions and so much more. The cost savings from these projects now go toward helping NOAA's overarching mission – the understanding and prediction of our changing environment; sharing that knowledge and information with others; and, conserving and managing coastal and marine ecosystems and resources.

California Research and Education Network



Credit: CENIC

N-Wave Makes Strides Toward an IPv6 Transition

N-Wave has had a productive year developing its IPv6 transition plan, while building collaboration within the various Department of Commerce (DOC) Bureaus and National Oceanic and Atmospheric Administration (NOAA) Line Offices to provide guidance and support as they too move toward this goal. As noted in the N-Wave News 2021 spring edition (pgs. 19-21), all federal agencies must comply with the Federal Office of Management and Budget's (OMB) Memorandum (M-21–07) to complete a multi-year transitional timeline to IPv6-only networks.

In its opening paragraph, M-21-07 sets out the issue and its solution for the federal government. "IPv6 is the next-generation Internet protocol, designed to replace version 4 (IPv4) that has been in use since 1983. Internet Protocol (IP) addresses are the globally unique numeric identifiers necessary to distinguish individual entities that communicate over the Internet. The global demand for IP addresses has grown exponentially with the ever-increasing number of users, devices, and virtual entities connecting to the Internet, resulting in the exhaustion of readily available IPv4 addresses in all regions of the world."

With this historical framework in mind, N-Wave is providing leadership for the transition efforts and will be sharing guidance and resources to offer best practices and assistance to Bureaus and Line Offices.

In January, Robert Sears, N-Wave's Director, was appointed as the Chair of the Federal IPv6 Task Force. The Federal IPv6 Task Force was established by the Federal CIO Council with the role to assist and coordinate agency activities in response to OMB's IPv6 policies. The Task Force's extensive technical and policy experience with IPv6 enables continuity of knowledge to help integrate the United States Government's IPv6 activities with those of the worldwide internet community. The Federal IPv6 Task Force's main goals are to assist the federal transition to IPv6-only in support of OMB's M-21-07 mandate through:

- Guidance and resources such as implementation plan templates, acquisition resources, project charters, potential pilot solutions and best practices and lessons learned from across the federal government.
- Regular engagement and outreach to government agencies via interagency meetings and summits to bring together IPv6 transition managers and IT modernization staff and provide answers and solutions to agency challenges.
- Engagement with industry and key vendors, including cloud service providers, to ensure that IPv6 products are available and meet federal requirements.
- Engagement with science, research and education communities to support IPv6 adoption.

In concert with the Federal IPv6 Task Force and a working sub-group that created an IPv6 Transition Planning Guidance document, NOAA's N-Wave is supporting activities at the agency-level for the IPv6 implementation efforts, including:

- Designating an agency-wide IPv6 integrated project team
- Publishing an IPv6 policy
- Identifying opportunities for IPv6 pilots; and,
- Developing an IPv6 implementation plan

N-Wave's own IPv6 implementation planning efforts are in full swing with a variety of efforts already underway. With N-Wave's role as NOAA's network service provider, a NOAA IPv6 Transition Project Charter was designed and approved by the CIO Council. This Project Charter has a specialized scope in place allowing for N-Wave to provide guidance to NOAA Line Offices for transitioning to IPv6 through a defined NOAA IPv6 Transition Coordination Team. Further integration of the team to include DOC bureau staff allowed for a larger membership with the knowledge, skills and abilities to provide a coordinated approach to the IPv6 transition.

This new DOC/NOAA IPv6 Transition Coordination Team is now holding regular bi-weekly meetings to discuss any updates or changes to the OMB mandate, troubleshooting issues or concerns, and sharing resources and information that can provide the most benefit to this networking community.

The finish line is 2025, when at least 80% of IP-enabled assets on all Federal networks are operating in IPv6-only environments. N-Wave looks forward to working with our federal agency partners and stakeholders to meet this deadline and provide a better networking experience to help support the important life-saving and critical missions of both the DOC and NOAA.

Check out these resources to help with the IPv6 transition effort:

Federal IPv6 Task Force - Additional resources, including templates, tools, and training resources are available on the IPv6 Federal Task Force OMB MAX Webpage. These materials are available to those with .gov or .mil email addresses. Information about the Task Force is maintained through both the Fedv6 Deploy listserv and the CIO Council's Cloud & Infrastructure Community of Practice (C&I CoP). To contact the Task Force directly, send an email to dccoi@gsa.gov.

N-Wave JETI Resources

- Internal Google Drive (must have a .gov or .mil email address to obtain access)
- NOAA JETI Public Site

Credit: NOAA/NESDIS/NODC

Security Update and New Initiatives

IPAM Web Interface Release
One critical function of a network service provider such as N-Wave is Internet Protocol Address Management or IPAM. This includes the assignment, tracking, preservation and reclaiming of IP addresses used by the service provider's customer base. IPAM has significant security implications, as an organization's ability to respond adequately to security incidents is directly tied to how accurately it tracks and manages its customer addressing.

For many months, the N-Wave team has been working to streamline and standardize IPAM functions in an effort to improve the accuracy of IPAM data and disseminate that data more effectively and rapidly to stakeholders. One key component of this effort is the development of a new IPAM web interface, available to all NOAA stakeholders via NOAA's centralized Identity, Credential, and Access Management (ICAM) authentication. We are pleased to announce the first version of the new IPAM web interface is now available at the following URL: https://ipam.nwave.noaa.gov

IPAM needs additional work before the system reaches full functionality, namely a programmatic integration with the Cyber Security Assessment and Management (CSAM) system to ingest key FISMA system metadata to be used in incident response. Nonetheless, this initial version represents a huge milestone towards improving NOAA and the Department of Commerce's IPAM capabilities.

Accelerated Vulnerability Scanning
As most government security and system administrator factions know, the Department of Homeland Security released Binding Operational Directive (BOD) 22-01, which requires aggressive (14-day) remediation timelines for any vulnerabilities published in the federal Cybersecurity and Infrastructure Agency's (CISA) Known Exploited Vulnerabilities catalog.

For N-Wave, this required a substantial overhaul to vulnerability scanning and remediation workflows, as these were previously based on a one-month cycle due to the vast number of devices comprising the N-Wave operational network. After much effort, N-Wave has migrated successfully from a monthly to a weekly scan cycle for the entire network in an effort to better respond to BOD 22-01 timelines.

Overall, this results in tighter vulnerability management and reduced mitigation timelines, significantly shrinking the attack surface of the operational network.

RADb Data Management Leveraging Automation
In the early days of the internet, security was very much an afterthought. The tendency was to completely trust routing protocols such as the Border Gateway Protocol (BGP), as these were operated by a small set of trusted backbone providers and attacks on it had not yet been envisioned or executed. Fast forward to today, and we routinely see crippling attacks launched against BGP, which can result in large volumes of traffic being diverted away from intended destinations.

One routing security mechanism designed to protect BGP is known as an Internet Routing Registry or IRR, in which routes and their origin Autonomous System Numbers (ASNs) must be registered by the originating entities. This allows providers to query the IRR to ensure traffic being received is originating from the expected ASN.

Perhaps the biggest and most widely used IRR is RADb. N-Wave (along with most other network service providers) has route objects registered in RADb, but historically this has been maintained by upstream peers on N-Wave's behalf. Recently, N-Wave has kicked off a project to manage its RADb entries directly using automation tools which will help ensure accuracy of the registered data.

What does all of this mean for providers? It means the increased ability for providers to trust, rely on and make operational decisions about the N-Wave data in RADb, which ultimately results in better routing security.

Updates on Automating the N-Wave Network for Scalability

Almost a year and a half ago, the N-Wave newsletter explained the near- and long-term objectives for automation on the N-Wave network with a solution through its partnership with Indiana University's Global Network Operations Center (GlobalNOC). (See Fall 2020 N-Wave News, p. 9). N-Wave has made significant progress on both of these automation goals.

The GlobalNOC automation tools combine both open source and proprietary tools, leveraging the model of the network maintained in the GlobalNOC Database to create device configurations. In addition, the GlobalNOC's automation tools give the ability to create straightforward mechanisms for repeatable tasks that update and deploy device configuration changes and monitor for configuration deviations.

GlobalNOC's automation tools include:

- AWX - the open source, community project version of Ansible Tower - provides a centralized location to launch playbooks and execute on different devices.
- GitHub Enterprise - stores the different playbooks for AWX as well as the templates used to create the device configurations.
- GlobalNOC Network Automation Tool (GNAT) - provides an interface to integrate the GlobalNOC Database, GitHub Enterprise, N-Wave's ticketing system and AWX into a single interface for engineers to interact with. Engineers can select specific devices and branches in GitHub enterprise, execute the proper AWX playbook and display the results. Optionally, it can require a ticket and update that ticket with changes pushed to the devices. GNAT generally is used for things that "are the same" across many or all devices (for example - NTP or RADIUS).

Near-term goals for automation:

Baseline Standardization	Mass Changes Across Devices	Software Updates
N-Wave now enforces a baseline configuration standard across more than 400 devices for the transport and services groups using GNAT. Currently, almost 300 lines of configuration on each device are managed through GNAT and monitored for deviations. Increasing the amount of baseline standardization across these devices will continue.	GNAT also provides bulk changes across the 400 managed devices, including password updates, vulnerability fixes and other required changes. These changes can be pushed out per device, role, function and type.	Utilizing some of the core aspects of the automation system, and custom implementations from GlobalNOC, device upgrades are now fully automated and verifiable. For example, engineers can select a node and change the code version, with checks to verify network configuration integrity post-upgrade (e.g. interface and Border Gateway Protocol (BGP) status). This work dramatically reduces the time engineers spend updating devices and verifying correctness once complete.

Long-term goals for automation:

Building New Configurations	Reporting on Changes
With GNAT's usage, the new device's base configuration is automatically generated based on information in the GlobalNOC Database and other services it references.	Both the software update and the base configuration aspects of automation utilize a new library written by GlobalNOC. The "GlobalNOC Maintenance Sanity Checker" is a library integrating into all of the different elements of the GlobalNOC automation suites. This library will expand over time to validate more network services. Currently, it validates both interface state and BGP states after maintenance is complete. The goal is to warn engineers if BGP peer states or interface states do not return to the pre-change state.

Network Changes and New Participants

(October 1, 2021 – March 31, 2022)

National Marine Fisheries Service (NMFS)

The Anchorage Federal Building - Anchorage, AK:

NMFS migrated from their existing connectivity in Anchorage to an N-Wave 100 Mbps connection.

Office of Law Enforcement Alaska Enforcement Division Kodiak Office - Gibson Cove, AK:

NMFS migrated from their existing connectivity in Gibson Cove to an N-Wave 10 Mbps connection.

National Ocean Service's Office of National Marine Sanctuaries (ONMS)

ONMS has an ongoing project to migrate all sites to N-Wave connectivity.

Olympic Coast National Marine Sanctuary (OCNMS) - Port Angeles, WA:

The OCNMS migrated to an N-Wave 100 Mbps connection.

Stellwagen Bank National Marine Sanctuary (SBNMS) - Scituate, MA:

The SBNMS migrated to an N-Wave 100 Mbps connection.

Department of Commerce (DOC)

The Bureau of Industry and Security (BIS) - Sterling, VA:

BIS migrated to a 500 Mbps Trusted Internet Connection and N-Wave provided diverse 10 Gbps connections to McLean, VA, and Ashburn, VA.

Turned Down Sites

National Ocean Service's Office of Response & Restoration (OR&R) Santa Rosa, CA:

Due to the OR&R moving out of the location, the Santa Rosa site was closed and connections were removed.

New Notification Subscription Portal

N-Wave has a new and improved system for providing email updates to its customers from the N-Wave Network Operations Center (NOC). This will launch on June 1, 2022 and is called the N-Wave Notification Subscription Portal. This new system will take the place of the current system in use now and provides customers with a better resource for staying connected with N-Wave.

Email alert updates from the N-Wave NOC provide information about technical issues, such as routine scheduled maintenance at a specific location, outages that may/may not affect systems and services and other issues. It provides an important communication tool for connecting with our customers.

Many of N-Wave's customers already receive email alerts from the N-Wave NOC today, but have limited flexibility in determining what is received in those updates. The new Notification Subscription Portal gives customers that flexibility and will allow them to set as many rules as they'd like to receive specific alerts based on location, FISMA ID and service. Customers can add, edit and modify these rules to expand or limit the number of email alerts received at any time giving customers full control over the type of notifications they receive.

Setting up a rule alert is easy in the new Notification Subscription Portal. There are only two steps. Customers simply log in to the portal and follow these instructions:

1. Select "**Add New Rule**"

   and choose the "Location", "FISMA ID" and "Service" based on preferences from the drop-down lists provided.

2. Click "**Save Rules**" before exiting to set the selections.

Rule Tip

When creating a rule, it is not recommended to select "All" for the three options (location, FISMA ID and service), as a large quantity of email alert notifications would be received. Instead, it is highly recommended to narrow the focus of the rule and select specific information. As a starting point, customers can select "Location = all", "FISMA = relevant FISMA" and "Service = all". Additional rule selections can be increased or decreased from this point.

The new Notification Subscription Portal is live now for N-Wave customers to go ahead and sign up. To register, log in to the Notification Subscription Portal at: https://notifications.nwave.noaa.gov/. Customers will begin receiving these new notification alerts on June 1, 2022. We encourage this action as soon as possible, because email alerts from the existing notification alert system will end on June 1, 2022.

If customers encounter any problems or have questions or need support, please contact N-Wave NOC:

- **Phone:** (812) 856-7477
- **Email:** nwave-noc@noaa.gov

N-Wave will continually strive to offer better products and services to meet its customers needs. We look forward to any feedback customers would like to share about their experience with the new Notification Subscription Portal. Feedback can be sent to adam.nemethy@noaa.gov.

N-Wave Enterprise Services Updates

(October 1, 2021 – March 31, 2022)

Enterprise Firewall Service
As described in the 2021 fall edition of the N-Wave newsletter (see p. 9), the Enterprise Firewall Service continues to grow in need and has picked up a lot of steam this year. N-Wave's services engineers have deployed firewalls across six sites. N-Wave has begun onboarding new customers and started some migrations of customers on legacy firewalls. We will continue to migrate customers currently using legacy firewalls managed by N-Wave to reduce the number of firewalls we manage and provide increased performance.

With a large volume of new service requests showing the high demand for the Enterprise Firewall Service, N-Wave looks forward to expanding this service and learning more about the needs of each new group.

Enterprise Wireless
N-Wave recently updated the wireless controller to 8 code. This was a major upgrade that included the need for additional hardware components not required in the previous versions. The benefits of making the shift to this new code include taking advantage of additional features, but more importantly being able to deploy newer Access Points (AP) with more features. N-Wave has begun ordering WiFi 6 capable APs. All new sites will be deployed with WiFi 6 APs and, in some cases, N-Wave plans to use the more capable WiFi 6E APs, where better optimization of these capabilities will be beneficial to customers in the future. WiFi 6 provides channels which allows more throughput. WiFi 6 operates on the 5 Ghz band and WiFi 6E operates on the 6 Ghz band. WiFi 6 and WiFi 6E have similar capabilities. User devices must be WiFi 6 capable to take advantage of the capabilities (the new APs are backwards compatible with previous generations of devices).

ERAV
60 VPN groups
6 NOAA Line Offices use ERAV
2 other federal entities use ERAV
9,000+ registered users

Firewall
6 service locations spanning the U.S.
16 firewalls including cloud firewall deployments
21 virtual firewall instances

Managed LAN
29 service locations spanning the U.S.
5 NOAA Line Offices use Managed LAN
312+ switches deployed

Wireless
26 service locations spanning the U.S.
15 states with service locations
1,035+ wireless access points

N-Wave is beginning to refresh older APs in the environment and is currently working on replacing 215 APs across multiple sites. The APs in the 2xx series are being replaced with the new WiFi 6 APs. These are not a replacement of all APs at a given site but rather only the 2xx series APs. Sites where a replacement is occurring include the Silver Spring Metro Center (SSMC), Seattle, WA; Charleston, SC, Office for Coastal Management; Fairmont, WV; Boulder, CO; and, Lakeland, FL.

N-Wave is testing wireless IPv6-only in the lab. We are working with the vendor about some considerations when rolling out this service. N-Wave is working to roll out an IPv6-only Service Set Identifier (SSID) across all N-Wave wireless locations within the calendar year and will continue expanding to make wireless IPv6-only for NOAA secure while leaving an IPv4 and IPv6 option for NOAA guests. This will keep true to the guest access experience and enable collaboration without segmenting out an unknown number of users that can't use IPv6 connectivity.

Enterprise Remote Access Virtual Provider Network (ERAV)

NOAA's Office of the Chief Information Officer (OCIO) mandated that the ERAV solution had to be able to do posture checking by March 2022. N-Wave met this requirement and posture checking has rolled out to the N-Wave ERAV group. We are starting to work with NOAA Line and Staff Offices to enable their groups. By March 2023, all VPN systems and groups must meet this requirement. The ERAV standard has several requirements, one of which is to verify that computers connected are government-furnished equipment.

Recently, the N-Wave Services team upgraded the ERAV firewalls in Washington, D.C. The new ERAV hardware has more than enough capacity for existing N-Wave customers and with a growing demand for NOAA-wide usage of the ERAV, this new hardware can provide even greater capabilities. An example of this is the 15 Gbps of bandwidth available up from the current 8 Gbps, as well as, having the ability to support 5,000 more users should the need arise.

Last year, N-Wave received a new service request for adding an ERAV firewall in Hawaii. Engineering work has begun on this new service with plans in place to deploy the node within the next six months. This will be a significant improvement for Hawaiian ERAV users. Currently, when they connect to the Virtual Private Network (VPN), their traffic goes to Denver and then back to their local campus to access resources. With a node located in Hawaii, traffic remains there, which will significantly cut down latency and improve usability.

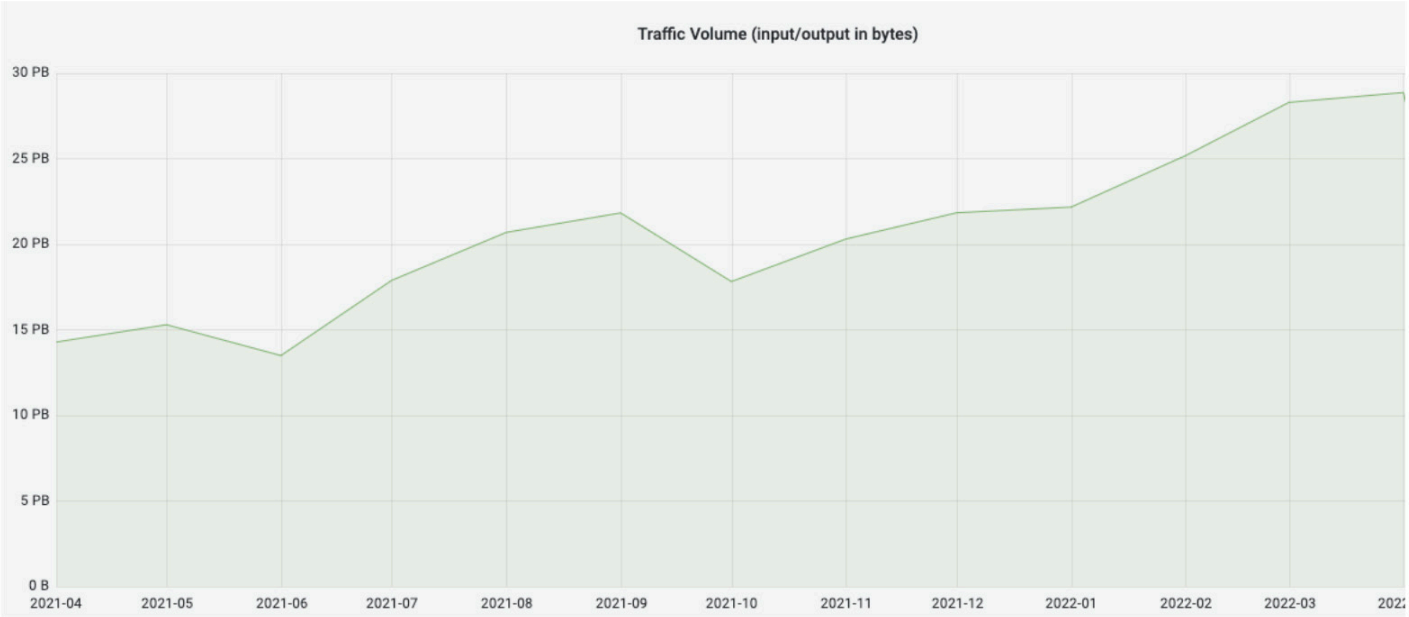
IPv6 Support on ERAV

Engineers are working to enable IPv6 support on ERAV. This is in line with other services such as wireless. For N-Wave to enable IPv6-only SSIDs in the wireless, users will need to be able to connect to ERAV from an IPv6 address. N-Wave is still early in the development process and more information will be forthcoming. The target dates to support IPv6 on VPN is set for the end of this calendar year.

Credit: NOAA/NMFS/AKFSC

Network Performance Metrics

(April 1, 2021 – March 31, 2022)

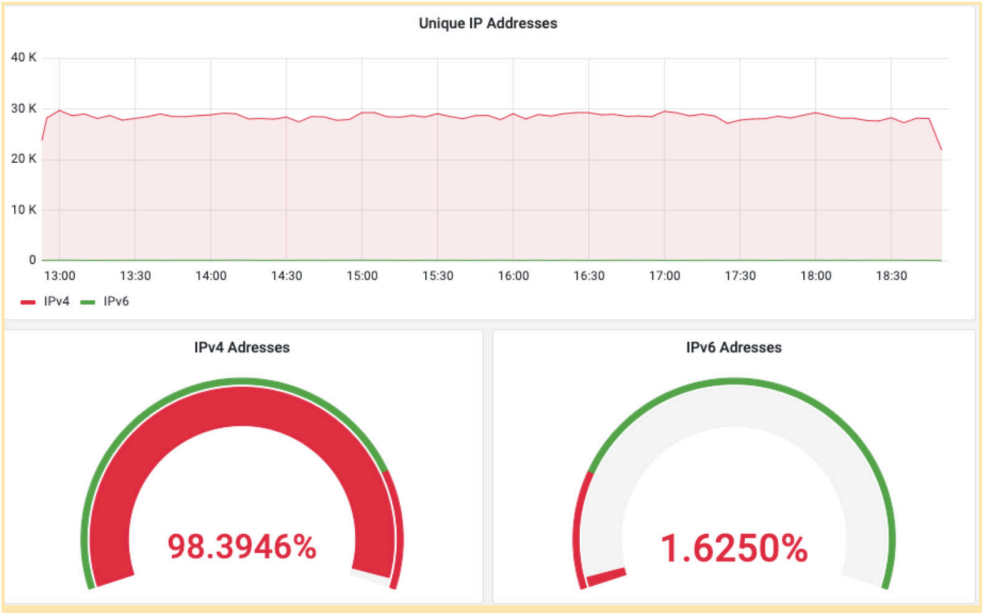


As mentioned in the last newsletter, N-Wave will be updating this graph for each newsletter with the start date remaining at April 2021. This will provide a cumulative timeline for network traffic information.

Please note from October 17, 2021 - November 8, 2021, there was an issue with data collection and is why there is a dip during that specific time period. N-Wave backbone traffic continues to grow at a steady rate with an increase of over 10PB since April 2021. N-Wave's work on the 400Gb backbone will ensure there is plenty of capacity as the traffic continues to grow.

Also discussed in the fall newsletter was a dashboard showing IPv4 vs IPv6 on the network. N-Wave has created an initial dashboard to visualize the current status.

N-Wave expects to have a dashboard to show historical tracking of IPv4 and IPv6 for the fall 2022 newsletter. Going forward the dashboard will track the growth of IPv6 being transported on the network.



Graph data captured May 1, 2022

Alaska Progress Update

The Fairbanks Command and Data Acquisition Station (FCDAS) - Gilmore Creek, AK:
N-Wave and the NESDIS office in Gilmore Creek, AK, worked together to migrate all NESDIS customers from connections with the existing N-Wave router to a new multi-tenant campus LAN switched infrastructure. This will improve redundancy at the site and increase the number of ports available for additional customer connections in the future.

A lot of planning was needed in order to migrate multiple NESDIS offices, all with operational needs and only minimal allowable downtime. The planning started by identifying all the customers at FCDAS. Next, all of the main technical and management points of contact for each customer connection were identified. N-Wave started a weekly meeting with all stakeholders to review the plan, answer questions and discuss any concerns they might have regarding the migration. Next, the focus was on determining a time frame for the migration. With so many operational programs, this was not an easy task. A week was determined, with specific downtimes identified for each customer circuit. Due to the criticality of the missions and the amount of work to be accomplished, N-Wave decided to have three engineers on site to help with the new equipment installation and migration. During the migration, a virtual meeting was held to accommodate testing while N-Wave engineers migrated the customer's connections. If any issues came up, N-Wave was there to actively help troubleshoot with the customer. Seventeen customer connections were migrated successfully as part of this work. After the migration, another call was held with all NESDIS customers to determine their satisfaction with the migration process and to learn how N-Wave could make improvements.

With this migration, NESDIS moved from the existing, dedicated infrastructure between Alaska and the Contiguous United States (CONUS) to the new, shared infrastructure with its inherent redundancy.

A TIC comes to Alaska

NOAA's Cyber Security Division and N-Wave are in the planning stages for the relocation of the former Dallas-Ft. Worth TIC to Anchorage, AK. The relocation will enable traffic between NOAA AK sites and Alaskan commercial and academic sites to stay within the state. This provides a double benefit. First, traffic within the state will not be delayed by the round trip to Seattle. Second, by not going back and forth between Seattle, the expensive bandwidth between Alaska and CONUS will not be used needlessly.

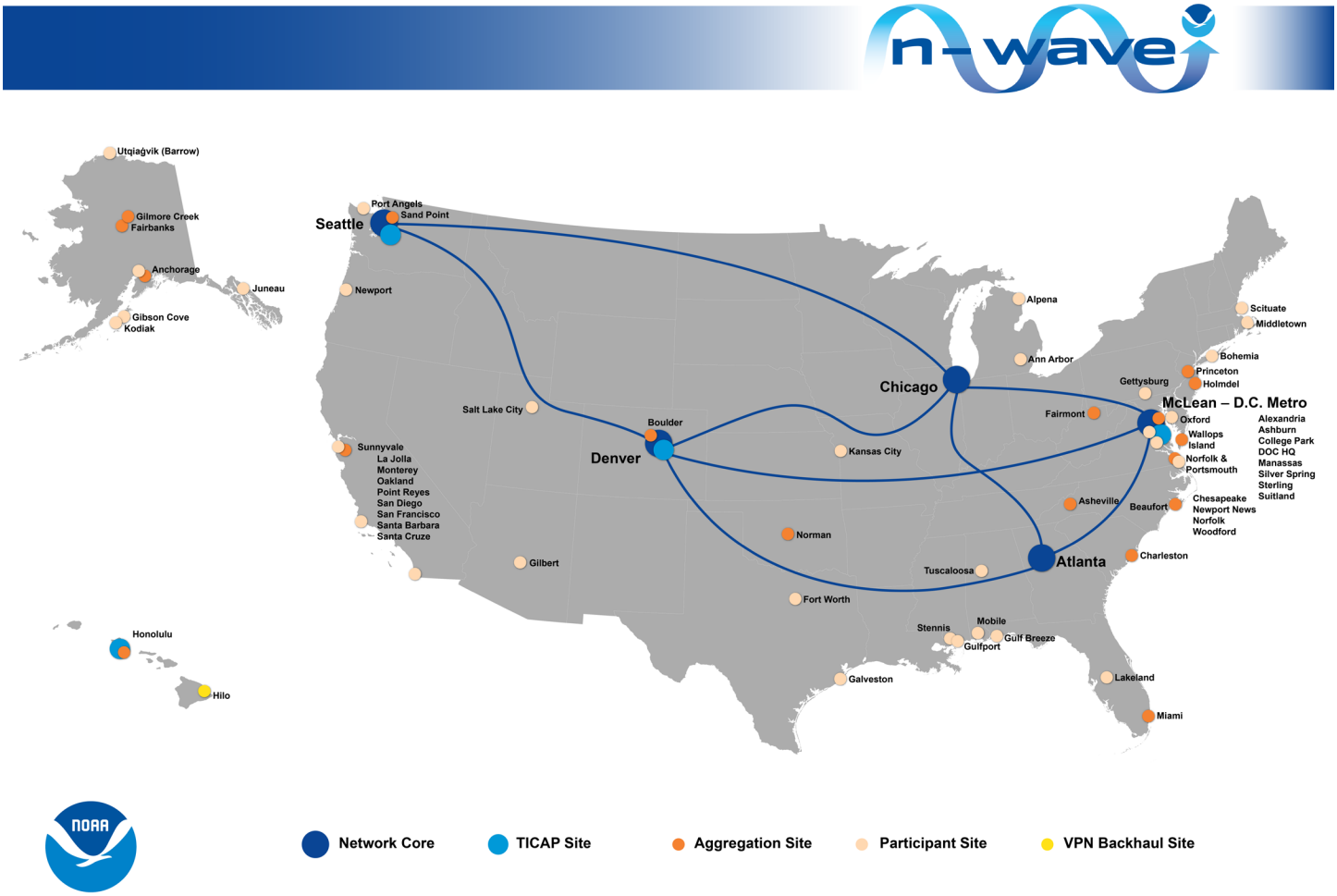
Collaboration within Alaska
With its immense size, small population and distance from CONUS along with NOAA's widely dispersed sites in the state, the costs of providing modern network services with the needed capacities is high and in many regions sparsely available. Other federal agencies have similar issues. N-Wave is working with Alaska- based partners in the National Weather Service's Anchorage office and the National Marine Fisheries Services Juneau office to host a federal interagency meeting to discuss network collaboration within Alaska.

The meeting is tentatively scheduled for September 13 -15, 2022, in Anchorage, and is the follow-up to the May 2019 kick-off meeting that was delayed due to the COVID-19 pandemic. The goal is to find where federal agencies in AK can benefit from shared infrastructure and services. For example, the new N-Wave Alaska core network with high speed connectivity to CONUS and the proposed Alaska multi-agency

Trusted Internet Connection (see sidebar and Spring 2021 N-Wave News, p. 5). In addition to various federal agencies, the meeting will include some of N-Wave's partners in AK, including Internet2, the University of Alaska and the Pacific Northwest Gigapop.

This effort was inspired by the Hawaiian Intranet Consortium (HIC) organized by the Department of Defense/Defense Research and Engineering Network several decades ago to share resources within, and between, the islands and to the mainland. "The HIC" has a nice ring to it. If you have a suggestion for a good name for the Alaska organization - a name with an equally good acronym - please let us know. You can email us at nwave-news@noaa.gov.

Credit: NOAA/NMFS/AKFSC



Network Operations Center (NOC) Metrics and Updates

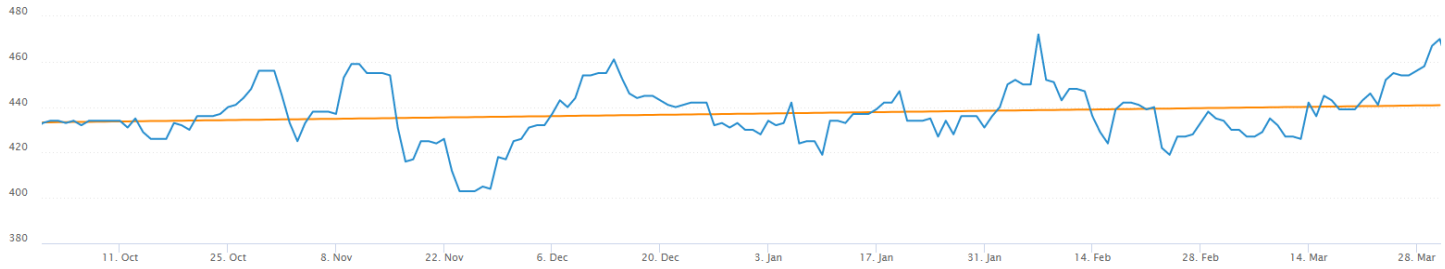
(October 1, 2021 – March 31, 2022)

N-Wave partners with GlobalNOC at Indiana University to provide advanced network operations, offering support 24 hours a day, 365 days a year and is integrated within the N-Wave Federal Information Security Modernization Act (FISMA) High system controls. N-Wave NOC support includes tier I, II and III engineering, along with monitoring, measurement and analysis.

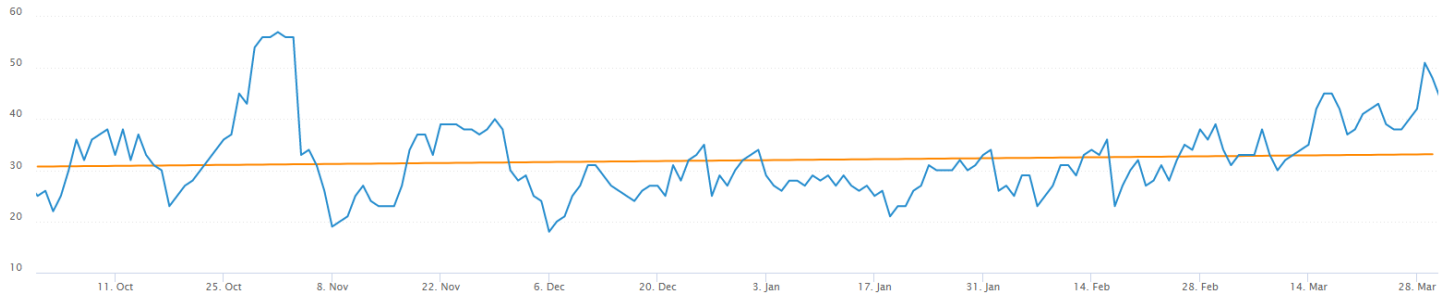
Support metrics gathered from October 2021 through March 2022 indicate the N-Wave NOC opened 11,259 tickets. These tickets encompass all incidents, service requests, change and maintenance events, and customer communication records, such as individual phone calls and incoming and outgoing email correspondence of the NOC. Service requests (17%) and communication records (56%) make up the bulk of those tickets, while incidents and changes together account for 22% of tickets.

Trends in Requests and Incidents

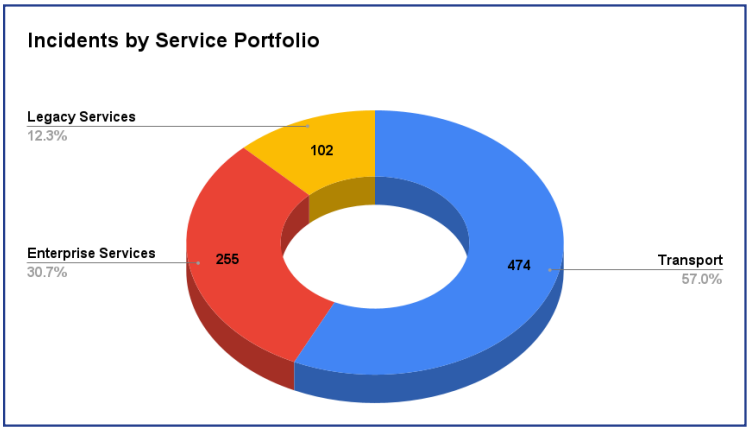
The trend lines for customer requests and for incidents is slightly increasing, reflecting the growth of the network (in the two graphs below the value of vertical axes are incident counts).



The Active Requests metric shows the trend of all catalog tasks active on any given day.

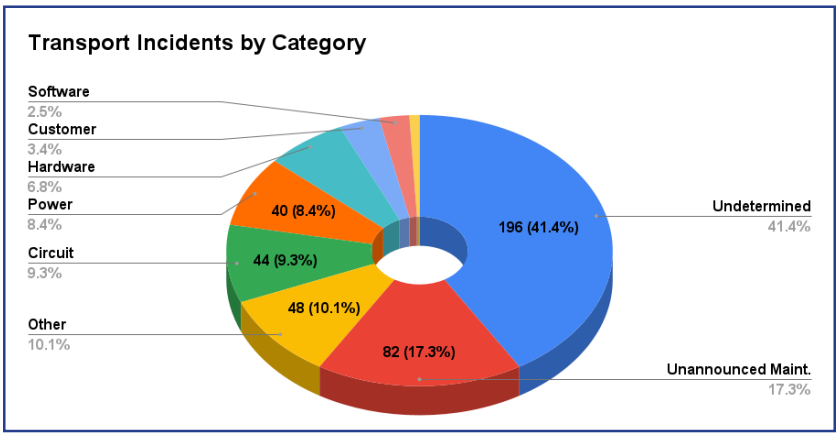


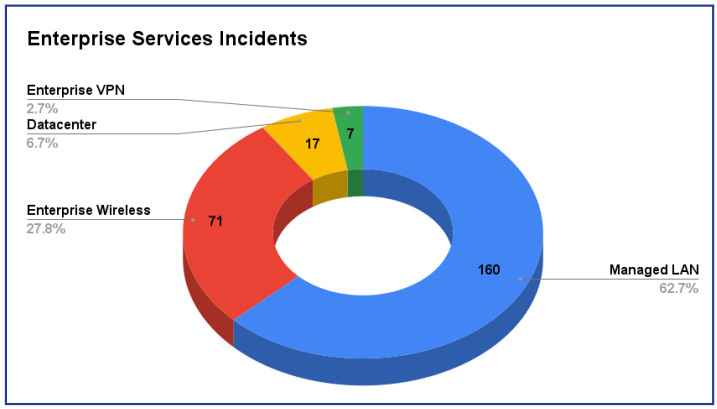
The Active Incidents metric shows the trend of all incidents active on a given day.



Incidents by Service Portfolio
This represents 831 total incidents, broken down by service portfolio: N-Wave Transport, N-Wave Enterprise Services and NOAA Silver Spring NOC Legacy Services.

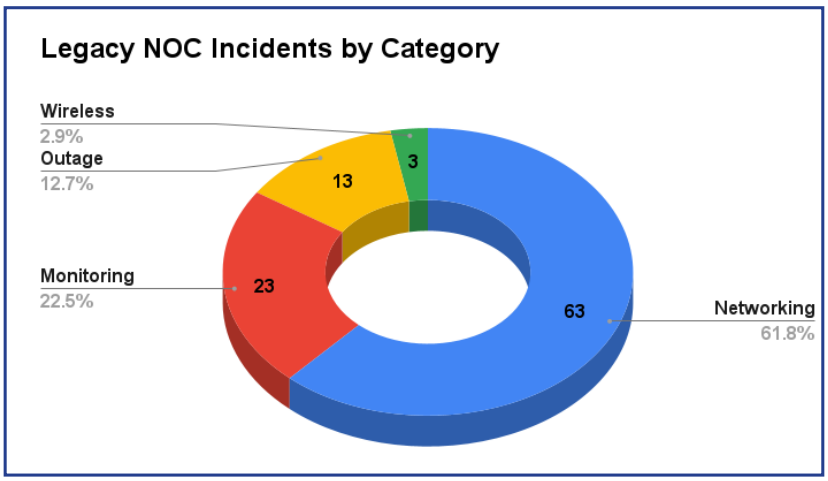
Transport Incidents by Category
This shows the 474 total Transport incidents, broken down by category. Undetermined incidents mostly comprise very brief, mainly non customer-impacting observed outages for which a vendor is not able to determine the cause. Unannounced maintenance events typically occur when customers or providers do not announce the maintenance to N-Wave. Circuit incidents are outages caused by fiber damage, bumped fiber, vandalism or cut fiber.





Enterprise Service Incidents
This shows the 255 total incidents related to N-Wave Enterprise Services, broken down by specific service: Datacenter, Enterprise Remote Access VPN (ERAV), Enterprise Wireless and Managed LAN.

Legacy NOC Incidents by Category
This shows 102 total incidents related to NOAA Silver Spring Legacy NOC, broken down by category: Outage, Networking, Wireless and Monitoring.



Research to Operations

Research to operations is the proving ground for new technology, architectures and designs that can be tested before rolling out to the production N-Wave network. This research-to-operations approach allows configurations to be developed and designs to be refined prior to release of the service. This includes:

- Adding PTX10001s to replace the current N-Wave core devices and provide high density 100 GE and 400 GE connections enabling the 400 Gbps core upgrade project.
- Testing a resilient design for a NAT64 service that will offer a simplified scalable deployment while providing well known resiliency through Border Gateway Protocol route propagation.
- Providing guidance on the configuration and architecture for a resilient DNS64 service similar to the recursive EINSTEIN 3 Accelerated compliant DNS service in production today (in cooperation with the NOAA Cyber Security Center (NCSC)).

As discussed at the December 2021 N-Wave Joint Engineering and Technical Exchange (JETI) Path workshop, and in coordination with NCSC, enterprise DNS64 and NAT64 are in the final stages of testing and will be made operational by the end of Q3, FY22. N-Wave's transport group will run the centralized NAT64 service while NCSC will run the coordinated DNS64 service. The combined services will allow IPv6-only clients to communicate with legacy IPv4-only servers. The N-Wave provided enterprise level service will alleviate the burden of having customers deploy their own DNS64/NAT64 infrastructure, but there is nothing precluding customers from doing so if they would like to.

In addition to the DNS64/NAT64 service enabling compliance with the OMB 21-07 memo on completing the transition to IPv6-only networking, the N-Wave lab is also in the midst of testing out a new IPv6-only Service Set Identifier (SSID) that will be deployed at locations where the N-Wave Enterprise Wireless Service is located. This IPv6-only network will allow network engineers, along with other pioneers, to test out and conveniently use an IPv6-only network (see page 13).

Looking toward the future, once the configuration is proven out in the lab, the existing N-Wave WiFi networks will transition to a dual-stack environment in preparation for the final step of removing IPv4 networking and operating in an IPv6-only stance, in compliance with OMB M-21-07.

The JETI Technical Crosstalk monthly one hour calls cover many topics including questions and lessons learned during the transition to IPv6-only. More details can be found on page 20 of this issue.

N-Wave Joint Engineering & Technical Interchange (JETI) Meetings

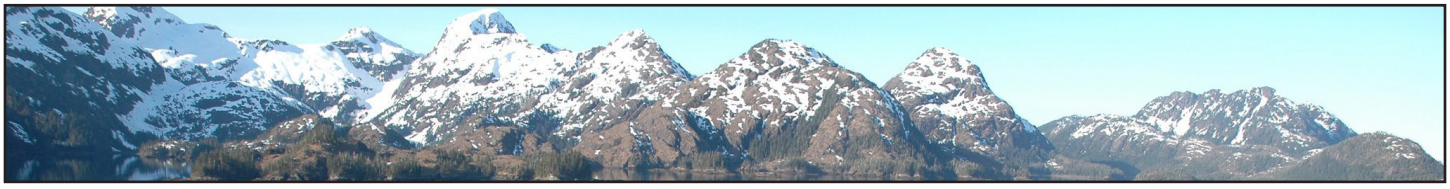
JETI Path Workshop

JETI meetings are focused on fostering collaboration within the Department of Commerce network engineering community and are hosted by N-Wave. One of the newest N-Wave Joint Engineering and Technical Interchange (JETI) meetings, called the JETI Path workshop event, was held on December 8, 2021. (See Fall 2021 N-Wave News, p. 21)

More than 98 attendees participated in this one-day virtual event with cross-bureau collaborative discussions focused on IPv6 and the Office of Management and Budget (OMB) IPv6-only mandate. Informative speakers highlighted the following topics:

- **Robert Sears**, Director, NOAA N-Wave - IPv6 business case overview along with transition planning guidance to include a history of IPv4 usage, the benefits of moving to IPv6, specific security deployment considerations, analytics associated with a questionnaire completed by the JETI community and resources to be provided by N-Wave.
- **Larry Rubendall**, Chief of Staff, Department of Commerce's (DOC) Office of the Chief Information Officer - Mr. Rubendall provided an update on DOC's IPv6 status, the Integrated Program Team, collaborative efforts among bureaus/line offices and the release of the FISMA Metrics Guidance document on December 6, 2021.
- **Ron Broersma**, Chief Engineer, Department of Defense's (DOD) Defense Research and Engineering Network (DREN) - Mr. Broersma provided an update on DREN's experiences with rolling out their management network as IPv6-only and included examples of obstacles encountered, lessons learned and advice for the JETI community on things to consider in working with vendors/contractors.
- **N-Wave Staff** - Provided updates and information surrounding cloud capabilities (AWS vs. Azure), IPv6 project planning (and mapping to OMB milestones), IP Address Management (IPAM), IPv6 Address Plans, and N-Wave's DNS64/NAT64 progress.
- **Open Forum Discussion entitled Birds of a Feather (BoF)** - In this session, participants get an opportunity to discuss a particular topic of interest to the JETI community. This BoF covered "What are hurdles being seen/experienced to meet the OMB mandate?" and included a robust conversation on how to get started in transitioning IPv4 networks to IPv6 (dual stack/DNS64/NAT64), budgetary concerns with upgrades to equipment in the transition process, overseas/international networks and potential connectivity constraints, along with so much more.

Additional information on the JETI Path event is available to its members in the Past Events portion of the JETI Google Site.



Credit: NOAA/NMFS/AKFSC

JETI Technical Crosstalk Sessions
In February 2022, the JETI community expanded its offerings with a new one-hour monthly JETI Technical Crosstalk session. These monthly Google Meet sessions are very informal and provide a forum for all who use N-Wave to raise issues and concerns, discuss questions and problems, and generally share ideas in a collaborative manner with other participants on the call. Technical Crosstalk is held on the second Wednesday of every month from 2:30-3:30 p.m. Eastern Time. In addition to the monthly meeting, a Google Space was created to foster ad hoc conversation outside of the monthly Google Meet session. If you would like to be invited and receive the calendar and Google Space invitation, please send an email to: nwave-jeti@noaa.gov.

JETI Annual Meeting
The annual JETI meeting is in the early planning stages with more information to be released soon. The program agenda will most likely include updates on the N-Wave backbone upgrade, Trusted Internet Connections (TICs), cloud services and the transition to IPv6-only. To get on the invite list and receive information about the upcoming event, send an email to nwave-jeti@noaa.gov.

The N-Wave Stakeholders and Science Engagement Summit was held March 1-3, 2022, and included more than 200 participants who gathered together virtually to learn, collaborate and share ideas about a variety of networking topics.

The Stakeholders Summit is part of N-Wave's continuing efforts to engage its network stakeholders in strategic discussions, including capacity planning for shared network resources and to look at challenges and opportunities for future network-related growth.

With engaging keynote presentations by Tim Gallaudet (PhD, Rear Admiral, U.S. Navy (ret.)), Vinton G. Cerf (Google's Vice President and Chief Internet Evangelist) and Eric R. Mill (Senior Advisor to the Federal Chief Information Officer, Executive Office of the President, Office of Management and Budget), attendees at this year's summit were given a peek into a variety of networking topics on national security, climate change, the economy, IPv6 and Zero Trust.

Speakers from the Department of Commerce Bureaus and NOAA Line and Staff Offices gave insights into future projects for network services, the use of Internet of Things (IoT) devices/sensors and cloud services. Attendees also heard from other federal agency speakers on IPv6 successes, challenges and lessons learned, while N-Wave speakers gave updates on service level agreements, status of the IPv6 transition, a new notifications dashboard and Next Generation Trusted Internet Connection Access Points (TICAPs) network architecture.

Thank you to everyone who attended or spoke at this year's event. The 2023 summit is currently in the planning stages and anticipated to be held in Silver Spring, MD. If you'd like to be added to the invite list for details when they become available, please send a request to the Stakeholders Summit planning team.

A Really Interesting, Very Short-lived Network – SCinet

The International Conference for High Performance Computing, Networking, Storage and Analysis – informally known as SC and formerly known as Supercomputing – is held every November in various cities around the U.S. Of interest to those of a [computer] networking persuasion, SCinet is the network built for SC each year. The network is built from scratch by volunteers from around the U.S., and internationally, with the needed hardware and circuits loaned by a variety of vendors, including Ciena, Cisco, Juniper, Lumen, ESnet, Internet2, etc. If you are interested in helping, there are openings available for volunteers this year and in 2023.

SCinet is a state-of-the-art, leading edge network evolving as technology does. While the design for this year's event is in the beginning stages, several 400G circuits are expected plus many 100G circuits. Over 150 volunteer professionals take a year to design it followed by a month to build it. SCinet is then used for a week to support the technical conference and exhibits at SC. And in a day, all is torn down, packed up and shipped back to the vendors who have loaned their equipment.

If you are interested in being part of SCinet, of working with some of the best network professionals and learning about new hardware and techniques, then consider volunteering. The SCinet volunteers are broken into 16 teams. You can find a description of each here. If one or more has piqued your interest, then drop a note to SCinet here. For next year's conference, all teams will have openings. For 2022, some teams have all the volunteers they need but you shouldn't hesitate to submit your areas of interest. The fiber, edge, and wireless teams are the most likely to need additional volunteers for this year.

One note on participating in SCinet. Volunteers will need to provide their travel, lodging and meals. SC/SCinet arranges for a block of hotel rooms very close to the conference's location with both government and non-government rates for volunteers to book. Participating in SCinet is a real world hands-on experience and can be part of a comprehensive training plan. In past SC's, N-Wave staff have joined various teams and held the Chair position for the wireless, architecture and wide area network teams.

SC22 will be held November 13-18, 2022, in Dallas, TX. The preceding three weeks will be when most of the assembly and turn-up takes place – some in Dallas and some remote. There will be planning calls in the months prior to discuss the design and implementation.

Credit: NOAA/GAEA

N-Wave Welcomes New Staff

Jeffery Bowmar

Jeffery Bowmar has been hired as the N-Wave Cloud Services Federal Manager. Jeffery previously worked for NOAA's Office of the Chief Information Officer's Cyber Security Division (CSD), where he was affiliated with Enterprise Cyber Security functions for the Department of Commerce (DOC) and NOAA for the past nine years. During his tour with CSD, he served in the roles of Federal Security Operations Manager, Security Operations Center Security Analyst, SIEM Security Engineer and Trusted Internet Connection Access Points (TICAP) Infrastructure Engineer. Prior to working in DOC and NOAA, Jeffery served multiple agencies across the Department of Justice and Department of Defense, focused in the disciplines of network infrastructure and network security.

Tim Ethington

Tim Ethington joined the N-Wave team to support Property Management and Administration in March 2022. He is based in Boulder, CO. Tim's main duties include overseeing critical IT assets deployed to NOAA customer program sites nationwide. Tim spent the last 25 years in financial technology doing everything from systems administration and support, to data center and people space logistics. He attended Metropolitan State University of Denver, CO, specializing in Computer Information Systems and Management Science.

Ian Holtson

Ian Holtson has been supporting N-Wave as the Service Desk Supervisor in the Global Network Operations Center (GlobalNOC) since 2019 and recently became fully dedicated to N-Wave operations due to the rapid growth of the program. His career with GlobalNOC began in 2016, where he worked as a technician and then a lead technician supporting frontline operations on various research and education networks. His professional focus has been on operations and supervision in his tenure at GlobalNOC. Ian graduated with a Bachelor of Science in Informatics from Indiana University in 2016. In his free time, Ian enjoys hanging out with his wife and dogs, golfing, and seeing friends and family.

Curtis Schongalla

Curtis Schongalla joined the GlobalNOC Network Engineering team in support of N-Wave in March 2022. He grew up in Washington, D.C., and went to school at Indiana University-Bloomington, where he studied Computer Science, Information Technology and Psychology. In his previous role at the GlobalNOC, he supported the Internet2 network. Curtis holds an impressive list of IT certifications including Cisco CCNP (2019), CCNA: Service Provider, CCNA: Security, CCNA: Route/Switch, as well as, Microsoft MCSA, CompTIA A+, Network+, and Security+. He currently resides in Bloomington, IN. In his spare time, he enjoys wrenching on, and driving remote control cars, including a nitro-powered Traxxas Revo and an electric Tekno MT410.

Josh Shamloo

Josh Shamloo has been hired as a Firewall Engineer with the N-Wave Enterprise Network Services team. Josh joined N-Wave in February 2022. He is based in northern Virginia, within a short distance of the Silver Spring, MD, office. His career background includes network, network security and cyber security at various telecommunication and cyber security companies and in the financial sector. This career has given Josh great opportunities to travel and see interesting places. One of the most interesting engagements he will always remember was standing up the first internet cafe in Gitega, the capital of the small African country of Burundi.

Christopher Tisdale

Christopher Tisdale joined N-Wave as a Network Engineer in support of the Services Team at NOAA in March 2022. He is based in Silver Spring, MD. His career background includes over 20 years of network infrastructure and operations services in support of federal agencies, the U.S. Armed Forces and private sector companies. Before joining N-Wave, Christopher provided consultation and implementation services as an IT Infrastructure Engineer on various public and private sector projects. Christopher graduated from Morgan State University in Baltimore, MD, with a Bachelor of Science degree in Information Science and Systems.

Dustin Woodyard

Dustin Woodyard joined the N-Wave team in December 2021 as a Network Engineer working with Enterprise Services. Prior to joining N-Wave, he worked for the Department of Defense (DOD), assisting in the development and support of their Automated Biometric Identification System. Dustin has also worked previously for NOAA's Cyber Security Center and served a crucial role in deploying and supporting NOAA's TICAPs. Dustin has a Bachelor of Science degree in Computer Science from West Virginia University in Wheeling, WV, and has had a long career as a network engineer. Dustin brings extensive knowledge and experience of Fortinet Fortigate Firewalls to the program. He is located in the Fairmont, WV, area. Dustin enjoys fishing, swimming, snorkeling, boating and just about anything to do with water and the outdoors.

Credit: NOAA/OAR/OER

N-Wave Outreach Events

N-Wave JETI Path Workshop Event (virtual) - TBA
JETI Path is a one-day workshop with a specific focus on a particular topic(s) of interest gleaned from the larger multi-day JETI meeting events.

N-Wave JETI Technical Crosstalk Meetings (virtual) - Second Wednesday of each month (2:30 - 3:30 p.m. ET)
These informal meetings are an open forum for dialogue and discussion surrounding topics brought up in real time by the participants in attendance. There is no registration required for these meetings and participants are free to join when they can.

N-Wave JETI Annual Meeting (virtual) - Tentatively set for August 2022
JETI events are designed to provide opportunities to exchange technical updates across NOAA Line and Staff Offices, DOC Bureaus and N-Wave's network partners, provide a forum for informal discussions between all participants and dive deeper into technical topics.

More details on JETI events can be found on page 20.

A Discussion on Network Resource Sharing in Alaska - September 13-15, 2022
A meeting of NOAA Line Offices, other federal agencies, N-Wave and N-Wave's Alaskan partners to explore ways to benefit from shared infrastructure and services within the state and to the Contiguous United States (CONUS). (See page 15 for more details.)

Other Events of Interest

CIO Council Federal IPv6 Task Force Summit - June 23, 2022
(sign up to receive alerts from the Federal IPv6 Task Force via Max.gov)

SC22 Conference - November 13 -18, 2022 (Dallas, TX)
The network built for SC22, SCinet, will be a great training opportunity for DOC/NOAA network engineers to gain skills and expertise in a very hands-on environment. (See page 22 for more details.)

Credit: NOAA/NMFS/OST

Visit the following webpages for more information about N-Wave meetings and events:

- N-Wave's Joint Engineering & Technical Interchange (JETI) meetings
- N-Wave's Annual Stakeholders & Science Engagement Summit

Send an email to nwave-communications@noaa.gov to be added to the invite list for information about N-Wave outreach events.

Credit: NOAA/NMFS/AKFSC

Robert Sears, Director, N-Wave

Paul Love, Newsletter Coordinator
Holly Palm, Design and Layout
Amy Bogner, Editor

Contributing Authors:
Grover Browning, Eric Estes, Ian Holtson,
Alex Hsia, Michael Mankarious,
Adam Nemethy, AJ Ragusa, David Ripley,
Ben Shively, Matt Smith and Eldar Urumbaev

U. S. Department of Commerce
National Oceanic and Atmospheric Administration
N-Wave
325 Broadway
Boulder, CO 80305-3337

For more information:
NOAA N-Wave Program
http://noc.nwave.noaa.gov
Office of the Chief Information Officer
https://www.noaa.gov/information-technology