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N-WaveNews

this issue

NOAA N-Wave

N-Wave is NOAA's science network. Built on partnerships and relationships among NOAA and the Academic and State research network communities, N-Wave connects researchers to the data and resources needed to advance environmental science.

Mission

N-Wave is committed to provide innovative networking capabilities with integrity, excellence, value, and flexibility, to enable NOAA's science and research through reliable high-performance networking.

Our Vision

A consolidated, agency-wide network resource that meets NOAA's research connectivity requirements and where appropriate, supplements NOAA's operational connectivity requirements.

From the N-Wave Network Manager

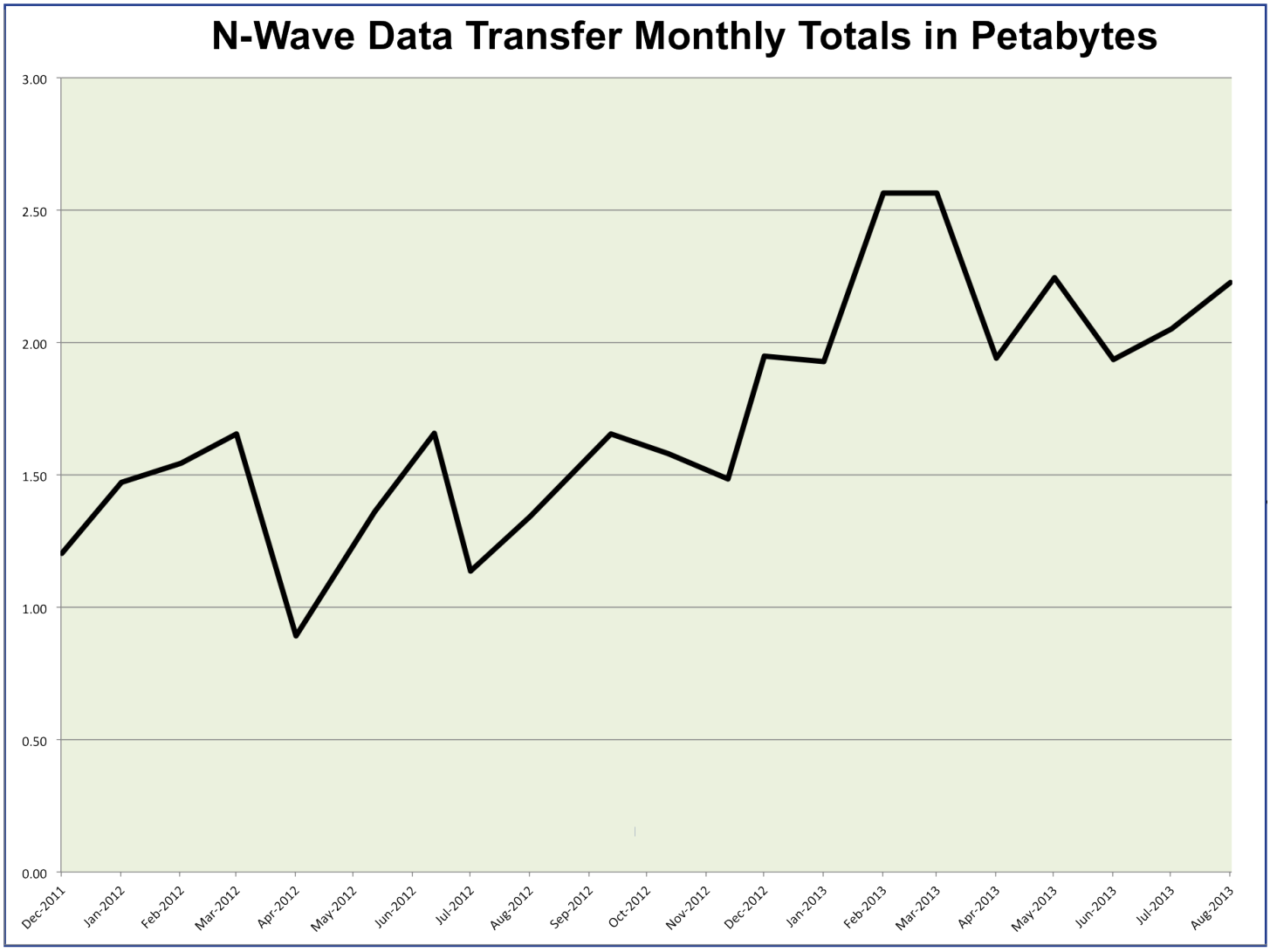
Since our first publication of N-Wave News in June, our team excelled through a demanding summer of new customer connectivity, established multiple project plans for continued customer connectivity and support, deployed enhanced traffic reporting capabilities, seamlessly augmented internal management responsibilities, and persevered through the challenges of government shutdown.

FY14 meets us with even greater opportunities to continue supporting NOAA's scientific and programmatic missions. Amongst ongoing projects with GOES-R, the Joint Polar Satellite System, multiple National Ocean Services sites, National Marine Fisheries Services, the National Weather Service, and other Line Offices, N-Wave will assist NOAA in meeting Trusted Internet Connection (TIC) mandates as both a transport vehicle to Trusted Internet Access Provider (TICAP) geographic sites and a provider for TICAP commodity peering and redundancy.

With the many tasks set before us, it is my personal goal and that of our entire N-Wave team, to retain customer service as paramount. We will continue to work with our provider partners to maintain our strong relationships while enhancing and exploring new opportunities that will support this goal. Please enjoy this edition of N-Wave News as we head into an exciting FY14!

Fair winds and following seas,

Robert Sears
Network Manager



N-Wave Network and Performance Metrics

N-Wave usage continues to increase, nearing three Petabytes (PB) per month.

There was a continued increase in traffic in the month of September due to the National Center for Environmental Prediction (NCEP) migrating to N-Wave for access to the Fairmont NOAA Environmental Security Computing Center (NESCC) archive.

New sites, such as the National Weather Service Radar Operations Center (ROC) and the Geophysical Fluid Dynamics Laboratory (GFDL), including NOAA's Research & Development High-Performance Computing Program (R&D HPCS) have started using N-Wave for access to the Boulder and Silver Spring Trusted Internet Connection (TIC) sites. The National Climatic Data Center (NCDC) is evaluating N-Wave for access to the TIC sites.

N-Wave deployed a new NetFlow traffic monitoring and collection system to monitor network usage. NetFlow data contains summarized, high-level information of the network traffic that passes through the N-Wave routers in near real time. The routers export NetFlow data to a NetFlow collector for archiving and reporting functions.

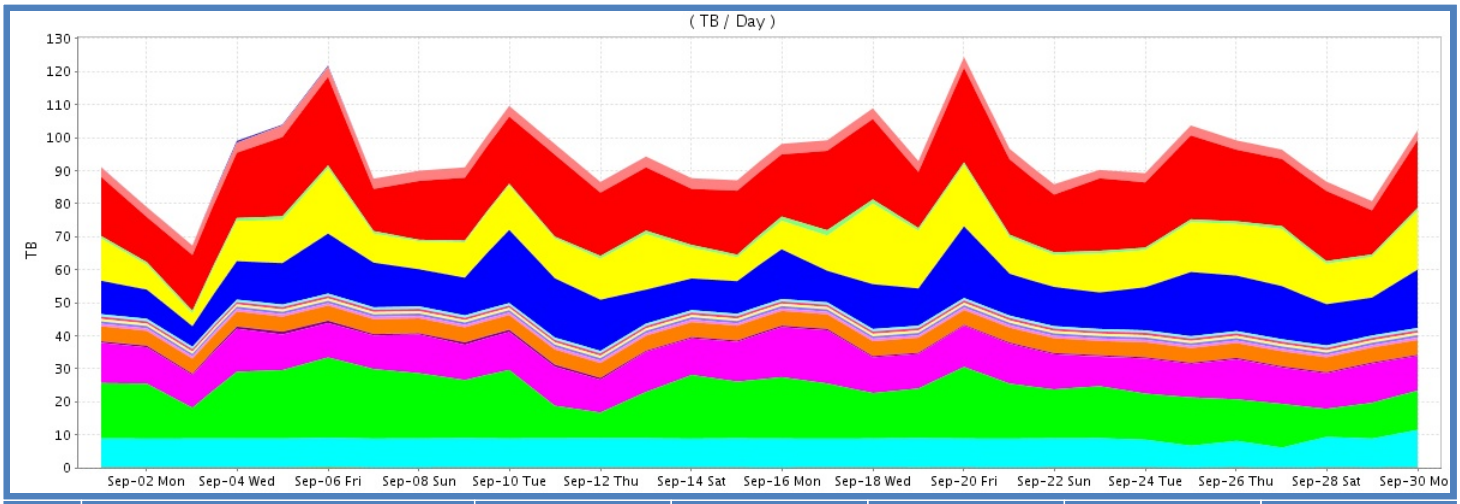
The new N-Wave package, NetFlow Auditor, includes better reporting functions as well as Internet Protocol Flow Information Export (IPFIX) and IPv6 support for the Juniper MX routing platform. NetFlow Auditor produces custom reports and utilization graphs based on user-defined criteria, such as IP address range and TCP/UDP ports.

In the near future, we expect N-Wave users to be able to use a web browser to access the monitoring system. That will allow them to track their network usage and generate custom reports.

IdeaData
TOTAL NETWORK VISIBILITY

CostCentre Outbound Traffic

Period From: Sun 2013-09-01 00:00:00 MDT
To: Mon 2013-09-30 23:59:59 MDT



No.	Source CostCentre	TB sum	TB avg	TB max	G.Pkts sum	K.Flows sum
1	RDHPCS-ORNL	605.325	20.177	28.619	68.043	306.911
2	NCEP-WCOSS-ORLANDO	473.706	15.790	24.355	58.347	656.554
3	RDHPCS-BOUL	402.063	13.402	22.113	67.287	975.470
4	RDHPCS-FAIR	382.130	12.738	24.413	147.377	2,422.132
5	NCEP-WCOSS-RESTON	341.721	11.391	16.087	39.269	205.955
6	CLASS-NSOF	260.543	8.685	11.325	173.724	1,648.337
7	NWAVE-AGG	135.352	4.512	4.573	132.670	48.824
8	Undefined	92.236	3.075	3.539	92.313	851.992
9	RDHPCS-GFDL	26.184	0.873	1.633	46.082	418.236
10	NWAVE-CHI	21.836	0.728	0.746	21.535	93.882
11	NWAVE-DEN	21.757	0.725	0.736	21.441	90.269
12	NWAVE-ATL	21.736	0.725	0.747	21.470	120.321
13	NWAVE-WASH	21.735	0.725	0.739	21.423	87.865
14	NWAVE-SEA	21.553	0.718	0.732	21.089	6.565
15	NOAA-Boulder	13.656	0.455	0.839	17.413	966.699
16	CLASS-BLDR	2.420	0.081	0.107	27.509	1,086.908
17	CLASS-ASH	2.117	0.071	0.249	29.586	713.615
18	WISC-EDU	1.377	0.046	0.614	1.270	3.136
19	NOAA-NSSL	0.299	0.010	0.040	5.135	379.441
20	NOAA-AOML	0.217	0.007	0.136	1.386	15.916
	Total (23)	2,847.963	94.934	124.382	1,014.369	11,099.028

Note: TB = 1000^4 Bytes, G.Pkts = 1000^3 Packets, K.Flows = 1000^1 Flows

If you would like to subscribe to the outbound traffic information, please go to:
noc.nwave.noaa.gov
There you can submit a service inquiry and fill in a request.

Internet2

A Key Partner for N-Wave

Dr. Alexander (Sandy) MacDonald, NOAA's Office of Atmospheric Research Chief Science Advisor, began his keynote at the 2013 Internet2 Annual Meeting last April by saying: "If you want to affect people, you have to show them what's happening on our planet."

> "If you want to affect people, you have to show them what's happening on our planet."

NOAA became an Affiliate Member of Internet2 in 2000, making use of the shared services of Internet2's first network that connected researchers and scientists, allowing them to reach their university-based collaborators. In 2010, with the advent of N-Wave, NOAA's Science Network, the use of dedicated optical waves on the Internet2 backbone further expanded the scientific collaboration, enabling NOAA to measure such things as potential terrestrial, atmospheric, and oceanic affects of climate change. NOAA scientists and research collaborators are trying to predict climate change and weather patterns in increasingly better ways – so everyone can understand what actions to take to protect our earth and its atmosphere.

This set of dedicated 10-Gigabit per second (Gbps) waves on Internet2's Advanced Layer 1 Service helped form the backbone of N-Wave used by many of NOAA's line offices. Waves from Internet2 are additionally used for some of the access circuits to NOAA laboratories and computational resources, complementing the local connections provided by the Regional Optical Network. The 10-Gbps links of this internal NOAA network provide high-capacity connections between the researchers and high-performance computing sites of NOAA across the nation, supporting large data flows that allow the users – scientists, researchers, and others – to easily share computational resources regardless of location.

Internet2 was instrumental in peering National Research and Education Networks (NREN) around the world. Currently they have 61 international MoUs – 52

with other NRENs and nine with multinational Research and Education (R&E) networks. These international connections allow the easy exchange of ever increasing data and research to global academic and government agencies at high speed and reasonable costs where dedicated circuits aren't a necessity.

The R&E community has an extensive history of excellence, staying on the leading edge of innovation, solving old problems in new ways and serving people across the globe. Built by and for the unique needs of R&E, the Internet2 community's technologies have positioned advanced networking at the forefront of innovation since the organization was founded in 1996 by 34 schools. This year marks the official completion of the Internet2 community's award from the Broadband Technology Opportunities Program, part of the American Recovery and Reinvestment Act. The $62.5M award helped fund the dark fiber network that forms the basis for Internet2's new network platform.

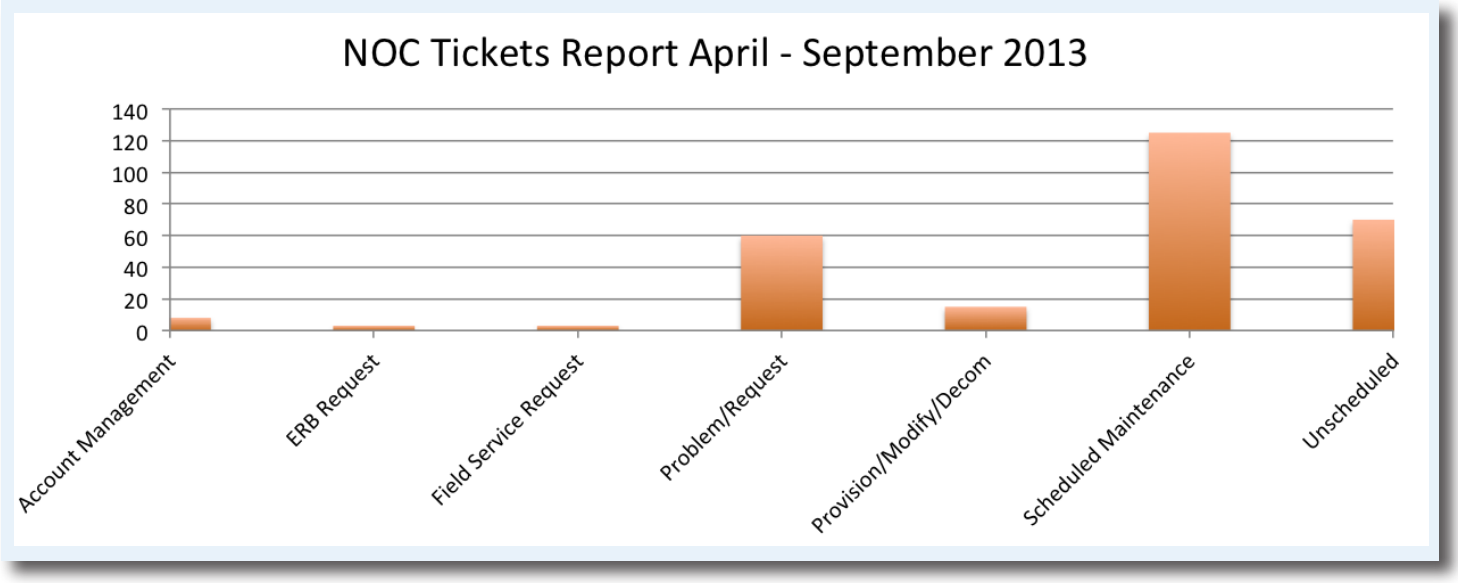
The new network is also providing the cornerstone of Internet2's United States Unified Community Anchor Network (U.S. UCAN) initiative – a program designed to work with regional research and education networks across the country to connect community anchor institutions, including schools, libraries, health care facilities and other public institutions, to advanced broadband capabilities. U.S. UCAN will enable these anchor institutions to serve their communities with telemedicine, distance learning and other significant applications, while simultaneously providing for the demanding science requirements of top global researchers.

The new network was designed for the world's leading science and research needs. With this new infrastructure, the Internet2 Network becomes the world's first transcontinental network deployment of 100-Gigabit Ethernet technology.

The Internet2 community of over 400-member institutions is pushing technology to the next level - an echo of Sandy MacDonald's vision and concluding sentiments in his keynote last April: "This is a complicated planet, and our ability to predict what will happen relies on how we use HPC, Internet, and cloud technologies. We have a giant responsibility, and the R&E community is really the holder of the sacred trust to make this world's future much better for the people who live here. All of this is possible because of the tremendous technology we have."

N-Wave NOC Tickets Report April through September 2013

This report contains data from 304 Tickets



This N-Wave tickets report tracks various ticket types that are used to support the N-Wave Network. In this issue, we will feature and discuss another one of these ticket types and its associated workflows; the Engineering Review Board or ERB Request ticket type.

ERB Request ticket type is used to track all major, architectural-type changes on N-Wave that require the Engineering Review Board (ERB) to review and approve the change. The N-Wave Change Management Process is used to assure proper tracking and approval of all change levels including larger modifications such as a new customer or site turn-up that requires ERB review and approval. The ERB approval process starts when a Service Request is submitted to the ERB as a master ticket that is created to track the following subtasks:

- Contracting subtask ticket – If an ERB change requires funding or other contractual agreements or work, this is tracked in this subtask.
- Security Impact subtask ticket – N-Wave ISSO performs a security impact review and prepares proper documentation for each ERB change.
- Master Install Ticket – a provisioning ticket for GlobalNOC N-Wave Engineers and the Service Desk to work on various tasks associated with properly turning up a service, site or a customer connection. Tracked in this ticket to ensure a proper turn-up and operational readiness are various tasks from physical connectivity, to monitoring, documentation, to customer contacts and notification.

The N-Wave Change Management (CM) process has many other moving parts that not only help meet NOAA security requirements, but also ensure smooth operations of the N-Wave Core Backbone and its participant connections for various NOAA connections. N-Wave CM includes a weekly review of all maintenances and outages during a regular Change Control Board meeting. We will discuss outage and maintenance events in future issues.

N-Wave was envisioned and engineered to be a robust and high-availability network that tracks outages and maintenances for each network event and whether it affects service or not. Most unscheduled outages occur due to lower-level problems that are normally out of control of N-Wave CM, Operations, or architectural design of the network. Fire at a nearby facility, wildlife caused damage, and various fiber cuts or brief fiber disturbances in the PoP co-location facilities are just some of the events that cause unscheduled outages which are tracked by the N-Wave NOC. The N-Wave Backbone is completely redundant and no single event affects traffic in the Backbone. Regardless, each event is tracked and reported. Most NOAA sites (N-Wave Participants) are multi-homed and are normally not affected by single outages/maintenances that are reflected in this report's ticket numbers. For instance, out of 198 Unscheduled Outage and Scheduled Maintenance tickets on this report, only six events were service impacting and in each case, service was interrupted because each N-Wave Participant had a single connection into the N-Wave Backbone.

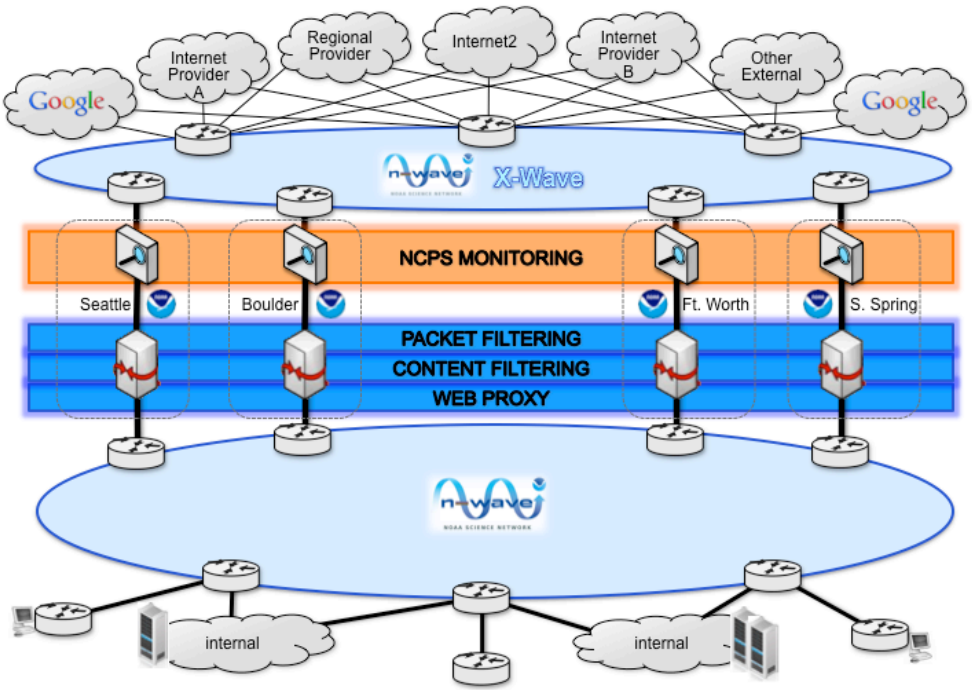
We encourage Participants to work closely with the N-Wave NOC or the N-Wave Project Management to customize the best possible architectural design on their services that run across the N-Wave Network.

N-Wave and NOAA's TIC Compliance Effort

Interconnecting TICAP locations

X-WaveN-Wave is helping with NOAA's effort to fulfill the Trusted Internet Connections (TIC) mandate. For those unfamiliar with TIC, it's an initiative to consolidate external access points across the federal government and implement security controls at those external access points.

NOAA's four TIC Access Points (TICAP) will be located in Seattle, WA; Boulder, CO; Ft. Worth, TX; and the Washington, DC area. N-Wave will manage the networking devices at the TICAP sites outside Washington.



Conceptual diagram for X-Wave

N-Wave, in close coordination with the Silver Spring NOC, will deliver coordinated and consolidated management of the equipment that will supply data to the security stack. This in turn will protect all of NOAA's connections to the Internet.

After the TICAPs are established, N-Wave will also help backhaul traffic from remote NOAA locations that are not collocated with a TICAP. This will be accomplished with a combination of direct circuits over the existing N-Wave infrastructure, building of tail circuits to connect remote sites to N-Wave and IPSec site-to-site VPN connections where direct connections are not feasible. Follow on efforts will include the provision of failover capabilities between TICAP locations through the use of a new external network (tentatively called X-Wave) that will interconnect the TICAP locations.

N-Wave Updates

Network Changes and New Participants

Since the last newsletter, the NOAA Coastal Services Center in Charleston, SC, has established a 1-GE connection to N-Wave. The tail circuit was done by a combination of a commercial service and the North Carolina RON, MCNC.

This past quarter, N-Wave has worked with the NWS Radar Operations Center (ROC) of Norman, OK and NESDIS National Coastal Development Center (NCDDC) of Stennis, MS to move their Internet traffic to the Boulder NOC for TIC access.

The ROC is using the existing N-Wave partnership with the University of Oklahoma, OneNet and National LambdaRail for access to the N-Wave core node in Denver. From Denver, the traffic is carried to Boulder for Internet access via the TICAP located there.

NCDDC is co-located with Mississippi State University's facility on NASA's Stennis Space Center. MSU has added dual 10-GE circuits to their facility and provides access to a low-cost gigabit Ethernet campus network connection. NCDDC is working with N-Wave to test secure TICAP transport.

RONS

Many Last Miles for N-Wave

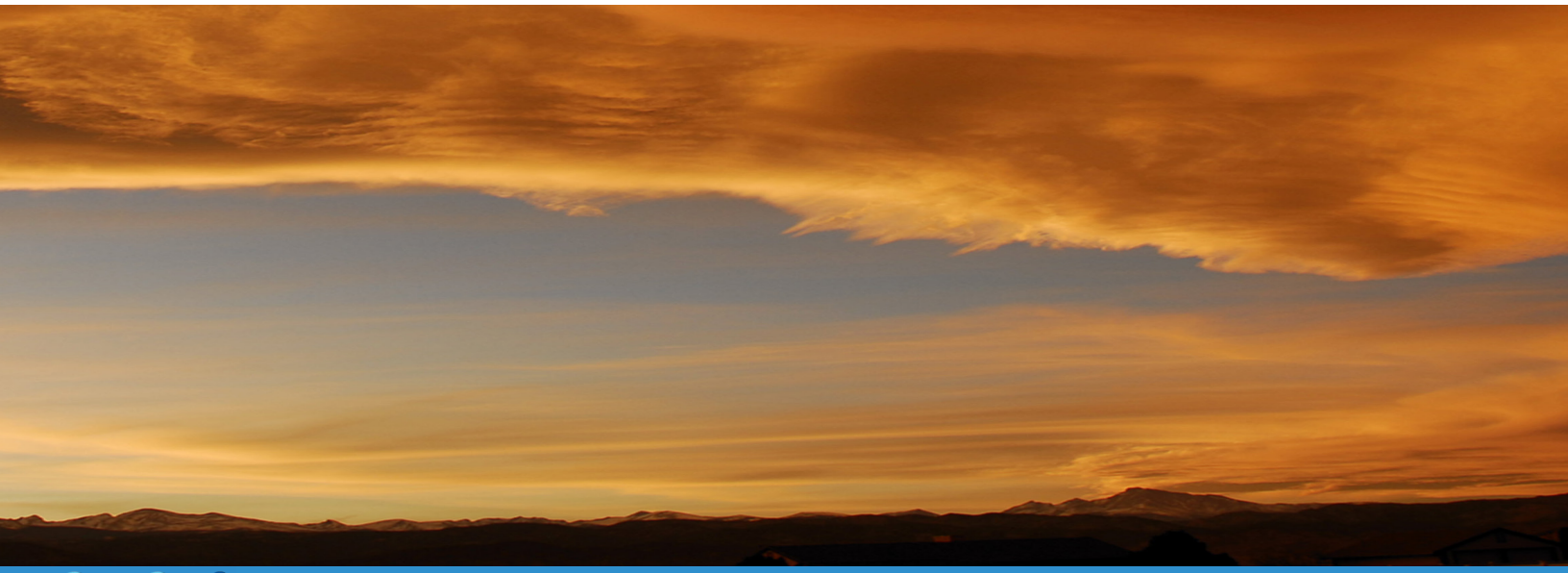
Building on a long history of collaboration and communication, Regional Optical Networks (RONs) were formed by universities, research institutions, government and private industry to advance their missions by providing economical access to high performance computing resources, big data storage and streaming, media. RONs build and and operate the high-performance network services needed to advance their members' missions across a region. Collaborating with neighboring RONs, national consortiums such as Internet2 and National LambdaRail (NLR), and other national Research and Education (R&E) networks such as ESnet (the Department of Energy's research and engineering network) and DREN (the Defense Research and Engineering Network), RONs expand the reach of their regional partners to access resources across the country and the world.

In much the same way that NOAA partners with joint and cooperative institutes, NOAA partners with RONs across the country to advance its mission to monitor and predict the environment and share resources with the research community. RONs provide their members with a variety of services including high-speed optical data transfer between members, peering with intra-regional, national and international networks, and Internet access and collocation. RONs run the network operations services to assure continuing operations and provide the expertise to develop cost-effective services while pursuing the technological advances needed to meet the demand for network resources. This article profiles some of NOAA's longest RON partnerships, predating N-Wave. Future issues will highlight more of NOAA's RON partnerships.

Front Range GigaPoP (FRGP) - http://www.frgp.net/

Located on the Front Range of the Rocky Mountains, the Front Range GigaPop (FRGP) consortium supports participants in Colorado and Wyoming. FRGP has supported a doubling in traffic growth every 2–3 years since its inception in 2000 and currently serves a research and education community of over 800,000. The University Corporation for Atmospheric Research (UCAR) provides the management, engineering, and network operations center support for the FRGP. FRGP partners with national networks including Internet2, NLR, ESnet, and the Western Regional Network (WRN) allowing regional researchers to roam far beyond the Bi-State Optical Network (BiSON), DREAM, and SCONE fiber resources that serve the Front Range Research and Education community.

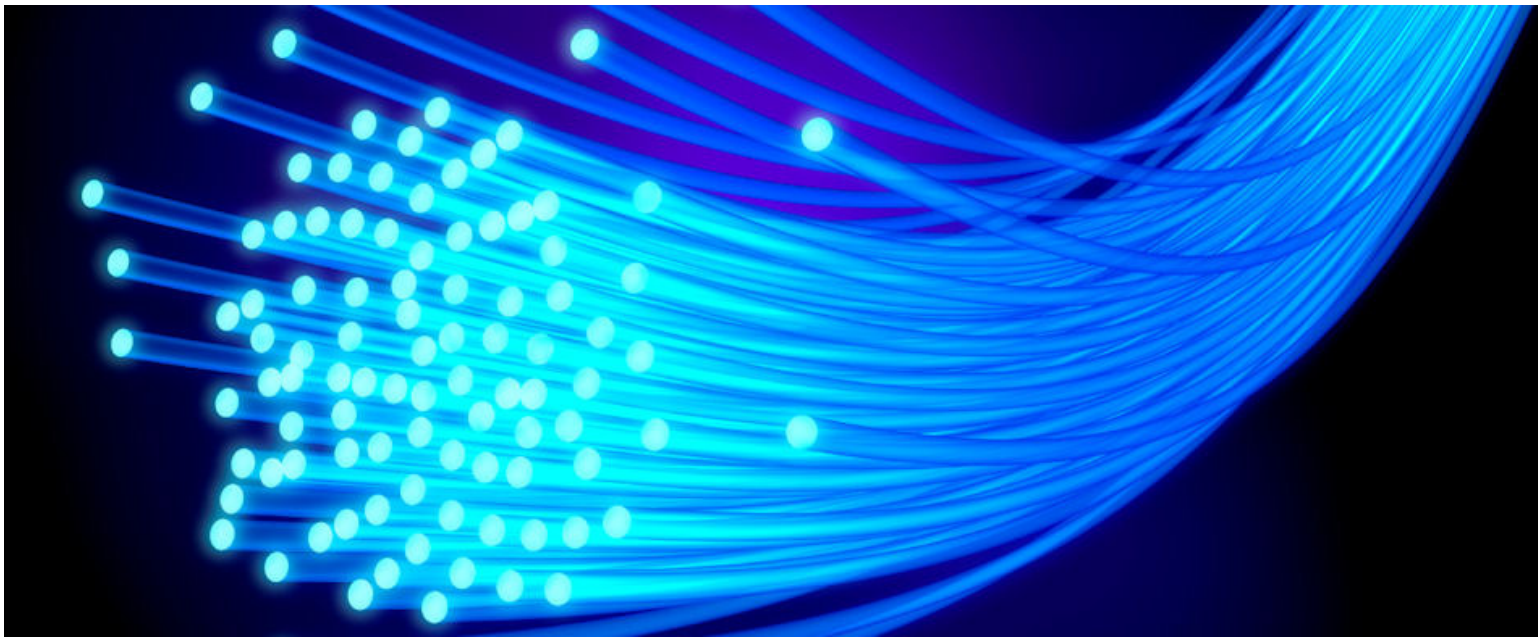
For the Department of Commerce (DOC) Boulder Campus, FRGP is their connection to external computing. Modelers run hurricane simulations on supercomputers in Texas and develop the next generation of weather forecast models on machines in Tennessee and West Virginia. Anywhere compute cycles are available, FRGP connections provide the first step for researchers to improve our understanding and prediction of the environment. Data archives maintained in the David Skaggs research Center (DSRC) for both the Comprehensive Large Array-data Stewardship System and the National Geophysical Data Center – are made more accessible and affordable by FRGP's connection to N-Wave.



Mid-Atlantic Crossroads (MAX) - http://www.maxgigapop.net/

Mid-Atlantic Crossroads (MAX) is a multi-state regional network led by the University of Maryland. MAX owns and operates an all-optical, Layer 1 core network that is the foundation for a high-performance infrastructure providing state-of-the-art 100-Gbps network technology and services. MAX participants include universities, federal research labs, and other research-focused organizations in the Washington D.C. and Baltimore metropolitan areas whose astronomy, biology, environmental science, computer science, engineering, geo-science, and physical science communities have large-scale data flow requirements. MAX serves as a connector and traffic aggregator to the Internet2 national backbone and peers with other major networks. Its mission is to provide cutting-edge network connectivity for its participants, tailored and generic data-transport solutions, and advanced services to accommodate and optimize large data flows, and to facilitate network and application research. MAX conducts its own research and development in core areas around dynamic optical networks, control plane architectures, network management, optical performance, and network virtualization, and is an active participant in the National Science Foundation's (NSF) Global Environment for Network Innovations (GENI) program.

In the Washington, D.C. metro area, the National Centers for Environmental Prediction (NCEP) produces and distributes forecast products for more than 20 operational numerical prediction systems used to protect life and property across the country. The National Environmental Satellite, Data, and Information Service (NESDIS) monitors the Earth continuously from space. These organizations rely on the MAX to transport the huge volumes of data they produce to data facilities and non-operational users. The NOAA Silver Spring campus has long relied on MAX for its regional and national connections.



Pacific Northwest GigaPoP (PNWGP) - http://www.pnwgp.net/

The Pacific Northwest GigaPoP (PNWGP) is a not-for-profit organization serving research and education organizations throughout the Pacific Rim. PNWGP designs, implements, and manages a multi-state, high-bandvwidth and high-capacity network specifically designed to meet the unique requirements of research and education communities. PNWGP contracts with the University of Washington Network Operations Center (UW NOC) located on the UW campus to provide sophisticated, around-the-clock monitoring and network management.

Spanning the Pacific basin, PNWGP connects the Pacific Marine Environmental Laboratory in Seattle and the Inouye Regional Center in Hawaii to N-Wave and NOAA high-performance computing and data resources. Serving as the NOC for the Northern Wave service of the Northern Tier Network Consortium (NTNC) PNWGP is a key player in N-Wave's diverse backup circuit provided by NTNC running across the northern tier of states from Seattle to Chicago.

Mid-Atlantic GigaPoP in Philadelphia for Internet2 (MAGPI) - http://www.magpi.net/

MAGPI is a regional high-speed network and aggregation point providing access to robust advanced network infrastructure and Next-Generation networking services for institutions in Pennsylvania, New Jersey, and Delaware. MAGPI is located in Philadelphia, Pennsylvania and is part of the University of Pennsylvania's Information Systems and Computing, Networking & Telecommunications central IT organization.

MAGPI worked with NOAA's Geospatial Fluid Dynamics Laboratory (GFDL) in Princeton, NJ, Internet2's FiberCo, and DOE's Princeton Plasma Physics Laboratory (PPPL) to create the original fiber build, giving GFDL & PPPL the high-performance network infrastructure necessary to send, receive, view, and manipulate vast amounts of climate and physics data across the United States and the world. MAGPI later worked with GFDL to enhance the fiber network supporting NOAA's scientist by building a diverse path from Princeton to New York City and then, via another wave from Internet2, onto the N-Wave core node in Chicago. MAGPI's decreasing cost model has attracted other institutions in the region, thereby reducing everyone's recurring fees. Princeton University has been a good partner to the initiative by participating in the shared fiber model and hosting the Ciena equipment in their High-Performance Computing Center. All together there are currently 53 Gbps of circuit capacity over this fiber.

Greg Palmer, Executive Director of MAGPI, had this to say about the collaborative relationship, "GFDL's participation in the shared fiber model has not only reduced NOAA's costs, but has enabled advancements to the academic and research initiatives throughout the region. NOAA has been a model partner and community citizen".

N-WAVE Connects to Inouye Regional Center

Hawaii Update

The Inouye Regional Center (IRC), located on historic Ford Island Naval Station Pearl Harbor in Honolulu, HI is scheduled to open December 16. Built in and around four historic buildings on Ford Island, it has culminated into a state-of-the art campus, which is environmentally sustainable, and certified "Gold" as a Leadership in Environmental and Energy Design. Many of the NOAA facilities, as well as some other non-NOAA government agencies, on the island of Oahu will relocate to the IRC. The main facility is an American Recovery and Reinvestment project supported by U.S. Senator Inouye and comprises a suite of laboratory and support areas to facilitate the needs for NOAA scientists conducting research in the Pacific.

At opening, N-Wave will provide services to the NOAA occupants of the IRC including the National Ocean Service, National Marine Fisheries Service, and the National Weather Service. Hawaii field offices and customers not physically residing at the IRC will be connected using the Hawaiian Telcom's state-wide Ethernet service.This allows them to connect to the the IRC, N-Wave and other NOAA offices in Hawaii and on the mainland.

n-wave
NOAA SCIENCE NETWORK

For more information contact:
NOAA N-Wave Science Network
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