

**National Oceanic and Atmospheric
Administration (NOAA)
Office of the Chief Information Officer (OCIO)**



Enterprise Network Services Strategic Plan, 2017 - 2021

Enterprise Network Program Office (ENPO)

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1. Introduction

The National Oceanic and Atmospheric Administration (NOAA) is a beacon for environmental science and exploration the world over. Synonymous with civilization is man's ability to leverage science to make our environment safer and optimized for human sustenance. NOAA's mission of climatic prediction, information sharing, and environmental conservation¹, is the cornerstone of this effort, whereby environmental science and the advancement of the human race intersect.

NOAA's mission and operations span all 50 states (as well as several international sites) and has practical implications on the daily lives of all US residents. Everything from transportation to emergency services are highly dependent on NOAA's ability to predict terrestrial, celestial and maritime climatic patterns with unprecedented accuracy. The collection, analysis, and distribution of scientific data has unalienable merits in this pursuit. As a result, it is paramount that the networking infrastructure, processes, and tools that support NOAA's mission are optimally developed and provisioned.

In 2014, the Enterprise Network Program Office (ENPO) was created within the NOAA Office of the Chief Information Officer (OCIO). The mission of the ENPO is to improve networking efficiency at NOAA by identifying and addressing a comprehensive list of networking challenges and risks, with a focus on enterprise network service delivery and acquisitions. The Enterprise Network Services Strategic Plan, 2017-2021 defines the vision of the ENPO and outlines a strategy to optimize networking at NOAA, by providing an in-depth description of four overarching strategic goals. These goals were originally identified by *The Network Optimization & Transport Services Strategic Plan (2013 - 2018 Strategic Plan)*, as the building blocks of NOAA's networking strategy. The Enterprise Network Services Strategic Plan, 2017 - 2021, elaborates on these goals by outlining a strategy that takes into account the progress made to date as well as any new strategic initiatives necessitated by NOAA's evolving mission requirements and industry trends. This document also outlines an implementation plan which includes specific implementation actions that are required to transition NOAA's networking vision from strategy to operations.

2. Vision Statement

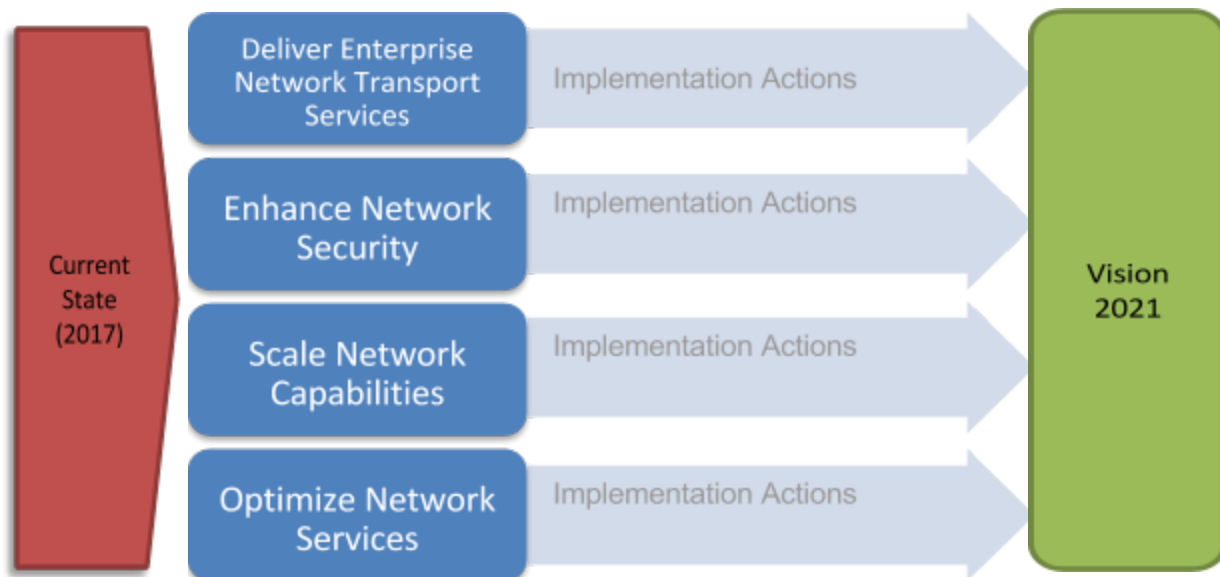
The vision of the ENPO is to transform NOAA's networks into an enterprise-managed, secure, agile, and reliable resource that enables NOAA's mission. This will be accomplished by leveraging NOAA's enterprise IT governance framework and industry best practices to respond to risks, challenges, and opportunities pertaining to NOAA's reliance on networking.

¹ NOAA Mission (n.d). Retrieved from: <http://www.noaa.gov/about-our-agency>

3. Goals

The following four goals have been identified as key elements in transforming NOAA's networks into a secure, reliable, and agile resource: 1) Deliver Enterprise Transport Services; 2) Enhance NOAA's Network security; 3) Scale Network Capabilities; and 4) Optimize Network Services. Specific implementation actions for each of the four goals can be found in Appendix A.

Figure 1



3.1 Deliver Enterprise Network Transport Services

NOAA's mission is heavily reliant on its ability to cost effectively, efficiently, and securely move large amounts data between the public, commercial entities, NOAA's scientific research communities, NOAA staff and line offices, and other federal government entities. Over time, NOAA's line and staff offices have met the requirement of providing reliable network transport by procuring transport services from external third party providers, either independently or through existing NOAA contract vehicles. As resourceful as this approach has been, it has created a siloed networking environment with limited top-down transparency. As a result, achieving economies of scale and implementing efficient standardized processes across NOAA poses a significant challenge. Addressing this challenge requires an enterprise approach to procuring, delivering, and managing network transport services. This enterprise approach to networking will provide NOAA's leadership with an accurate and comprehensive understanding of NOAA's network transport services landscape. Such transparency will better inform the development of realistic operational network goals, as well as the prioritization

between technical, financial, operational, and security considerations. The following four objectives have been identified as essential in accomplishing this goal:

3.1.1 Manage NOAA's Networks at the Enterprise Level

The 2013 -2018 Strategic Plan proposed a common service, infrastructure, and funding model to deliver and manage network services across NOAA. In line with this strategy, strides have been made towards optimally positioning NOAA network service providers (from a governance and technical perspective) to meet the requirements of an enterprise solution to networking. An example of this is the N-Wave Program's transition to the NOAA OCIO from the Office of Oceanic and Atmospheric Research (OAR). This move, along with on-going network capacity planning initiatives, optimally positions N-Wave as a NOAA provider of enterprise network services. With this foundation in place, the plan going forward will be to establish a common reference architecture for NOAA wide network service delivery, ordering, monitoring and reporting. This reference architecture will be supported by the following initiatives:

- Continuously scaling the network capacity of internal network service providers to meet customer demand.
- Optimizing existing network services and identifying opportunities to create new ones.
- Establishing a customer service driven enterprise delivery model
- Gaining NOAA-wide buy-in to the enterprise service delivery model through proper communication and awareness initiatives.

If these actions are properly implemented, NOAA's enterprise network services will continue to build momentum. Architecture principles, which define the underlying rules and guidelines that govern the use and deployment of enterprise network resources, will be implemented to ensure that standards that sustain the enterprise model are followed. With improved transparency and architecture principles in place, NOAA's IT leadership will be equipped with a comprehensive understanding of its network transport landscape. This will inform the development of realistic operational network goals and optimal delegation of implementation actions.

3.1.2 Provide Network Services through the Enterprise IT Service Catalog

All enterprise networking services will be provided through the IT service catalog. The IT service catalog will include a catalog of standard, repeatable network services, designed to meet current mission requirements. Benefits of this model include cost savings and better alignment of network services with mission requirements.

In order to ensure comprehensive and lean network services are provided, the underlying maturity of the enterprise networking model is paramount. As a result, the ENPO was created to facilitate the adoption of an enterprise solution to networking. The development or enhancement of a network service is usually a response to a risk or challenge. The mission of The ENPO is to identify these networking risks and challenges, then facilitate the development of solutions through the optimization, development, and/or acquisition of network services.

This process is essential in ensuring that the services on the network service catalog address the NOAA mission networking requirements.

3.1.3 Consolidate NOAA Network Operating Centers (NOC)

NOAA currently has five “service delivery” NOCs located in Seattle, WA; Denver, CO; Dallas, TX; Washington DC Metro Area; and Honolulu, HI. These NOCs host NOAA Trusted Internet Connection Access Points (TICAP), provision networking services, and monitor NOAA’s networks across multiple NOAA organizations. A NOC assessment was performed by the OCIO in April of 2015 with the objective of evaluating services, operating models, practices, and tools used at these NOCs. The assessment concluded that the different NOCs provided overlapping services under distinct operating models, employed site-specific processes and practices, and used a variety of site-specific or redundant tools². Consolidating all NOAA’s service delivery NOCs under the management of one enterprise NOC would remediate these inefficiencies by eliminating service redundancy, standardizing processes, and leveraging a cost effective standard suite of tools.

3.1.4 Standardize Network Acquisitions Across NOAA

All enterprise transport services will be provided through the IT service catalog. Acquisitions from internal and external network service providers will support this model as necessitated by demand. NOAA will align its acquisition strategy (from external service providers) with GSA’s Network Services 2020 Strategy, which was designed to strategically source telecommunications and information technology (IT) infrastructure services³. The first GSA contract vehicle to implement this strategy is the Enterprise Infrastructure Solutions contract (EIS). EIS, which is the follow-on contract to GSA’s Networx, WITS3, and the Local Telecommunications Services (LTS) contracts, is a comprehensive solution-based contract vehicle designed to address all aspects of federal agency IT, telecommunication, and infrastructure requirements. NOAA will leverage EIS to standardize network acquisitions by working with service providers that meet GSA and NOAA’s acquisition standards. EIS alternatives may be sought by internal NOAA service providers in order to access non commercially available services. All acquisitions outside of EIS will require a cost benefit analysis in accordance with OMB Memoranda.

3.2 Enhance NOAA’s Network Security

Securing NOAA’s data is just as important as disseminating said data internally between systems and externally to the public. Security considerations must therefore be paramount in planning and executing all networking endeavors. NOAA’s network security strategy will be informed by the current industry best practices and standards, NOAA mission requirements, and federal mandates and guidelines.

² Network Operations Center (NOC) Assessment v.12 - April 3rd 2015

³ The Network Services 2020 Strategy - GSA White Paper (April 2014). Retrieved from GSA.gov

3.2.1 Route Networks Through a TICAP

Routing all networks through a TICAP was mandated by The Office of Management and Budget (OMB) as outlined in the OMB Memorandum, M-08-05, dated November 2007. The purpose of this requirement is to optimize and standardize the security of individual external network connections currently in use by federal agencies⁴. Benefits of this model include quicker resolution of security incidents and a more streamlined implementation of new technologies.

NOAA has TICAPs in five locations: Washington DC Metro Area; Honolulu, HI; Seattle, WA; Dallas, TX; and Denver, CO. The TICAPs are managed and operated by NOAA's Cyber Security Division (CSD), while network access to the TICAPs is provided by N-Wave. As of the 4th quarter of FY16, N-Wave has completed the provisioning of the network infrastructure that supports the TICAPs. By the end of the fourth quarter of FY17, all NOAA external connections will be fully TICAP 2.0 compliant.

3.2.2 Establish Enterprise-Wide Network Security Controls

Establishing enterprise-wide network security controls will further enhance NOAA's network security by ensuring that all network services and infrastructure operate and are assessed within the parameters of technical and administrative security controls. The integrated NOC will monitor NOAA's border routers, leveraging security controls to align network operations with NOAA's security policies. Internal network security controls will work in conjunction with the TICAP external traffic filtering policies. From a systems and service delivery standpoint, security controls will provide guidelines for Interconnection Security Agreements (ISA), Interface Control Documents (ICD), and Service Level Agreements (SLA). Such documents will be templated in order to reduce the level of effort for future implementations.

3.2.3 Utilize Security Operations Center (SOC) to Monitor Enterprise Services

NOAA's SOC, managed and operated by CSD, is at the frontlines of identifying and communicating cyber security threats. Integration between the enterprise NOC and the SOC on a system and/or human resource level will be vital in identifying cyber security threats and responding to security incidents. SOC engineers will have real-time visibility into NOAA's networks and NOC engineers will have real time awareness of security threats. This makes it easier to identify the origin of security incidents and quickly implement remedial actions.

3.3 Scale Network Capabilities

NOAA's networks are designed to provide end users with access to both enterprise and non-enterprise IT services (shared services and staff/line office specific services). As new services are introduced and existing services are consolidated into enterprise services hosted internally or on cloud platforms, networking capabilities need to be scaled accordingly to ensure these services are adequately supported without compromising core elements of the network such as high availability,

⁴ OMB Memorandum M-08-05. Retrieved from <https://www.dhs.gov/trusted-internet-connections>

network speed, access, and security.

3.3.1 Strategically Acquire Network Capabilities

With internal NOAA network providers such as N-Wave providing enterprise network services, deploying new network capabilities across NOAA's evolving enterprise network service landscape becomes more feasible. Internal network service providers will augment their service offerings with new industry standard network capabilities where possible. In cases where required network capabilities are not available through the service catalog, provisions will be made for NOAA's internal network service providers to acquire these capabilities via existing contract vehicles such as EIS. The ENPO will work with the The Department of Commerce (DOC) and General Services Administration (GSA) to ensure that the EIS contract meets the networking requirements of NOAA's Line and Staff Offices.

3.3.2 Build Network Engineering Staff Core Competencies

Network optimization from an infrastructure and architectural standpoint will fall short if the capabilities of NOAA's engineering staff are not augmented accordingly. The NOAA Network Committee (NNC), which includes representatives from the LOs and provides advocacy for the Line Offices on networking issues, will be leveraged to assess the training requirements of NOAA's networking staff. Training initiatives will not only help engineers effectively deploy and manage new network technologies, it will also foster an industry trend awareness which will ensure that NOAA's networks are at the cusp of networking technological evolution.

3.3.3 Deploy NOAA Enterprise Services for Federal Agency Accessibility

Making NOAA enterprise network services available to other federal agencies will help grow the existing customer base for NOAA's enterprise service offerings. A larger customer base creates an environment that can sustain an increase in new service offerings and optimization of existing services. This brings about additional cost savings through added efficiency and economies of scale.

3.3.4 Ensure Adequate Network Support of Data Center Consolidation

The Data Center Optimization Initiative (DCOI) established by the OMB Memorandum M-16-19, requires agencies to develop and report on data center strategies to consolidate inefficient infrastructure, optimize existing facilities, improve security posture, achieve cost savings, and transition to more efficient infrastructure, such as cloud services and inter-agency shared services.⁵ In support of DCOI, NOAA's wide area networks (WAN) must be deployed with provisions for resiliency and high availability, in order to provide optimized access to cloud and other data center platforms. Single points of failure on the network will be prevented by establishing redundant paths. NOAA's enterprise network providers will work with NOAA Line and Staff Offices to plan for network capacity augmentation based on current

⁵ MEMORANDUM FOR HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES (M-16-19). Retrieved from <https://www.whitehouse.gov>

and future demand forecasts. Network capacity planning will be done in conjunction with with CSD's TICAP capacity planning to ensure adequate support of cloud based data centers on external networks.

3.4 Optimize Network Services

The 2013 - 2018 Strategic Plan outlined a strategy for optimizing network services by identifying opportunities, enhancing service delivery, and continuously modernizing enterprise standards. Actions taken to date to implement this strategy include the creation of the ENPO, transition of N-Wave to the NOAA OCIO from OAR, and the ongoing NOAA NOC consolidation. Going forward, the success of these initiatives should be ensured by the provision of adequate funding and planning.

3.4.1 Enhance Network Service Delivery

In order to optimize networking services, critical networking challenges, risks, and opportunities will be identified and addressed. The ENPO will play a facilitative role in this process by leveraging both governance and architecture principles to influence and inform solutions respectively⁶. The end result of this process will be the implementation of solutions that optimize existing services and/or deploy new ones.

In order to effectively create solutions that address identified risks, challenges and opportunities, an optimally functioning service delivery model will be implemented. This model will operate within a governance framework that provides executive oversight from the CIO council, mission advocacy from the NNC, and solution facilitation from the ENPO. Within this model, service delivery will work in concert with NOAA's Acquisitions and Grants Office (AGO) to ensure that mission requirements that cannot be met through internal service provisioning are met through acquisitions from external providers. Service reliability will be ensured by centralized monitoring of all enterprise services.

3.4.2 Establish a Network Service Reference Architecture

A network service reference architecture will be established to guide the development of all enterprise network services. This reference architecture will be informed by The Enterprise Network Services Strategic Plan, 2017 - 2021, which calls for the consolidation of networking services (currently operating in silos) to enterprise network services or shared services. The reference architecture will outline a model for planning, designing, and implementing all shared services. A typical service architecture defines all the building blocks and interfaces of a shared service from the user interface to the service provider's interface. It also defines exactly how internal and external service providers interface in the end to end to end provisioning of a shared service. It is important to note that the network services reference architecture proposed by The Enterprise Network Services Strategic Plan, 2017 - 2021 is not intended to serve as the architecture for specific network services but as a reference model for shared service architecture design. The latter will be completed during the development of the shared

⁶ Enterprise Network Program Office (ENPO) Concept of Operations - June 30, 2015

service.

The main driving factors in establishing a network service reference architecture are as follows:

1. Providing NOAA line and staff offices with the most cost effective services that meet their requirements.
2. Providing NOAA with a comprehensive view of NOAA's service landscape. This will better inform the capacity planning efforts of internal service providers and ultimately enable internal service providers to play a more significant role in providing shared services across NOAA.

3.4.4 Establish Enterprise Architecture Principles

Architecture Principles will inform solutions by defining the criteria by which networking technology and services are acquired, delivered, managed, and secured⁶. These principles will be informed by ENPO guiding principles (transparency, mission advocacy, and requirements driven engineering) industry best practices, and mission networking requirements. The ENPO will work closely with the NNC to develop these architecture principles. The NNC, being the advocacy arm of the governance framework, will ensure that mission requirements are taken into consideration in defining architecture principles. The NNC will also be used as a forum to communicate these principles back to the line offices. Leveraging such transparency, architecture principles will be continuously validated and updated based on industry trends and changes in mission requirements.

3.4.5 Optimize Network Performance

The move towards implementing enterprise network services begets the consolidation of network Infrastructure. Consolidated network infrastructure allows for a network architecture with top-down transparency. This simplifies the deployment of advanced and proven technologies and configurations that improve network performance, enhance stability and ensure integrity. The NOC consolidation effort will also improve network performance by standardizing network management tools, processes, and configurations. Network monitoring will be centralized, making it easier to identify and improve areas of suboptimal performance. In addition to monitoring interfaces on the network infrastructure, applications will also be monitored. Overall network performance is highly dependent on the stability and performance of hosted applications.

4.0 References

1. NOAA Mission (n.d). Retrieved from: <http://www.noaa.gov/about-our-agency>
2. Strategic Plan Network Optimization & Transport Services 2013-2018
3. The Network Services 2020 Strategy - GSA White Paper (April 2014). Retrieved from GSA.gov
4. Network Operations Center (NOC) Assessment v.12 - April 3rd 2015
5. OMB Memorandum (M-08-05). Retrieved from <https://www.dhs.gov/trusted-internet-connections>
6. Enterprise Network Program Office (ENPO) Concept of Operations - June 30, 2015
7. MEMORANDUM FOR HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES (M-16-19). Retrieved from <https://www.whitehouse.gov>

Appendix A: Implementation Plan

Strategic Goals	Strategic Objectives	Implementation(Projects & Programs)	Owner	Estimated Completion Date
Deliver Enterprise Transport Services	Manage NOAA's NOCs at the Enterprise Level	Assess Internal network capacity	N-Wave	Annually
	Provide Network Services Through an IT Services Portfolio	Update network services catalog	ENPO/SDD	Annually
	Consolidate NOAA Network Operating Centers (NOCs)	Integrate all NOAA service delivery NOCs into an enterprise NOC leveraging a common suite of tools, configuration management and management oversight	N-Wave	Q2-FY17
	Standardize Network Acquisitions Across NOAA.	Establishment of The ENPO	OCIO	TBD - Pending final staffing
		Transition from Networkx to EIS	ENPO	Q3-FY20
Enhance NOAA's Network Security	Route Networks Through TICAPs	Build X-Wave	N-Wave	Q3-FY17
		Complete TICAP v2.0 migration	N-Wave	Q4-FY17
		NOC Integration - common enterprise-wide security controls	N-Wave/CSD	Q2-FY17
	Establish Enterprise Wide Security Controls	Security control enhancement review	CSD/N-Wave	FY17 - FY18
	Utilize SOC to monitor network services	Establish transparency between SOC and NOC to monitor NOAA core and border routers	CSD/N-Wave	FY17 - FY18

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Strategic Goals	Strategic Objectives	Implementation(Projects & Programs)	Owner	Estimated Completion Date
Scale Network Capabilities	Strategically Acquire Networking Capabilities	Networkx to EIS transition	ENPO	Q2-FY20
		Networkx capacity planning	N-Wave	Annually
	Build Network Engineering Core Competencies	Establish networking center for excellence	ENPO	FY17 -FY18
	Deploy NOAA Enterprise Services for Federal Agency Accessibility	Provision transport as needed	N-Wave	TBD
	Ensure Adequate Network Support of Data Center Consolidation.	Network capacity planning	N-Wave	Annually
		TICAP capacity planning	CSD	Annually
Optimize Network Services	Establish a Network Service Reference Architecture	Develop Reference Architecture for Network Services	OCIO	FY17 -FY21
	Enhance Service Delivery	Develop a new ordering and invoice management operating model for networking services	SDD/ENPO/NOAA-link	FY17 -FY18
	Establish Architecture Principles	Establish architecture principles	ENPO	FY17 - FY18
	Optimize network performance	Establish/consolidate monitoring on all NOAA networks	ENPO	FY21