Review of Information Technology Network Performance

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Highlights

Objective

Our objective was to determine if the U.S. Postal Service's network performance is optimized to support infrastructure demands and ensure system availability.

The Postal Service operates and maintains one of the world's largest computer networks, linking more than 31,000 retail locations and making communication possible among hundreds of thousands of employees. The Postal Service processes more than 146 billion mailpieces annually and delivers nearly half of the world's mail. To do this, the Postal Service relies on about 86,000 network devices that support the Information Technology (IT) and mail processing infrastructures.

As the Postal Service invests in IT infrastructure to meet the changing needs of its customers and remain relevant in the digital future, an optimized network is the foundation for achieving its strategic and future ready goals.

To evaluate the overall performance and efficiency of the network, we assessed IT segments that support the four largest mail processing facilities, the primary data center, and a pilot location used for a mail processing infrastructure redesign. We also evaluated the Postal Service's network inventory system that accounts for the network devices and the network diagrams that show the relationship between these devices to understand the architecture, its connectivity, and the potential impact of changes.

Findings

The Postal Service IT network is not fully optimized to meet future requirements. While the network handles current operational requirements, performance and system availability should be improved for the future.

Management did not establish enterprise-wide performance metrics and improvement targets for optimal network performance and operating efficiency. For example, the Sacramento Processing and Distribution Center (P&DC) experienced 51 network connectivity issues that resulted in additional manual mail processing costs of over $1.1 million from the period of December 2017 through June 2019. In addition, the facility was missing critical system controls,

such as backup generators and properly configured network devices to ensure uninterrupted service. Monitoring against enterprise-wide performance metrics and improvement targets could have helped prevent these service disruptions.

We also found instances where the Postal Service did not upgrade the network's bandwidth for circuits that exceeded their recommended capacity at mail processing and other key facilities. We assessed six sites from November 2017 through December 2018 and leveraged data from the Postal Service vendor's bandwidth utilization reports to determine circuits that should be upgraded. We found bandwidth utilization issues at three facilities. For example, circuits at the Kansas City P&DC were running above the Postal Service's recommended capacity for over a year.

Further, we found the Postal Service's IT network diagrams and inventory system were not sufficient to efficiently manage and operate the enterprise network. For example, the ███████████ had a ███████████ not represented on their network diagrams. ██ Also, inventory records were not always accurate. We identified about 1,900 devices that were not accounted for in the inventory system. The inventory records also contained 1,730 duplicate internet protocol addresses, 2,697 duplicate hostnames, 3,458 missing serial numbers, and 3,333 missing device models.

> "*For example, the Sacramento Processing and Distribution Center (P&DC) experienced 51 network connectivity issues that resulted in additional manual mail processing costs of over $1.1 million from the period of December 2017 through June 2019.*"

As the Postal Service moves into the digital future, an understanding of the existing network and its architecture is essential to consistently meet customer needs. Left uncorrected, the Postal Service will not have the necessary information available to identify ████████████████, understand the impact of architectural changes, and minimize downtime to troubleshoot network issues and avoid incurring additional manual processing costs. Without performance metrics, the Postal Service cannot determine if systems operate within desired parameters. Further, the Postal Service's IT network is at risk of experiencing sub-optimal network performance, resulting in potential disruptions to mail operations.

Recommendations

We recommended management:

- Establish a network strategy to include a process to continuously monitor the information technology network and develop enterprise-wide performance metrics and improvement targets.

- Implement a solution, such as use of sitewide emergency generators, to prevent network connectivity issues and adjust the configuration settings of network devices at the Sacramento Processing and Distribution Center.

- Develop an automated process to regularly review vendor bandwidth utilization reports and upgrade bandwidth when it exceeds determined thresholds.

- Develop and maintain detailed Postal Service information technology network diagrams.

- Perform a manual review of the automated inventory process on a periodic basis and update the inventory data accordingly.

Transmittal Letter

January 17, 2020

MEMORANDUM FOR: PRITHA MEHRA
VICE PRESIDENT, INFORMATION TECHNOLOGY

SCOTT BOMBAUGH
VICE PRESIDENT, ENGINEERING SYSTEMS

TOM SAMRA
VICE PRESIDENT, FACILITIES

McDavid, Margaret

FROM: Margaret B. McDavid
Deputy Assistant Inspector General for Inspection Service,
Information Technology and Operations

SUBJECT: Audit Report – Review of Information Technology Network
Performance (Report Number 18TG005IT000-R20)

This report presents the results of our audit of the Review of Information Technology
Network Performance.

We appreciate the cooperation and courtesies provided by your staff. If you have any
questions or need additional information, please contact Mary Lloyd, Acting Director,
Information Technology, or me at 703-248-2100.

Attachment

cc: Postmaster General
Corporate Audit Response Management
Chief Information Officer and Executive Vice President

Results

Introduction/Objective

This report presents the results of our self-initiated audit of the Review of Information Technology (IT) Network Performance (Project Number 18TG005IT000). Our objective was to determine if the U.S. Postal Service's network performance is optimized to support infrastructure demands and ensure system availability.

Background

The Postal Service has the resources, network infrastructure, and logistic capabilities to regularly deliver to every residential and business address in the nation. To accomplish this, the Postal Service has one of the world's largest IT networks, linking more than 31,000 retail locations and making communication possible among hundreds of thousands of employees. Additionally, the network links over 8,500 pieces of automated mail processing equipment. The Postal Service relies on over 86,000 network devices that support the administrative, mail processing, and payment card industry networks. This network infrastructure provides the foundation for the various Postal Service IT systems that process over 146 billion mailpieces annually.

Optimal IT network performance is a critical component to ensure the availability of systems and is vital for the Postal Service to support its core business functions and processes. The Postal Service's IT infrastructure includes the hardware, software, facilities, and service components that support business systems and IT enabled processes. Appropriately managing this infrastructure is an important part of delivering IT services to the organization's end-users. As the Postal Service invests in its infrastructure to meet customers' changing needs and remain relevant in the digital future, an optimized IT network is the foundation for achieving its strategic and future ready goals. According to the Postal Service's 2017-2021 Five-Year Strategic Plan, the digital economy offers an unprecedented opportunity to address the needs of both mail and package

customers. The Postal Service intends to improve its network and infrastructure to meet those needs.

Summary

The Postal Service IT network[1] is not fully optimized to meet future requirements. While the Postal Service IT network handles current operational requirements, network performance and system availability should be improved for the future. Specifically, we found the Postal Service did not have performance metrics and improvement targets for desired network performance, experienced reoccurring network connectivity issues, and exceeded bandwidth utilization thresholds. Further, the Postal Service relied on existing network diagrams and a network inventory system that did not provide complete visibility of the network.

Finding #1: Measuring and Monitoring Network Performance

While the Postal Service IT network handles current operational requirements, it is not fully optimized. Specifically, we found the Postal Service did not establish enterprise-wide performance metrics or improvement targets for network devices[2] and did not proactively monitor and resolve reoccurring network connectivity issues. Ensuring efficient, cost-effective delivery of nearly half of the world's mail requires the Postal Service to promptly resolve IT network issues that may result in additional manual mail processing costs when automated equipment does not work as intended.

Enterprise-Wide Performance Metrics

The Postal Service cannot determine if its network performance is optimized. We found the Postal Service did not have enterprise-wide performance metrics,[3] improvement targets, and a methodology to evaluate the health of the network. For example, the Postal Service did not establish thresholds for management

"The Postal Service cannot determine if its network performance is optimized."

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1   For the purposes of this report, the IT network includes the administrative and mail processing infrastructure networks.
2   The Postal Service has availability goals for their applications; however, it has not established performance metrics for the network infrastructure that supports these applications and business operations.
3   Performance metrics provide the key performance indicator baselines.

latency,[4] management jitter,[5] and processor memory utilization.[6] Establishing performance metrics can provide indications of how the network is performing and identify potential network problems.[7] To ensure the IT network can handle future requirements, establishing performance metrics provides baselines from which optimization and performance improvement goals can be set.[8]

According to Gartner,[9] organizations should benchmark against their current performance, determine key performance indicator baselines, establish improvement targets, and continue to measure against their existing benchmark until reaching their target. Management stated they did not establish enterprise-wide network performance metrics because it would take them a significant amount of time to determine the appropriate performance thresholds for the enterprise. Consequently, the Postal Service did not establish performance metrics for network devices or develop a network strategy.[10] Rather, management relied on individual engineers' experience to identify normal operating performance and react to incidents. As a result, network devices operating outside of normal ranges may not be identified and may not support increased network traffic or operational demands. Without established performance metrics to measure network health, the Postal Service could be susceptible to sub-optimal network performance resulting in potential disruptions to mail operations and could have limited ability to identify whether systems are operating within their desired parameters, or to proactively identify issues and forecast whether the network could support new initiatives.

Monitoring and Resolution of Network Connectivity Issues

The Postal Service did not effectively monitor and resolve network connectivity issues. While the Postal Service has network performance monitoring tools that generate a wealth of monitoring data, the Postal Service did not review or analyze this data to gain insight into network performance to identify systemic issues and prevent service disruptions. During our assessment of the second largest P&DC (Sacramento), we identified 51 network connectivity issues from the period of December 2017 through June 2019 that revealed ineffective monitoring, outdated configuration settings and missing availability controls (e.g., lack of a backup generator). Specifically, we found network devices supporting mail operations were flapping (i.e., unexpectedly turning on and off), inaccessible, or not working as intended due to Hot Standby Router Protocol (HSRP)[11] instability. These issues reoccurred for more than a year without proper resolution and the Postal Service missed opportunities to optimize the network because they were unaware of these systemic issues until we brought them to their attention during this audit.

According to Gartner,[12] organizations use Network Performance Monitoring and Diagnostics tools to allow IT operations to understand the performance of applications, the network, infrastructure components, and the quality of end user experience. The goal of these tools is not only to monitor the network components to facilitate outage and degradation resolution, but also to identify performance optimization opportunities. In addition, Cisco recommends performing operating system upgrades or configuration changes to HSRP timers and HSRP "hold times" to address instability issues. Further, Postal Service policy[13] states that resources or processes that may be deployed to ensure high availability include, but are not limited to, the following: uninterruptible power supplies, power conditioning systems, and backup generators.

The monitoring issues occurred because the Postal Service did not have a network strategy to define an effective monitoring process or enterprise-wide performance metrics for desired network performance and improvement targets.

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4   Management latency is the measure of time between initiating a network request and receiving a response.
5   Management jitter is a variation in the delay of received packets due to network congestion, improper queuing, or configuration errors.
6   Processor memory utilization is the consumption of internal memory built into a computer processor.
7   Gartner article, "The Monitoring Metrics IT Operations Should Report On," Vivek Bhalla, Will Cappelli, and Pankaj Prasad, dated October 2017.
8   While the Postal Service has service level agreements that define performance requirements for vendor devices, they did not establish performance metrics for their own network devices.
9   Gartner article, "Generic Benchmarking of Monitoring Metrics and KPIs Will Lead to Failure," Padraig Byrne and Vivek Bhalia, dated February 2008, and revalidated July 2019.
10 A network strategy provides an understanding of the current and future state of the IT network to ensure the infrastructure can support key business initiatives.
11 Cisco TechNotes Document ID: 13782 states that HSRP Instability occurs when a network disruption triggers an active router to have a duplicate IP address with the standby router.
12 Gartner article, "2019 Network Performance Monitoring and Diagnostics Magic Quadrant Inclusion Criteria," Sanjit Ganguli, dated July 2018.
13 Handbook AS-805, *Information Security*, Section 9-9.6, High Availability, dated December 2018.

In addition, the network connectivity issues occurred because of missing integrity and availability controls. Further analysis revealed that network devices were misconfigured due to an outdated configuration setting and network devices were not supported by a backup generator. We found that the HSRP instability was triggered by power fluctuations and power outages. Since the Sacramento P&DC has a predisposition for mandatory power outages due to wildfires and other unforeseen circumstances, it is easier to detect this issue at this facility. We determined that a sitewide backup generator could improve service by preventing these types of network connectivity issues from occurring in the future. As a result, when the network was inaccessible, Sacramento P&DC mail clerks had to manually process the mail instead of using automated mail processing equipment. For the 51 network connectivity issues evaluated during the audit period, the Sacramento P&DC incurred costs exceeding $1.1 million to manually process mail that could have been machine sorted.

Recommendation #1
We recommend the **Vice President, Information Technology,** and **Vice President, Engineering Systems,** establish a network strategy to include a process to continuously monitor the information technology network, and develop enterprise-wide performance metrics and improvement targets.

Recommendation #2
We recommend the **Vice President, Engineering Systems,** in coordination with **Vice President, Information Technology,** and **Vice President, Facilities,** implement a solution, such as sitewide emergency generators, to prevent network connectivity issues and adjust the configuration settings of network devices at the Sacramento Processing and Distribution Center to prevent Hot Standby Router Protocol Instability.

Finding #2: Bandwidth Utilization

The Postal Service did not upgrade the bandwidth[14] for circuits[15] operating above recommended capacity as defined in the internal best practice.[16] The Postal Service used a threshold of 80 percent as their internal best practice for when circuit bandwidth should be upgraded. We found instances where

bandwidth utilization exceeded Postal Service's internal threshold at P&DCs and other key facilities.

Bandwidth utilization represents the percentage of a network's maximum available capacity that is currently being consumed by network traffic. Monitoring bandwidth utilization allows IT to easily identify when a circuit in the network is overloaded. Consistently high bandwidth utilization is an indicator of possible network stress, slowdown, or failure and it highlights a need for changes or upgrades in a network infrastructure. We assessed six sites from November 2017 through December 2018 and found issues at three of the facilities during peak season for mail operations. Specifically, we found:

- Two of 31 circuits at the Eagan, MN, Data Center exceeded the 80 percent threshold for five months. This facility experienced increased network traffic for five months and should consider upgrading the network circuits to continue to operate efficiently. Each bar in the figure below is representative of the total combined inbound or outbound bandwidth of the two circuits (see Figure 1).

Figure 1. Eagan, MN Data Center Bandwidth Usage

Bandwidth Usage Over 80%
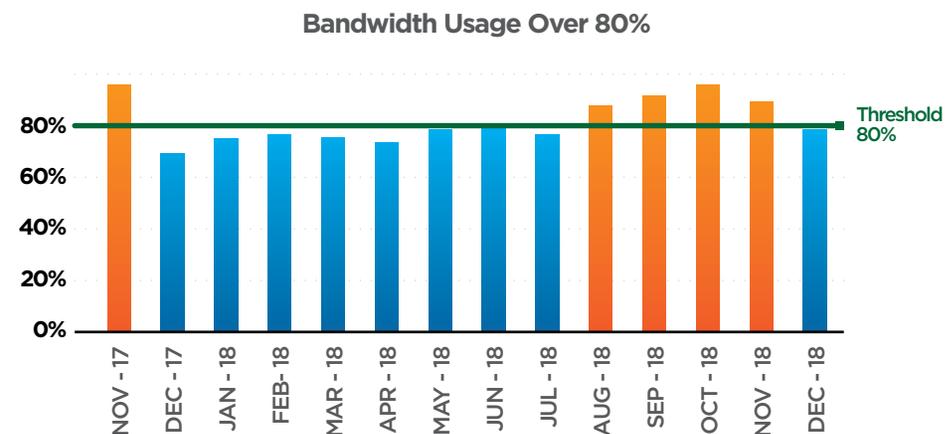
Source: OIG assessment tool.

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14 The capacity of a wired or wireless network communications link to transmit the maximum amount of data from one point to another over a computer network or internet connection in a given amount of time.
15 A discrete path between two or more points over which signals can be carried.
16 As noted previously in this report, the Postal Service does not have enterprise-wide performance metrics for its IT network. However, the Postal Service Telecommunication Services Group uses the USPS Telecom Services Network Performance Best Practice for Criteria for Bandwidth Upgrade Recommendation. There is no policy that requires the Postal Service to follow this internal best practice.

- The only two circuits at the Kansas City P&DC, the third largest P&DC, exceeded the 80 percent threshold for 14 months. In addition, the combined load for the two circuits was over 95% for more than a year. This facility experienced increased network traffic during the entire audit period and should upgrade these circuits to ensure they can handle future operational demands. Each bar in the figure below is representative of the total combined inbound or outbound bandwidth of the two circuits (see Figure 2).

> *"The only two circuits at the Kansas City P&DC, the third largest P&DC, exceeded the 80 percent threshold for 14 months."*

Figure 2. Kansas City, MO, P&DC Bandwidth Usage

Bandwidth Usage Over 80%
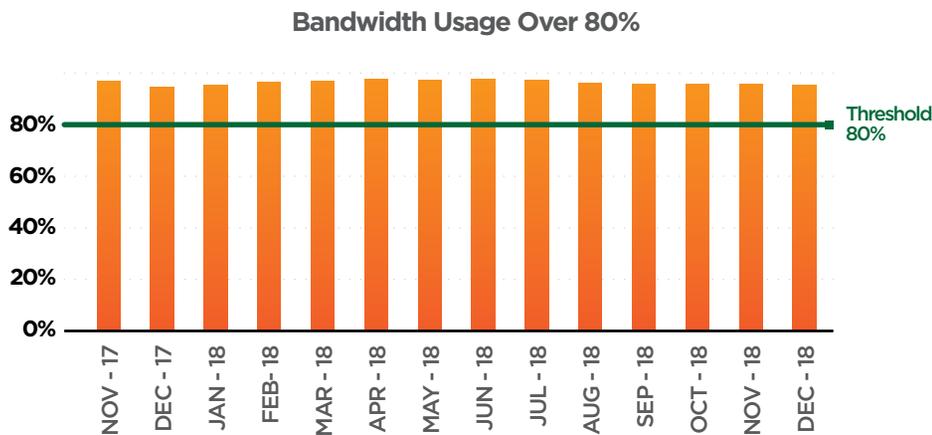
Source: OIG assessment tool.

- Two of the four circuits at the Sacramento P&DC, the second largest P&DC, exceeded the 80 percent threshold for one month. Although this facility experienced increased network traffic during peak holiday season, we found during our audit period that the circuits could handle operational demands.

Each bar in the figure below is representative of the total combined inbound or outbound bandwidth of the two circuits (see Figure 3).

Figure 3. Sacramento, CA, P&DC Bandwidth Usage

Bandwidth Usage Over 80%
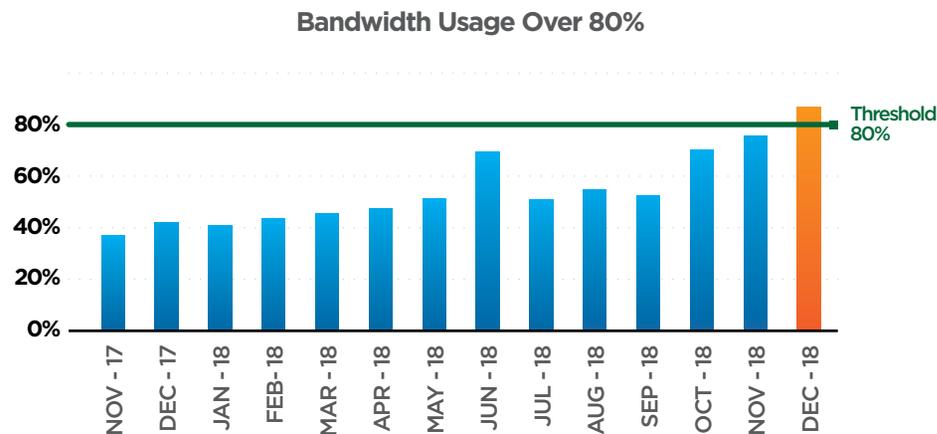
Source: OIG assessment tool.

The Postal Service's Telecommunication Services Group internal best practice states bandwidth should be upgraded if high availability sites operate at or above 80 percent bandwidth utilization for 30 days as shown on the vendor utilization report.[17] Bandwidth circuits at critical sites exceeded the internal upgrade recommendations because the Telecommunication Services Group did not prioritize monitoring the vendor bandwidth utilization reports in order to make appropriate upgrades and relied on mail processing facilities to report bandwidth issues. As a result, neglecting to upgrade overloaded circuits could negatively impact business operations and increase the risk that the IT network infrastructure cannot support future capacity. Further, exceeding established thresholds could lead to degradation in service. By continually allowing utilization to exceed these internal thresholds, the network could experience delays or lose connectivity at sites supporting critical IT systems, or sites that process large mail volumes.

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17 The Postal Service receives monthly bandwidth utilization reports from their vendors referred to as the P95 Report.

Finding #3: Network Visibility

Management does not have complete visibility into the IT network to efficiently manage and operate their enterprise. Visibility is gained from having detailed network diagrams and an accurate inventory of network devices. We found that the Postal Service IT network diagrams[18] and inventory system do not contain sufficient information for a complete representation of its IT network. As a result, the Postal Service does not have complete awareness and visibility of its network architecture to support its business systems and IT services.

Enterprise Network Diagrams

The Postal Service did not develop sufficiently detailed network diagrams of its IT architecture.[19] Specifically, we found the Postal Service's existing IT network diagrams did not identify the architecture in adequate detail ▮▮▮▮▮▮▮▮ ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮ While Postal Service network engineers made independent network management decisions, the existing diagrams did not identify complete network connectivity, ▮▮▮▮▮▮▮▮ ▮▮▮▮▮▮▮▮▮▮▮▮▮

As part of our audit work, we independently generated detailed network diagrams. ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮ ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮ of the six sites we reviewed. ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮ ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮ ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮ Sufficiently detailed network diagrams should represent the actual layout within the network architecture and would allow the Postal Service to quickly identify and remediate these kinds of issues.

Postal Service policy[20] states that architectural diagrams need to include all connectivity, data flow, business flow, and supporting functions. In addition, network component diagrams must include servers, routers, firewalls, switches, interfaces, ports, network monitoring equipment, and other connectivity requirements. Postal Service policy[21] also states that infrastructure, including telecommunication services, must not be engineered to have a common point of failure.

The Postal Service did not have complete visibility into the IT network because management did not follow policy that outlines the components that should be included within their network diagrams. Management also stated that the complexity of the network was challenging to depict within a diagram. Additionally, although the Telecommunication Services Group was aware of the ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮ they did not make it a priority to remediate the existing configuration.

As the Postal Service moves into the digital future, an understanding of its existing network and architecture is essential to deliver sustainable customer service. Without detailed network diagrams, management is hindered in effectively identifying ▮▮▮▮▮▮▮▮▮▮▮▮▮, understanding the impact of architectural changes, and efficiently troubleshooting network issues to minimize downtime. In addition, if failure occurred at the ▮▮▮▮▮▮▮▮▮▮▮, it could hinder automated mail processing of 4.9 billion mailpieces annually and disrupt ▮▮▮▮▮▮ ▮▮ network devices that support mail operations.

> **"***Specifically, we found the Postal Service's existing IT network diagrams did not identify the architecture in adequate detail*** ▮▮** **▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮** **▮▮▮▮▮▮▮▮▮▮** **▮▮▮▮▮▮▮▮ ▮▮▮▮▮▮.***"**

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18 Network diagrams provide a graphical depiction of the network and allows an organization to gain an understanding of the network's connectivity.
19 During the audit, we independently collected network configuration data and generated detailed diagrams of the infrastructure. We provided this data to Postal Service management on December 3, 2018.
20 Handbook AS 805-D, *Information Security Network Connectivity Process*, Section 5-3, Architectural Diagrams, dated July 2015.
21 Handbook AS-805, Section 9-9.2, Redundancy, dated December 2018.

Enterprise Network Inventory System

While the Postal Service has a process to collect network inventory data, this process has not resulted in an accurate inventory of network devices connected to its IT network. Specifically, of the 106,302 network devices we identified,[22] about 1,900 were not accounted for in the Postal Service's inventory system. Additionally, we identified the following inaccurate, incomplete, or duplicate data within their inventory records:

- 1,730 duplicate IP addresses;

- 2,697 duplicate hostnames;

- 3,458 missing serial numbers; and

- 3,333 missing device models.

Postal Service policy[23] states the manager of Telecommunication Services must maintain an accurate inventory of the Postal Service network information resources. The Postal Service did not have an accurate record of network devices in their enterprise inventory system because management did not manually review the inventory data to ensure the records were accurate. Additionally, the Postal Service's Cybersecurity Operations Center (CSOC) relies on the enterprise's network device inventory system to obtain and maintain accurate inventory data to secure the network. Therefore, inaccuracies in the inventory data could present a significant system management and security risk.

During our audit, the Postal Service performed corrective action to remediate the ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮ connection. Therefore, we are not issuing a recommendation for this finding.

> ### Recommendation #4
> We recommend the **Vice President, Information Technology,** and **Vice President, Engineering Systems,** develop and maintain detailed Postal Service information technology network diagrams.

> ### Recommendation #5
> We recommend the **Vice President, Information Technology,** perform a manual review of the automated inventory process on a periodic basis and update the inventory data accordingly.

Management's Comments

Management agreed with all of our findings and recommendations but disagreed with the monetary impact.

Regarding recommendation 1, management stated that they will develop a strategy to monitor the network with enterprise-level performance metrics. The target implementation date is December 31, 2020.

Regarding recommendation 2, management stated that they identified two generators in close proximity to the Sacramento P&DC to provide support for outages going forward. Additionally, they stated that they have a large generator fleet to augment locally rented generators should additional capacity be needed. Management also stated that they adjusted the configuration settings of network devices at the Sacramento P&DC to prevent HSRP Instability. The target implementation date was October 30, 2019.

Regarding recommendation 3, management stated that they will develop an automated process to review bandwidth utilization reports and initiate upgrades based on predefined thresholds. The target implementation date is December 31, 2020.

Regarding recommendation 4, management stated that they will develop a strategy to create and maintain detailed network diagrams to be monitored on an ongoing basis. The target implementation date is June 30, 2021.

Regarding recommendation 5, management stated that they will implement procedures to review the automated inventory process on a periodic basis and update the inventory data accordingly. The target implementation date is June 30, 2020.

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23 Handbook AS-805, Section 2-2.19, Manager, Telecommunications Services, dated December 2018.

Regarding the monetary impact, management disagreed with the financial impact attributed to network outages at the Sacramento P&DC. They stated that the design of the mail processing equipment sustains mail sorting capabilities during a network connectivity outage.

See Appendix B for management's comments in their entirety.

Evaluation of Management's Comments

The OIG considers management's comments responsive to the recommendations and corrective actions should resolve the issues identified in the report.

Regarding recommendation 2, we noted that the Postal Service stated that its existing recovery plan addresses the outages; however, we continue to believe that it should upgrade existing controls to mitigate future outages. Should the Postal Service continue to believe that its existing recovery plan is adequate, management should submit documentation to formally accept the risk or explain how they will upgrade existing controls to address outages moving forward. On January 14, 2020, Postal Service management provided us support to confirm that they updated the configurations to resolve the HSRP instability.

Regarding the monetary impact, the volume of mail we used to calculate the monetary impact was the actual cased mail for flats and letters the Postal Service reported on the days the Sacramento P&DC experienced network connectivity issues in its route performance statistics report. Therefore, the monetary impact amount is accurate. Cased mail is mail that is manually sorted by mail clerks. If the mail processing equipment continued to sort mail automatically during the network connectivity issues, mail clerks would not have manually sorted abnormal amounts of mail on those days.

All recommendations require OIG concurrence before closure. Consequently, the OIG requests written confirmation when corrective actions are completed. Management's target implementation date for recommendation 2 has expired and they submitted partial documentation to support closure of this recommendation. The OIG plans to follow up with management to ensure all issues identified in this report have been remediated. Therefore, recommendations should not be closed in the Postal Service's follow-up tracking system until the OIG provides written confirmation that the recommendations can be closed.

Appendices

Click on the appendix title below to navigate to the section content.

Appendix A: Additional Information

Scope and Methodology

The scope of the audit included critical infrastructure[24] residing on the Postal Service's administrative and mail processing infrastructure networks. We assessed current network monitoring and remediation capabilities and the efficiency and performance of segments of the network supporting the demands of select critical IT Infrastructure. We also focused solely on network devices (i.e., switches, routers, firewalls, wireless access points, and controllers). We did not analyze security aspects of the network including cybersecurity. The network performance assessment was limited to the analysis of selected sites that are critical to operations, represented high traffic areas of the network, and processed the largest volume of mail. The critical sites in our assessment included:

- The four largest P&DCs (Los Angeles, Sacramento, Kansas City, and North Houston);
- The Postal Service's main data center (Information Technology/Accounting Service Center in Eagan, MN); and
- The pilot location for the Postal Service's mail processing redesign (Pasadena P&DC).

We identified about 1,500 network devices across these six sites. We focused our review on 122 of these devices representing the core connection points that all traffic flows through and are the most critical from a risk perspective. We limited data collection to three periods: from March 26 through August 28, 2018; October 24 and October 26, 2018; and November 7 and November 8, 2018. Our network assessment represents the condition of the network during these points in time. Additionally, we reviewed performance reports from the internet service providers that covered November 2017 through December 2018. We also reviewed incident data for the period of December 2017 through June 2019.

To accomplish our objective, we:

- Reviewed policies and procedures to gain an understanding of how the Postal Service managed and monitored IT network performance.
- Reviewed best practices for managing and monitoring network performance.
- Reviewed and assessed the adequacy of existing network diagrams and network inventory.
- Interviewed Postal Service personnel to gain an understanding of the processes for managing and monitoring the IT network to include: roles and responsibilities, establishment of performance metrics, network requirements, and remediation capabilities.
- Determined and analyzed the process to monitor network performance, detect issues, and remediate sub-optimal performance on the Administrative and MPI networks.
- Used an automated tool for data collection and the assessment of inventory, creation of detailed diagrams of the infrastructure, and independently assessed the Postal Service's network performance. We also performed data collection to identify the before and after state of the network.
- Determined the universe and selected a judgmental sample of critical sites based on operations, network traffic, and mail volumes to assess specific areas of the network.
- Performed a network assessment of the data obtained for segments of the Postal Service network supporting critical infrastructure.
- Evaluated the multi-Virtual Local Area Network and the Eagan, MN Data Center spine-and-leaf redesign implementations and compliance with industry best practices.
- Reviewed incident tickets to determine if there was a correlation between network incidents and the bandwidth utilization reports.

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24 IT Infrastructure for this audit is considered the hardware, software, and service components that support the delivery of business systems and IT-enabled processes.

We conducted this performance audit from October 2017 through January 2020[25] in accordance with generally accepted government auditing standards and included such tests of internal controls as we considered necessary under the circumstances. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objective. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objective. We discussed our observations and conclusions with management on December 18, 2019 and included their comments where appropriate.

We assessed the reliability of mail processing data by re-running the queries and cross-referencing datasets. We determined that the data were sufficiently reliable for the purposes of this report.

Prior Audit Coverage

The OIG did not identify any prior audits or reviews related to the objective of this audit in the last five years.

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25 During the course of this audit we identified issues that resulted in the following interim reports: *Access Issues Identified on Mail Processing Environment* (Report Number IT-MT-18-001, dated September 2018), *Availability for Tier 1 Business Critical Services* (Report Number IT-AR-18-004, dated September 2018), *Data Analysis Memorandum – U.S. Postal Service Network Maps* (Report Number IT-PM-19-001, dated December 2018), and *Postal Service Management of End-of-Life Devices* (Report Number IT-AR-19-006, dated September 2019).

Appendix B: Management's Comments

UNITED STATES POSTAL SERVICE

December 31, 2019

LAZERICK POLAND
DIRECTOR, AUDIT OPERATIONS

SUBJECT: Review of Information Technology Network Performance
(Report Number [18TG005IT000])

In general, Management agrees with the findings provided by the OIG team. Management does not agree with the financial impact attributed to network outages at the Sacramento P&DC.

Management questions the report's assertion that mail clerks at the West Sacramento P&DC had to manually process mail each time the site experienced a network connectivity issue. Design of the Mail Processing Equipment is such that machine availability is sustained during a network connectivity outage, and the equipment will continue to operate and sort mail in a degraded mode wherein any mail processing result data generated during the sorting process will be temporarily stored until it can be forwarded over the network; thus, mitigating the need to process automation-capable letter and flat mail manually.

Recommendation 1:
We recommend the Vice President, Information Technology, and Vice President, Engineering Systems, establish a network strategy to include a process to continuously monitor the information technology network, and develop enterprise-wide performance metrics and improvement targets.

Management Response/Action Plan:
Management agrees with this recommendation. Management will develop a strategy to monitor the network with enterprise level performance metrics.

Target Implementation Date:
December 31, 2020

Responsible Official:
Manager, Enterprise Access Infrastructure

Recommendation 2:
We recommend the Vice President, Engineering Systems, in coordination with Vice President, Information Technology, and Vice President, Facilities, implement a solution, such as site wide emergency generators, to prevent network connectivity issues and adjust the configuration settings of network devices at the Sacramento Processing and Distribution Center to prevent Hot Standby Router Protocol Instability.

2

Management Response/Action Plan:
Management agrees with the recommendation.

USPS National Preparedness maintains a fleet of twenty (20) large generators, two 1.8 MW and nine pairs of 1.0 MW portable generators for use during natural disasters or other long term power outages. Those generators are staged at various locations across the US to effect rapid deployment to all parts of the continental US. These generators will be used for extended power outages. Facilities works with the local utility on the timing for any planned outages for the utilities maintenance requirements. Typically, the plan allows sufficient time to have a USPS generator sent to the site to maintain operations. Currently, USPS HQ Facilities organization has in place a connection plan for the Sacramento P&DC facility to provide temporary full building power using the USPS large portable generator fleet when needed. There are two 1 MW units within proximity to Sacramento to provide support for outages going forward (units located in Las Vegas, NV and Portland, OR). Additionally, the large generator fleet may be augmented with the addition of locally rented generators should a situation require additional capacities or have multiple impacted locations.

Management also agrees with the recommendation to adjust configuration settings of network devices at Sacramento, CA P&DC to prevent Hot Standby Router Protocol instability.

Target Implementation Date:
Emergency Large Generator Capability 2015 (Completed)
Hot Standby Router Protocol October 30, 2019 (Completed)

Responsible Official:
Manager, Enterprise Access Infrastructure
VP Engineering or Director, Engineering Software and Testing
VP Facilities or Manager, Repair and Alteration

Recommendation 3:
We recommend the Vice President, Information Technology, develop an automated process to regularly review vendor bandwidth utilization reports and upgrade bandwidth when it exceeds determined thresholds.

Management Response/Action Plan:
Management agrees with this recommendation. Management will develop a process to review bandwidth utilization reports and initiate upgrades based on predefined thresholds.

Target Implementation Date:
December 31, 2020

Responsible Official:
Manager, Enterprise Access Infrastructure

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Recommendation 4:
We recommend the Vice President, Information Technology, and Vice President, Engineering Systems, develop and maintain detailed Postal Service information technology network diagrams.

Management Response/Action Plan:
Management agrees with this recommendation.

Management will plan and develop a strategy to create and maintain detailed network diagrams to be monitored on an ongoing basis.

Target Implementation Date:
June 30, 2021

Responsible Official:
Manager, Enterprise Access Infrastructure
Director, Engineering Software and Testing

Recommendation 5:
We recommend the Vice President, Information Technology, perform a manual review of the automated inventory process on a periodic basis and update the inventory data accordingly.

Management Response/Action Plan:
Management agrees with this recommendation.

Management will plan and implement procedures to review the automated inventory process on a periodic basis and update the inventory data accordingly.

Target Implementation Date:
June 30, 2020

Responsible Official:
Manager, Enterprise Access Infrastructure

4
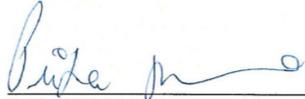
Pritha N. Mehra
Vice President, Information Technology

Scott R. Bombaugh
Vice President, Engineering Systems

Tom A. Samra
Vice President, Facilities

cc:
Manager, Corporate Audit Response Management

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