

**Audit of the Data Center
Consolidation Initiative at NARA**

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Executive Summary

The federal government's demand for information technology (IT) is ever increasing. In recent years, as federal agencies modernized their operations, put more of their services online, and increased their security profiles, they have demanded more computing power and data storage resources. This increasing demand has led to a dramatic rise in the number of federal data centers and a corresponding increase in operational costs. The Office of Management and Budget (OMB) launched the Federal Data Center Consolidation Initiative (FDCCI) in February 2010, as part of an overall plan to improve the Government's operational efficiency. As part of the initiative, agencies were to inventory their data center assets, develop consolidation plans throughout FY 2010, and integrate those plans into agency FY 2012 budget submissions.

The purpose of this audit was to assess NARA's progress in meeting its consolidation objectives and consolidating its data centers.

Our audit found that NARA had not met preliminary targets identified in their data center consolidation plan and had not reduced energy consumption at the data center. Although NARA developed a Data Center Consolidation Plan in response to OMB's Federal Data Center Consolidation Initiative, NARA's plan was incomplete and did not reflect key aspects of the initiative. Specifically, the plan did not list all of the agency's data centers, did not include a complete list of hardware and software assets, and did not include an adequate cost benefit analysis. Without a complete baseline state of the environment NARA does not have the information needed to identify potential areas of cost savings.

We also found that NARA had not conducted the analysis needed to consolidate and virtualize¹ servers resulting in overlap and duplication within NARA's main data center. In addition, the governance structure outlined in the plan did not provide the appropriate oversight needed to measure and manage implementation of the FDCCI.

This report contains six recommendations which upon implementation will assist NARA in implementing the initiative and potentially result in cost savings by reducing energy usage.

¹ Virtualization is a technology that allows multiple, software-based virtual machines, with different operating systems, to run in isolation, side by side, on the same physical machines.

Background

The Federal Chief Information Officer (CIO) found that operating data centers is a significant cost to the federal government, including hardware, software, real estate, and cooling costs. In September 2009, OMB attempted to establish a comprehensive, government-wide inventory of data center activity by federal agency to identify potential improvements to efficiency, performance, and the environmental footprint of Federal data center activities². The results of this government-wide inventory found that the number of data centers grew from 432 in 1998 to over 2,000 by 2010. The Federal Chief Information Officer reported that operating and maintaining such redundant infrastructure investments was costly, inefficient, and unsustainable, and had a significant impact on energy consumption.

In response to the government-wide inventory, the Administration launched the Federal Data Center Consolidation Initiative (FDCCI) in February 2010, and issued guidance for Federal CIO Council agencies³. The guidance called for agencies to inventory their data center assets, develop consolidation plans, and integrate those plans into agency FY 2012 budget submissions. The FDCCI was to reduce the number of data centers across the government and assist agencies in applying best practices from the public and private sector, with goals to:

- Promote the use of Green IT by reducing the overall energy and real estate footprint of government data centers;
- Reduce the cost of data center hardware, software, and operations;
- Increase the government's overall IT security posture; and
- Shift IT investments to more efficient computing platforms and technologies.

OMB issued another memorandum⁴ in October 2010 to provide an update on the FDCCI. According to the memorandum, throughout the fall of 2010, CIO Council agencies were to work with OMB to review, adjust, and finalize data center consolidation plans. OMB planned to approve agency consolidation plans by December 31, 2010.

² OMB Budget Data Request No. 09-41 "Inventory of Federal Data Center Activity," August 10, 2009

³ OMB Memorandum "Federal Data Center Consolidation Initiative," February 26, 2010, <http://www.cio.gov/documents/Federal-Data-Center-Consolidation-Initiative-02-26-2010.pdf>

⁴ OMB Memorandum "Update on the Federal Data Center Consolidation Initiative," October 1, 2010, <http://www.cio.gov/documents/State-of-the-Federal-Datacenter-Consolidation-Initiative-Report.pdf>

NARA created a Data Center Consolidation Plan in response to the OMB initiative. In the plan, NARA established goals to reduce data center energy usage, increase average server utilization, pilot cloud computing services, use Federal data center facilities and establish senior management oversight of the data center consolidation and strategic sustainability activities. An official from NARA's IT Infrastructure Support Division was assigned as the Program Manager for the implementation. NARA received feedback on their draft consolidation plan from a group of government peers at a GSA workshop but did not receive feedback or approval from OMB regarding their consolidation plan.

GAO issued two reports related to the FDCCI. GAO 11-318SP "Opportunities to Reduce Potential Duplication in Government Programs, Save Tax Dollars, and Enhance Revenue," March 2011, reported on the status of FDCCI and noted that data center consolidation makes sense economically and as a way to achieve more efficient IT operations, but that challenges exist. Those challenges included ensuring the accuracy of agency inventories and plans, providing upfront funding for the consolidation effort before any cost savings accrue, integrating consolidation plans into agency budget submissions (as required by OMB), establishing and implementing shared standards, overcoming cultural resistance to such major organizational changes, and maintaining current operations during the transition to consolidated operations. According to GAO, mitigating these and other challenges will require commitment from the agencies and continued oversight by OMB and Federal CIO.

GAO Report GAO 11-565 "Data Center Consolidation" July 2011, found that of the 24 participating agencies⁵, only one of the agencies submitted a complete inventory and no agency submitted complete plans. Further, OMB did not require agencies to document the steps they took, if any, to verify the inventory data. The reason for these gaps, according to several agency officials, was that they had difficulty completing their inventories and plans within OMB's timelines. According to GAO, until these inventories and plans are complete, agencies may not be able to implement their consolidation activities and realize expected cost savings. Moreover, without an understanding of the validity of agencies' consolidation data, OMB cannot be assured that agencies are providing a sound baseline for estimating consolidation savings and measuring progress against those goals

⁵ NARA was not listed as one of the 24 participating agencies.

In July 2011, OMB issued a memorandum⁶ to provide an update on FDCCI activities and publish a schedule of deliverables. The memorandum asked participating agencies to complete all the missing elements in their respective consolidation plans and submit them to the General Services Administration. In addition, the plan resubmission was to include a signed verification letter from the CIO which attested to the completeness of agency consolidation plans, actions agencies took to verify their asset inventories, and any limitations of inventory and/or consolidation plan information. NARA officials did not update their consolidation plan by September 2011. According to a NARA official, NARA was not a participating agency and therefore, was not required to submit an updated consolidation plan⁷. Although NARA is not a participating agency in the FDCCI, the CIO stated he agreed with the spirit of the initiative and was completely in favor of using cloud technology, reducing energy usage, and consolidation.

⁶ OMB Memorandum “The Federal Data Center Consolidation Initiative,” July 20, 2011, <http://www.cio.gov/documents/FDCCI-Update-Memo-07202011.pdf>

⁷ After issuance of the draft audit report, the CIO’s office provided an email from an OMB official which confirmed NARA was not one of the 24 agencies participating in the IT reform initiative. In the email from January 2011, the OMB official encouraged NARA’s existing efforts in their own data center consolidation initiative covering cloud investment, energy usage reduction, and virtualization efforts.

Objectives, Scope, Methodology

The purpose of this audit was to assess NARA's progress in meeting its consolidation objectives and consolidating its data centers.

This audit included a review of NARA's implementation of OMB's Federal Data Center Consolidation Initiative. We reviewed OMB memorandums related to FDCCI as well as guidance issued by the CIO Council to identify the requirements for agencies to follow. To determine whether NARA developed a consolidation plan consistent with the initiative's consolidation effort we obtained the draft and final consolidation plans and compared the final plan to the CIO Council guidance. We also interviewed NARA and contractor officials who participated in writing the plan to obtain the definition used for a data center and gather information as to how the plan was created. To determine whether NARA developed a complete asset inventory to identify and document the current data center environment we reviewed the final consolidation plan and compared it to the CIO Council guidance. We also obtained an asset inventory of servers as of July 22, 2011.

To determine the progress NARA had made on implementing their consolidation targets we reviewed each of the five goals identified in the consolidation plan and met with NARA officials to review actions taken during the year toward each goal. To determine whether the governance process was effective in monitoring the implementation of the data center consolidation project we interviewed the Program Manager and reviewed the meeting minutes from the three groups identified in the consolidation plan: the Information Technology Executive Committee, the Architecture Review Board, and the Technical Review Group.

We also met with NARA's Energy Manager and requested current electricity usage information for the main data center and the new data center created for the network storage equipment to determine whether NARA had met their goal of reduced energy usage. NARA did not have sub-meters installed to measure the electricity usage for the data centers therefore, the Energy Manager provided an average using a handheld meter at the entry point to the data center. NARA officials expected to have a sub-meter installed for the Archives II data center by December 2011 so that specific data on the amount of electricity used by the data center will be available in the future. As of January 3, 2012, a contract had been awarded to install the electrical meter but the

contractor was still working with their sub-contractors to determine the installation schedule.

Our audit work was performed at Archives II in College Park, MD between May 2011 and February 2012. We conducted this performance audit in accordance with generally accepted government auditing standards. 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 objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Audit Results

1. Incomplete Data Center Consolidation Plan

Although NARA developed a data center consolidation plan in response to OMB's Federal Data Center Consolidation Initiative, NARA's plan did not reflect key aspects of the initiative. Specifically, the plan did not list all of the agency's data centers, did not include a complete list of hardware and software assets, and did not include a cost benefit analysis. This occurred because NARA officials used the definition of a data center in OMB Bulletin 96-02⁸ for identifying data centers instead of using a measurement consistent with more recent OMB definitions. Further, NARA officials were not able to conduct a cost benefit analysis in the time period allowed. OMB's purpose of the agency data center consolidation plans was to assist agencies in identifying and proposing potential areas where optimization or asset consolidation could be used to generate cost savings. However, without a complete consolidation plan, NARA lacks the information needed to identify potential areas of cost savings and to determine whether other efficiencies can be achieved.

OMB's goal for the data center consolidation initiative was to identify potential improvements to efficiency, performance, and the environmental footprint of Federal data center activities. Within the first phase of the data center consolidation initiative, agencies were to perform metrics gathering in order to derive a baseline state of their current data center environment. Agencies were to identify and document an inventory of their data center assets across four areas of focus: 1) Software Assets and Utilization; 2) Hardware Assets and Utilization; 3) IT Facilities and Energy Usage; and 4) Geographic Location and Real Estate.

NARA Data Centers

Despite OMB and CIO Council guidance, NARA's data center consolidation plan did not identify and document the baseline state of the data center environment. Instead, NARA officials identified only one data center for the entire agency. According to NARA officials, the "Archives II" data center referred to in the plan actually included at least

⁸ OMB Bulletin 96-02, "Consolidation of Agency Data Centers," October 4, 1995 was OMB's first initiative to consolidate federal data centers more than 15 years ago.

three different computer rooms within the Archives II building⁹ which the officials chose not to report as separate data centers in their consolidation plan. In addition, NARA did not report the computer rooms used to house servers and network equipment at the 44 other NARA locations such as Archives I, the Presidential Libraries, Regional Archives, Records Centers, and the leased data center located in Rocket Center, West Virginia.

Budget Data Request 09-41¹⁰ defined a data center as a repository (room or building) for the storage, management, and dissemination of data and information. This repository houses computer systems and associated components and generally includes redundant or backup power supplies, environmental controls, and special security devices housed in leased, owned, collocated, or stand-alone facilities. The CIO Council further clarified in their FDCCI guidance that all data centers should be reported regardless of ownership or management. In addition, servers under a desk or field offices that have two or three servers each should be included as separate “data centers” with the appropriate data center tier value reported in the final inventory baseline template.

NARA Officials chose to limit the definition of a data center they used in creating their consolidation plan. For example, the Executive for Business Support Services¹¹ explained that the definition NARA used was from the OMB Budget Data Request 09-41 and OMB Bulletin 96-02. The definition in OMB Bulletin 96-02 included a caveat that there had to be five Full Time Equivalents (FTE) assigned to the data center in order for the room to be considered a data center. According to the Executive for Business Support Services, the term FTE includes only government employees and does not include contractor support personnel therefore, the only data center was at Archives II.

According to the CTO, the main factor in determining the number of data centers at NARA was the number of FTE’s involved in the management of the room. Since most of NARA’s data centers are managed by contractors instead of Government FTE’s these computer rooms were not included in NARA’s data center consolidation plan. The Chief Technology Officer (CTO) agreed with the definition NARA used in determining the number of data centers to report, stating that one reason computer rooms at the field offices were not reported was because routers and switches would always be needed

⁹ The Archives II building, located in College Park, MD, is approximately 1.7 million gross square feet. According to NARA’s plan, the data center “Archives II” consisted of 6,302 square feet and contained 98 racks.

¹⁰ BDR 09-41 was the precursor data request to the OMB memorandum establishing the FDCCI.

¹¹ The Executive for Business Support Services was the Deputy CIO and Acting CIO at the time of plan creation.

therefore, there would not be a way to consolidate or reduce the number of computer rooms. The CTO stated that while the number of servers at the field sites could be reduced, it would be impossible to reduce the number of computer rooms.

As part of the FDCCI, a peer review of each agency's draft consolidation plan was conducted before the final consolidation plan was due. NARA received feedback that should have been used to revise the consolidation plan. For example, the feedback stated that the number of data centers needed to be clarified and that more quantitative numeric metrics needed to be attached to the goals. In addition, the feedback stated that clearer targets were needed that would address the entire data center environment for the agency, not limited to just one data center. NARA officials chose not to incorporate these comments received from the peer review into the final consolidation plan.

Inventory of Hardware and Software

The consolidation plan also did not include a complete list of hardware and software assets. According to NARA officials, the number of servers was derived from the servers located in the Archives II main data center, the new data center established for NARA's storage area network, and the small data center maintained by the Archival Operations staff. NARA's final consolidation plan dated August 30, 2010 reported a total of 423 servers. We requested a current listing of deployed servers and found that as of July 2011, there were 660 servers deployed across NARA. Of the 660 servers, 450 were located at the Archives II building. NARA's consolidation plan should include all servers deployed at NARA in order to assess consolidation and virtualization options across NARA's environment.

The purpose of the software assets template in the consolidation plan was to document all major and non-major investments (i.e. systems) hosted in a data center, identify their key elements, and to evaluate the feasibility of their consolidation via: decommission, consolidation, virtualization or cloud computing. NARA reported on the CIO IT dashboard that it has 29 total investments, 8 of which are major investments. However, NARA's consolidation plan evaluated only 15 of those 29 investments at NARA. For example, the plan identified one system as a possible candidate for consolidation, two systems as possible candidates for consolidation and virtualization, and identified four systems to be decommissioned. The plan does not include other investments at NARA including two major investments: EDOCS and ERA. The plan also does not include details as to how or when servers would be decommissioned or consolidated. This

information is needed so that NARA officials can begin planning and determine what actions need to be taken.

Cost Benefit Analysis

NARA's consolidation plan did not contain a cost benefit analysis. Specifically, for each fiscal year included as part of the Final Consolidation plan, agencies were to state aggregate year-by-year investment and cost savings calculations through FY15. These figures were to be realistic estimates of funding needed or savings to be realized from closings of facilities, the associated reduction in energy use, real property savings, personnel reductions, and IT infrastructure (network) cost savings. In NARA's consolidation plan, NARA officials stated that a cost benefit analysis for each of the four goals in the plan could not be conducted in the time period allowed therefore, NARA obtained a savings estimate through an alternate means. Specifically, NARA used VMware's online virtualization savings calculator and determined that by reducing 124 servers, NARA would have a savings of almost \$600,000 in capital expenses and over \$151,000 in power savings for a total savings of over \$700,000.

According to NARA's FDCCI Program Manager, while the plan identifies targets for reducing the number of servers every year for the next five years, he did not anticipate reducing any servers. The Program Manager stated that the number of servers would most likely increase over the next five years as his office responds to needs identified by the agency. According to the Program Manager, the CIO or the CTO would need to make strategic decisions as to the virtualization or consolidation of servers. Conducting a cost benefit analysis could be used to help the CIO and CTO in making strategic decisions associated with FDCCI.

The FDCCI presents an opportunity for NARA to improve the efficiency of its data centers however, without a complete baseline state of the environment and an inventory of hardware and software assets, NARA does not have the information needed to identify potential areas of cost savings. In addition, without a complete consolidation plan, NARA may not realize anticipated cost savings, improved infrastructure utilization, and energy efficiency.

Information Services officials stated they would not be updating the NARA Data Center Consolidation Plan because NARA is not a participating agency in the FDCCI and does not have to report their progress to OMB. Instead, the Information Services officials

stated they maintain a Master System List which includes the estimated number of servers and physical location for each application. In addition, the Office of Information Services stated they do not plan to invest in a cost benefit analysis when funding is not available. Instead, the Office of Information Services officials stated they will use the Enterprise Architecture to outline the year-by-year evolution of NARA's applications and supporting IT infrastructure.

While the Master System List includes an estimate of the current inventory of servers, it does not reflect NARA's goals to reduce energy usage, pilot cloud computing, and increase server utilization through consolidation and virtualization. Specifically, the Master System List does not contain the total number of servers by type, the average server utilization, or how many servers are virtualized. The Master System List also does not include energy usage calculations or savings metrics. This type of information would assist NARA in monitoring their progress toward their data center consolidation goals.

Recommendation 1

The Executive for Information Services/CIO should update the Master System List and/or the Enterprise Architecture to incorporate:

- a) NARA's data center consolidation goals including the approach, rationale, and a preliminary timeline of activities;
- b) Energy usage calculations;
- c) Realistic estimates of funding needed or savings to be realized from implementing NARA's data center consolidation goals; and
- d) Annual savings metrics such as rack count reduction, server count reduction, energy usage reduction, and energy cost reduction to monitor progress.

Management Comments

The Archivist concurred with the need for action and the intended outcome, but did not agree with the proposed implementation process embedded in the recommendation. Specifically, the Archivist stated NARA is not subject to the FDCCI policy and therefore, was not expected to respond to the policy's template-based reporting. Instead of using the template-based approach, the Archivist stated modifications were made to both the Information Technology Master System List and Enterprise Architecture documentation

to capture pertinent system data and this documentation will continue to be updated to support NARA's needs.

Audit Response

We support the Archivist's decision to use the IT Master System List and Enterprise Architecture documentation instead of updating NARA's Data Center Consolidation Plan. However, as stated in the report, these mechanisms as currently written do not adequately capture NARA's goals towards reducing energy usage, piloting cloud computing, and increasing server utilization through consolidation and virtualization. The mechanisms also do not currently contain NARA's progress in working toward those goals. The audit recommendation does not limit the CIO to using a specific template in capturing this information. Instead, the intent of the recommendation is to ensure the CIO's goals are incorporated into strategic planning documents and periodically measured to monitor NARA's progress toward those goals.

Recommendation 2

The Executive for Information Services/CIO should update transition plans within the Enterprise Architecture annually to outline the year-by-year evolution of NARA's applications and supporting IT infrastructure in the context of OMB's guidance on cloud-first deployment and consolidation.

Management Comments

The Archivist concurred with the recommendation.

2. Overlap and Duplication within NARA's Data Center

Overlap and duplication of hardware existed within NARA's main data center. Besides reducing the number of data centers across the government, the main focus of FDCCI was the optimization of server, rack space, and floor space utilization in terms of data processing. However, NARA officials have not conducted the analysis needed to determine which servers can be consolidated or virtualized. As a result, NARA is missing an opportunity to reduce the cost of hardware, the overall energy usage, and the real estate footprint of NARA's data centers.

We found that an opportunity exists to potentially reduce the square footage needed for the data centers by increasing the rack space utilization and virtualization of servers. This would reduce overlap and duplication of hardware within NARA's main data center. For example, NARA's consolidation plan reported an estimated rack space utilization of 61%. We observed that racks within the data center were not always filled to capacity and BT officials reported that there are no virtualized servers on NARANet¹². According to BT officials, the racks and servers were purchased by separate offices therefore, it would be up to each office whether they would be willing to share rack space or a server with another NARA office. The BT officials also stated that since there are several support contractors that have access to the room, separate locked racks ensure contractors only have access to the systems they manage.

According to the CIO Council, OMB's end goal is optimizing the overall IT infrastructure and operations within the federal government; however, the immediate focus of FDCCI was limited to developing agency Data Center Consolidation Plans as part of an agency's overall IT strategy: "Agencies should be looking at all of their systems and analyzing where its data is residing today and where the agency wants it to be in the future within an optimized, secure, and reliable IT infrastructure." Further, OMB reported that the average utilization rate for servers ranges from 5% to 15% however, many agencies are paying the energy costs to run data centers at 100% capacity. Therefore, agencies could reduce the cost of hardware and save on energy usage by consolidating servers. As shown in Table 1 below, the results NARA reported in their Consolidation Plan were comparable to other agencies within the Federal government but do not meet the target results established for the FDCCI.

¹² Information Services officials reported that some applications have been virtualized however, these applications do not reside on NARANet.

Table 1. Comparison of NARA’s Environment to Typical Federal Agency Results and Target OMB Results

Utilization Metrics	Typical Results	NARA Results	Target Results
Average Virtualization (%)	0 - 10%	0%	30 - 40%
Average Virtual OS per Host (#)	5 - 10	9	15 - 20
Average Server Utilization (%)	7 - 15%	10 - 40%	60 - 70% (application dependent)
Average Rack Space Utilization	50 - 60%	61%	80 - 90%

Source: Typical and Target results were obtained from the FDCCI Workshop held June 4, 2010, and the NARA results were obtained from NARA’s Consolidation Plan.

In September 2009, NARA reported that the average server central processing unit (CPU) utilization was 13%. NARA’s consolidation plan reported that average server utilization was between 10% and 40%. Creating virtual servers would allow offices to share servers and keep data separate to meet security needs. For example, one agency official noted that he would have to purchase a new server to put in the data center to run a small application even though space was most likely available on an existing server.

NARA’s Consolidation Plan included the consolidation and virtualization for two major application domains and the General Support System infrastructure used to provide email, file and print, and web hosting services. According to the preliminary timeline in the plan, NARA officials were to develop the systems engineering analysis during the first half of FY 2011. However, the CTO stated that virtualization would require extensive analysis to determine which servers could be effectively virtualized and this analysis had not been completed yet due to other priorities. According to the CTO, he expects that this analysis will be done eventually as a way to use resources more efficiently however, a Business Support Services official stated that due to staffing and budget constraints the work on virtualization has been put on hold.

NARA’s consolidation plan also included a proposal to transition NARA’s data center to below grade. According to the NARA Facilities Director, the Storage Network was too heavy to put in the fourth floor data center therefore, a new room in the basement was built to house the equipment. This included adding a new A/C unit to the room. The Facilities Director stated that a plan has been discussed to consolidate the 4th floor data

center into the basement data center. According to the Facilities Director, moving the data center from the fourth floor to the basement would reduce data center energy usage because less energy would be needed to cool the room. Before NARA continues with this plan, NARA needs to conduct the analysis to virtualize and consolidate servers to determine the appropriate floor space needed.

Improving IT asset utilization is the key driver for reducing energy consumption per unit of performance. This is achieved primarily by increasing the number of virtual servers per hosts (virtualization); decommissioning underutilized physical servers; relocating underutilized racks; and shutting down underutilized facilities. Benefits from virtualization include reduced energy consumption which leads to significant energy cost savings, reduced facilities maintenance and operations costs, reduced server maintenance and operations costs, and improved automation for server management and provisioning. NARA officials should conduct the analysis needed to determine whether NARA can take advantage of the benefits in virtualization and determine whether the size of the current data center can be reduced by changing the organization of rack space.

Recommendation 3

The Executive for Information Services/CIO should conduct the consolidation/virtualization analysis to investigate the impact of consolidating or virtualizing two major application domains (NISP and ERA) and the General Support System (NARANet) as planned or evaluate other alternatives to increase the average server utilization rate.

Management Comments

The Archivist agreed on the need to perform a detailed consolidation/virtualization analysis and stated he plans to assess systems on a case-by-case basis as these systems are considered for replacement or upgrade. Specifically, the Archivist stated that he does not agree that a comprehensive approach as recommended is a good use of resources. Instead, the Archivist stated that a phased approach that is coordinated with other planned systems analysis meets the intent of the recommendation and allows NARA to best use limited resources to optimize systems.

Audit Response

Consolidation and virtualization are two strategies to address the issues of server underutilization and data center capacity. The first steps in implementing these strategies usually involves identifying the performance characteristics of servers currently in the data center and collecting information about the hardware, operating system, and applications running on the servers. Performing a detailed analysis on a case-by-case basis as systems are considered for replacement or upgrade would delay implementation of consolidation or virtualization even further. In order to gather adequate performance characteristics about each server, NARA will need to capture CPU utilization data over a period of time. Therefore, it would not be advantageous for NARA to wait months or even years to begin capturing this data.

Our recommendation was based on NARA's original consolidation plan which identified two major applications (NISP and ERA) and the general support system (NARANet) as candidates for a virtualization analysis to be completed. According to the Master System List, NARANet has an estimated 235 servers and ERA is estimated to have over 150 servers. Therefore, conducting the consolidation and virtualization analysis for these systems would focus resources towards two of NARA's largest systems. The Archivist should reconsider his position or include a timeframe as to when a consolidation and virtualization analysis for NISP, ERA, and NARANet would be completed.

Recommendation 4

The Executive for Business Support Services should evaluate the current organization of rack space and determine whether servers can be consolidated into fewer racks when considering space optimization, power consumption, operations management, and component failure/recovery perspectives.

Management Comments

The Archivist concurred with the recommendation.

3. Improvement Needed within Governance Structure

NARA had not met preliminary targets identified in their data center consolidation plan. OMB recommended agencies develop a governance structure to measure and manage performance and risk of the FDCCI implementation within the agency. The Director of IT Infrastructure Support was named program manager for this initiative; however, an individual was not assigned responsibility for tracking implementation of the Data Center Consolidation Plan. As a result of not meeting its preliminary targets, NARA is missing out on the benefits provided by this initiative such as cost savings.

NARA's Data Center Consolidation Plan included five goals for data center consolidation, the approach NARA would use to reach each goal, and a preliminary timeline for some of the goals. We found that NARA has made minimal progress towards their goals and has not met any of the timelines outlined in the plan. For example, the first goal identified in NARA's consolidation plan was to reduce data center energy usage by 7% by 2012. According to the consolidation plan, the data center used approximately 1,752,000 kWh/year. Therefore, in order to reduce energy usage by 7%, the number of kWh/year would need to be reduced by 122,640. Current estimates provided by Facilities found that NARA's data center energy usage is approximately 1,720,726 kWh/year, which is reduction of only 31,274 kWh/year. While this number is lower than the amount reported in the consolidation plan, NARA's Energy Manager noted that NARA officials rounded up the amount of kilowatts used in their calculation¹³.

Although NARA did not meet its target of reducing data center energy usage by 7%, NARA officials did make some progress toward this goal. NARA's approach to reducing data center energy usage included increasing the use of blade technology, requiring new acquisitions to include energy-star qualified products, enterprise wide storage utilizing "spin-down" technology to power-down unused drives, installation of advanced power metering technology, and transitioning NARA's data center to below grade. According to NARA officials, blade servers were acquired for the ARC system and the storage area network however, additional planned actions were limited by funding constraints this fiscal year. NARA officials did not request any additional funding to complete data center consolidation activities.

¹³ In 2009, NARA's Energy Manager found that NARA's main data center used approximately 191 kW's however, in developing the consolidation plan, NARA officials calculated the amount of energy used for the year based on 200 kW's.

The Data Center Consolidation Plan also identified that NARA would reduce its number of Windows servers by approximately 20 each year starting in FY 2012, with a total of 80 less servers in the environment by the fourth quarter of FY 2015. The plan does not include any details as to which Windows servers will be removed or whether they will be consolidated. In addition, the Director of IT Infrastructure Support, who is also the FDCCI Program Manager, did not believe NARA would be able to reduce the number of servers needed since data needs are constantly increasing.

Another goal identified in the plan was consolidation and virtualization. In the first half of FY 2011, NARA planned to investigate the engineering alternatives for consolidating or virtualizing two major application domains and the General Support Systems infrastructure. However, this analysis has not been conducted. According to the CTO, there were several higher priority projects that delayed this analysis but he expects this analysis will be done eventually. In January 2012, a Business Support Services official stated that due to staffing and budget constraints the work on virtualization has been put on hold.

According to OMB, large IT projects often fail to meet goals because of distributed accountability for success. Large, complex, and critical infrastructure programs, such as data center consolidation, require a single person to lead the coordinated effort. OMB requested each agency to designate a senior, dedicated data center consolidation program manager with project management experience and technical competence in IT infrastructure. The data center program manager at each agency was responsible for developing a plan with interim, verifiable milestones to reach the agency's data center reduction target and monitoring progress toward those goals.

NARA planned to use existing IT governance frameworks for tracking the data center consolidation activities to ensure each of the IT initiatives met the strategic objectives of the plan. The IT Executive Committee (ITEC) and the Architecture Review Board (ARB) were to provide executive oversight to include investments and tracking of the data center consolidation initiative. The ITEC and ARB along with two subgroups of the ARB: the Technical Review Board and the Business Architecture Working Group were to ensure that the goals associated with the consolidation initiative were carefully considered as part of the planning of any new NARA IT initiatives. This governance structure does not identify which office or individual within NARA was charged with taking the lead to ensure the goals were met.

According to NARA's Data Center Consolidation Plan, data center consolidation risks would be managed within its governance processes. For example, the plan states that a program manager would be appointed to oversee the integration and coordination of individual FDCCI projects. According to the plan, the FDCCI Program Manager, with the help of the Chief Technology Officer, was to determine the program level risks and manage and report on their mitigation plans to the TRG. In addition, twice a year, the FDCCI program manager was to report on FDCCI-level risk mitigation issues to the TRG and ARB.

The FDCCI Program Manager stated that his role in the initiative was to provide data that could be used to make decisions. We reviewed the meeting notes from the TRG, ARB, and ITEC meetings held from February 2010, (when OMB's FDCCI was announced) to June 2011. We found only two instances where data center consolidation topics were discussed. Specifically, on May 3, 2010, the TRG discussed data center rationalization and on April 25, 2011, the TRG minutes referenced a discussion on migration to the cloud. According to the Program Manager, he has not briefed the ITEC; however, he did discuss the initiative with the Chief Technology Officer, the CIO, and the Deputy CIO.

GAO Report 11-565 identified challenges faced by Federal agencies during data center consolidation efforts and provided lessons learned by State governments who already implemented similar initiatives. Lessons learned included obtaining executive support and empowerment to champion the consolidation and to communicate early and often with key agency officials. Another lesson learned was to establish a governance model with a single point of control and vision. NARA's current governance model does not take advantage of these lessons learned which places NARA at an increased risk of failing to meet the goals outlined in their consolidation plan.

NARA does not have plans to update their data center consolidation plan and instead will use the Enterprise Architecture to implement and monitor their FDCCI goals. The CIO stated he would take responsibility for ensuring the agency is considering OMB's cloud first policy and guidance on virtualization and consolidation.

Recommendation 5

The Executive for Information Services/CIO should review and approve the annual Enterprise Architecture update to ensure that the agency is considering OMB's cloud first policy and guidance on virtualization and consolidation.

Management Comments

The Archivist concurred with the recommendation.

Recommendation 6

The Executive for Information Services/CIO should strengthen governance and oversight activities through periodic monitoring.

Management Comments

The Archivist concurred with the recommendation.

Appendix A – Acronyms and Abbreviations

CIO	Chief Information Officer
CTO	Chief Technology Officer
FDCCI	Federal Data Center Consolidation Initiative
FTE	Full Time Equivalent
GAO	Government Accountability Office
kWH/yr	Kilowatt Hours per year
NARA	National Archives and Records Administration
OMB	Office of Management and Budget

Appendix B - Management's Response to the Report



Date: APR 04 2012
To: Paul Brachfeld, Inspector General
From: David S. Ferriero, Archivist of the United States
Subject: OIG Advisory Report 12-08, Audit of the Data Center Consolidation Initiative at NARA

Thank you for the Audit Report on our Federal Data Center Consolidation Initiative (FDCCI). We particularly commend auditor Carol Johnson for working with the Office of Information Services (I) throughout the audit process. The report will help NARA to continue its data center consolidation work that is focused on virtualization, consolidation, or moving applications to the cloud, in accordance with our Capital Planning and Investment Control policy.

We fully concur with four of the six audit recommendations. For the remaining two recommendations, we concur with the need for action and the intended outcome, but disagree with the proposed implementation process embedded in the recommendations. We will continue working with your staff to define implementation plans.

Specifically, we do not agree with recommendation 1, to strictly comply with an implementation approach based on OMB FDCCI reporting templates. As noted in the report, NARA is not subject to the FDCCI policy and therefore was not expected to respond to the policy's template-based reporting. Accordingly, we did not use this template-based approach, but rather made modifications to both our Information Technology Master System List and Enterprise Architecture documentation to capture pertinent system data. We will continue to update this documentation to support our needs.

In recommendation 3, we agree on the need to perform a detailed consolidation/virtualization analysis, and we plan to assess systems on a case-by-case basis as these systems are considered for replacement or upgrade. We do not agree that a comprehensive approach as recommended is a good use of resources. Instead, a phased approach that is coordinated with other planned systems analysis meets the intent of the recommendation and allows us to best use our limited resources to optimize our systems.

Information Services will continue to work with your office as we address the specific areas where we disagree. Please let Mike Wash or Steve Heaps know if you have any questions or require additional information.



DAVID S. FERRIERO
Archivist of the United States

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Appendix C - Report Distribution List

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