

The Library of Congress
Office of the Inspector General



Library-Wide

Information Technology Services

*The Library has an Opportunity
to be More Proactive in Adopting
More Efficient Computing Technologies*

Survey Report No. 2013-IT-101
March 2013

FOR PUBLIC RELEASE



UNITED STATES GOVERNMENT

LIBRARY OF CONGRESS

Memorandum

Office of the Inspector General

TO: James H. Billington
Librarian of Congress

March 29, 2013

FROM: Karl W. Schornagel
Inspector General

SUBJECT: Cloud Computing and Server Efficiency
Survey Report No. 2013-IT-101

This transmits our final report summarizing the results of the Office of the Inspector General's survey of server efficiency and cloud computing. The executive summary begins on page *i*, and results of our audit survey appear on pages 6 to 13.

Based on written comments to the draft report, we consider all of the recommendations resolved except for recommendation I.2. Please provide, within 30 calendar days, an action plan addressing implementation of the recommendations, including an implementation date, in accordance with LCR 2023-9, *Rights and Responsibilities of Library Employees to the Inspector General*, §6.A.

We appreciate the cooperation and courtesies extended by Information Technology Services during this audit.

cc: Deputy Librarian of Congress
Deputy Associate Librarian for Strategic Initiatives
Director, Information Technology Services

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▶▶ EXECUTIVE SUMMARY

During this time of severe fiscal constraint, the Library of Congress, like all federal agencies, must continuously be alert to opportunities to reduce the costs of its operations. Server virtualization and cloud computing are technologies that have emerged in prominence in recent years, and would likely increase the efficiency of the Library's information technology (IT) infrastructure, while yielding substantial savings in associated hardware, energy, and maintenance costs.

We initiated this audit survey to determine whether the Library is making efficient use of the IT servers it currently employs, and has taken steps to evaluate the feasibility of using cloud computing to perform some of its information processing needs. Our survey work revealed that the Library has taken steps toward improving server efficiency by converting, over the past 7 years, 7.6% of its physical servers to a more efficient virtualization configuration. However, the Library can do more.

Taken collectively, our findings indicate that the Library is missing opportunities to achieve significant cost savings. A summary of our results are provided in the following sections.

The Library Needs to Make More Progress with Server Virtualization to Achieve Greater Cost Savings

The Library does not collect and maintain the data needed to make informed management assessments regarding its IT infrastructure. Specifically, it does not 1) collect data on efficiency levels of servers, 2) maintain comprehensive server inventory data in a central repository, and 3) continuously track data on the power used by its data center. As a result, the Library cannot readily identify potential areas for consolidation or areas where optimization through server virtualization alternatives may be used.

Further, the Library has not made significant progress with addressing recommendations from an August 2011 consultant's report to improve its existing virtualization environment. Particularly, the Library has not achieved a significant level of server virtualization as envisioned and recommended in the report. The consultants' report addressed weaknesses in the Library's IT environment by making

recommendations to improve server virtualization, provide decision-making criteria for selecting both virtualization and cloud computing options, and provide cost efficient solutions to support the Library's expanding charter and storage needs. The lack of further progress in its virtualization environment minimizes potential savings from reduced energy, hardware, and maintenance costs. We recommend that Information Technology Services (ITS) collect the data to make informed IT assessments of its infrastructure and report to the Deputy Librarian its progress on adopting the recommendations from the consultants' report.

The Library Needs to Develop an Enterprise-wide Plan to Evaluate Use of Cloud Computing and Achievable Cost Savings

The Library lacks an enterprise-wide cloud migration strategic plan (enterprise-wide plan) to guide management evaluations of possible IT service migrations to cloud-based solutions. Without such an enterprise-wide plan, the Library may miss opportunities to improve its IT operational efficiency and achieve substantial savings. At a minimum, the Library's enterprise-wide plan should include determining milestones and targets to measure progress, risks involved, required resources, and a retirement plan for legacy systems. We recommend that the Library create an enterprise-wide plan to guide management decisions on migrating to cloud-based solutions and instruct ITS to take the lead in initiating evaluations of viable cloud computing solutions.

Based on our results, we decided to issue a report at the end of our audit survey since the Library has made some progress on its server virtualization infrastructure but has not adopted a cloud computing initiative. In the future, we will revisit the Library's progress with implementing cloud-computing technologies.

Management concurred with three of our four recommendations. They consider the implementation timeline in the consultant's report unrealistic and do not consider their recommendations as the basis for the Library's implementation plan for virtualization.

▶▶ BACKGROUND

The IT infrastructure of the Library of Congress provides an integral means through which the Library fulfills its mission. That infrastructure consists of the hardware and software technology that provides critical services such as networking, data processing, and data storage for digital collections.

Continuing declining budgets will require the Library to shift the way it provides reliable and secure IT services. Server virtualization and cloud computing have emerged in prominence in recent years and have the potential to offer cost savings to the Library. While the two technologies are distinct by design, server virtualization and cloud computing share similar benefits, such as increased reliability, efficiency, and flexibility, at reduced maintenance, energy, and hardware cost to the Library.

Funding for Virtualization and Cloud IT initiatives

In FY 2010, OSI submitted to Congress a five-year (FYs 2010-2014) appropriation request for \$77 million for cyclical reinvestments in the Library's technology infrastructure. Of that amount, ITS stated it expended \$8.9 million during FYs 2011 and 2012 for the Library's virtualization technology.

For the past two years, the Committees on Appropriations of the Senate and the House of Representatives have expressed interest in the Library's progress with implementing cloud computing. During a hearing on March 31, 2011, the Senate Committee on Appropriations asked the Librarian of Congress whether the Library 1) was using, or planned to implement, a cloud-based IT infrastructure to operate and deliver programs to the public, and 2) was considering moving particular applications, such as email or other programs, to the cloud. In response, the Librarian stated that the Library was evaluating moving certain applications to the cloud but would continue to monitor the federal agency guidance being developed from the Office of Management and Budget, National Institute of Standards and Technology (NIST), and GSA before broadly implementing cloud computing initiatives.

In a FY 2013 Legislative Branch Appropriations Bill, dated June 1, 2012, the House of Representatives Committee on Appropriations directed the Library "to complete a cost-

benefit analysis supporting the Legislative Branch financial system hosting environment through external cloud computing services, as opposed to continuing to provide support within the Library's Capitol Hill technology infrastructure." The Library had not developed the cost-benefit analysis as of the end of February 2013. The Office of the Chief Financial Officer plans on leveraging data and information from an analysis that the Architect of the Capitol plans to perform to identify potential functional gaps and issues related to the migration of Architect of the Capitol's financial data into the Library's financial systems environment. In addition, the Library plans to engage an independent contractor to perform a cost-benefit analysis associated with moving the financial system to an externally hosted provider.

The Library's Computer Operations

The Library controls its computer operations through four data centers:

- Primary Computing Facility in Washington, DC—the primary data center of the Library.
- Alternate Computing Facility in Virginia—the data center of the IT disaster recovery site of the Library.
- Packard Campus Data Center in Culpeper, VA—the data center of the National Audio-Visual Conservation Center.
- Taylor Street in Washington, DC—the data center of the National Library Service for the Blind and Physically Handicapped.

According to ITS, it managed 618 physical Library servers located in its four data centers as of January 17, 2013. This total does not include servers used by service units, such as the Congressional Research Service, which support their own servers.

Server Virtualization and its Benefits

A server is a physical computer connected to a network and provides software functions that are used by other computers. It manages requests from users such as storing files, printing, email, internet, or processing database queries. As stand-alone units, servers in practice are normally severely underutilized due to the inefficient configuration of physical servers.

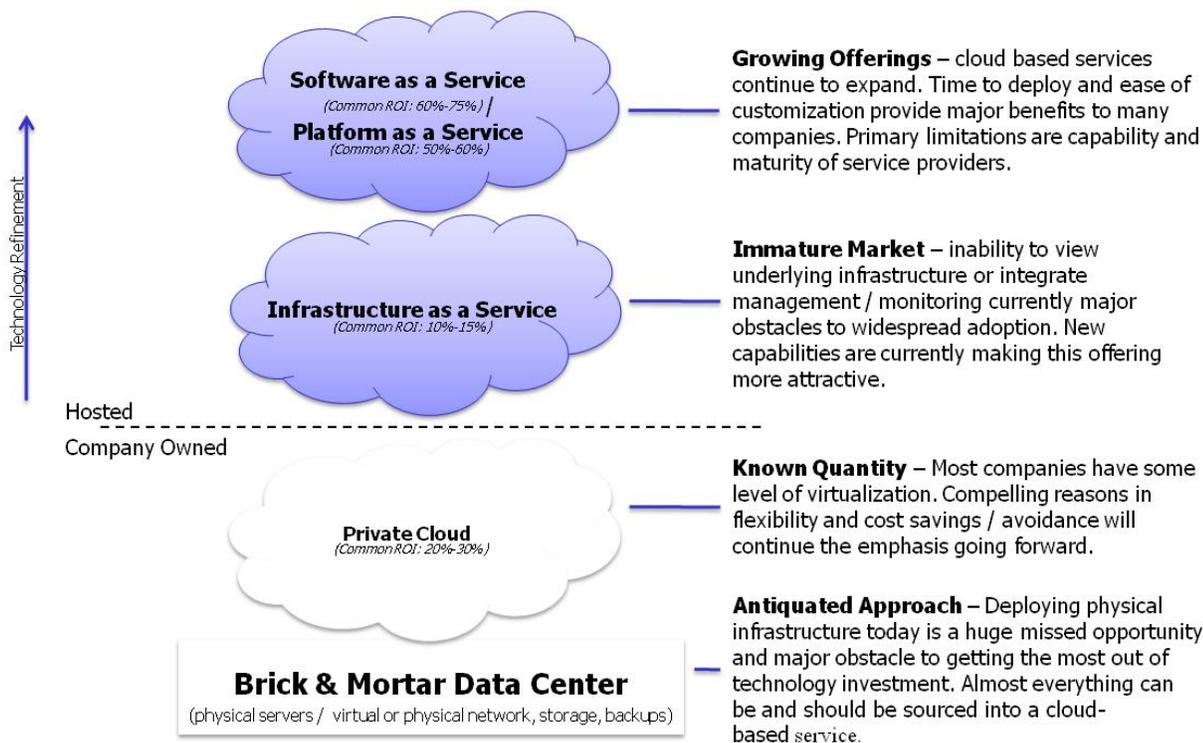
Server virtualization is a method of combining the processing power onto fewer servers to operate at higher utilization. Essentially, server virtualization involves the consolidation of applications onto fewer physical servers. Agencies realize cost efficiencies from 1) the purchase and maintenance of fewer physical servers, 2) reduced energy needed to power and cool down fewer physical servers, and 3) potential consolidation of data centers. According to ITS, in the last seven years the Library has virtualized 7.6% of its servers (47 out of 618 physical servers).

One of the most common reasons for adopting server virtualization is operational efficiency. According to the Department of Energy, most servers run at or below 20 percent utilization most of the time, yet still draw full power during the process. Virtualization allows the same amount of processing to occur on fewer servers, thereby increasing server utilization and saving on energy costs.

Cloud Computing

Cloud computing is a general term for anything that involves hosted services over the internet. The name “cloud computing” was inspired by the cloud symbol that is often used to represent the Internet in flowcharts and diagrams.¹ NIST defines cloud computing as “a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.” An example of a cloud computing service is email. In contrast with a traditional email system, which operates on an entity’s on-premise IT infrastructure, a cloud-based email solution uses email applications that run on a third-party infrastructure that is accessible from any device with a web browser, and costs less to maintain. The diagram below shows the relative maturity of the various cloud offerings and common levels of return of investment (ROI), and a quick look at each of the options and their applicability to the Library.

¹ Postsecondary Electronic Standards Council, *What is Cloud Computing*, 2010.



| | Private Cloud | IaaS | PaaS | SaaS |
|---------------------------------------|--|--|--|---|
| Best Practice Usage | Large globally distributed organizations that provide IT as a service internally | Data center overflow, bursty application requirements, data center migration | Test/Dev, rapid application development, Lotus Notes db migrations | Large systems with robust functionality, Recruiting, Content Management |
| Level of Maturity | Low | Medium | Medium | High |
| Primary Industry Providers | VMware, HP, IBM | Amazon | Google, Microsoft | Salesforce.com, Workday, Netsuite |
| Overall Level of Adoption in Industry | Low | Low | Low | Medium |
| Applicability to the LOC | Low | High | Low | Low |

Source: CACI International Inc. and Acumen Solutions, *Virtual Assessment Study for the Library of Congress* (August 31, 2011).

►► OBJECTIVES, SCOPE, AND METHODOLOGY

We initiated this audit survey to assess the Library's progress with using server virtualization and cloud computing technologies. Our objectives were to determine whether the Library 1) is making efficient use of the servers it currently employs, and 2) has taken steps to evaluate the feasibility of using cloud computing to perform some of its information processing needs. We refer to this as an audit survey rather than an audit because we did not review all internal controls or compliance with all laws and regulations, only those that we believe were most relevant to our review objectives.

The scope of our survey included the over 600 physical servers managed by the Information Technology Services (ITS), of which 379 virtual servers have been created from 47 physical host servers. We did not verify the accuracy of the number of physical and virtual servers reported to us by ITS. We reviewed key documents such as the Office of Strategic Initiative's Strategic Plan for fiscal years 2011 to 2016 and the August 2011 Virtualization Assessment Study prepared by CACI International Inc. and Acumen Solutions.

To accomplish our objectives, we interviewed Library officials from ITS. We also reviewed internal documentation prepared by ITS, Government Accountability Office audit reports, best practice guidance from the Office of Management and Budget, and other federal and industry reports relating to cloud computing and server virtualization.

We conducted our survey from November 2012 through February 2013 in accordance with generally accepted government auditing standards and LCR 211-6, *Functions, Authority, and Responsibility of the Inspector General*. Government auditing 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 objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

▶▶ RESULTS OF AUDIT SURVEY

Since 2006, when the Library began using virtualization to provide an environment to test applications, it has made some progress in adopting server virtualization, but more can be done, such as implementing the recommendations that its outside consultant made in 2011 and collecting basic information on its IT infrastructure performance. Further, because of the limited number of cloud service providers and relative immaturity of cloud computing, the Library has not yet broadly implemented a cloud computing initiative.

Details on the results of our survey are provided in the following sections.

I. The Library Needs to Make More Progress with Server Virtualization to Achieve Greater Cost Savings

The Library has not made significant progress with addressing recommendations from an August 2011 consultants' report² to expand its existing virtualization environment. The consultants stated that the Library had not yet achieved a significant amount of server virtualization. The report provided a virtualization roadmap that outlined a series of initiatives the Library needed to undertake. According to data provided by ITS in January 2013, the Library has virtualized 7.6% of its physical servers (47 out of 618 physical servers).

Although the Library has not made the progress outlined in its consultants' report, it is planning to develop further its virtualization infrastructure. An example of the Library's current virtualization effort is the Web Delivery Infrastructure project. As part of the project, ITS performed market research on virtualization technology software and hardware products to provide an integrated, scalable, manageable, and highly available virtual IT infrastructure. The project is intended to set the ITS standard for its approach to web delivery that enables a more efficient use of servers dedicated to that function.

² CACI International Inc. and Acumen Solutions, *Virtualization Assessment Study* (August 31, 2011).

In 2011, in response to a Library contract, CACI International Inc. and Acumen Solutions performed a two-month assessment of the Library's existing and future virtualization efforts. In August 2011, the consultants issued a report to the Library on their results that identified best practices and provided technical and operational recommendations for virtualizing the Library's computing environments on-premise or via cloud computing. The report's recommendations focused on 1) increasing efficiency and reliability of the Library's virtual computing infrastructure, 2) providing clear decision-making criteria for selecting virtualization and cloud computing options for existing and new IT requests, and 3) providing cost efficient solutions to support the Library's expanding charter and growing storage needs.

Significant issues identified in the report were:

1. Facilities—The Library made insufficient use of virtualization to materially reduce the power and cooling needs of the main and alternate data centers.
2. Servers— The Library had limited ability to quickly create a clone of an existing server used to test new applications.
3. Servers— The Library lacked the ability to support “no downtime” system maintenance, upgrades, and patch installations.
4. Storage — The Library had not implemented server virtualization to help better optimize and manage its massive data storage needs.
5. Storage— The IT environment did not allow for high fluctuations in storage processing and was not scalable³ to meet future storage demands.

The Library stated that the consultant's report was not to serve as an established ITS plan, but rather to provide ITS a basis on which to make further plans.

The Library may be hampered in its virtualization efforts and the ability to make further plans because it cannot readily identify potential areas for consolidation or areas where optimization through server virtualization alternatives may be used. Specifically, the Library does not 1) collect data on

³ Scalability refers to the ability of a system to expand and contract its resource pool to accommodate heavier or lighter IT demands.

efficiency levels of servers, 2) maintain comprehensive server inventory data in a central repository, and 3) continuously track data on the power used by its data center. Without such information, the Library is not able to make informed management assessments regarding the efficient use of its IT infrastructure, and is missing an important internal control.

In February 2010, out of concerns over the costly, inefficient, and unsustainable growth of redundant IT infrastructure throughout the federal government, OMB created the Federal Data Center Consolidation Initiative (Federal consolidation initiative). The Federal consolidation initiative is focused on:

- Promoting the use of Green IT by reducing the overall energy and real estate footprint of government data centers;
- Reducing the cost of data center hardware, software, and operations;
- Increasing the overall IT security posture of the government; and
- Shifting IT investments to more efficient computing platforms and technologies.

The Federal consolidation initiative requires executive branch agencies to annually report inventories of data center assets to GSA.⁴ Among other things, agencies must provide information/data on:

- Physical server counts,
- Average and maximum server utilization,
- Number of virtual hosts, and
- Power utilization efficiency.

Performing inventories of IT assets, measuring levels at which servers are used, tracking amounts of power that data centers use, and annually reporting this information to GSA are standard requirements of the Federal consolidation initiative. However, those requirements are applicable to executive branch federal agencies and not to the Library because it is part of the legislative branch. Furthermore, the Library does not have a direct monetary incentive to collect or track data on the power it takes to run its data centers because the power the Library uses to run its data centers is provided by AOC.

⁴ OMB, *Federal Data Center Consolidation Initiative* (February 26, 2010).

Having complete and reliable IT server inventory and usage data will enable the Library to measure progress made with server virtualization as well as power and space usage efficiency, and will be an important short-term step in the Library's path to its possible adoption of cloud computing.

Recommendation

We recommend that ITS:

1. Collect data on efficiency levels of servers, maintain comprehensive server inventory data in a central repository, and continuously track data on the power used by its data center; and
2. Report to the Deputy Librarian the progress it has made in adopting the specific recommendations of the outside consultants' report on server virtualization, and the steps and timeframes it will take to implement such recommendations and the Library's return on investment/cost savings to be achieved.

Management Response

Management concurred with recommendation 1 but disagreed with recommendation 2. They consider the implementation timeline in the consultant's report unrealistic and do not consider their recommendations as the basis for the Library's implementation plan for virtualization.

OIG Response

The consultants' report recommended a number of steps to achieve a more efficient infrastructure. We believe that management should determine which of the consultants' recommendations will or will not be implemented. Timelines and milestones can be adjusted based on cost and other factors determined by management. The Deputy Librarian should receive periodic updates on progress made on this assessment.

II. The Library Needs to Develop an Enterprise-wide Plan to Evaluate Possible Use of Cloud Computing and Achievable Cost Savings

The Library may be missing an opportunity to further increase its IT efficiency and reduce costs because it does not have an

enterprise-wide cloud migration strategic plan(enterprise-wide plan) to guide management decision-making on possible cloud migration. The executive branch is required to reevaluate its technology sourcing strategy to include consideration and application of cloud computing solutions as part of the budget process. The Library is moving cautiously towards moving any services to the cloud, and we applaud such an approach. Nevertheless, the Library needs to have a cohesive decision-making process—an enterprise-wide plan—to decide whether the risks associated with moving computer services to a cloud outweigh the benefits to maximize capacity, improve IT flexibility and responsiveness, and minimize cost.

While the executive branch and private sector have increasingly recognized the benefits of migrating IT services to a cloud-based computing environment, doing so in practice can be a challenging process. Accordingly, it is in an agency's best interest to develop and follow an enterprise-wide plan to guide management decisions on adopting cloud-computing technology. OMB has published guidance for developing such an enterprise-wide plan, including the *25 Point Implementation Plan to Reform Federal Information Technology Management* issued in December 2010. At a minimum, an agency's plan should include

- Major milestones,
- Execution risks,
- Adoption targets,
- Required resources, and
- Retirement plan for legacy services.

Additionally, *Enterprise Risk Management for Cloud Computing* issued by the Committee of Sponsoring Organizations of the Treadway Commission⁵ in June 2012 provides guidance that can help identify the risks and impact cloud computing will have on the Library.

The *Federal Cloud Computing Strategy* issued by OMB in February 2011 states in part that, "Cloud computing offers the

⁵ This is a joint initiative of five private sector organizations (the Institute of Internal Auditors, American Institute of Certified Public Accountants, American Accounting Association, Financial Executives International, and the Institute of Management Accountants) dedicated to providing thought and leadership through the development frameworks and guidance on enterprise risk management, internal control, and fraud deterrence.

government an opportunity to be more efficient, agile, and innovative through more effective use of IT investments, and by applying innovations developed in the private sector.” This document also provides a decision framework and case examples to support agencies considering migrating towards cloud computing. Additionally, a report issued by the Government Accountability Office in July 2012 states that federal agencies are shifting to the deployment of cloud services as part of a comprehensive effort to increase the operational efficiency of federal technology assets and deliver greater value to the American taxpayer. The report also indicates that delivering computing services via cloud computing has the potential to provide IT services faster, more efficiently, and at a lower cost than a custom-developed system.

The use of cloud computing in the federal government has gained momentum over the last few years, and in August 2012 GSA established 20 blanket purchase agreements to allow federal agencies to order a broad range of cloud email services. Various federal agencies have already adopted cloud email, and have claimed significant cost savings.

ITS does not have an enterprise-wide plan similar to that required of executive agencies that details the decision steps and milestones for evaluating and moving to cloud computing. Library officials stated that the limited number of cloud service providers under the Federal Risk and Authorization Management Program (FedRAMP) was one reason the Library has not yet broadly implemented cloud computing. The Office of Management and Budget established FedRAMP in December 2011 as a mandatory program for executive branch federal government agencies intended to provide a standardized approach to security assessment, authorization, and continuous monitoring for cloud products and services. FedRAMP has also issued a contract clause template for cloud security to assist agencies in procuring cloud-based services. The Library’s progress in adopting cloud technologies should accelerate as the number of authorized service providers grows. The program certified and authorized its first cloud service provider on December 27, 2012, and as of the end of February 2013, authorized a total of two cloud service providers.

The issuance of certifications to approved cloud service providers enables a cost-effective and risk-based approach to cloud services by providing a repository of authorization packages that all government agencies can leverage. The Library can therefore accelerate the adoption of secure cloud solutions by leveraging existing security assessments and authorizations, which the GSA estimates costs federal agencies more than \$100,000 per application and takes up to nine months to complete.⁶

Since it is an agency in the legislative branch, the Library is not required to follow FedRAMP or other executive branch policies. Executive departments and agencies are required to default to a cloud-based solution whenever a secure, reliable, and cost-effective option exists.⁷ Nevertheless, the Library can still leverage the benefit of FedRAMP by evaluating a cloud provider's authorization package and comparing that information to its own requirements.

Without an enterprise-wide plan that guides management on the decisions necessary for adopting appropriate cloud-computing technology, the Library may be missing opportunities for cost savings. At a minimum, an agency's enterprise-wide plan should include requirements to estimate costs involved in a service migration, establish performance goals applicable to the process, determine milestones to measure progress, and determine plans for retiring relevant legacy systems.⁸

To the Library's credit, ITS has prepared an internal guidance document that ITS staff use when they work with service unit officials to evaluate whether external hosting or cloud computing would be viable options for a service unit's business application needs.⁹ However, the Library has not made such an evaluation a top-down approach where ITS is required to assess each service unit's viability for cloud computing based on pre-determined criteria, such as budget

⁶ We did not obtain data on the average cost the Library spends on security assessments.

⁷ Office of Management and Budget, *25 Point Implementation Plan to Reform Federal Information Technology Management* (December 9, 2010).

⁸ Government Accountability Office, Report 12-756 (July 2012).

⁹ Information Technology Services, *Alternative Hosting Environments, Guidance on Best Practices for Implementing Alternative Hosting Environments ("Cloud Services")* (October 16, 2012).

savings to the Library and internal customer service requirements. Rather, the service unit is responsible for identifying candidate applications for external hosting or cloud computing, and these service units may not have the requisite technical knowledge of how best to achieve ITS's sourcing strategy.

Recommendation

We recommend that the Library:

1. Develop an enterprise-wide plan to guide management decision-making on possible cloud solutions.
2. Instruct ITS to take the lead in initiating evaluations of viable cloud computing solutions for the Library.

Management Response

Management concurred with our recommendations.

Major Contributors to This Report:

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►► APPENDIX A: MANAGEMENT RESPONSE

THE LIBRARY OF CONGRESS
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WASHINGTON, D.C. 20540-1300



OFFICE OF THE ASSOCIATE LIBRARIAN
FOR STRATEGIC INITIATIVES

Date: April 2, 2013

To: Karl Schornagel
Inspector General

From: Jim Gallagher 
Acting Associate Librarian for Strategic Initiatives

Subject: The Library has an Opportunity to be More Proactive in Adopting
More Efficient Computing Technologies
Draft Survey Report No. 2013-IT-101

I have attached our responses to the recommendations contained in the subject report, as requested in your email dated March 14, 2013.

Over the last several years, ITS has taken a number of steps to further our knowledge of virtualization and cloud computing technologies. One of those steps was to hire an independent consultant to perform an objective analysis of our "as is" computing environment and provide recommendations for our virtualization strategy going forward. We appreciated having this objective, third party perspective.

The consultant's report has proven valuable to us. Several of its recommendations are in the process of being implemented now, including: our transition to a standard virtualization product thereby reducing inefficient infrastructure variety, the standardization of server and application build and deployment procedures, and the actual implementation of virtualized applications to support critical Library business processes.

That being said, the consultant was not asked, nor expected given the short time the consultant was on board, to provide timelines and milestones for achieving the virtualization strategy. This would have required extensive analysis of budget, manpower, expert resources, legacy applications and Library priorities. The timelines provided by the consultant were unrealistic as they did not, nor could have, conducted such an extensive analysis.

As noted in your report, we have made strides in the area of virtualization. We believe these strides to be more significant than merely the percentage of physical servers we have dedicated thus far to

virtualization. Each Library application that is virtualized represents a cost savings in terms of server hardware that does not need to be purchased, housed, or maintained. In these times of significant resource constraints, our virtualization efforts have allowed us to support a great many more Library initiatives than we otherwise would have.

Please let me know if you have any questions on the comments.

I. The Library Needs to Make More Progress with Server Virtualization to Achieve Greater Cost Savings

We recommend that ITS:

1. Collect data on efficiency levels of servers, maintain comprehensive server inventory data in a central repository, and continuously track data on the power used by its data center;

Agree. ITS will establish criteria for measuring and reporting on server efficiency levels, ensure that there is a comprehensive server inventory, and will work with the Architect of the Capitol to track data on the power used by the data center.

2. Report to the Deputy Librarian the progress it has made in adopting the specific recommendations of the outside consultants report on server virtualization, and the steps and timeframes it will take to implement such recommendations and the Library's return on investment/cost savings to be achieved.

Disagree. ITS contracted for an expert consultant to make recommendations on technical architecture analysis and documentation for the ITS technology infrastructure. A subset of the analysis included a focus on virtualization. The consultant was asked to review the current ITS virtual computing infrastructure, current virtual computing systems, projects and plans, as well as other available products and industry trends to provide recommendations on a virtual computing strategy. The consultant was not asked, nor expected given the short time the consultant was on board, to provide timelines and milestones for achieving the virtualization strategy. This would have required extensive analysis of budget, manpower, expert resources, legacy applications and Library priorities. The unrequested timelines provided by the consultant were unrealistic as they did not nor could have conducted such an extensive analysis. So while the recommendations have proven to be insightful and useful in informing our strategy, we do not consider them as the basis for the Library's implementation plan for virtualization. ITS will continue to work with Library leadership and within and under current fiscal constraints to achieve the virtualization strategy.

II. The Library Needs to Develop an Enterprise-wide Plan to Evaluate Possible Use of Cloud Computing and Achievable Cost Savings

We recommend that the Library:

1. Develop an enterprise-wide plan to guide management decision-making on possible cloud solutions.

Agree. ITS will support a Library-wide plan to guide management decision-making on possible cloud solutions.

2. Instruct ITS to take the lead in initiating evaluations of viable cloud computing solutions for the Library.

Agree. ITS will take the lead on initiating evaluations of cloud computing solutions if it is determined that such evaluations are of strategic value to the Library.