U.S. Small Business Administration

Data Center Optimization Initiative Strategic Plan

Document Version: 6.0
May 1, 2018

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1. Purpose

The Office of the Chief Information Officer (OCIO) of the U.S. Small Business Administration (SBA) developed this Data Center Optimization Initiative (DCOI) Strategic Plan in response to the August 1, 2016 Memorandum for Heads of Executive Departments and Agencies (M-16-19)[1]. This plan addresses the requirements of that memorandum for SBA to develop, implement, monitor, and report on data center strategies to:

- Consolidate inefficient infrastructure;
- Optimize existing facilities;
- Improve security posture;
- Achieve cost savings; and
- Transition to more efficient infrastructure, such as cloud services and inter-agency shared services.[2]

At the time that M-16-19 was released, SBA was without a permanent Chief Information Officer (CIO). Without that leadership, SBA began reporting on its data center plans and metrics without identifying or implementing specific consolidation, migration, or optimization strategies. An initial SBA DCOI draft plan was developed in the fall of 2016, but it was not formally approved or implemented. Data previously reported by SBA under that draft plan was both incomplete and inaccurate. The original version of this strategy document corrected those deficiencies beginning with the 4th Quarter of FY 17. New baselines that align to this document were also published to SBA.gov on August 31, 2017. This FY 18 update to the strategic plan expands upon the lessons learned in FY 17 and more closely aligns the DCOI initiative with SBA's cloud first strategy.

2. SBA Data Center Summary

SBA identified a total of ten, tiered data centers per the definition in M-16-19. These are government owned and managed enterprise data centers that support the mission of the agency. All have their own sources of power and cooling and include physical file servers and storage arrays as the primary computing equipment. At SBA, data centers are currently operated by one of three offices: OCIO, the Office of Capital Access, and the Office of Disaster Assistance. The complete inventory of tiered data centers by SBA operator is as follows:

Name/Location	*SBA Operator*
SBA Headquarters (HQ, Primary Data Center)	Office of the Chief Information Officer
Denver, CO	Office of the Chief Information Officer
Birmingham, AL	Office of Capital Access
El Paso, TX	Office of Capital Access
Fresno, CA	Office of Capital Access

[1] OMB Data Center Optimization Initiative Memorandum M-16-19, August 1, 2016, https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2016/m_16_19_1.pdf
[2] Federal Information Technology Shared Services Strategy, May 2, 2012, https://www.whitehouse.gov/sites/default/files/omb/assets/egov_docs/shared_services_strategy.pdf.

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Name/Location	*SBA Operator*
Herndon, VA (1)	Office of Capital Access
Sacramento, CA	Office of Capital Access
Buffalo, NY	Office of Disaster Assistance
Fort Worth, TX	Office of Disaster Assistance
Herndon, VA (2)	Office of Disaster Assistance

In addition to these government managed data centers, SBA has a collocated data center instance at the CenturyLink Herndon, Virginia data center. CenturyLink's Irvine, California data center provides backup instances for the Herndon location. CenturyLink maintains its own statistics on power utilization, consumption, and efficiency of their data centers. The CenturyLink - non-government managed data center - is not included as part of the DCOI initiative. As such, these managed data centers have not been incorporated into this strategic plan. However, SBA's OCIO initiative to move everything possible to the cloud will continue to reduce the on-premise SBA data centers and replace them with cloud or collocated data centers.

To support its Cloud First initiatives, SBA implemented a cloud based instance in the Microsoft Azure cloud, which will be referred to as the SBA Azure Cloud. This instance is the primary destination for SBA's consolidation and migration efforts and supports Infrastructure as a Service (IaaS) as its initial implementation. Additionally, SBA is using FedRAMP cloud instances to deliver Platform as a Service (PaaS) and Software as a Service (SaaS) capabilities. Cloud instances are not included in this plan, except as the destination for SBA's migration efforts.

SBA also identified 35 regional and district office sites that meet the criteria of non-tiered data centers as stipulated in M-16-19. These locations primarily provide file, print, and patching services. They are under review and evaluation for migration, consolidation, and eventually a move to the SBA Azure Cloud.

2.1 Development Freeze for New and Current Data Centers

SBA met the requirement that it "may not budget any funds or resources toward initiating a new data center or significantly expanding an existing data center without approval of the OMB OFCIO."[3] Since the memorandum was issued, SBA has not expanded its data center footprint, and in fact, consolidated and reduced its data center footprint at the main HQ Data Center. This location serves as the primary data center for SBA to test and evaluate its DCOI strategies for their effectiveness and applicability to the remaining government-owned and privately-owned data centers.

3. Development of SBA's Data Center Optimization Initiative Plan

SBA is leveraging best practices and recommendations for DCOI from other government and private industry organizations for the development of this plan. These documents included:

[3] OMB Data Center Optimization Initiative Memorandum M-16-19, August 1, 2016, https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2016/m_16_19_1.pdf

- GSA's IaaS Considerations for the Data Center Community, DCOI PMO Cloud Series, v1.11[4]
- 18F DCOI Review and Recommendation[5]

In addition to these documents, SBA also reviewed the DCOI plans of other federal agencies and incorporated their best practices into this strategy document.

4. SBA's Data Center Optimization Initiative Objectives and Requirements

OMB stipulated three overarching DCOI goals in M-16-19: optimization, cost savings and avoidance, and closed data centers. Pursuant to these goals, SBA established the following high-level objectives and requirements for implementing DCOI. Metrics, achievements, and challenges will be reported per OMB guidance and published on SBA.gov.[6]

4.1 Goal 1: Optimization

OMB established five optimization metrics that agencies are expected to meet: energy metering, power usage effectiveness (PUE), virtualization, server utilization and automated monitoring, and facility utilization. The definition, calculation methodology, and end of FY 18 target values of each can be found in the table on the following page:

[4] IaaS Considerations for the Data Center Community, March 15, 2017, https://www.gsa.gov/portal/getmediadata?mediald-162846

[5] 18F DCOI Review and Recommendations, August 15, 2016,https://github.com/18f/DCOI-recommendations/blob/master/DCOI-recommendations.pdf

[6] SBA DCOI Strategic Plan, September 21, 2017 https://www.sba.gov/about-sba/sba-performance/open-government/digital-sba/digital-strategy/dcoi-strategic-plan

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Table 1. Government-wide Optimization Targets for Tiered Data Centers[24]			
Metric	**Definition**	**Calculation**	**FYE 2018 Target Value**
Energy Metering	(%) Percent of total gross floor area (GFA)[25] in an agency's tiered data center inventory located in tiered data centers that have power metering.	$\frac{\text{Total GFA of Energy Metered Data Centers}}{\text{Total GFA of All Tiered Data Centers}}$	100%
Power Usage Effectiveness (PUE)[26]	(Ratio) Proportion of total data center energy used by IT equipment.	$\frac{\text{Total Energy Used}}{\text{Total IT Equipment Energy Used}}$	≤ 1.5 (≤ 1.4 for new data centers)
Virtualization	(Ratio) Ratio of operating systems (OS) to physical servers.	$\frac{\text{Total Server Count} + \text{Total Virtual OS}}{\text{Total Physical Servers}}$	≥ 4
Server Utilization & Automated Monitoring	(%) Percent of time busy (measured as 1 – percent of time spent idle), measured directly by continuous, automated monitoring software,[27] discounted by the fraction of data centers fully equipped with automated monitoring.	Average Server Utilization * Percent of Data Centers Fully Equipped with Automated Monitoring	≥ 65%
Facility Utilization	(%) Portion of total gross floor area in tiered data centers that is actively utilized for racks that contain IT equipment.	$\frac{\text{Total Active Rack Count}^{28} * 30\text{ sq. ft.}}{\text{Total Gross Floor Area}}$	≥ 80%

SBA's planned and achieved optimization metrics through FY 19 can be found in the table below:

	FY 17 Planned	**FY 17** Achieved	**FY 18** Planned	**FY 19** Planned	OMB Target
Energy Metering	10%	70%	75%	80%	100%
Power Usage Effectiveness	1.5	3	3	3	≤1.5
Virtualization	1.91	1.91	2	3	≥4
Server Utilization & Automated Monitoring (Tiered)	25%	40%	70%	90%	≥65%
Server Utilization & Automated Monitoring (Non-Tiered)	25%	30%	75%	90%	≥65%
Facility Utilization	33%	33%	25%	15%	80%

4.1.1 Planned and Achieved Consolidation and Migration by Fiscal Year

In FY 17, OCIO implemented steps to migrate the majority of servers in the HQ Data Center to the SBA Azure Cloud, with a small portion remaining on-premise and/or in a privately-managed facility. The first step was to build a complete inventory of the equipment and servers located in the data center. Next, OCIO consolidated and migrated existing physical servers to virtual servers. In addition to the HQ Data Center migration to the SBA Azure Cloud, OCIO is identifying other servers and data assets across the enterprise for consolidation and migration to cloud infrastructure.

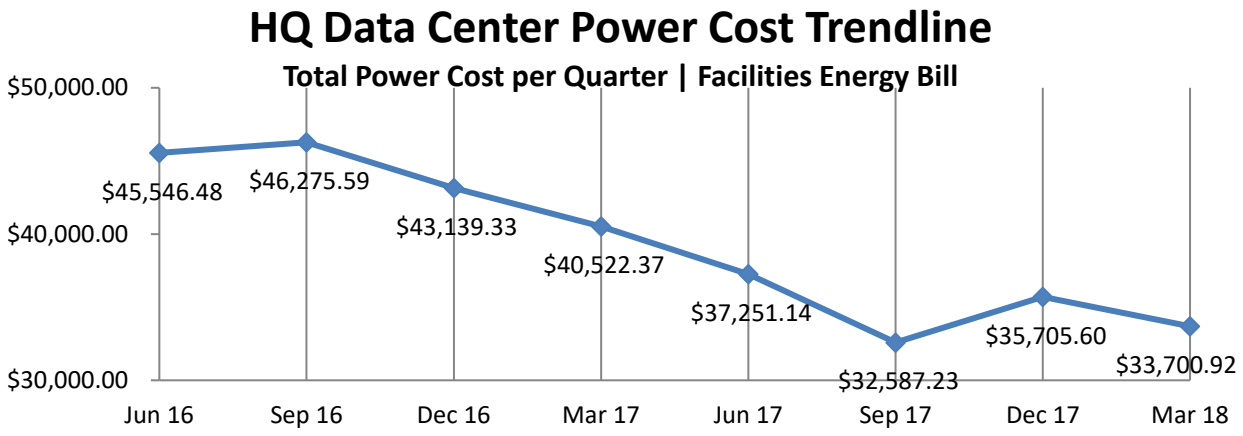
Concurrently, OCIO inventoried its Denver, Colorado tiered data center. In FY 18, OCIO is consolidating these servers, migrating them to the SBA Azure Cloud or another government-owned facility, and close this tiered data center. The same process will be undertaken with OCIO's non-tiered data centers in FY 18, with six slated for closure by the end of FY 18.

Lessons learned from these efforts will be used to inventory, consolidate, and migrate the remaining SBA data centers beginning in FY 19.

4.1.2 Energy Metering and Power Usage Effectiveness Metrics

SBA is on track to meet the DCOI goals for both energy metering and power usage effectiveness (PUE) by the end of FY 18. During FY 17 Q1-Q3, the OCIO consolidated and shut down 180 servers in the HQ Data Center.

As a result of shutting down 180+ servers, the data center was overcooling so OCIO raised the temperature from 65 degrees to 73 degrees. The combination of shutting down the servers and raising the temperature significantly reduced energy consumption as indicated in the chart below.



In FY 17, SBA implemented energy metering technologies in the HQ Data Center to evaluate the effectiveness of its consolidation efforts. Metering was in place on all Windows servers in the HQ Data Center by the end of FY 17. Metering will also be in place on all servers throughout the enterprise by the end of FY 18.

SBA will calculate a consolidated PUE rating for the entire environment for the ten tiered and nearly three dozen non-tiered data centers across the country, and the privately-managed data centers. The targeted areas for improving the PUE are the ten government-owned tiered data centers. Strategies implemented in the HQ Data Center to lower the PUE rating will be applied to the non-HQ data centers, including:

- Virtualizing as many servers as possible and maximizing utilization of virtual resources (CPU);
- Migrating as many virtual servers as possible to the SBA Azure Cloud;

- Consolidating the number of physical servers and storage arrays;
- Improving the density of the data center racks and their airflow; and
- Raising the temperature of the data center from 65 degrees to 73 degrees.

4.1.3 Virtualization and Server Utilization & Automated Monitoring Metrics

SBA will continue its FY 17 strategies to virtualize, consolidate, and migrate servers as much as practicable. SBA implemented Microsoft Systems Center and Microsoft Operations Manager Suite for automated monitoring and server utilization management. This is a consolidation of the previous tools used to monitor the enterprise: BigFix, EM7, and LanSweeper. Using a single enterprise tool set enables SBA's OCIO staff and contractors to monitor and manage servers throughout the enterprise environment, regardless of where that data center or server is located.

SBA is installing monitoring agents in all data centers and expects to exceed the OMB target for the server utilization & automated monitoring metric. However, SBA does not expect to meet the OMB target for the virtualization metric because privately hosted data centers—including CenturyLink and the SBA Azure Cloud—are not measured as part of the DCOI initiative. Therefore, new and consolidated virtual services hosted in the SBA Azure Cloud will not be included in future metric calculations. Although the number of physical and virtual servers will decline as the Agency consolidates its servers, it is unlikely that this progress will be visible through this metric because most servers will be in the cloud hosted environment and not be included in the DCOI reporting.

4.1.4 Facility Utilization Metric

Because SBA is consolidating and migrating servers to the cloud, SBA does not initially expect to meet the OMB target of 80% facility utilization. By migrating these servers to the cloud and removing them from the data center, SBA is reducing our facility utilization numbers. However, if funding is approved, the OCIO has plans to reduce the physical size of the HQ Data Center by nearly 80%, from 3701 ft^2 to less than 790 ft^2. This effort will also result in power savings of more than 50% while greatly improving the density of the remaining on-premise servers. Should funding not be approved for this resizing, SBA's facility utilization metrics will continue to decrease as more servers are moved to the cloud, leaving fewer servers in the same physical space.

4.2 Goal 2: Cost Savings and Avoidance

Despite a late start (Q3 FY 17) to the planning of FY 17's cost savings or avoidance, SBA exceeded the FY 17 target of $966,000 by achieving $975,000. As previously highlighted, SBA began the process of optimizing and closing two, tiered data centers: Headquarters and Denver, Colorado. Consequently, the Agency expects to experience nearly $1 million in combined cost savings and avoidance in FY 18 by reducing power consumption and repurposing contracts away from physical data center maintenance and toward SBA's cloud migration initiative (about $926,000). These strategies will be applied to other agency data centers beginning in FY 19. Planned and achieved cost savings and avoidance figures can be found below.

	FY 17 Planned	**FY 17** Achieved	**FY 18** Planned	**FY 19** Planned	OMB Target

Reduced Power Consumption	$40,000	$49,000	$65,000	$70,000	-
Repurposed Contracts	$926,000	$926,000	$926,000	$950,000	-
TOTAL	$966,000	$975,000	$991,000	$1,020,000	$860,000

4.3 Goal 3: Planned Closures

SBA plans to meet or exceed all targets of DCOI by the end of FY 18, except for the virtualization and facility utilization metrics for reasons previously explained. OCIO is migrating its first two, tiered data centers to the cloud and will use that experience and lessons learned to migrate additional tiered and non-tiered data centers to the cloud. Generally, these data centers will be transitioned to appliance closets used for security, maintenance, and monitoring purposes (e.g., Microsoft System Center Configuration Manager distribution points, Nessus vulnerability scanners, switches, routers). All file and application servers will be consolidated in the cloud or hosted in other privately-managed data centers in accordance with National Archives and Records Administration guidance.[7] Print servers are being decommissioned in FY 18, and the printing environment will be transitioned to Direct IP printing. Government-owned, on-premise data centers will only be maintained as a last resort. SBA targets and timelines are included in the tables below.

Name/Location	*SBA Operator*	*Tiered or Non-Tiered*	*Target Closure Date*
Denver, CO	OCIO	Tiered	FY 2018
Boise, ID	OCIO	Non-Tiered	FY 2018
Hazard, KY	OCIO	Non-Tiered	FY 2018
Jacksonville, FL	OCIO	Non-Tiered	FY 2018
Philadelphia, PA	OCIO	Non-Tiered	FY 2018
Sacramento, CA	OCIO	Non-Tiered	FY 2018
Santa Ana, CA	OCIO	Non-Tiered	FY 2018

	FY 17 Planned	**FY 17** Achieved	**FY 18** Planned	**FY 19** Planned	OMB Target
Tiered Closures	0	0	1	2	3 (25% of 10)
Non-Tiered Closures	0	0	6	12	21 (60% of 35)
TOTAL	0	0	7	14	24

As of Q3 FY 17, SBA has classified ten of its data centers as tiered. The remaining 35 are non-tiered. Based on the planned closures above, SBA expects to operate nine, tiered data centers and 29 non-tiered data centers in FY 2018.

SBA will continue to optimize, consolidate, and migrate its data centers from government-owned and privately-managed facilities to the cloud as much as is practicable, closing both tiered and non-tiered data centers where that possibility exists. This effort is expected to continue beyond the length of the current DCOI period, beginning in FY 19 and beyond, using the lessons learned to undertake this initiative throughout the enterprise and across all data center operators.

[7] NARA Bulletin 2010-05, Guidance on Managing Records in Cloud Computing Environments, September 8, 2010 https://www.archives.gov/records-mgmt/bulletins/2010/2010-05.html

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5. Achievements

5.1 Data Center Closures

SBA continues actively migrate HQ Data Center and Denver, Colorado Data Center to the cloud. SBA anticipates that it will vastly downsize its HQ Data Center and close its Denver, Colorado Data Center by September 30, 2018. SBA's HQ Data Center consolidation project has already led to the decommissioning of approximately 180 servers and network equipment from the HQ Data Center. This resulted in tangible energy savings and set a model for future endeavors at both tiered and non-tiered data centers throughout the agency. SBA also expects to close another six non-tiered data centers by the end of FY 2018 as indicated in Section 4.3 above.

5.2 Cloud First Initiative

SBA is the first agency to implement DHS's Continuous Diagnostics and Mitigation (CDM) program in the cloud. It should be noted that CDM was designed for on-premise implementation, yet SBA avoided investing in additional data center hardware by implementing CDM in the Cloud. Not only did SBA not have to invest further in its on-premise physical data center in FY 17, this also eliminated future hardware recapitalization cost requirements.

Moreover, SBA had no designated budget to fund its Cloud First Initiatives. To fund the SBA Azure Cloud, the OCIO's office cut on-premise hardware and software maintenance contracts back to only cover what was actually needed for the reduced on-premise environment and subsequently applied the contract savings to fund the cloud investment. Leveraging unused Microsoft Enterprise Agreement consulting and training credits, SBA obtained Azure cloud architect specialists to design and implement the SBA Azure Cloud. These efforts have not only set a model for the rest of the enterprise, but for all government agencies looking to migrate to the cloud quickly, securely, and with minimal additional funding.

6. Challenges

SBA's Office of the Chief Information Officer leadership team has experienced a high turnover—eight CIOs since 2005—and the CIO position was vacant from July 2015 until October 2016. Thus, initiatives like DCOI did not have the requisite OCIO leadership attention until the arrival of Maria Roat as CIO in October 2016 and Guy Cavallo as Deputy CIO in January 2017. SBA now has the leadership in place to properly develop, implement, monitor, and report results of this DCOI strategy.

Further, the migration to the cloud from the privately-managed data centers will require larger data connections and the updating of continuity of operations plans at each of SBA's locations to ensure a seamless transition for customers. In many cases, such initiatives must first be completed before decommissioning a data center. This is especially important to consider in the case of the Office of Disaster Assistance whose data center operations are critical to its hurricane relief efforts.

Finally, because of the decade-long leadership and technology vacuum at OCIO, several SBA Program Offices developed their own IT organizations that have operated largely independently of the OCIO.

With new OCIO leadership and SBA's implementation of FITARA and its technology governance requirements, this has changed to a more collaborative and partnership approach.