



**Social Security Administration
Data Center Optimization Initiative
Strategic Plan**

(FY2016 – FY2018)

DOCUMENT CHANGE HISTORY

Revision	Date	Revision/Change Description	Pages Affected
1.0	03/27/2017	Moved original SSA DCOI Strategic Plan into a template and added tables in Appendix A, B, C and D for future quarterly updates	All

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1 Purpose

Under the Data Center Optimization Initiative (DCOI), released August 1, 2016, Social Security Administration (SSA) has developed a DCOI Strategic Plan that will report on data center strategies, goals, and challenges in meeting all requirements outlined in the Memorandum for Heads of Executive Departments and Agencies (M-16-19).

2 Background

The Social Security Administration has two enterprise level co-processing production data centers that process casework for the millions of citizens and beneficiaries in the United States, the Second Support Center (SSC) in Durham, North Carolina, and the new National Support Center (NSC) in Urbana, Maryland. The SSC became operational in 2009, greatly enhancing SSA's data processing and disaster recovery posture. The SSC is a Tier 2 traditional data center that utilizes a hot-aisle/cold-aisle configuration.

The National Support Center (NSC) in Urbana, MD, opened for business in September 2014. SSA received ARRA funds to build and migrate the IT infrastructure and operations in the National Computer Center (NCC) to the new data center. The NSC is a LEED Gold and Uptime Tier 3 certified data center. The NSC also is a featured Federal Flagship Data Center in the DOE/CEQ Better Buildings Challenge and received the coveted GSA Honor Award in Engineering in 2016.

The NSC is a leader in the data center arena for its design, processing ability and energy efficiencies. It makes use of free-cooling ~200 days a year as well as being a co-generator of power through a 1.2-megawatt photovoltaic solar array. This clean renewable power is directly fed into the data center and on sunny days produces the majority of energy consumed.

Throughout the NSC, there are other energy and cost avoiding features like passive solar water heating, instant-on LED lighting and other heat recovery mechanisms. What we have learned in the NSC will aid us in making the SSC more energy efficient. While GSA owns the NSC, the SSC is a leased facility and we will have to make efficiency changes in accordance with the lease agreement.

What we do in one data center we will try to take advantage of in the other. The NSC utilizes a high-density hot-aisle containment solution as well as liquid cooling. We could realize further energy efficiencies at the SSC through cold-aisle-containment, which can be attained in older traditional data centers. The SSC could also take advantage of liquid cooling of the mainframes.

The SSA will strive to continue to economize and evolve their data center optimization management through internal teamwork, participation in the DOE/CEQ Better Buildings Challenge as well as being a leading member in the DCOI Community of Practice. SSA already works closely with the DCOI PMO and currently has open dialogue and

information exchange with other Federal and private organizations that will serve to enhance data center operations.

3 Data Center Goals, Achievements, and Challenges

The following are DCOI high-level goals, requirements and metric achievements, and challenges SSA included in their DCOI Strategic Plan in September 2016 and new to this plan. Refer to Appendix B Table 2 Quarterly Updates: Achievements and Challenges for quarterly updates to Section 3.

3.1 Goals

1. Energy Metering: Since SSA satisfies this metric, through the refinement of a Data Center Infrastructure Management (DCIM) tool SSA will continue to optimize this feature to better manage and optimize the whitespace moving forward to a shared services provider offering.
2. PUE: While SSA achieved this metric right away for the NSC, the Data Center Optimization Management Team will continue work towards improving this metric:
 - a. SSA will continue to refine and tune the inner core energy and HVAC functionality.
 - b. SSA will step up the temperature in the inner core one degree per month until a temperature of 78° has been reached.
 - c. SSA will also work to increase the usage of the whitespace with more equipment that will be used for shared services. To note, the NSC was built for SSA's processing purposes for the next 25 years.
 - d. SSA will also work to refine the containment solution to maximize its efficiency. We will do this by augmenting the containment to reduce air blow-by and recirculation.
 - e. Over the next 5 years, SSA aims to achieve a PUE of 1.2 with a decrease of ~.05 per year.
3. Virtualization SSA will continue to virtualize and consolidate as much as practicable. Our goal is to have failover capability within the data center, disaster recovery capability for both data centers and load balancing between data centers. With our "Virtual 1st" policy, constant consolidation review and our pursuit of being a shared service provider we feel our strategy is in line with the overall Federal objective.
4. Server Utilization and automated monitoring: Since SSA meets this objective; our focus will be enhancing the management benefits and total data center

optimization. As we implement a DCIM tool, SSA will work with the Federal DCOI PMO to publish and share our progress and lessons learned. The goal for tracking and managing the usage of servers is to directly enhance system failover, disaster recovery, load-balancing and shared services management capabilities.

5. Shared Service Provider: SSA is currently developing the capability for on-premise shared services that through the help of the DCIM tool we will be able to better manage, track and offer these services to other Federal Departments and Agencies in the near future. SSA is working closely with the DCOI PMO and have agreed to share information as they implement the DCIM tool and have agreed to pursue the new-shared services framework that the DCOI PMO is developing.
6. DCIM Tool Implementation: SSA has procured and is currently implementing a DCIM Tool, Nlyte/Neo with a DCOI Dashboard. The tool has been installed on the DEV environment at the NSC and SSC and SSA is currently working on Hewlett Packard Asset Manager (HPAM) and Service Manager (HPSM) connections into the tool with the goal to allow for real-time dynamic updating of data. All milestones for this implementation will be updated in Appendix C, Table 3 DCIM Tool Implementation Milestones.

3.2 Achievements

3.2.1 Data Center Closures

SSA had one data center slated to close, the National Computer Center (NCC) in Woodlawn, MD. As of August 23, 2016, the migration to the NSC completed and the NCC is no longer a data center.

3.3 Challenges

1. Migration from the NCC to the NSC over the past three years: There was much overlap in hardware, network configuration and operability. During the migration both the NSC and NCC were presented as one logical data center. Each had staff to operate, install/remove equipment in the production environments. All of our costs and metrics were skewed because of this. Starting in FY17 we will baseline operations so going forward we may properly measure and manage our data center costs and metrics.
2. Power Usage Effectiveness Metric: For the SSC, within the boundaries of the lease agreement we will try to improve this number by .15 each year for 5 years. We will do this by a combination of energy and HVAC conservation, including raising the temperature of the whitespace and with the possible use of cold-aisle containment. Since SSA is in pursuit of being a shared services provider, the

adding of equipment to create a higher density inner core naturally lends itself to an improvement of PUE.

Since the PUE is an aggregate of both centers, the SSC, because of its limitations will be a challenge for the SSA

4 Data Center Optimization Metrics

The following optimization metrics are listed in order of priority as outlined in the Data Center Optimization Initiative (DCOI) Memorandum dated August 1, 2016. Agencies shall achieve and maintain all listed target values by the end of fiscal year 2018:

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.	$\text{Average Server Utilization} * \frac{\text{Percent of Data Centers Fully Equipped with Automated Monitoring}}{100}$	$\geq 65\%$
Facility Utilization	(%) Portion of total gross floor area in tiered data centers that is actively utilized for racks that contain IT equipment.	$\frac{\text{Total Active Rack Count}^{28} * 30 \text{ sq. ft.}}{\text{Total Gross Floor Area}}$	$\geq 80\%$

In this section, SSA is reporting the following Q3 2016 metric values in the DCOI Strategic Plan submitted September 30, 2016. Moving forward all quarterly updates will be entered in Appendix A Table 1 Quarterly Updates: Optimization Metrics.

a) **Energy Metering**

Definition	Calculation	FYE 2018 Target	SSA Value	Result
Percent of total gross floor area (GFA) in an agency's tiered data center inventory located in tiered data centers that have power metering.	Total GFA of Energy Metered Data Centers ÷ Total GFA of All Tiered Data Centers	100%	NSC =100% SSC =100%	Met

b) **Power Usage Effectiveness (PUE)**

Definition	Calculation	FYE 2018 Target	SSA Value	Result
Ratio of total data center energy used by IT equipment.	Total Energy Used ÷ Total IT Equipment Energy Used	Target ≤ 1.5 (≤ 1.4 for new data centers)	NSC = 1.4 SSC = 1.96	Not Met <u>Met</u>

There are multiple ways to calculate PUE. Since SSA has two very different data centers, we either standardize on how we measure both or calculate each one differently. Currently SSA's Data Center Optimization Management Team is working towards standardizing the calculation. SSA is expecting the DCIM tool will gather, monitor and aggregate this instantaneously for both data centers.

No data center should be a static environment and should always be in a constant state of refinement. In the upcoming years, we will continue to strive to improve our data center efficiencies. For both data centers, we will continue with our Virtual First policy as well as continue to take advantage of EnergyStar equipment.

For our new NSC our program of requirements analyzed the SSA workloads and extrapolated the size and energy needed the data center to handle our processing needs for 25 years. The data center is designed for 6MW of compute now and can expand to 10MW in the future. What this means is that SSA will grow into the data center over that 25-year span. The program of requirements was created in 2009 and at the time did not consider shared services as part of the scope. Our PUE will improve as we grow into and maximize the space and power available. PUE efficiency lends itself to the IT load being as close to the capacity of the incoming power to attain a measure that is close to 1.0.

In addition, we will also systematically raise the temperature in the whitespace at both data centers to achieve the maximum cooling potential from the HVAC system. We will also continue to conserve lighting throughout the data center and continue to develop a higher density solution for the SSC. Our data center

optimization management team is made up of both IT and Facilities Energy Managers and will continue to work closely to achieve maximum optimization results.

c) **Virtualization**

Definition	Calculation	FYE 2018 Target	SSA Value	Result
Ratio of operating systems to physical servers.	$(\text{Total Server Count} + \text{Total Virtual OS}) \div \text{Total Physical Servers}$	Target ≥ 4	$\text{NSC} = (890 + 2402) \div 890 = \mathbf{3.7}$ $\text{SSC} = (1069 + 1373) \div 1069 = \mathbf{2.3}$	Not Met *See note below.

This metric is only for Servers (20% of our production processing) and does not take into consideration Mainframe (80% of our production processing), Storage nor Network virtualization. We calculate %Virtualized, our goal was $\geq 60\%$ based on the Program of Requirements for the NSC. We are at 77% for the NSC and 61% for the SSC.

The DCOI metric assumes all servers are virtual hosts and each one is running at least 4 virtual servers.

d) **Server Utilization & Automated Monitoring**

Definition	Calculation	FYE 2018 Target	SSA Value	Result
(%) Percent of time busy (measured as 1 – percent of time spent idle), measured directly by continuous, automated monitoring software, discounted by the fraction of data centers fully equipped with automated monitoring.	$(\text{Average Server Utilization}) * (\text{Percent of Data Centers Fully Equipped with automated Monitoring})$	Target $\geq 65\%$	100%	Met

This metric is for servers only. We have the capability to monitor/measure this on every server but it is up to the server owner (physical or virtual) to request the data.

SSA employs several tools to monitor and measure utilization, performance, and sizing and modeling:

- NTSMF and DCMS are installed in our standard Windows image, which enables DSPSM to actively collect resource utilization from those devices.
- Microsoft System Center Operations Manager to monitor many servers. We keep 90 days of utilization statistics.
- vRealize Operations, which also stores utilization statistics. The data is not available via any intranet site, but our Virtual Infrastructure Team can generate reports,
- Real-User Monitoring for web and application monitoring
- BMC Patrol Capacity and Optimization - Collects performance metrics for applications and systems
- Nagios for network, server and application monitoring, and
- Systems Center Operations Manager (SCOM)

We will use the DCIM tool to automatically record and report on this.

e) **Facility Utilization**

Definition	Calculation	FYE 2018 Target	SSA Value	Result
(%) Portion of total gross floor area in tiered data centers that is actively utilized for racks that contain IT equipment.	(Total Active Rack Count * 30 ft ²) ÷ Total Gross Floor Area	Target = ≥ 80%	$\underline{NSC} = (1363 * 30 \text{ ft}^2) \div 51,120 \text{ ft}^2 = 80\%$ $\underline{SSC} = (1066 * 30 \text{ ft}^2) \div 40,000 \text{ ft}^2 = 80\%$	Met

The metric changed from cabinets with servers to cabinets with IT equipment. If we count all the server cabinets + DASD cabinets + (Silo floor space area ÷ area of a server cabinet) + (Mainframe floor space area ÷ area of a server cabinet) then we achieve this target. This will not change year-to-year.

5 Data Center Cost Savings

Starting in FY17, we set an aggregated goal to save, through energy efficiencies, \$500K per year and increasing that by \$75K per year over 5 years. After the first year, we will have a clearer picture of our energy savings portfolio and through the information gained by our DCIM tool; we will refine the numbers and energy saving methods as necessary.

Data Center Optimization Management Teams will continue to work together at both data centers to achieve energy efficiencies and operational improvements. As we work through the upcoming year we will, with the help of the DCIM tool, be able to accurately calculate and manage our efficiency cost avoidances.

Refer to Appendix D – Table 4 Quarterly Updates: Cost Savings for updates.

Appendix A - Table 1 Quarterly Updates: Optimization Metrics

Requirements & Metrics	FY16				FY17				Target	Met/ Not Met
	Q1 Feb	Q2 May	Q3 Aug	Q4 Nov	Q1 Feb	Q2 May	Q3 Aug	Q4 Nov		
Data Center Closures			1							Met
Facility Utilization				80%					≥ 80%	Met
Energy Metering				100%					100%	Met
Server Utilization & Automated Monitoring				100%					≥ 65%	Met
Power Usage Effectiveness (PUE) (NSC/SSC)	NSC 1.34 SSC 1.87	NSC 1.71 SSC 1.48	NSC 1.48 SSC 1.6	*NSC 1.5 SSC 1.54	NSC 1.5 SSC 1.4				≤ 1.5 ≤ 1.4 for new data centers	
Virtualization (NSC/SSC)	NSC 3.7 SSC 2.0	NSC 3.7 SSC 2.3	NSC 3.6 SSC 2.3	NSC 3.9 SSC 2.5	NSC 4.0 SSC 2.6				≥ 4	Not Met in FY2016
*NSC is reporting a PUE against a full IT load. See Appendix B for SSC enhancements.										

Appendix B - Table 2 Quarterly Updates: Achievements and Challenges

SSA DCOI Strategic Plan Section	Qtr / FY	A / C	Comment
3.3 / 1. Migration	Q4/2016	A	With the completion of the IT Migration to the NSC in August 2016, operations at the NSC has now been baselined. Metrics are now being reported against a full IT load at the NSC.
3.1 / 6. DCIM Tool	Q1/2017	A	SSA has procured and is implementing a DCIM tool.
3.3 / 2. PUE	Q1/2017	A	SSC has made improvements to their infrastructure that has enhanced the PUE metric: a) Adjustment to the second chiller and pump to engage simultaneously to supplement the chilled water supply, b) DASD refresh, and c) adjustments to the floor tiles, which affected air distribution.
3.1 / 6 DCIM Tool	Q2/2017	C	DCIM Tool does not currently report on the Server Utilization DCOI metric. Vendor is working to provide this using the formula provided in M-16-19 with the goal of having this capability available to the SSA by end of May 2017.
3.1 / 2.PUE	Q2/2017	A	NSC : The challenge: Chimney Inner Core design restricts internal cabinet airflow allowing the room cold air to travel down the back of the Chimney Cabinet rows. This has been resolved: SSA/GSA converted the chimney cabinets that make up the server area from 'chimney heat exhaust' to 'Hot Aisle Containment' via end doors and curtains.

Appendix C - Table 3 DCIM Tool Implementation Milestones

SSA DCOI Strategic Plan Section	Qtr / FY	Milestone
3.1 / 6	Q2/2017	The tool has been installed in DEV environment at NSC and SSC and all standard and advanced training has been conducted. The tool is using the calculations as defined in M-16-19 to produce the DCOI optimization metrics.

Appendix D - Table 4 Quarterly Updates: Cost Savings

<SSA will present cost savings with the Q2 DCOI Update>