

HHS Data Center Consolidation Plan

1 Introduction

The Department of Health and Human Services (HHS) is comprised of 11 Operating Divisions (OPDIVs), each with distinct missions and each with Information Technology management organizations. HHS coordinates information technology using a federated model with cross-organizational groups including the Chief Information Officers Council, the Chief Technology Officers Council, the Chief Information Security Officers workgroup, and the Enterprise Architecture workgroup. These groups work in conjunction with the Department leadership for each distinct area and all report to the Department's Information Technology Review Board. Decisions that are made within each leadership group are promulgated as direction for HHS Operating Divisions.

HHS has been embracing enterprise computing and consolidating servers and data centers over the past eight years. Along with early adoption of virtualization as a reliable approach to off-loading systems and decommissioning servers, HHS views itself as a leader in this effort among Federal departments.

In response to the OMB guidance related to the Federal Data Center Consolidation Initiative, HHS has developed an approach that includes HHS-mandated and previously planned consolidations of data centers, continuation of virtualization efforts, promotion of Enterprise solutions and implementation of data center operations policies that will result in efficient data center utilization and reductions in power consumption across HHS Data Centers. There are 181 data centers within HHS. Plans are in place to close 38 (19%) of those data centers as well as make significant reductions in server and rack assets. Sixteen of the 38 targeted data centers have been consolidated/decommissioned.

In addition to the closures, three new HHS data centers will be constructed between 2011 and 2013 to address increasing demands for data center assets by programs, such as the human genome research activities at NIH, with rapidly expanding requirements for computational resources. These three new data centers will also serve as hosts and accept the server assets from at least seven consolidating data centers.

Immediately following each data center consolidation and later, annually,, HHS will survey the utilization of servers and racks. Data centers that fall below a specified utilization threshold will require operating authority based on justification. HHS has established operational and structural criteria in policy that will guide decisions related to server and rack asset reductions.

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HHS has long recognized the benefit of virtualization and has achieved significant reduction in server inventory since the practice began in 2007. Planned virtualization efforts that will continue through FY2012 and virtualization efforts to begin following the primary data center consolidation efforts in FY 2011 through FY 2013 will result in increased asset reductions.

While the HHS approach concentrates heavily on virtualization as a proven technology, HHS believes that the promise of Cloud Computing has the potential to achieve ever greater reduction of unnecessary hardware by shifting processing to cloud infrastructures. Concurrently with the our data center consolidation efforts, HHS has begun work at an enterprise level for Cloud Computing and for High performance Computing and views these implementations and initiatives as enterprise shared services.

As part of the commitment to achieve the goals of the consolidation plan, HHS has designated a lead resource to coordinate, manage and report all HHS efforts under this plan. HHS has identified risks associated with completion of the HHS DCCI final plan and proposed efforts to mitigate each of the risks. The plan is designed to accommodate the projected need for growth and flexibility in IT capacity and complexity due to the requirements of new large-scale business systems, by reporting the corresponding asset increases as offsets to the asset inventories to more clearly identify initiative progress.

2 Agency Goals for Data Center Consolidation

HHS plans to reduce the number of reported data centers by 19% by the end of Q4 FY 2015. The HHS DCCI efforts have produced a 9% data center reduction through the end of FY 2011. Additional reductions of 4% in FY2012, 4% in FY2013, and 1% in each of FY2014 and FY2015 are expected. After consolidations are complete, virtualization efforts will result in increased asset reductions.

HHS has implemented policy designed to result in efficient and effective data center management and includes measures that address minimum data center size, reduction of program and bureau specific data centers, operating thresholds and standards. The policy will result in asset reduction as operating divisions and data center managers undertaking projects to assess, address and adjust server and rack configurations to meet standards.

The HHS DCCI primary goals are listed in the table below.

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Table 1. HHS DCCI primary goals.

	Calculated from Baseline	Target				
	4Q10	4Q11	4Q12	4Q13	4Q14	4Q15
Total Number of Data Centers (#)	181	165	156	150	148	146
Aggregate Gross Floor Area (sq.ft.)	227974	205284	202132	204769	203481	202524
Total Number of Racks (#)	2906	2736	2583	2432	2282	2133
Total Number of Physical Servers (#)	14950	14127	13388	12650	11911	11172

The baseline value of PUE listed in this plan, 1.58, was calculated only from valid values reported by four data centers in the HHS operating divisions with electricity metering installed. Although these four data centers host approximately 50% of the total HHS server assets, the reported aggregate HHS electricity usage and PUE values must be considered very rough estimates. The actual aggregate PUE value for all HHS data centers is expected to be noticeably higher with a value near 2.0. The HHS Sustainability Initiative will directly relate to implementation of metering followed by monitoring across HHS.

3 Implementing Shared Services/Multi-tenancy

HHS has long been a proponent of shared services and multi-tenancy. Some examples of measures implemented in the past five years are:

1. Smaller OPDIVs have consolidated the management of their IT resources and infrastructure
2. Enterprise level applications have replaced those that served duplicate functions throughout the department (i.e. HHS Unified Financial Management System, Enterprise Architecture repository, etc.)

Several initiatives are underway that promote shared services and multi-tenancy in the areas of Cyber Security Services and Network Telecommunications. While the HHS DCCI shared services and multi-tenancy efforts will initially concentrate on consolidation and

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virtualization, HHS believes that the promise of cloud computing and high performance computing has the potential to achieve ever greater improvements in asset reduction and information processing efficiency.

Cloud Computing Initiative

HHS established a Cloud Computing Advisory Committee (CCAC) to develop and implement cloud computing guidance and policies and coordinate HHS' enterprise level cloud-based initiatives. HHS has developed a HHS Cloud Computing Strategy which applies and extends the Federal Cloud Computing Strategy to our unique mission and needs by outlining a path to agency-wide cloud self-service, with specific interim goals and objectives that embrace and build upon the Federal Cloud First policy. The HHS Cloud Strategy is designed to progressively improve the Department's information technology (IT) elasticity and responsiveness while minimizing cost and maximizing capacity utilization through systematic coordinated implementation of cloud and related technologies, leading to seamless, cost-effective and rapid service delivery.

HHS has also developed a *HHS Cloud Computing Strategic Implementation and Transition Plan* which provides a phased approach to incrementally implement the HHS cloud computing strategy. The Cloud Computing Strategy and the Cloud Computing Implementation and Transition Plan are in the final stages of the review and approval process. Together, these documents form the foundation for HHS cloud computing activities.

High Performance Computing

The National Institutes of Health, the Food and Drug Administration and the Centers for Disease Control are creating best practice guidelines for HHS programs that face similar problems of exponentially increasing data volume, increased need for complex modeling and analysis and decreasing or stagnant resources (both financial and computational). Depending on the program, these problems must be dealt with to handle disease modeling, genome sequencing, gene and protein expression analysis, economic modeling and many more mission critical efforts that will require enormous aggregated CPU and computational hours.

Operating Divisions are working out agreements that will provide for resource sharing across organizational boundaries. Additional work is underway to establish private high performance computing clouds or other environments to meet HHS OPDIVs' scientific missions.

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4 Agency Approach, Rationale and Timeline

HHS has developed an approach that includes completion of previously planned data center closures and HHS-mandated consolidations of data centers based on minimum server count thresholds and OPDIV-specific selection criteria. It also includes continuation of virtualization efforts, promotion of Enterprise solutions and implementation of data center operations policies that will result in efficient data center utilization and reductions in power consumption across HHS Data Centers.

The overall approach can be characterized as:

Consolidate > Assess > Virtualize

Consolidate

The HHS plan featured a concerted effort to identify and schedule data centers to be consolidated, beginning in 2011. The consolidation selection process began with identification of target data centers, based primarily on minimum server count threshold. Operating divisions have determined disposition of assets within each of the target sites and submitted migration plans to the Operating Division CIO.

Each OPDIV has begun executing the steps required to close targeted data centers. Sixteen data centers were closed in 2011 and the OPDIVs are on target to meet the remaining data center closures scheduled through the end of 2015. Progress and asset utilization status will be reported for each data center to the HHS DCCI Program Lead as we continue to move through this process.

Assess

HHS Operating Divisions will annually assess the utilization conditions in all surviving data centers as directed by HHS-OCIO Policy for Data Center Management. Data centers that fall below the aggregate server utilization threshold will require operating authority based on justification. HHS will use a similar assessment process for rack utilization, with the result that under-utilized racks will be powered-off and have their equipment moved to optimally configured racks.

Virtualize

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HHS has long recognized the benefit of virtualization and has achieved significant reduction in server inventory since the practice began in 2007.

In parallel with the consolidation effort, the operating divisions will continue to virtualize systems that remain in data centers that are targeted for continued operations. HHS will routinely conduct virtualization projects based on inclusion of new systems that are migrated due to consolidation of data centers. HHS anticipates that a subset of existing systems will be moved to virtualized servers during the primary consolidation effort with many additional systems moving to virtualized servers after the selected centers have been consolidated.

HHS perceives two advantages of performing the extensive virtualization effort after consolidating data centers. First, after consolidation, the surviving data centers that accepted server assets from consolidated data centers will contain a larger pool of systems and physical servers, from which suitable virtualization candidates can be selected to ensure a better virtualization ROI. Second, by concentrating the virtualization effort to a smaller number of sites after consolidation, the effort will require a smaller percentage of the aggregate data center staffs to receive training to obtain or refine virtualization skills. Other staff can focus on the remaining aspects of consolidation and data center operations.

Tracking Consolidation Progress

The HHS DCCI Program Lead will track consolidation progress and completion status via quarterly HHS progress surveys, the annual DCCI Asset Inventory, annual HHS Asset Utilization Plans, and annual HHS data center certifications.

HHS will integrate monitoring of virtualization and consolidation progress through the existing HHS Prosight Investment tool. The Prosight tool is used to monitor IT investments and includes functions that can easily adapt and include measures for virtualization, utilization and consolidation efforts across HHS. Operating divisions are required to use the tool to report on Capital Planning and Investment Control requirements and has incorporated measures for EPLC management issues as well as ad hoc measures that are driven by HHS or OMB from time to time.

In addition to the Prosight tool to track project progress, HHS will implement and manage the data center inventory under the direction of the Enterprise Architect. Prior to the issuance of the OMB guidance, HHS determined a need to manage the systems

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inventory at an Enterprise level. In June 2010, HHS directed the Operating Division CIOs to enter, validate and manage systems information that are within their domains. By adding the data center information in the repository, we can document the correlation between each system and its physical data center location.

HHS expects to deploy a data center asset tracking solution and have it fully operational in FY 2012. HHS believes the use of management and performance tracking tools will augment the consolidation governance process that is described later in this plan.

Continued Promotion of Enterprise Solutions

HHS began evaluating multiple implementations of common functions over 10 years ago. As a result of a “One HHS Strategy”, HHS has undertaken efforts to reduce duplicative stove piped solutions and has embraced an Enterprise Solution approach to common technology support requirements.

HHS targeted two grants processing systems as hosts for all HHS Operating Division grant processing, with all research related grant processing now hosted at the NIH ERA system. The remaining discretionary, entitlement and formula/block grants are hosted in the ACF Gates system.

HHS decreased the number of duplicative financial systems through wide-spread use of the Unified Financial Management System (UFMS) hosted at the Program Support Center. In addition, HHS is moving toward a centralized HR solution by reducing redundant, individual operating division systems.

Recent efforts have shifted data gathering and enterprise information management to centralized control under the Offices of the Enterprise Architect, the Capital Planning and Investment Control group and the HHS Information Technology Security team. Previously distributed collections have been retired and replaced by the EA Systems Inventory, which has been extended to address additional information requirements for CPIC, EVM and FISMA reporting. Further, HHS will invest in an Enterprise level Asset Tracking solution to better track investments across the enterprise. The consolidation project will make use of the existing inventory and asset management and incorporate information gathering through these enterprise tools.

HHS has outsourced internal travel and payroll management services to other federal agencies, relying on DFAS for payroll and GovTrip for travel needs.

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Data Center Management

HHS has implemented policies governing standards for data center operations across Operating Divisions. The policies are designed to promote Green IT, requiring actions to reduce power consumption, dispose of unused servers, and establish and achieve utilization thresholds for efficient data center operations. Policy has been implemented for:

Refresh Cycle and Green IT procurement

HHS has created a policy that directs Operating Divisions to replace high energy consuming servers that reach end of life with servers having energy consumption specifications that fall within the Energy Star approved ranges, where such products meet IT project requirements. Following guidance in Executive Order 13423, HHS policy stipulates that data center hardware refresh cycles will be set to the longest practical time duration that is no shorter than four years.

Data Center Temperatures

HHS can achieve immediate savings by raising the operating temperatures in data centers. HHS has initiated this through directives in the new HHS data center management policy.

Shut Down Un-used Servers

HHS has created a policy to shut down all servers that are not in use. HHS recognizes that a server that is idle is consuming 50% of the energy that a fully engaged server is consuming. HHS will evaluate the extent to which the policy that directs unused servers to be turned off will contribute toward achieving OMB goals, by tracking the number and type of unused servers shut down.

Data Center Utilization

HHS has created policy centered on thresholds for data center equipment utilization. HHS has determined policy target utilization levels for servers and racks that will result in improvements consistent with the goals of this consolidation plan.

Virtualization and Hosting Centers

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HHS will undertake assessment of surviving centers during and after consolidation efforts in FY 2011 and FY 2012 and promote cross division virtualization and server hosting services among operating divisions. HHS will continue to promote the Centralized NIH Federal Data Center as a host entity for HHS servers and racks.

Cloud Computing -> Promote for Consideration

HHS believes that Cloud Computing provides enormous potential to reduce dedicated servers by migrating solutions to cloud platforms and decommissioning current host production, staging, testing and development hardware. While HHS recognizes the potential, it also recognizes that current CIO concerns about migration to cloud platforms, principally Security and Data Loss Prevention issues, along with latency in standing up federal service provider solutions, poses significant obstacles to immediate transition.

HHS recognized that the OMB pass back directed all new systems that were undertaken during FY 2011 needed to include cloud computing as an option in planning. In addition, the OMB pass back stipulated that current mixed life systems had to begin the same planning in FY 2012. The DCCI will work with the HHS CPIC team to include controls with the information toolsets (Prosight, EPLC) that capture compliance with this directive.

HHS Master Program Schedule

The following Master Program Schedule describes the planned completion dates in quarters for several key milestones in the HHS consolidation plan. These milestones include steps associated with achieving consolidation goals, OMB reporting requirements, and HHS policy requirements.

	FY 10	FY11				FY12				FY13				FY14				FY15			
	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
Collect & submit HHS Baseline 2010 Asset Inventory	▲
Submit initial HHS consolidation plan to OMB	▲

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	FY 10	FY11				FY12				FY13				FY14				FY15				
	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	
Consolidate HHS data centers/ Qty		▲ 1		▲ 11	▲ 4	Δ 3		Δ 1	Δ 5				Δ 9				Δ 2		Δ 2			
Create HHS Policy for Data Center Management			▲																			
Select HHS data centers for closure				▲																		
Collect & submit updated HHS annual Asset Inventories to OMB				▲				Δ				Δ				Δ					Δ	
Generate annual HHS Asset Utilization Plan templates					▲				Δ				Δ				Δ					Δ
Submit updated HHS consolidation plan to OMB					▲																	
Submit quarterly consolidation progress reports to OMB					▲	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ
Perform audits of completed HHS data center consolidations						Δ				Δ				Δ				Δ				

▲ - indicates a completed task or deliverable. Δ - indicates a planned task or deliverable.

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HHS DCCI Timeline

The high-level timeline below lists the specific HHS data centers to be consolidated along with the scheduled consolidation timeframe. A more detailed milestone schedule, which identifies all consolidation candidates and related stages of consolidation, is provided in Appendix B.

No.	Agency Component	Data Center	Location	Action to be Taken	Action Taken During Calendar Year
1	NIH	NIH Data Center 41	Bethesda, MD	Consolidated / Decommissioned	CY11
2	IHS	IHS - Headquarters Albuquerque	Albuquerque, NM	Consolidated / Decommissioned	CY11
3	NIH	NIH Data Center 23	Bethesda, MD	Consolidated / Decommissioned	CY11
4	NIH	NIH Data Center 24	Bethesda, MD	Consolidated / Decommissioned	CY11
5	NIH	NIH Data Center 5	Bethesda, MD	Consolidated / Decommissioned	CY11
6	NIH	NIH Data Center 32	Bethesda, MD	Consolidated / Decommissioned	CY11
7	NIH	NIH Data Center 46	Bethesda, MD	Consolidated / Decommissioned	CY11
8	NIH	NIH Data Center 68	Bethesda, MD	Consolidated / Decommissioned	CY11
9	NIH	NIH Data Center 71	Bethesda, MD	Consolidated / Decommissioned	CY11
10	NIH	NIH Data Center 74	Bethesda, MD	Consolidated / Decommissioned	CY11
11	NIH	NIH Data Center 76	Bethesda, MD	Consolidated / Decommissioned	CY11
12	NIH	NIH Data Center 80	Bethesda, MD	Consolidated / Decommissioned	CY11
13	FDA	Parklawn	Rockville, MD	Consolidated / Decommissioned	CY11

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No.	Agency Component	Data Center	Location	Action to be Taken	Action Taken During Calendar Year
14	NIH	NIH Data Center 57	Rockville, MD	Consolidated / Decommissioned	CY11
15	NIH	NIH Data Center 55	Bethesda, MD	Consolidated / Decommissioned	CY11
16	NIH	NIH Data Center 69	Bethesda, MD	Consolidated / Decommissioned	CY11
17	NIH	NIH Data Center 77	Bethesda, MD	Consolidated / Decommissioned	CY11
18	OS	Silver Spring	Silver Spring, MD	Consolidated / Decommissioned	CY11
19	NIH	NIH Data Center 52	Bethesda, MD	Consolidated / Decommissioned	CY12
20	OIG	OIG Data Center 1	Washington, DC	Consolidated / Decommissioned	CY12
21	NIH	NIH Data Center 18	Bethesda, MD	Consolidated / Decommissioned	CY12
22	CDC	Spokane	Spokane, WA	Consolidated / Decommissioned	CY12
23	NIH	NIH Data Center 47	Bethesda, MD	Consolidated / Decommissioned	CY12
24	NIH	NIH Data Center 58	Bethesda, MD	Consolidated / Decommissioned	CY12
25	IHS	IHS - Tucson Area Clinic02	Santa Rosa, AZ	Consolidated / Decommissioned	CY12
26	NIH	NIH Data Center 25	Rockville, MD	Consolidated / Decommissioned	CY13
27	NIH	NIH Data Center 13	Rockville, MD	Consolidated / Decommissioned	CY13
28	NIH	NIH Data Center 30	Rockville, MD	Consolidated / Decommissioned	CY13
29	NIH	NIH Data Center 36	Rockville, MD	Consolidated / Decommissioned	CY13
30	NIH	NIH Data Center 38	Rockville, MD	Consolidated / Decommissioned	CY13

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No.	Agency Component	Data Center	Location	Action to be Taken	Action Taken During Calendar Year
31	NIH	NIH Data Center 40	Rockville, MD	Consolidated / Decommissioned	CY13
32	NIH	NIH Data Center 59	Rockville, MD	Consolidated / Decommissioned	CY13
33	NIH	NIH Data Center 70	Bethesda, MD	Consolidated / Decommissioned	CY13
34	NIH	NIH Data Center 73	Rockville, MD	Consolidated / Decommissioned	CY13
35	NIH	NIH Data Center 4	Bethesda, MD	Consolidated / Decommissioned	CY14
36	NIH	NIH Data Center 31	Bethesda, MD	Consolidated / Decommissioned	CY14
37	NIH	NIH Data Center 9	Hamilton, MO	Consolidated / Decommissioned	CY15
38	NIH	NIH Data Center 43	Hamilton, MO	Consolidated / Decommissioned	CY15

5 Agency Governance Framework for Data Center Consolidation

Governance Structure

IT Governance within HHS positions the HHS CIO as the primary point of accountability for information technology within the department. The CIO is supported by agency leads within offices of the Enterprise Architect, the Capital Planning and Investment Control group and the Office of the HHS Chief Information Security Officer. The agency leads support the CIO decision making process and manage activities within their domains across operating divisions within HHS.

Most Operating divisions have identical IT governance structures and are accountable for all IT roles and responsibilities within their domains. Each Operating division executes HHS IT policy and reports through the CIO Office Agency leads on technology, enterprise

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architecture, IT investment and security issues. The CIO of each operating division is accountable for information technology within their division

HHS has implemented coordination and management of IT through the HHS CIO Council. The council is comprised of all operating division CIOs and meets on a monthly basis to consider and approve policy, to make decisions related to IT operations across HHS and to develop and promote IT Strategic Planning.

To facilitate technical direction, HHS has implemented a Chief Technology Officers Council that meets to consider technological investment, enterprise IT management and make recommendations to the CIO Council on inclusion of new technology or improvements to IT management. The CTO Council drafts and recommends policy for CIO Council consideration.

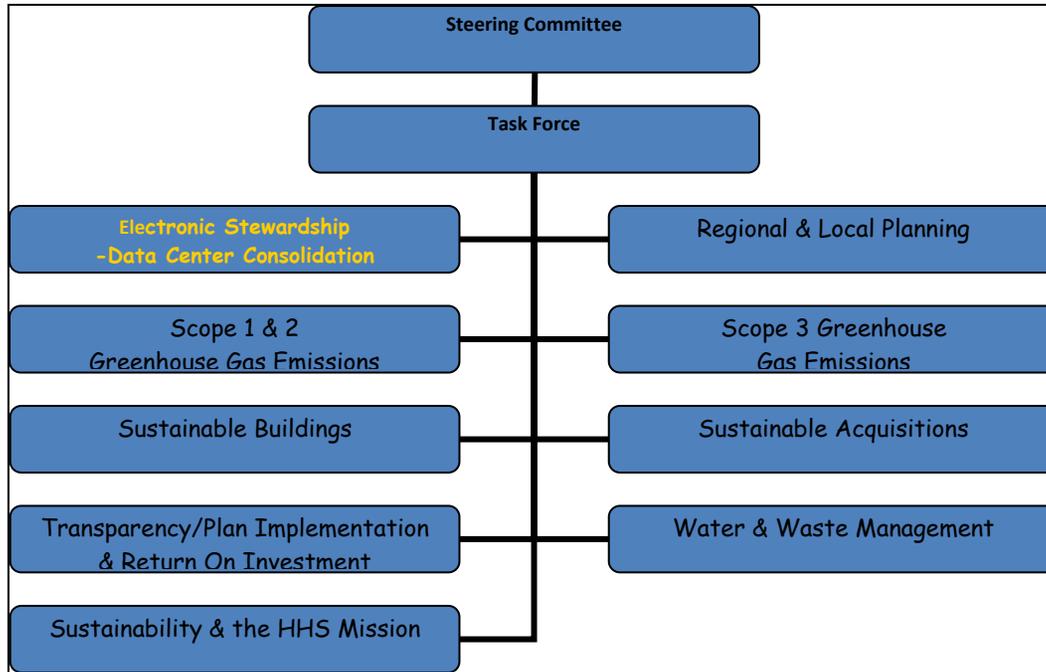
This framework of current governance will continue to serve as the underpinning of the data center consolidation governance structure. HHS has incorporated the Electronic Stewardship Group and Data Center Consolidation Workgroup as adjunct reporting streams of the overall structure.

The initial planning has been coordinated and developed by a work team comprised of CTO Council representatives and all planning will continue to be presented to the CTO Council for endorsement prior to consideration by the CIO Council and the CIO prior to submission to OMB.

All segments of the consolidation plan that touch reductions in energy consumption are reported to the Electronic Stewardship group for inclusion in agency tracking and performance measures within the Sustainability initiative. HHS recognizes that in addition to designing and implementing specific project based actions, promulgation of policy geared toward reducing power consumption would also contribute toward achieving OMB goals.

In addition to the project management structure mentioned in the introduction, HHS has created a Sustainability Governance structure to guide HHS efforts among emerging requirements from federal leadership. The structure includes a Steering Committee that provides oversight for recommendations and actions to be undertaken by a number of workgroups. The structure is designed for business direction of sustainability efforts.

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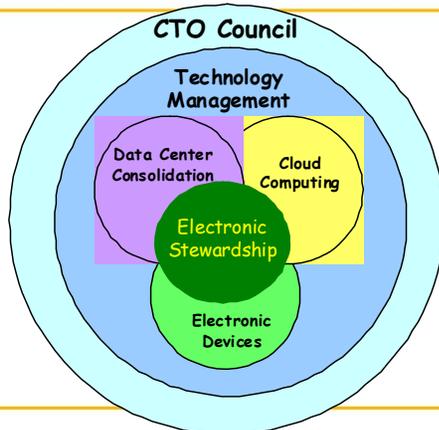


The Electronic Stewardship group serves as the coordinating body for activities performed within the Data Center Consolidation, Cloud Computing and the Electronic Devices initiatives. The Data Center Consolidation Workgroup manages high level planning and makes recommendations for consolidation policy to the HHS CTO Council.

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View of Electronic Stewardship



U.S. Department of Health and Human Services

Enterprise System Inventory, Asset Management and Performance Measures

The process will continue to make use of existing enterprise information management solutions to establish baseline inventory, create tracking mechanisms that are consistent with this plan's performance goals and measures, manage information assessment at each stage of the project and enforce an enterprise approach to common IT functions. This process includes incorporating the EA Systems Inventory as the authoritative source for all systems information across HHS. Additional elements will be added to system records to close the gap between the current technical reference components HHS collects and those collected by OMB. System records will be open to the HHS community to facilitate transparency.

HHS will deploy a data center asset tracking solution as a critical feature of the consolidation plan. HHS will continue to use the asset inventory to track progress from the initial inventory baseline to annual points in time to assess the decommissioning trend on servers, racks and data centers within HHS.

HHS also will integrate operating division project progress reporting through the existing Capital Planning and Investment Control reporting process. All HHS investments, systems, networks, data centers and IT programs are required to report on issue specific

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measures for their investments on an established schedule. This project makes use of the existing process by adding consolidation specific measures that are reported by the operating division CIOs on a quarterly basis.

Execution Process

HHS has designated a lead resource to coordinate, manage and report all HHS efforts under this plan. The HHS DCCI Program Lead reports to the CTO Council on cross cutting or operating division specific issues related to the progress of the plan execution. The HHS DCCI Program Lead reports to the CIO council and presents CTO Council recommendations on corrective actions, needed direction or policy adjustments that can be decided by the CIO Council. The HHS DCCI Program Lead will continue to coordinate with operating division data center managers and other designated points of contact within each operating division for virtualization efforts and site specific migration issues.

The HHS DCCI Program Lead serves as a member of the Electronic Stewardship workgroup and coordinates information exchanges between groups related to energy consumption issues. The Program Lead will continue to promote all policy to the CIO Council in conjunction with the development of the HHS Data Center Management Standards detailed in the policy section of this plan.

5.1 Risk Management and Mitigation

HHS has identified risks associated with completion of the HHS DCCI final plan as proposed. The risks have been categorized into four groups: technical, security and access, funding, and program and data center management. HHS has proposed efforts to mitigate each of these risks as indicated below and intends to incorporate those efforts into the implementation of the plan.

Technical

Risk: Implementing virtualization may lead to application performance degradation and application incompatibilities that are not apparent during the virtualization design step, including workload demand that peaks for short periods during one or more years.

Mitigation: Incorporate analysis of time-varying server workloads during the virtualization design phase of applications targeted for migration. Emphasize the use of application performance management/measurement tools to identify potential degradation and take corrective actions in the earliest stages following virtualization.

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Risk: Disaster recovery of the applications affected by the virtualization and consolidation efforts have not been emphasized in the Federal consolidation plan. Incomplete consideration of disaster recovery requirements may lead to unacceptable system downtime during a disaster.

Mitigation: Include planning for disaster recovery of each affected system as a required step in each migration plan submitted by the operating divisions in preparation for consolidations of candidate data centers and virtualization efforts.

Risk: If data centers are consolidated, there could be bandwidth or telecommunication constraints. For example at NIH, transmitting sequencing data that is generated in a lab to a scientific computing resource for processing the data is a huge issue. Another example is the set of many clinics in small towns and Indian reservations that are administered by Indian Health Service (IHS). Adequate bandwidth is physically not available at these sites.

Mitigation: HHS has identified bandwidth and telecommunication constraints as likely criteria to justify exceptions of data centers from selection for consolidation. HHS will establish procedures with specific criteria to justify exceptions for data center consolidations.

Risk: Many systems cannot be virtualized because many COTS products are not certified on a virtualization platform.

Mitigation: Lack of certification of COTS products for virtualized platforms will be considered when HHS develops the set of justifications for exception to consolidation. Substitute products that are certified will be evaluated as alternatives and the costs associated with migrating to the alternate product will be included in the consolidation cost/benefit analysis.

Security and Access

Risk: Overly aggressive consolidation goals may not be achievable due to the lack of consolidation host capacity with required security levels.

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- There may also be some security concerns if you have a FISMA high rated system transferred to a moderate or low rated data center, either within or among operating divisions.
- There is a risk of consolidating different data centers without fully understanding the security and access implications of each organization. For example, if access is needed at midnight to a server room that is only supported 9am-5pm, there will be issues. There is also the issue of building access and security of OPDIV equipment in the location. Will there be secure racks assigned to customers? If so, there is the potential for wasted rack space.
- The IHS has major concerns with risks to healthcare operations and patient safety by having dependence on the availability of remote computing.

Mitigation: Coordinate between Operating Division security personnel, HHS security personnel and business application/system owners to clearly identify security and physical access requirements during determination of application migration and virtualization suitability. Match the capacities and capabilities of the destination host centers to **all** the requirements of the systems from the planned consolidated source data center. Evaluate the potential benefit of converting data centers to higher security ratings in order to host additional systems from consolidated data centers.

Funding

Risk: Funding limitations may delay consolidation progress.

- Although consolidation will lead to savings, this will not be realized until years later, but the upfront cost to support consolidation and virtualization is immediate. Without proper funding, the consolidation effort may be delayed.

Mitigation: Perform detailed cost/benefit analysis for the consolidation of each candidate data center. Present results of the analysis to the operating division CIO and HHS CIO for determination, approval and allocation of funds necessary for the approved consolidation activity.

Program and Data Center Management

Risk: Demand for quick implementation of several higher priority legislations and programs may lead to addition of new servers and data centers that may be counterproductive to the goals of the consolidation effort. Allocation of limited resources to several higher priority projects may also delay progress in the consolidation initiative.

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Mitigation: Ultimately, the HHS CIO and operating division CIOs will decide the priority of effort when multiple programs compete for the same limited resources. HHS will identify new assets added to the HHS inventory that are needed for the implementation of required new business systems. These increased assets will be reported as justified "offsets" to the baseline inventory in the HHS DCCI progress reports submitted to OMB.

Risk: Poor planning and aggressive virtualization effort may lead to virtual sprawl with complex configuration and increased IT overhead. Eventually no one will know how many VMs are across the enterprise, who owns them and what are their intended purposes.

Mitigation: HHS will promote training for data center personnel to further the understanding of industry best practices for virtualization and consolidation during the data center consolidation effort. Operating division CIOs will be responsible to ensure that virtualization activities will be implemented with proper consideration of those best practices, especially with regard to cross-division migrations.

Risk:

Transferring and consolidating data centers between different operating divisions may pose political issue of division's loss of control, reduced budget, reduced staff as well as security and performance concerns of their applications running in another operating division's facility and may slow down the effort.

Mitigation: HHS will follow the practice of generating internal service level agreements between the operating division whose system applications are migrated and the operating division that will host the migrated systems. These agreements will address application performance and security requirements.

Risk: This initiative is focusing primarily on hardware instead of focusing on applications and possible application consolidation.

Mitigation: HHS has undertaken efforts to reduce duplicative stove-piped solutions and has embraced an Enterprise Solution approach to common technology support requirements.

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HHS will invest in an Enterprise level Asset Management solution to better track investments across the enterprise. The consolidation program will make use of the existing inventory and asset management and incorporate information gathering through these enterprise tools to identify candidates for continued application consolidation.

5.2 Acquisition Management

HHS anticipates four primary areas of acquisition associated with the DCCI effort.

1. Refresh Cycle and Green IT Procurement – Replacement of servers that reach end of life or are within specific age categories with servers having energy consumption specifications that are Energy Star compliant. HHS intends to utilize the GSA Advantage web site for purchasing new servers, because the site clearly identifies Energy Star compliant products along with comparisons of vendor prices and product availability. HHS will issue policy specifying IT procurement, and will ensure operating division CIOs have final approval on all IT acquisitions.
2. Procurement of Hardware and Software to Implement Virtualization – Nearly all Operating Divisions within HHS have completed or have begun virtualization efforts. HHS will promote the sharing of lessons learned, both within and across HHS agencies to streamline and increase value associated with virtualization-related procurement.
3. Procurement of Shared Services, Collocation Services and Cloud Computing Services – HHS has experience with implementing shared services and multi-tenancy within the Department and across Operating Divisions. Several Operating Divisions also have experience with or are planning to acquire collocation services. HHS intends to leverage that experience to expedite the furtherance of these services throughout the duration of the DCCI. HHS will also explore the use of GSA's Apps.gov website for the procurement of cloud computing services.
4. Consolidation of Data Centers – Moving/migrating systems from consolidated data centers to new hosting centers; provisioning additional storage and network capacity to accommodate transferred systems; activities associated with discontinuing use of a data center facility (renegotiating lease terms dealing with early termination, removal of IT infrastructure equipment, repurposing the building space). CDC, FDA and CMS have recently completed major consolidation projects and HHS intends to leverage their experience and lessons learned to benefit the DCCI consolidation efforts. HHS/CMS hosted a "data center consolidation and sustainability technology day" in December 2010, which kicked-off the sharing of best-practices and lessons learned among event participants. Representatives from HHS operating divisions, other federal agencies, including GSA, and industry vendors participated.

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5.3 Communications Strategy

The HHS DCCI Program Lead has primary responsibility for communicating with OMB, the HHS DCCI Workgroup, the HHS CTO Council, and the HHS CIO Council through the HHS CTO Council for matters related to implementation of the HHS DCCI final plan.

HHS anticipates that the HHS DCCI Program Lead will continue to hold regularly scheduled meetings at two-week intervals or more often, as necessary, with the members of the HHS DCCI Workgroup. The workgroup is comprised of at least one representative from each HHS OPDIV, from the HHS Enterprise Architecture group and from HHS Security. Workgroup members have primary responsibility for ensuring that quarterly and annual report data, describing consolidation metrics for each reporting period are submitted in a timely manner to the Program Lead. The HHS DCCI Program Lead is responsible for integrating the reporting metrics from each Operating Division and submitting the integrated HHS reports to OMB.

The HHS DCCI Program Lead reports regularly to the HHS CTO Council on the progress of consolidation efforts. The Program Lead also communicates as needed with the HHS Electronic Stewardship lead to ensure that the objectives of the two efforts are mutually consistent.

6 Progress

6.1 FDCCI Consolidation Progress

HHS has not only successfully consolidated the four data centers initially targeted for closure in FY2011, but has also completed an additional 12 closures for a total of 16 data centers closed during FY2011. The increase resulted from finalization of consolidation decisions for several data centers previously under consideration, plus the inclusion in the closure selection list of several data centers with less than 500 sq. ft. of floor area.

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For FY2012, HHS has again expanded the list of data centers planned for closure, from four to nine data centers, compared to the original list submitted to OMB in April 2011. The HHS OPDIVs are on schedule to complete the FY2012 data center closures as planned. The table below contains the complete list of planned closures of HHS data centers in 2011 and 2012, along with their current phases of closure.

Data Center Information - 2011 Closings				
Department Name	Agency / Component Name	Data Center Name	Target Date For Closure	Phase Of Closure
HHS	NIH	NIH Data Center 41	2/2010- Q1/2011	Closed
HHS	NIH	NIH Data Center 68	Q3 / 2011	Closed
HHS	NIH	NIH Data Center 5	Q3 / 2011	Closed
HHS	NIH	NIH Data Center 32	Q3 / 2011	Closed
HHS	IHS	IHS - Headquarters Albuquerque	Q3 / 2011	Closed
HHS	NIH	NIH Data Center 23	Q3 / 2011	Closed
HHS	NIH	NIH Data Center 24	Q3 / 2011	Closed
HHS	NIH	NIH Data Center 74	Q3 / 2011	Closed
HHS	NIH	NIH Data Center 76	Q3 / 2011	Closed
HHS	NIH	NIH Data Center 46	Q3 / 2011	Closed
HHS	NIH	NIH Data Center 80	Q3 / 2011	Closed
HHS	NIH	NIH Data Center 71	Q3 / 2011	Closed
HHS	FDA	FDA Parklawn	Q4/2011	Closed
HHS	NIH	NIH Data Center 77	Q4 / 2011	Closed
HHS	NIH	NIH Data Center 55	Q4 / 2011	Closed
HHS	NIH	NIH Data Center 57	Q4 / 2011	Closed

Data Center Information - 2012 Closings				
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HHS Data Center Consolidation Plan

Data Center Information - 2011 Closings				
Department Name	Agency / Component Name	Data Center Name	Target Date For Closure	Phase Of Closure
HHS	NIH	NIH Data Center 52	Q1 / 2012	Stage 1: Inventory
HHS	NIH	NIH Data Center 69	Q1 / 2012	Stage 3: Migration Planning
HHS	OS	Silver Spring	Q1 / 2012	Stage 4: Migration Execution
HHS	OIG	OIG Data Center 1	Q3 / 2012	Stage 1: Inventory
HHS	NIH	NIH Data Center 58	Q4 / 2012	Stage 1: Inventory
HHS	NIH	NIH Data Center 47	Q4 / 2012	Stage 4: Migration Execution
HHS	IHS	IHS - Tucson Area Clinic02	Q4 / 2012	Stage 1: Inventory
HHS	CDC	Spokane	Q4/2012	Stage 2: Application Mapping
HHS	NIH	NIH Data Center 18	Q4/2012	Stage 1: Inventory

7 Appendix – FDCCI Templates

7.1 Appendix B: HHS DCCI Milestone Schedule

HHS DCCI Milestone Schedule

Department Name	Agency/ Component Name	Data Center Name	Phase of Closure	Planned completion dates for consolidation milestone stages (MM/DD/YYYY)					
				Inventory	Application Mapping	Migration Planning	Migration Execution	Equipment Removal	Closed
HHS	NIH	NIH Data Center 41	Closed	-	-	-	-	-	-

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HHS	NIH	NIH Data Center 68	Closed	-	-	-	-	-	-
HHS	NIH	NIH Data Center 5	Closed	-	-	-	-	-	-
HHS	NIH	NIH Data Center 32	Closed	-	-	-	-	-	-
HHS	IHS	IHS - Headquarters Albuquerque	Closed	-	-	-	-	-	-
HHS	NIH	NIH Data Center 23	Closed	-	-	-	-	-	-
HHS	NIH	NIH Data Center 24	Closed	-	-	-	-	-	-
HHS	NIH	NIH Data Center 74	Closed	-	-	-	-	-	-
HHS	NIH	NIH Data Center 76	Closed	-	-	-	-	-	-
HHS	NIH	NIH Data Center 46	Closed	-	-	-	-	-	-
HHS	NIH	NIH Data Center 80	Closed	-	-	-	-	-	-
HHS	NIH	NIH Data Center 71	Closed	-	-	-	-	-	-
HHS	FDA	FDA Parklawn	Closed	-	-	-	-	-	-
HHS	NIH	NIH Data Center 77	Closed	-	-	-	-	-	-
HHS	NIH	NIH Data Center 55	Closed	-	-	-	-	-	-
HHS	NIH	NIH Data Center 57	Closed	-	-	-	-	-	-
HHS	NIH	NIH Data Center 69	Stage 3: Migration Planning	12/31/2010	3/30/2011	6/30/2011	9/30/2011	9/30/2011	12/31/2011

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HHS	OS	Silver Spring	Stage 4: Migration Execution	3/4/2011	4/15/2011	5/10/2011	9/30/2011	10/14/2011	12/31/2011
HHS	CDC	Spokane	Stage 1: Inventory	5/23/2011	9/30/2011	12/31/2011	7/31/2012	8/31/2012	9/30/2012
HHS	NIH	NIH Data Center 18	Stage 1: Inventory	12/31/2011	12/31/2011	3/31/2012	9/30/2012	9/30/2012	9/30/2012
HHS	NIH	NIH Data Center 52	Stage 1: Inventory	12/31/2011	12/31/2011	3/31/2012	9/30/2012	9/30/2012	9/30/2012
HHS	NIH	NIH Data Center 58	Stage 1: Inventory	12/31/2011	12/31/2011	3/31/2012	9/30/2012	9/30/2012	9/30/2012
HHS	NIH	NIH Data Center 47	Stage 4: Migration Execution	3/31/2011	5/31/2011	9/30/2011	6/1/2011	12/30/2011	9/30/2012
HHS	OIG	OIG Data Center 1	Stage 1: Inventory	9/30/2011	12/30/2011	6/30/2012	8/31/2012	9/30/2012	9/30/2012
HHS	IHS	IHS - Tucson Area Clinic02	Stage 1: Inventory	10/1/2011	2/1/2012	3/1/2012	8/15/2012	8/31/2012	12/31/2012
HHS	NIH	NIH Data Center 70	Stage 1: Inventory	12/31/2011	6/30/2012	12/31/2012	9/30/2013	9/30/2013	9/30/2013
HHS	NIH	NIH Data Center 59	Stage 1: Inventory	12/31/2011	6/30/2012	12/31/2012	9/30/2013	9/30/2013	9/30/2013
HHS	NIH	NIH Data Center 40	Stage 1: Inventory	12/31/2011	6/30/2012	12/31/2012	9/30/2013	9/30/2013	9/30/2013
HHS	NIH	NIH Data Center 30	Stage 1: Inventory	12/31/2011	6/30/2012	12/31/2012	9/30/2013	9/30/2013	9/30/2013
HHS	NIH	NIH Data Center 36	Stage 1: Inventory	12/31/2011	6/30/2012	12/31/2012	9/30/2013	9/30/2013	9/30/2013
HHS	NIH	NIH Data Center 25	Stage 1: Inventory	12/31/2011	6/30/2012	12/31/2012	9/30/2013	9/30/2013	9/30/2013

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HHS	NIH	NIH Data Center 13	Stage 1: Inventory	12/31/2011	6/30/2012	12/31/2012	9/30/2013	9/30/2013	9/30/2013
HHS	NIH	NIH Data Center 73	Stage 1: Inventory	12/31/2011	6/30/2012	12/31/2012	9/30/2013	9/30/2013	9/30/2013
HHS	NIH	NIH Data Center 38	Stage 1: Inventory	12/31/2011	6/30/2012	12/31/2012	9/30/2013	9/30/2013	9/30/2013
HHS	NIH	NIH Data Center 4	Planning	6/30/2012	12/31/2012	12/31/2013	9/30/2014	9/30/2014	9/30/2014
HHS	NIH	NIH Data Center 31	Planning	6/30/2012	12/31/2012	12/31/2013	9/30/2014	9/30/2014	9/30/2014
HHS	NIH	NIH Data Center 9	Planning	9/30/2013	9/30/2013	12/31/2014	6/30/2015	6/30/2015	6/30/2015
HHS	NIH	NIH Data Center 43	Planning	9/30/2013	9/30/2013	12/31/2014	6/30/2015	6/30/2015	6/30/2015