Federal Data Center Consolidation Initiative (FDCCI)

Workshop II: Final Asset Inventory Baseline

June 11, 2010

FDCCI – Agenda – June 11, 2010

1. Welcome	**Katie Lewin – GSA** Director Cloud Computing Program	**10 min.**
2. DC Consolidation Lessons Learned	**Dan Timlick – DHS** Data Center II PM	**20 min.**
3. Preparing IT Asset Inventory Baseline	**Zachary Baldwin – GSA** IT Specialist, Policy & Planning	**10 min.**

10 Minute Break

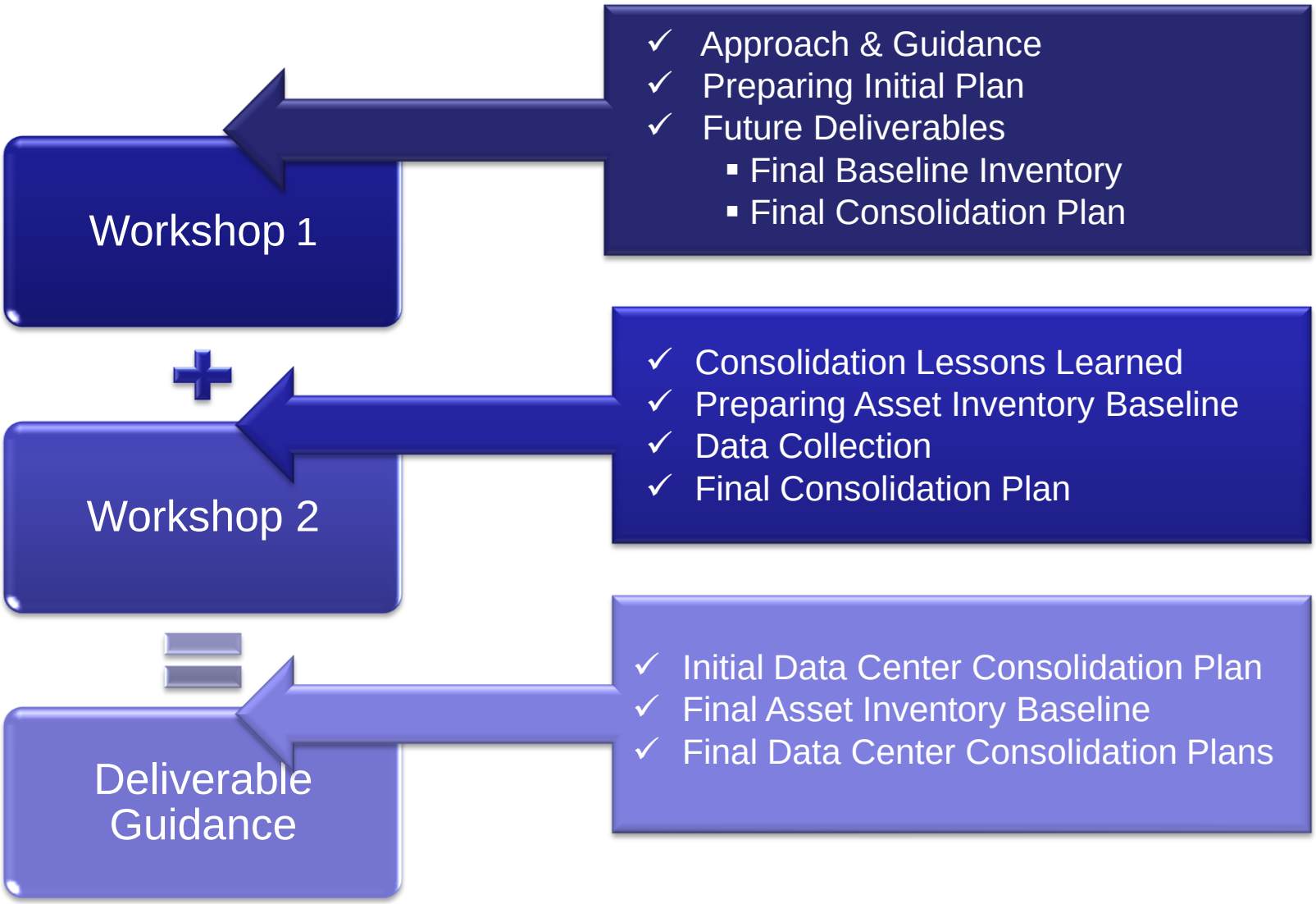
4. Data Collection IT Software Assets & Utilization IT Hardware Assets & Utilization	**GSA PMO Team**	**15 min.**
5. Data Collection - Continued IT Facilities, Energy, Storage & Telecom Geographic Location and Real Estate	**GSA PMO Team**	**15 min.**
6. Preparing Final DC Consolidation Plan	**GSA PMO Team**	**15 min.**
7. Questions	**Zachary Baldwin – GSA** IT Specialist, Policy & Planning	**25 min.**

1. Welcome

Katie Lewin – GSA

Director Cloud Computing Program

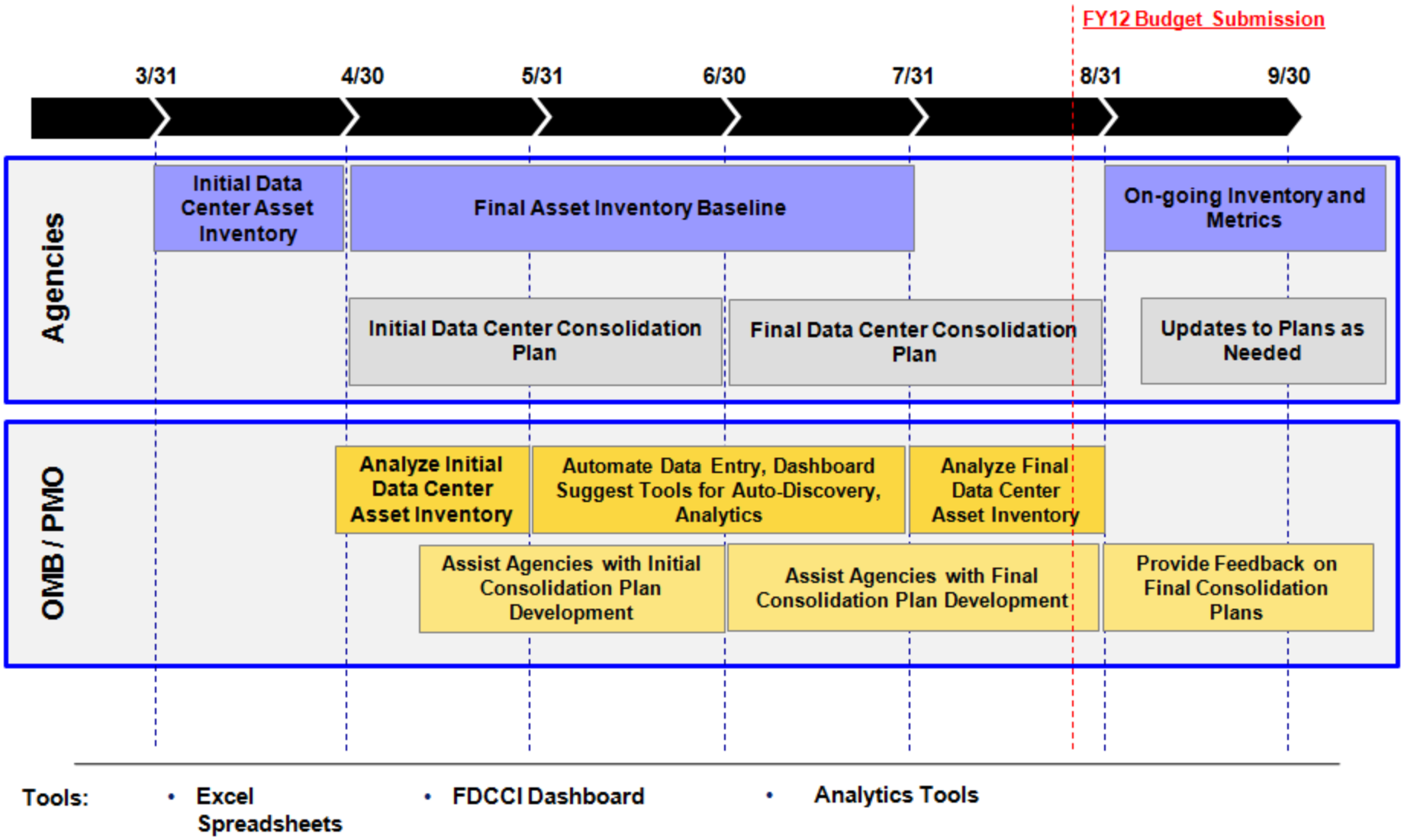
Workshop I & II – What's the Difference?



Agency Reporting Schedule

Deliverables	Agency Task	Agency Deadlines	FDCCI PMO Task	PMO Deadlines
1. INITIAL ASSET INVENTORY	Conduct an initial inventory of data center assets.	April 30, 2010 (Completed)	• Assist Agencies with the analysis and comparison of data center count, rack and server count, and supported Major Systems across the Federal Government; Identify potential areas of asset consolidation, reuse and cost savings.	May 31, 2010 (Completed)
2. INITIAL DATA CENTER CONSOLIDATION PLAN	**Develop an initial data center consolidation plan.**	**June 30, 2010**	• Assist Agencies in identifying and proposing potential areas where optimization through server virtualization or cloud computing alternatives may be used and offer a high-level transitioning roadmap.	**July 30, 2010**
3. FINAL ASSET INVENTORY BASELINE	**Collect the final asset inventory baseline containing more detailed data.**	**July 30, 2010**	• Analyze detailed utilization patterns and virtualization and cost savings opportunities. This will serve as the foundation for the final data center consolidation plans.	**Aug 30, 2010**
4. FINAL DATA CENTER CONSOLIDATION PLANS	**Develop final data center consolidation plans. Reflect data center consolidation plans in FY12 budget.**	**Aug. 30, 2010**	• Evaluate and provide guidance and feedback on technical roadmap and approach for achieving the targets for infrastructure utilization, rack density and consolidation.	**Nov 30, 2010**
5. ONGOING MONITORING	**Conduct ongoing annual monitoring, reporting starting in FY11. Reflect data center consolidation plans in next FY budget.**	**June 30, 2011 Sept. 30, 2011**	• Maintain and analyze updated asset inventory annually (FYQ3) • Consolidate reporting on FDCCI progress (FYQ4)	**Sept 30, 2011 Dec 31, 2011**

Timeline for FDCCI



2. DC Consolidation Lessons Learned

The DHS Perspective

Dan Timlick

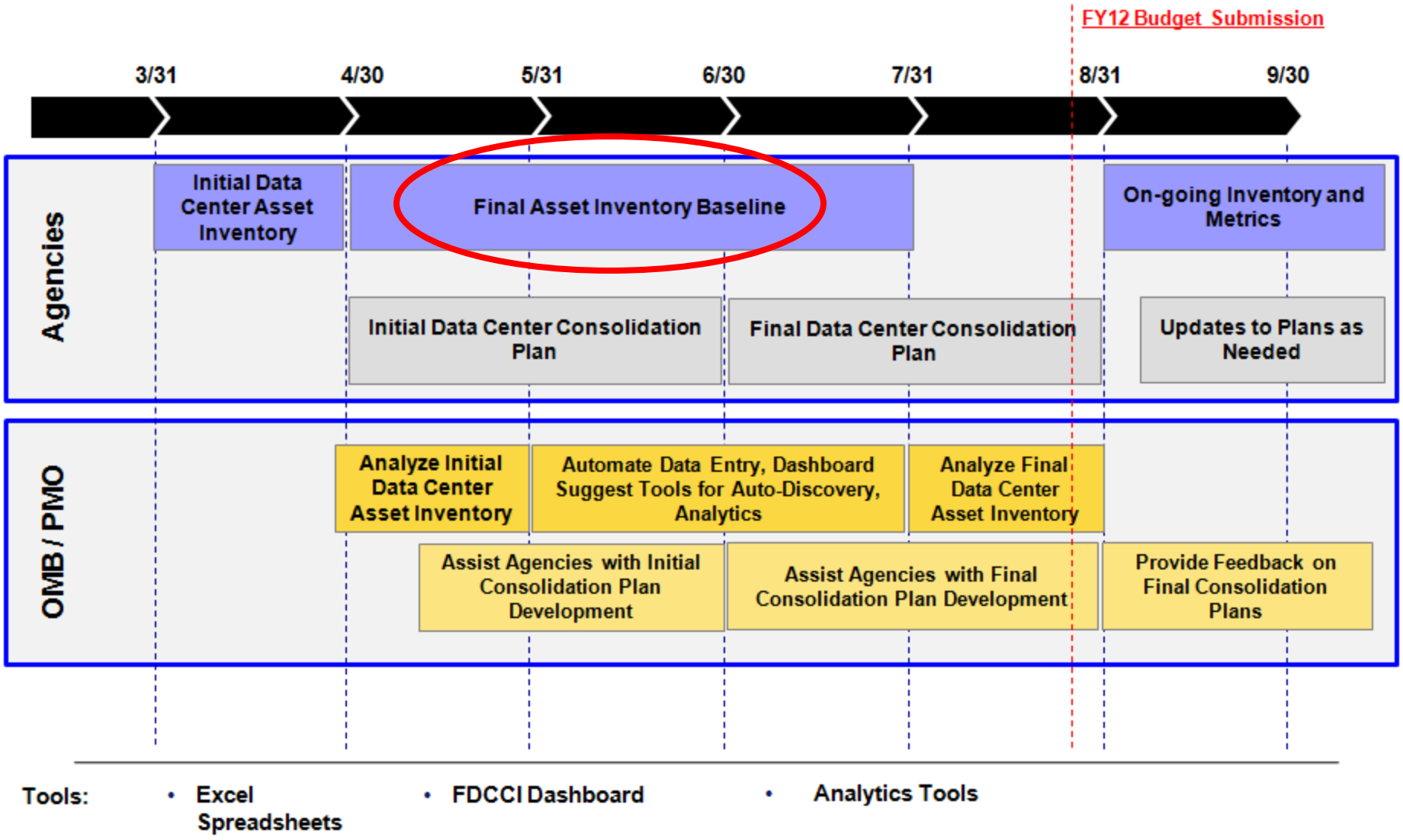
Data Center II PM

3. Preparing Final IT Asset Inventory Baseline

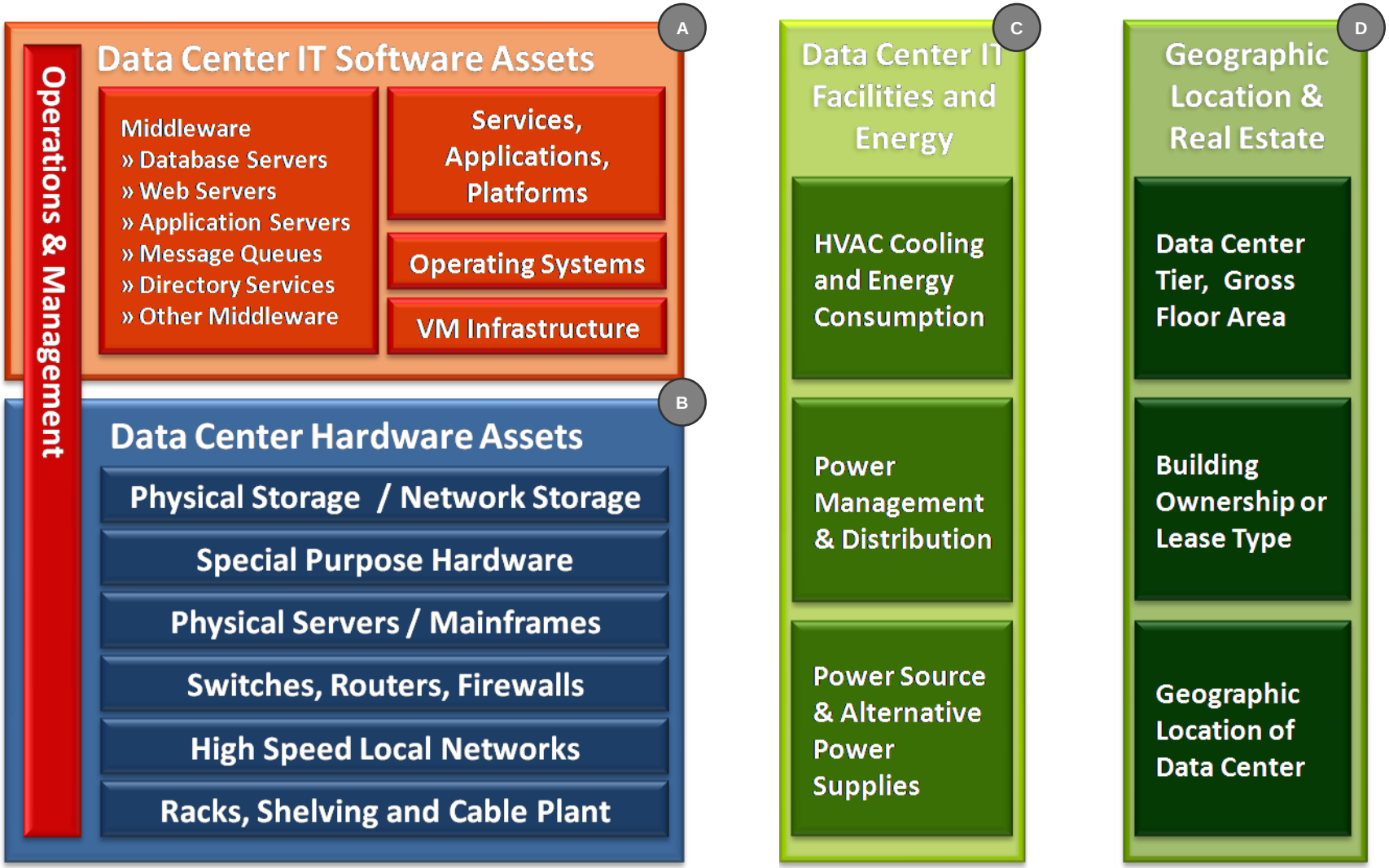
Four Key Impact Areas for Data Center Consolidation

Zachary Baldwin – GSA
IT Specialist, Policy & Planning

Final Asset Inventory Baseline Due on July 30



Four Key Impact Areas for Consolidation – II



The Four Asset Inventory Baseline Templates

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IT Software

Data Center Name	Major or Non-Major Investments (Systems)	Support Platforms (TRM: 865, 866)		Servers / Computers (TRM: 877)		Consolidation Approach (enter value 1-5)
		Vendor	Product	Vendor	Product	
Data Center 1						
Data Center 1						
Data Center 1						
Data Center 1						
Data Center 1						

Consolidation Approach - Values (1-5)
1: Not Applicable
2: Decomissioning
3: Consolidation
4: Virtualization
5: Cloud Computing

A

IT Hardware

Data Center Name	Server Types	Physical Servers			Virtualization	
		Total Physical Server Count (#)	Max Server Utilization (%)	Average Server Utilization (%)	Total Virtual Host Count (#)	Total Virtual OS Count (#)
Data Center 1	Mainframes (IBM or compatible)					
Data Center 1	Mainframes (Other)					
Data Center 1	Windows Servers					
Data Center 1	Linux Servers					
Data Center 1	UNIX Servers					
Data Center 1	Other Servers					

B

IT Facilities, Energy				
FY2010 Construction, Expansion, Consolidation Budget ($/year)				
Annual Data Center Building Operational Cost ($/year)				
Annual Data Center Electricity Cost ($/year)				
Annual Total Electricity Usage (kWh/year)				
Annual IT Electricity Usage (kWh/year) - Measured at the output of the UPS meter, or if not available - at the PDU meter				
Total Data Center IT Power Capacity (kW)				
Rack Count (#)				
Rack Space Utilization (%) - Estimated				

C

Centralizad Network Storage				
DAS (Direct Attached Storage) - Total (TB)				
DAS (Direct Attached Storage) - Used (TB)				
NAS (Network Attached Storage) - Total (TB)				
NAS (Network Attached Storage) - Used (TB)				
SAN (Storage Area Network) - Total (TB)				
SAN (Storage Area Network) - Used (TB)				

Location and Real Estate

Data Center Name	Data Center 1	Data Center 2	Data Center 3	Data Center 4
Street Address				
City				
State				
ZIP				
Gross Floor Area (sq.ft.)				
Cost ($/sq.ft./year)				
Ownership Type (enter value 1-8)				
Provider Name (Optional - if Outsourcing or Cloud Provider)				
Data Center Tier (enter value 1-8)				

D

Ownership Type Values (1-8)
1: Agency Owned Facility
2: GSA Owned Facility
3: Lease and Retrofit
4: Turnkey Lease
5: Collocation
6: Outsourcing to Contractor
7: Outsourcing to Other Agency
8: Using Public Cloud Provider

Data Center Tier Values (1-8)
1: Tier I
2: Tier II
3: Tier III
4: Tier IV
5: Server Room/Closet
6: Other Room, Lab, etc.
7: N/A (Unknown)
8: Public Cloud Provider

Final Asset Inventory Baseline - Requested Data:

A. IT Software – Major and Non-Major Investments (Systems)

B. IT Hardware – Count and Utilization of Physical Servers; Count of Virtual Hosts and VMs

C. Location and Real Estate – Location, Gross Floor Area, Tier, Ownership Type, Cost

D. IT Facilities, Energy, Storage – Budget, Operations Costs, Electricity Usage, Rack Count, Rack Space Utilization, Centralized Network Storage

Asset Inventory Baseline – Data Collection – I

4. Data Collection

IT Software Assets & Utilization

IT Hardware Assets & Utilization

GSA PMO Team

Data Center Consolidation Strategy

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Infrastructure Sprawl

- Uncontrolled IT asset and data center growth
- Outdated legacy hardware and obsolete tools for systems management

Physical Consolidation

- Consolidate IT assets and data centers
- Centralize and standardize management based on best practices (ITIL)

Virtualization

- Virtualize infrastructure
- Enable resource sharing across the organization
- Unify physical & virtual systems management

Cloud Computing

- Adopt Service Oriented Architecture
- Implement Dynamic Service Management

Drawbacks

- Inconsistent Ad Hoc processes
- Soaring IT & energy costs

Benefits

- Consistent Streamlined Processes
- Energy Savings by phasing out inefficient HW

Benefits

- Increased, more efficient system utilization
- Energy savings by maximizing effective usage

Benefits

- Rapid IT resource provisioning
- Massive scaling
- Energy Savings via automated load distribution

IT Software and Hardware Templates (TRM, ITI LoB)

IT Software							
Data Center Name	Major or Non-Major Investments (Systems)	Support Platforms *(TRM: 865, 866)*		Servers / Computers *(TRM: 877)*		Consolidation Approach (enter value 1-5)	Consolidation Approach - Values (1-5)
		Vendor	Product	Vendor	Product		
Data Center 1							1: Not Applicable
Data Center 1							2: Decomissioning
Data Center 1							3: Consolidation
Data Center 1							4: Virtualization
Data Center 1							5: Cloud Computing

IT Hardware						
Data Center Name	Server Types	Physical Servers			Virtualization	
		Total Physical Server Count (#)	Max Server Utilization (%)	Average Server Utilization (%)	Total Virtual Host Count (#)	Total Virtual OS Count (#)
Data Center 1	Mainframes (IBM or compatible)					
Data Center 1	Mainframes (Other)					
Data Center 1	Windows Servers					
Data Center 1	Linux Servers					
Data Center 1	UNIX Servers					
Data Center 1	Other Servers					

Final Asset Inventory Baseline - Requested Data:

- **IT Software** – Major and Non-major Investments (Systems)
- **IT Hardware** – Count and Utilization of Physical Servers; Count of Virtual Hosts and VMs

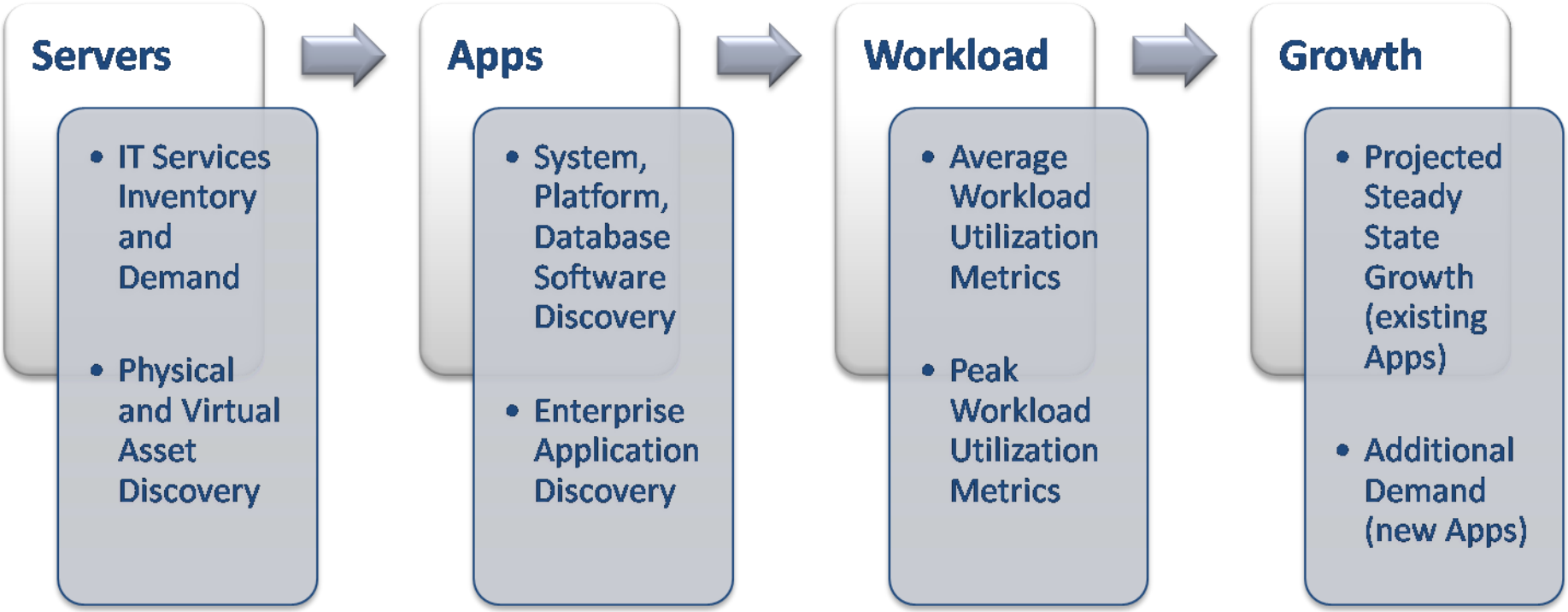
IT Software and Hardware – Reducing Complexity

SW Template – preserved key information, simplified the layout

HW Template – preserved key information, removed noncritical fields, simplified the layout:

- ✓ **Removed 'Average CPU Capacity' and 'Average Power at Full Load'**
- ✓ **Removed 'Total Storage' and 'Used Storage' per Server Type**

Asset Inventory Data Collection – Baseline



Asset Inventory Baseline – Data Collection – II

5. Data Collection - Continued

IT Facilities, Energy, Storage & Telecom

Geographic Location and Real Estate

GSA PMO Team

IT Facilities Template (Best Practices, EPA Guides)

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IT Facilities, Energy	Data Center 1	Data Center 2	Data Center 3	Data Center 4
FY2010 Construction, Expansion, Consolidation Budget ($/year)				
Annual Data Center Building Operational Cost ($/year)				
Annual Data Center Electricity Cost ($/year)				
Annual Total Electricity Usage (kWh/year)				
Annual IT Electricity Usage (kWh/year) - Measured at the output of the UPS meter, or if not available - at the PDU meter				
Total Data Center IT Power Capacity (kW)				
Rack Count (#)				
Rack Space Utilization (%) - Estimated				

Centralizad Network Storage				
DAS (Direct Attached Storage) - Total (TB)				
DAS (Direct Attached Storage) - Used (TB)				
NAS (Network Attached Storage) - Total (TB)				
NAS (Network Attached Storage) - Used (TB)				
SAN (Storage Area Network) - Total (TB)				
SAN (Storage Area Network) - Used (TB)				

Final Asset Inventory Baseline - Requested Data:

- **IT Facilities, Energy, Storage** – Budget, Operations Costs, Electricity Usage, Rack Count, Rack Space Utilization, Centralized Network Storage

IT Facilities – Reducing Complexity

IT Facilities, Energy, Storage Template - removed several noncritical fields (Telecom), expanded on Centralized Storage (per FAQ), clarified Energy Collection fields:

- ✓ **Replaced 'Average Rack Space Utilization (%)' with 'Rack Space Utilization (%) - Estimated', thereby allowing both accurate numbers from Facilities Management Systems and also Estimates, if accurate numbers are N/A**
- ✓ **Removed all four Telecom/NW bandwidth fields**
- ✓ **Expanded the Total/Used Storage fields by Centralized Storage Type - DAS, NAS, SAN**

Location & Real Estate Template (Best Practices)

Location and Real Estate				
Data Center Name	**Data Center 1**	**Data Center 2**	**Data Center 3**	**Data Center 4**
Street Address				
City				
State				
ZIP				
Gross Floor Area (sq.ft.)				
Cost ($/sq.ft./year)				
Ownership Type (enter value 1-8)				
Provider Name (Optional - if Outsourcing or Cloud Provider)				
Data Center Tier (enter value 1-8)				

Ownership Type Values (1-8)
1: Agency Owned Facility
2: GSA Owned Facility
3: Lease and Retrofit
4: Turnkey Lease
5: Collocation
6: Outsourcing to Contractor
7: Outsourcing to Other Agency
8: Using Public Cloud Provider

Data Center Tier Values (1-8)
1: Tier I
2: Tier II
3: Tier III
4: Tier IV
5: Server Room/Closet
6: Other Room, Lab, etc.
7: N/A (Unknown)
8: Public Cloud Provider

Final Asset Inventory Baseline - Requested Data:

- ❑ **Location and Real Estate** – Location, Gross Floor Area, Tier, Ownership Type, Cost

Location & Real Estate – Reducing Complexity

Location and Real Estate Template - removed several noncritical fields, simplified layout, clarified Ownership Type info:

- ✓ **Removed the two 'Potential Expansion' fields**
- ✓ **Added more descriptive selection values to 'Ownership Type' and to 'Data Center Tier' to include 'Cloud Provider' and other options that came back with the Initial Inventory**
- ✓ **Added an optional field 'Provider Name' for Outsourcing or Cloud Provider ownership type**

Affects Strategic Long-term Investment Decisions

GSA

EPA eGRID Subregions

Factors to Consider When Choosing Location and Real Estate:

- **Sustainable Energy Sources**
- **Green House Gas (GHG) Emissions**
- **Internet Hub Access**
- **Price per Square Foot**
- **Climate Zone - Median Temperature**

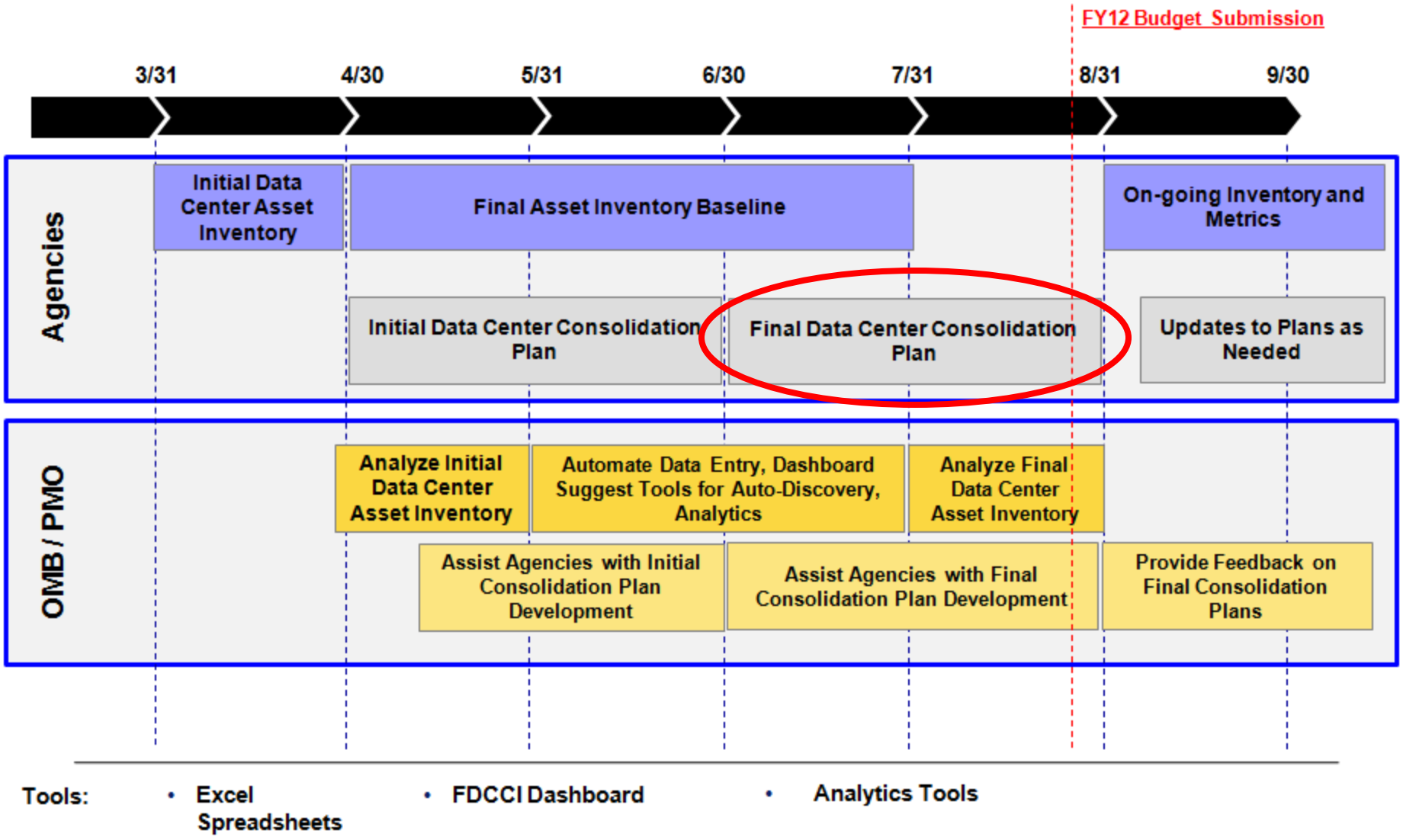
Source: ***www.epa.gov/cleanenergy/egrid***

6. Preparing Final DC Consolidation Plan

Final Baseline Inventory & Final Consolidation Plan

GSA PMO Team

Final Consolidation Plan due on August 30



Final FDCCI Vision (Pending SW Acquisition, C&A)

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4/30 Agencies Submit Initial Data Center Inventory

Preliminary Inventory Assessment	
Department Name	
Agency Name	
Data Center Name	Data Center 1
Data Center Tier (I - IV)	
Data Center Availability	
Tier I - 99.600%	
Tier II - 99.750%	
Tier III - 99.980%	
Tier IV - 99.995%	
N/A - Server Room/Closet	
Rack Count (#)	
Total Physical Server Count (#)	
Mainframes (IBM or compatible)	
Mainframes (Other)	
Windows Servers	
Linux Servers	
UNIX Servers	
Other Servers	
Major Systems (Business Applications)	

4/30 thru 6/30 – PMO Assists OMB Analyze Initial Inventory and Initial Consolidation Plans

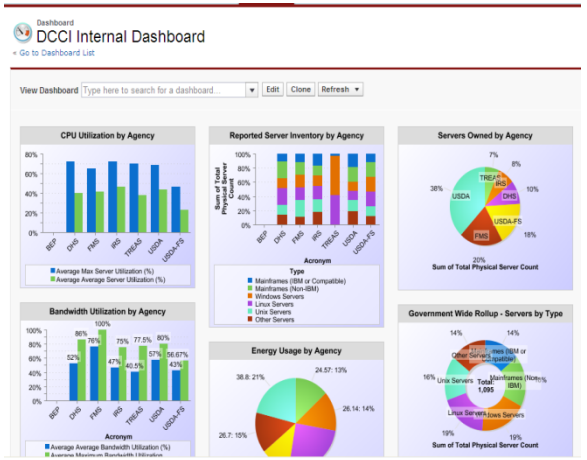
Excel → **Analyze Initial Inventory & Recommend Planning Steps** → Upload

Excel

Agency-Wide Savings Plan				
Department Name				
Agency Name				
	Calculated from Baseline	Target		
	4Q10	4Q11	4Q12	4Q13
Total Number of Data Centers (#)				
Aggregate Gross Floor Area (sq.ft.)				
Total Number of Racks (#)				
Total Number of Physical Servers by Type (#)				
Mainframes (IBM or compatible)				
Mainframes (Other)				
Windows Servers				
Linux Servers				
UNIX Servers				
Other Servers				
Aggregate Data Center Energy Usage (kWh/year)				
Aggregate Data Center Energy Costs ($/year)				
Aggregate Data Center Building Operational Cost ($/year)				
Aggregate FY Construction, Expansion, Consolidation Budget ($/year)				

6/30 – Agencies Submit Initial Consolidation Plan

6/30 through 9/30 – PMO Assists OMB w/ Final Inventory, Consolidation Plans



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7/30 Agencies Submit Final Data Center Inventory

8/30 Agencies Submit Final Consolidation Plan

Initial vs. Final Consolidation Plan

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Asset Count & Savings Metrics

Savings Metrics	Planned Program Cost Savings by 4Q12
Data Center Count Reduction (#)	
Gross Floor Area Reduction (sq.ft.)	
Rack Count Reduction (#)	
Server Count Reduction (#)	
Mainframes (IBM or compatible) Reduction (#)	
Mainframes (Other) Reduction (#)	
Windows Servers Reduction (#)	
Linux Servers Reduction (#)	
UNIX Servers Reduction (#)	
Other Servers Reduction (#)	
Energy Usage Reduction (kW)	
Energy Cost Reduction ($)	

Initial Analysis

Initial Plan: Asset Count & Savings Targets

Agency-Wide Savings Plan				
Department Name				
Agency Name				
	Calculated from Baseline	Target		
	4Q10	4Q11	4Q12	4Q13
Total Number of Data Centers (#)				
Aggregate Gross Floor Area (sq.ft.)				
Total Number of Racks (#)				
Total Number of Physical Servers by Type (#)				
Mainframes (IBM or compatible)				
Mainframes (Other)				
Windows Servers				
Linux Servers				
UNIX Servers				
Other Servers				
Aggregate Data Center Energy Usage (kWh/year)				
Aggregate Data Center Energy Costs ($/year)				
Aggregate Data Center Building Operational Cost ($/year)				
Aggregate FY Construction, Expansion, Consolidation Budget ($/year)				

Utilization Metrics

Utilization Metrics	Typical Results	Target Results
Average Virtualization (%)	0-10%	*30-40%*
Average Virtual OS per Host (#)	5-10	*15-20*
Average Server Utilization (%)	7 – 15%	60 – 70% *(application dependent)*
Average Rack Space Utilization (%)	50 – 60 %	80 – 90%
Average Power Density Usage Equivalent (W/sq.ft.)	50 – 100 W/Sq Ft	150 – 250 W/Sq Ft
Power Usage Efficiency (PUE)	3 – 2	1.6 – 1.3

Final Analysis

Final Plan: Utilization Targets

Department Name				
Agency Name				
	Calculated from Baseline	Target		
	2Q10	4Q10	4Q11	4Q12
Average Virtualization (%) (Virtual Host Count / Total Server Count in %)				
Mainframes (IBM or compatible)				
Mainframes (Other)				
Windows Servers				
Linux Servers				
UNIX Servers				
Other Servers				
Average Number of VMs per Virtual Host (#)				
Mainframes (IBM or compatible)				
Mainframes (Other)				
Windows Servers				
Linux Servers				
UNIX Servers				
Other Servers				
Average Physical Server Utilization (%)				
Mainframes (IBM or compatible)				
Mainframes (Other)				
Windows Servers				
Linux Servers				
UNIX Servers				
Other Servers				
Average Rack Space Utilization (%)				
Average Power Density Usage Equivalent (W/sq.ft.)				
Average Power Usage Efficiency (PUE)				

Initial Data Center Consolidation Plan Template

Agency-Wide Savings Plan				
Department Name	Department ABC			
Agency Name	ABC Agency Name			
	Calculated from Baseline	Target		
	4Q10	4Q11	4Q12	4Q13
Total Number of Data Centers (#)				
Aggregate Gross Floor Area (sq.ft.)				
Total Number of Racks (#)				
Total Number of Physical Servers by Type (#)				
Mainframes (IBM or compatible)				
Mainframes (Other)				
Windows Servers				
Linux Servers				
UNIX Servers				
Other Servers				
Aggregate Data Center Energy Usage (kWh/year)				
Aggregate Data Center Energy Costs ($/year)				
Aggregate Data Center Building Operational Cost ($/year)				
Aggregate FY Construction, Expansion, Consolidation Budget ($/year)				
(*) Only fields in 'blue' are to be filled out for the Initial Consolidation Plan, fields in 'grey' to be filled out in the Final Consolidation Plan				

Initial Consolidation Plan - Requested Data:

1. **Data Center Count Reduction (#)**
2. **Rack Count Reduction (#)**
3. **Server Count Reduction – by Server Type:**
   - Mainframes (IBM or compatible) (#)
   - Mainframes (Other) (#)
   - Windows Servers (#)
   - Linux Servers (#)
   - UNIX Servers (#)
   - Other Servers (#)

Final Data Center Consolidation Plan Template

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Final Consolidation Plan: Utilization Targets				
Department Name				
Agency Name				
	Calculated from Baseline	Target		
	2Q10	4Q10	4Q11	4Q12
Average Virtualization (%) (Virtual Host Count / Total Server Count in %)				
Mainframes (IBM or compatible)				
Mainframes (Other)				
Windows Servers				
Linux Servers				
UNIX Servers				
Other Servers				
Average Number of VMs per Virtual Host (#)				
Mainframes (IBM or compatible)				
Mainframes (Other)				
Windows Servers				
Linux Servers				
UNIX Servers				
Other Servers				
Average Physical Server Utilization (%)				
Mainframes (IBM or compatible)				
Mainframes (Other)				
Windows Servers				
Linux Servers				
UNIX Servers				
Other Servers				
Average Rack Space Utilization (%)				
Average Power Density Usage Equivalent (W/sq.ft.)				
Average Power Usage Efficiency (PUE)				

Final Consolidation Plan - Requested Data:

1. Average Virtualization – by Server Type (%)
2. Average # of VMs per Host – by Server Type (#)
3. Average Physical Server Utilization – by Server Type (%)
4. Average Rack Space Utilization (%)
5. Average Power Density Usage Equivalent (W/sq.ft.)
6. Average PUE

Target Utilization Improvement Metrics

- **Improving IT asset utilization is the key driver for reducing energy consumption per unit of performance. This can be achieved primarily by:**
  - Server Virtualization (increasing the number of virtual servers per hosts)
  - Server Consolidation (decommissioning underutilized physical servers)
  - Rack Space Consolidation (relocating underutilized racks)
  - Data Center Consolidation (shutting down underutilized facilities)

Utilization Metrics	Typical Results	Target Results
Average Virtualization (%)	**0-10%**	*30-40%*
Average Virtual OS per Host (#)	**5-10**	*15-20*
Average Server Utilization (%)	**7 – 15%**	**60 – 70%** *(application dependent)*
Average Rack Space Utilization (%)	**50 – 60 %**	**80 – 90%**
Average Power Density Usage Equivalent (W/sq.ft.)	**50 – 100 W/Sq Ft**	**150 – 250 W/Sq Ft**
Power Usage Efficiency (PUE)	**3 – 2**	**1.6 – 1.3**