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U.S. Department of Education Enterprise Architecture Program Office (EAPO)

Enterprise Transition Plan **FY 2011 -2012**

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Revision History

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1. Background

The Enterprise Transition Plan (ETP) for FY 2011-2012, developed by the Office of the Chief Information Officer (OCIO), provides the migration plan the Department of Education uses to achieve its target architectural environment. The plan presents:

- A priority-driven approach to planning and executing the activities needed to transition from the baseline architecture to the target architecture,
- Improved strategic decision-making and communication to achieve the enterprise vision for technology at the Department,
- Increased control mechanisms for technology planning and investment,
- Improved responsiveness to the enterprise technology needs of the Department's business, and
- The ability to leverage technology to create a more effective and efficient Department.

The resulting ETP, updated annually, is a strategic roadmap for modernizing the Department's business and its enabling information technology (IT). It is a plan for moving toward the Department's target architecture, which defines the desired future state of the Department's business, applications, services, technology, security capabilities and performance.

The Department has made significant and steady progress toward business transformation over the last year. The following Department activities were accomplished during Fiscal Year 2010:

- Defined a target vision that is shared by all business stakeholders and built an actionable strategy for achieving that vision;
- Identified common enterprise service needs and performance gaps;
- Developed an Investment Review Board (IRB)-approved portfolio, driven by the vision and strategy defined by an *integrated* Enterprise Architecture (EA)/Capital Planning and Investment Control (CPIC) program; and
- Completed a durable and relevant set of artifacts with the tools, techniques, and processes to support business transformation.



This ETP is developed to support the following laws and policies:

- The Clinger-Cohen Act of 1996¹—This law assigns the Chief Information Officers (CIO) with the responsibility to develop Information Technology Architectures (ITAs);
- Office of Management and Budget (OMB) Circular A-130²—This circular establishes policy for the management of Federal information resources; and
- OMB Circular A-11³, Parts 6 and 7.

Part 6 describes requirements for strategic plans and annual program performance reports and provides an overview of the performance budget.

Part 7 discusses planning, budgeting and acquisition of capital assets, and explains how to prepare and submit information on new and past acquisitions.

1.1. Document Organization

This document is composed of five sections: Executive Summary, Introduction, Baseline Enterprise Architecture, Target Architecture, and Recommendations.

The first section, *Executive Summary*, provides background information for the Enterprise Transition Plan. The section lists the benefits of transition activities and business transformation accomplishments at the Department over the last year. This section also identifies the laws and policies that are supported by the ETP.

The second section, *Introduction*, explains the ETP's alignment to the Department's overall mission and its vision for IT. The first subsection outlines the methodology followed in preparing the ETP, and includes the standards and artifacts used. The second subsection describes the strategic goals and detailed objectives that support the Department's mission. The third subsection explains the use of the Enterprise Architecture framework to develop and organize the Department's architectural segments.

The third section, *Baseline Enterprise Architecture*, describes the current state of the Department and demonstrates a clear understanding of the business needs requested by the Department's leadership. The baseline architecture is used as input for planning, baseline metrics and benchmarking.

¹ http://www.cio.gov/Documents/it_management_reform_act_feb_1996.html

² http://www.whitehouse.gov/omb/circulars_a130

³ http://www.whitehouse.gov/omb/circulars_a11_current_year_a11_toc/



The fourth section, *Target Architecture*, describes how the enterprise will look operationally, tactically, and strategically. A target architecture represents enhancements to the existing baseline architecture while supporting existing business operations.

The fifth section, *Recommendations*, describes the steps to implement agency technology goals and legislative mandates.



2. Introduction

The ETP defines the strategy to achieve the Department's strategic goals and objectives⁴ while improving business performance. Additionally, the ETP describes the services and capabilities that are required by the Department's lines of business (LoB) to achieve its target EA. The Information Resource Management (IRM) Plan⁵ describes the technology standards and direction the Department will use in its EA over the IRM Plan's time period. Together, these documents promote the CIO's vision for using IT to effectively deliver the Department's services.

2.1. *Standardization and Artifacts for ETP Development*

The ETP reflects the OCIO's implementation of standards for gathering information from the segments as follows:

Documentation: The OCIO and the Enterprise Architecture Office create templates to standardize all artifacts and modernization plans ensuring the same information is collected, measured, and reported.

Analysis: The OCIO follows the Federal Enterprise Architecture Framework (FEAF)⁶ and the Federal Segment Architecture Method (FSAM)⁷ in addition to other federally available tools and measures (for example, the Consolidated Reference Model⁸) to conduct current-state, future-state, and gap analyses for the Department's EA.

Design: The OCIO uses the FEAF and FSAM to design a modernization blueprint and transition plan for the Department's enterprise architecture.

Reporting Activities: The OCIO's reporting activities comply with the OMB's program reporting requirements for the EA and CPIC programs.

The ETP builds upon a standard set of artifacts and documents that are listed below.

Segment Modernization Plan: An EA-produced document; one for every Department LoB, thirteen in total. It documents segment-specific information such as goals, vision, and performance objectives. The segment modernization plan includes an alignment to the Technical Reference Model (TRM).

Information Resource Management (IRM) Strategic Plan: An OCIO-created document that describes the Department's strategic plan for how organizations and programs will

⁴ <http://www2.ed.gov/about/reports/strat/index.html>

⁵ <http://www2.ed.gov/about/reports/annual/ocio/irmstratplan2010.doc>

⁶ <http://www.whitehouse.gov/omb/e-gov/fea/>

⁷ <http://www.whitehouse.gov/omb/e-gov/fsam/>

⁸ http://www.whitehouse.gov/sites/default/files/omb/assets/fea_docs/FEA_CRM_v23_Final_Oct_2007_Revised.pdf



use information resources to carry out Department’s mission and achieve its strategic goals.

Budget Formulation Database (BFD): The BFD contains data for the Department’s budget submissions including resources the Department has identified as necessary to complete its mission and goals.

Investment Funding Workbook (IFW): This CPIC artifact is a consolidated report on funding activities for the Department’s IT investments.

OMB Exhibit 300⁹: The Exhibit 300 is designed to coordinate OMB’s collection of agency information for its reports to the Congress required by the Federal Acquisition Streamlining Act of 1994¹⁰ (FASA Title V) and the Clinger-Cohen Act of 1996, and to ensure the business cases for investments are made and tied to the mission statements, long-term goals and objectives, and annual performance plans developed pursuant to the Government Performance and Results Act (GPRA)¹¹. For IT, Exhibit 300s are designed to be used as one-stop documents for many IT management issues such as business cases for investments, IT security reporting, Clinger-Cohen Act implementation, E-Gov Act¹² implementation, Government Paperwork Elimination Act¹³ implementation, agency’s modernization efforts, and overall project investment management.

OMB Exhibit 53¹⁴: Each Federal agency reports its IT Investment Portfolio annually to OMB via an Exhibit 53. The Exhibit 53 provides budget estimates for all IT investments by agency and identifies those that are major investments. By completing an Exhibit 53, ED meets the Clinger-Cohen Act of 1996 requirements to provide a full and accurate accounting of IT investments for the agency. OMB uses the Exhibit 53 to create an overall “Federal IT Investment Portfolio” published as part of the President’s Budget.

⁹ http://www.whitehouse.gov/sites/default/files/omb/assets/a11_current_year/s300.pdf

¹⁰ https://www.acquisition.gov/comp/seven_steps/library/act_fed-acq-stream.pdf

¹¹ <http://www.whitehouse.gov/omb/mgmt-gpra/gplaw2m>

¹² <http://thomas.loc.gov/cgi-bin/bdquery/z?d107:HR02458;|TOM:/bss/d107query.html>

¹³ http://www.cio.gov/documents/paperwork_elimination_act.html

¹⁴ http://www.whitehouse.gov/sites/default/files/omb/assets/a11_current_year/s53.pdf



2.2. *The Department’s Mission*

The Department of Education is responsible for fulfilling its mission.

Table: Department of Education Mission

<p style="text-align: center;">Department of Education Mission</p> <p style="text-align: center;"><i>“To promote student achievement and preparation for global competitiveness by fostering educational excellence and ensuring equal access.”</i></p>
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The Department’s Strategic Plan 2007-2012 embodies four strategic goals.

Table: Department of Education Strategic Goals

<p style="text-align: center;">Department of Education Strategic Goals</p> <p>Goal One: Improve student achievement, with a focus on bringing all students to grade level in reading and mathematics by 2014.</p> <p>Goal Two: Increase the academic achievement of all high school students.</p> <p>Goal Three: Ensure the accessibility, affordability, and accountability of higher education, and better prepare students and adults for employment and future learning.</p> <p>Goal Four: Cross-goal Strategy on Management.</p>
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2.3. *The Department’s Strategic Goals*

The Department’s strategic goals are articulated through strategic objectives. The Department’s current operating strategic objectives, as described in the Department’s Strategic Plan, are depicted in the following table.



Table: Department of Education Strategic Goals and Objectives

Strategic Goals	Strategic Objectives
Goal One: Improve student achievement, with a focus on bringing all students to grade level in reading and mathematics by 2014.	1.1 Improve student achievement in reading/language arts.
	1.2 Improve student achievement in mathematics.
	1.3 Improve teacher quality.
	1.4 Promote safe, disciplined, and drug-free learning environments.
	1.5 Increase information and options for parents.
	1.6 Increase the high school completion rate.
	1.7 Transform education into an evidence-based field.
Goal Two: Increase the academic achievement of all high school students.	2.1 Increase the proportion of high school students taking a rigorous curriculum.
	2.2 Promote advanced proficiency in mathematics and science for all students.
	2.3 Increase proficiency in critical-need foreign languages.
Goal Three: Ensure the accessibility, affordability, and accountability of higher education, and better prepare students and adults for employment and future learning	3.1 Increase success in and completion of quality post-secondary education.
	3.2 Deliver Federal student aid to students and parents effectively and efficiently.
	3.3 Prepare adult learners and individuals with disabilities for higher education, employment, and productive lives.
Goal Four: Cross-goal Strategy on Management	4.1 Maintain and strengthen financial integrity, management, and internal controls.
	4.2 Improve the strategic management of the Department's human capital.
	4.3 Achieve budget and performance integration to link funding decisions to results.

2.4. Transition Framework

The Department’s Enterprise Architecture uses the OMB FEAF and Federal Enterprise Architecture (FEA) Reference Models to generate a common taxonomy that is consistent with internal Department nomenclature and that of the greater Federal IT community.

The Department defines a baseline architecture that represents the current environment and a target architecture that represents the desired, future environment. The transitional steps used to guide the Department from its current to its target architectural environments are defined in the figure below.

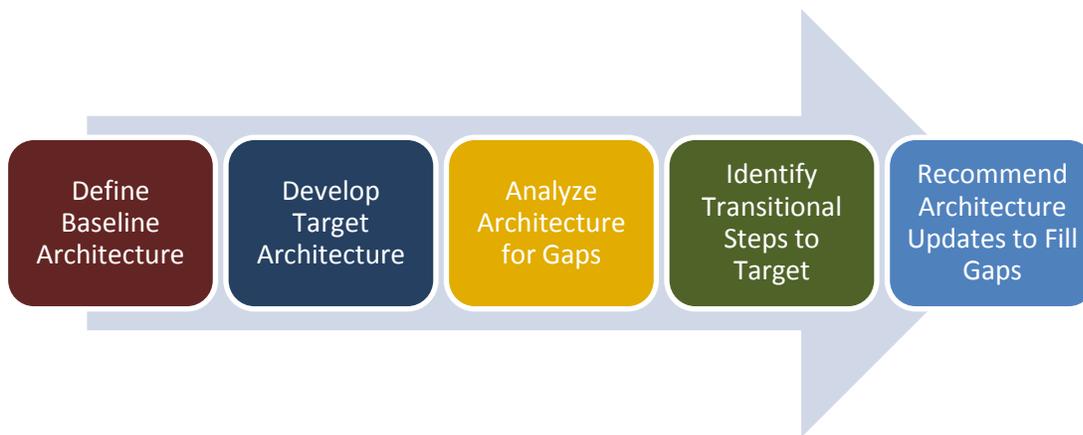


Figure: Stages of the Enterprise Transition Plan at the Department of Education

2.5. *The Department’s Segment Architecture*

The Department’s use of the FSAM to develop EA segments is a step by step process that leverages existing best practices, analysis techniques and templates to expedite architecture development. The processes and artifacts provide the structure, repeatability, information exchange, and buy-in that are essential to successful use of an EA program.

The Department’s enterprise architecture staff has developed a LoB perspective to describe the various business functions that the agency is engaged in across programs and principal offices. The Department’s enterprise architecture also identifies the primary business capabilities for each LoB, which drive IT services and investments. Each EA segment architecture corresponds to a Departmental LoB.

The following figure shows the LoBs in which the Department is engaged. It provides a visual representation of principal offices and their engagement in Departmental LoBs.

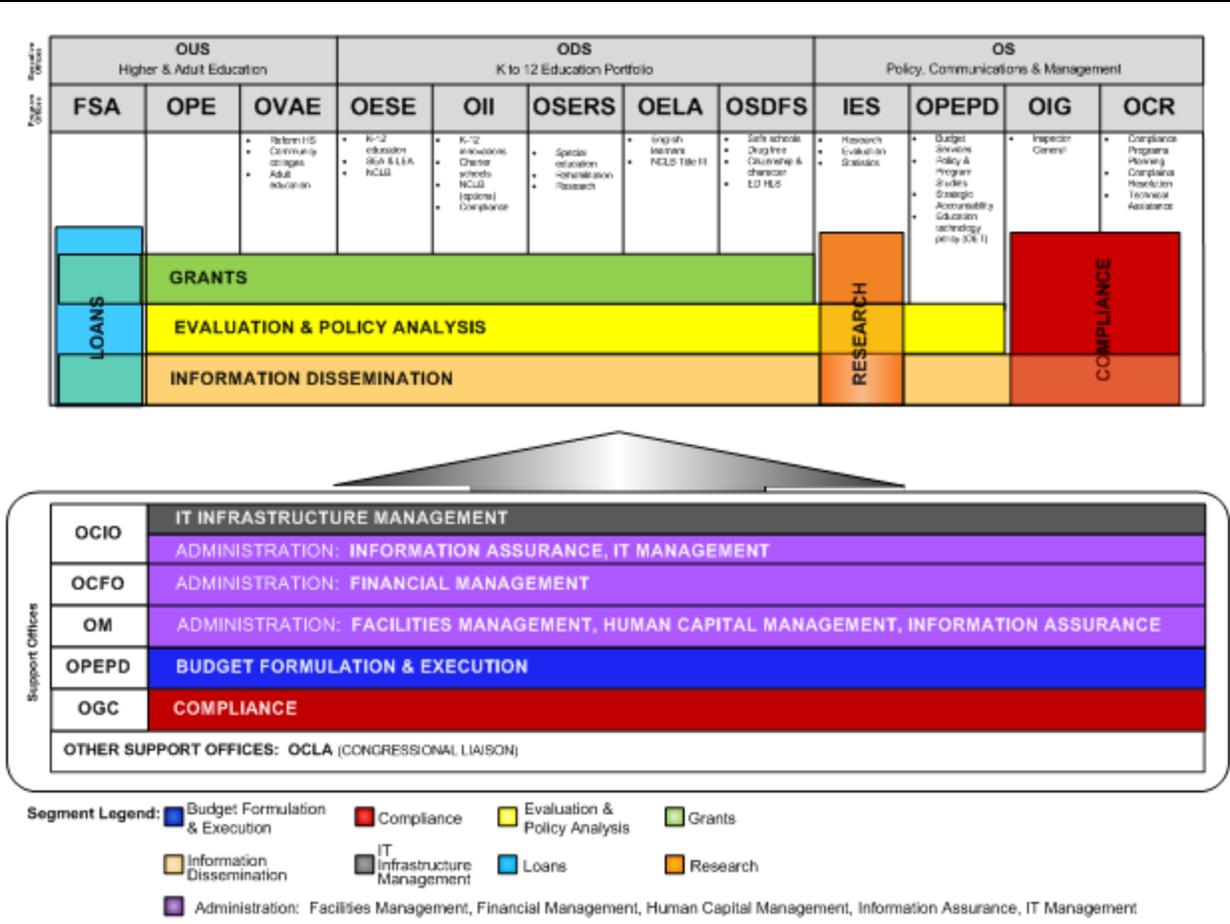


Figure: Current State at the Department

The Department’s business processes and IT investments are developed to move the Department away from a stove-piped environment, where capabilities are deployed to meet single program office needs, to a cooperative environment, in which common capabilities and services can be employed to meet similar principal office needs.

The Department’s enterprise architecture future state business model is established around the 13 segment architectures for the LoBs. Current and future IT investments, which can span multiple program offices, are managed as a portfolio, delivering technical capabilities in support of each segment’s needs. For example, while the Office of Elementary and Secondary Education (OESE)¹⁵ and Office of Postsecondary Education (OPE)¹⁶ serve very different education segments, K-12 and post-secondary education respectively, the segment mode of delivery remains the same: through formula and discretionary grants. The grants mode of delivery of these two offices is very similar in terms of process workflow and system support requirements. By focusing on grants management capabilities across the enterprise, the Department reduces the need for duplicate systems within each program office.

¹⁵ <http://www2.ed.gov/about/offices/list/oese/index.html>

¹⁶ <http://www2.ed.gov/about/offices/list/oep/index.html>



The process used to define the Department’s 13 segments aligns with the FEA Practice Guidance¹⁷ as presented below.

Table: Federal Enterprise Architecture Practice Guidance

Segment identification applies a variety of internal and external inputs such as the agency mission statement, strategic goals and objectives, legislative mandates, common or shared business and information requirements, and cross-agency initiatives. The process organizes and consolidates enterprise assets into logical groups aligned with a common purpose (mission area) or common service, and identifies segments in three categories: core mission areas, business services and enterprise services.

The extent to which a LoB (i.e., segment) addresses the goals of the agency’s strategic plan is described in the following figure.

Lines of Business (LoB)	LoB Description	Goal 1: Improve student achievement, with a focus on bringing all students to grade level in reading and mathematics by 2014	Goal 2: Promote advanced proficiency in mathematics and science for all students	Goal 3: Prepare adult learners and individuals with disabilities for higher education, employment, and productive lives	Goal 4: Cross-goal Strategy on Management
Loans	Management and delivery of federally funded or federally guaranteed financial assistance for post-secondary education			●	●
Grants	Review, award, and disbursement of formula and discretionary grants through the various Program Offices	●	●	●	●
Evaluation & Policy Analysis	Assessment of ED's programs and related policies for meeting national education objective	●	●		●
Research	Research and statistical analysis on the condition of education in the U.S.	●	●	●	
Information Dissemination	Distribution of education information products through multiple channels and formats	●	●	●	
Compliance	Assurance that policies mandated by ED and by Federal law are being carried out				●
IT Infrastructure	Improve customer service and reduce ED operational risks by improving performance, providing a common technology platform for business applications, and facilitating better information management				●
Budget Formulation & Execution	Enable ED budget personnel to reduce manual processes and improve budget formulation and execution efficiency and data accuracy				●
Information Assurance	To build and enable mutual trust needed to support widespread use of electronic identity authentication interactions between the public and government				●
Financial Management	Deliver responsive financial management capabilities, including centralized data, increased access, electronic recordkeeping, and improved reporting				●
Human Capital Management	Improve strategic management of the Department's human capital				●
IT Management	Facilitate the agencywide governance of information resources; include the practice of enterprise architecture and Capital Planning and Investment Control (CPII)				●
Facilities Management	Track assets and the provision of services related to those assets; include the operation of office buildings, space planning, and other capital assets that are possessions of the Department				●

Figure: Segment Alignment to Department Strategic Goals

¹⁷ http://www.whitehouse.gov/sites/default/files/omb/assets/fea_docs/FEA_Practice_Guidance_Nov_2007.pdf

3. Baseline Enterprise Architecture

The baseline enterprise architecture aligns the Department LoBs, or *segments*, to the FEAF Service Areas and articulates the segment type, mission, vision, goals, and major/key investments at the Department.

3.1. Segments and Key Investments at the Department of Education

Segment identification is a process that organizes and consolidates enterprise assets into logical groups aligned to a common purpose or service. The logical groups are classified as core mission, business services, and enterprise services. Grouping similar mission functions facilitates eliminating or merging redundant processes and investments, and improves enterprise data sharing.

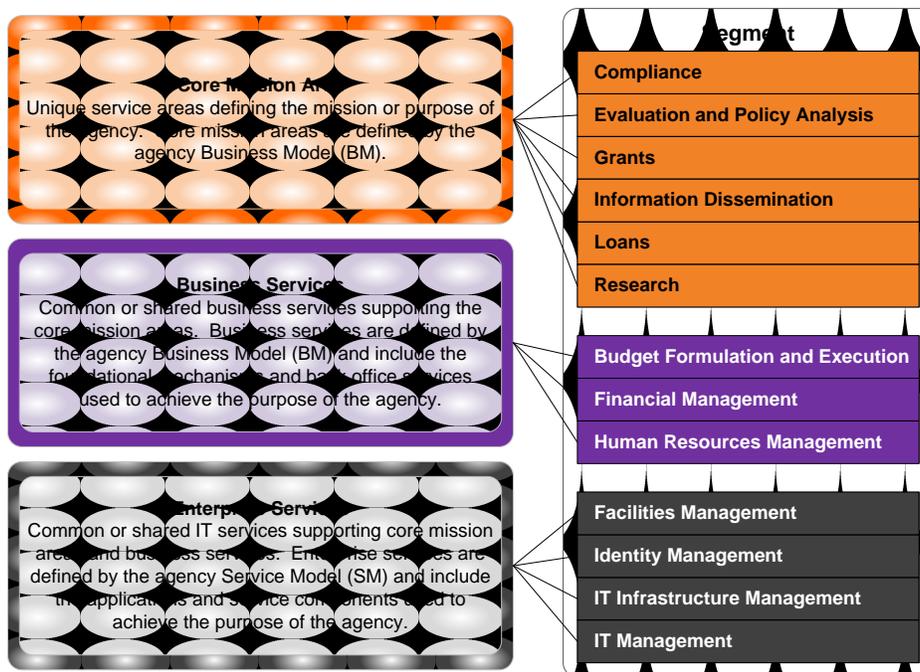


Figure: Department Architecture Segments Grouped in their Service Areas



The following table describes the segments that articulate the Department’s lines of business where:

Mission is a clear concise statement that defines what the agency does and presents the main purpose for its major functions and operations;

Vision is the succinct and strategic statement of the target business and information management environment to fulfill requirements, address change drivers, and achieve performance improvements; and

Goals are a specific result that a task would like to achieve, ideally associated with metrics.

Table: Segment Goals and Current Investments

Segment	Type	Mission	Vision	Goals	Major ¹⁸ /Key Investments
Compliance	Core Mission	To support the Department’s compliance with governing statutes, regulations, and directives. The segment’s investments also ensure consistent, high-quality enforcement and implementation of Federal laws, regulations, and agency policies and procedures, and provide guidance and support on the applicability of such laws, regulations, and policies.	The vision describes how the program office needs include: Streamlining the processes through the use of efficient, available, and reliable IT. Increased efficiency, availability, and reliability of the systems supporting Compliance to ensure effective law enforcement.	1. More efficient use of information resources. 2. Reduce the amount of time to manage processes (i.e., FOIAXpress amount of time to upload documents; scanning to produce PDFs). 3. Increase reliability and availability of systems while increasing overall quality control capacity.	1. OCR CAMS 2. OGC CAMS 3. FOIAXpress 4. OGC Knowledge Management System (KMG)

¹⁸ Major IRB-approved investments required to submit an Exhibit 300 are denoted by (*)



Segment	Type	Mission	Vision	Goals	Major ¹⁸ /Key Investments
Evaluation and Policy Analysis	Core Mission	To provide data and information services to support the management and evaluation of education programs.	The vision for the Evaluation and Policy Analysis Segment is a business process architecture that harmonizes performance data in a manner that provides immediately accessible and useful policy and performance-related information to meet the needs of business users, within and external to the Department. In this vision, the Evaluation and Policy Analysis Segment provides extended support for evidence-based policy, management, and budget decisions throughout the Department, including the consolidation and/or recasting of any data collections that business users deem useful for sharing information across organizations and functions.	1. Enable the use of EDFacts Data Warehouse (underlying Oracle) for other segment investments.	1. EDFacts*
				2. Create alternative designs for updating systems	
				3. Improve communication among investments within the segment	
				4. Fully integrate fiscal data (GAPS/G5) with performance data (segment investment), audit data (RMS) and program process data (monitoring artifacts)	
				5. Coordinate with groups drafting legal/policy changes	
Grants	Core Mission	To provide management of solicitation, award, monitoring, termination, and closeout of grants at the Department; streamlined discretionary and formula grants processes, common tools and technology solutions for grants processing; and improved grants risk management.	To improve performance of the grants line of business by creating a fully automated grants process by utilizing common tools, processes, and data to improve disbursement and effectiveness from funds distributed.	1. To improve the effectiveness of grant programs across the Department.	1. G5-Grants Management Re-Design*, 2. Grants Administration Payment System (GAPS)*
				2. To leverage the Department of Education's intellectual capital to create an end-to-end grant management solution for agency and Government wide use.	
				3. To align grants management investments to an overall plan and improve communication with Department stakeholders.	
				4. To create common business processes and tools in order to: streamline discretionary and formula grants processes; provide common tools and technology solutions; improve grants risk management.	



Segment	Type	Mission	Vision	Goals	Major ¹⁸ /Key Investments
Information Dissemination	Core Mission	<p>The mission of this segment is to:</p> <ol style="list-style-type: none"> 1. Project the Administration's message and support the Administration's goals 2. Help citizens find what they're looking for on the web, and help citizens complete their top tasks on the web. 	<p>The vision of the Information Dissemination segment is to maximize the impact and usefulness of information on the web, including social media, while minimizing cost to the Government (and public); and to ensure that when citizens and stakeholders visit Department websites and social media channels and profiles, so they:</p> <ul style="list-style-type: none"> - encounter information and tasks that, to the degree possible and appropriate, support the Administration's goals and priorities - find information they're looking for and complete their top tasks. 	<ol style="list-style-type: none"> 1. Improve management of agency websites and social medial profiles 2. Ensure that agency-related messages on the web and social media are on-message 3. Encourage low-cost, high-yield use of syndication and related emerging technologies by demonstrating at ED.gov how it can be done 4. Improve management of ED program information on the web 5. Increase awareness across the Department that accessibility is a requirement, along with transparency 	<ol style="list-style-type: none"> 1. ED Web* 2. Migrant Student Information Exchange (MSIX)*
Loans	Core Mission	To deliver financial aid efficiently and effectively.	To be the most trusted and reliable source of student financial aid, information, and services in the nation	<ol style="list-style-type: none"> 1. Provide superior service and information to students and borrowers 2. Work to ensure that all participants in the system of postsecondary education funding serve the interests of students, from policy to delivery 3. Develop efficient processes and effective capabilities that are among the best in the public and private sectors 4. Ensure program integrity and safeguard taxpayers' interests 5. Strengthen FSA's performance culture and become one of the best places to work in the federal government 	<ol style="list-style-type: none"> 1. Federal Student Aid Financial Management System (FSA FMS)* 2. Comprehensive Security Program* 3. Enterprise IT Services* 4. IT Infrastructure* 5. Integrated Partner Management* 6. Financial Partner Data Mart*



Segment	Type	Mission	Vision	Goals	Major ¹⁸ /Key Investments
Research	Core Mission	To provide greater awareness and timely access to evidence-based research. This mission will allow the Department to: improve educational outcomes for all students; track progress and trends in Education; identify problems and opportunities for policy improvement; manage and monitor Education programs; promote scientifically valid research findings in Education; and provide credible scientific evidence to answer questions of effectiveness in Education.	The vision describes how, through the increased use of technology, IES will develop/adapt systems that can be used to: 1) increase access to training via webinars and virtual on-line learning 2) provide secure remote access to restricted-use data via secure technology 3) increase use of technologies/methodologies for electronically collecting survey/evaluation data 4) electronically track grants awarded by IES 5) improve access to and dissemination of education information to practitioners, scholars, and agency staff and contractors.	<ol style="list-style-type: none"> 1. Increase access to training via webinars and virtual on-line learning 2. Provide secure remote access to restricted-use data via secure technology 3. Increase use of technologies/methodologies for electronically collecting survey/evaluation data 4. Electronically track grants awarded by IES 5. Improve access to and dissemination of education information to practitioners, scholars, and agency staff and contractors 	<ol style="list-style-type: none"> 1. Education Resources Information Center (ERIC)* 2. Integrated Post-secondary Education Data System (IPEDS)* 3. National Assessment of Educational Progress (NAEP)* 4. NCES Web Support*



Segment	Type	Mission	Vision	Goals	Major ¹⁸ /Key Investments
Budget Formulation and Execution	Business	To improve customer service and reduce Department operational risks by improving performance, providing a common technology platform for business applications, and facilitating better information management.	The vision is to improve end-to-end budget formulation processes through standardized practices and prudent application of automated information systems, made available from within the Department and through the BFELoB.	1. Publicize BFELoB products, tools, and services across major agencies and components to encourage/stimulate usage	1. Budget Formulation and Execution Line of Business*
				2. Develop and enhance BFE tools and capabilities for Government-wide use	
				3. Improve the administrative budget formulation process by automating the integration of budget text and numbers in budget submissions via the Budget Formulation Database (BFD)	
				4. Perform analysis to identify viable automated solutions to produce detailed budget table and State allocation table used by the Department, OMB, and congressional offices	
Financial Management	Business	To provide financial resource management, and reporting in accordance with Federal financial regulations.	The vision describes how the Financial Management Segment vision is to deliver responsive financial management capabilities, including centralized data, increased access, electronic recordkeeping, and improved reporting.	1. Modernize procurement systems	1. Contracts and Purchasing Support System (CPSS)* 2. Financial Management Support System (FMSS)* 3. Integrated Support Services (ISS)*
				2. Improve availability/ access to high quality data to managers and FMSS users	
				3. Comply with HSPD-12 requirements	
				4. Increase efficiency of Financial Management business processes	
				5. Move to a shared service solution	



Segment	Type	Mission	Vision	Goals	Major ¹⁸ /Key Investments
Human Capital Management	Business	To transform the Department of Education into a high performance, customer-focused organization by providing services to our customers that help them do a better job of managing their people, processes, and overall strategy.	The vision is to offer cost-effective, standardized, and interoperable human resource solutions providing common, core functionality to support the strategic management of human capital and addressing duplicative systems and processes.	1. Achieve cost savings/avoidance through Human Resource Line of Business participation	1. FPPS 2. Micropact
				2. Maintain satisfactory customer service rating in annual Departmental Organizational Assessment	
				3. Improve operational efficiencies in the acquisition, development, implementation, and operation of human resource systems	
Facilities Management	Enterprise Services	To track assets and provision of services related to those assets, to include the operation of office buildings, space planning, and other capital assets that are possessions of the Department.	The vision is to develop an integrated common Department-wide Facilities Management solution to improve use of facility resources and asset tracking.	1. Streamline business processes for managing the Department's assets	1. Database Management System (DMS)
				2. Integrate best practices in managing the Department's assets	
				3. Improve relationship with internal stakeholders to better manage the Department's assets	



Segment	Type	Mission	Vision	Goals	Major ¹⁸ /Key Investments
Information Assurance	Enterprise Services	To ensure the confidentiality, availability, integrity, and non-repudiation of information assets to provide continuity of the Department's services under all circumstances.	The vision is to achieve an agile, effective, and cost-efficient approach to Information Assurance Services that are focused on people, processes, technology, and aligned with the Department's business needs.	1. Improve information assurance training, awareness, and education to enhance the workforce	1. OVMS 2. EDSTAR 3. Identity Management 4. Cyberwatch 5. Security Authorization
				2. Improve the protection, detection, response, and remediation against cyber incidents and events	
				3. Enhance continuous monitoring of information security	
				4. Establish a comprehensive, near real-time, corporate risk management capability	
				5. Strengthen and maintain the trusted and resilient information and communications infrastructure	
IT Infrastructure Management	Enterprise Services	To manage all the common IT resources such as hardware, software, networks, facilities, and services that are required to design, develop, test, deliver, monitor, control, support, maintain, or manage IT services used to support or deliver either Mission, Business, or Enterprise applications.	The vision is to improve customer service and reduce Department operational risks by improving performance, providing a common technology platform for business applications, and facilitating better information management.	1. Implement common services to meet program office business needs	1. EDUCATE*
				2. Reduce operational risk of the Department's operations	
				3. Improve the performance of the Department's operations and the ability to measure that performance and establish accountability	
				4. Increase the provision of common technology platforms for business applications in order to increase compliance with Federal mandates such as Domain Name System SECurity (DNSSEC), Trusted Internet Connection (TIC) and others	



Segment	Type	Mission	Vision	Goals	Major ¹⁸ /Key Investments
IT Management	Enterprise Services	To provide high quality Information Resource Management (IRM) planning and investment management services to the Department.	The vision sets the Department’s vision for increased performance by providing a totally automated mechanism for collecting, analyzing, and reporting the data necessary to efficiently and effectively manage the Department’s IT Portfolio.	1. Implement an integrated EA, CPIC, and IV&V data repository 2. Define and implement EA, CPIC, and IV&V process integration and process automation	1. EA 2. ITIM Support Services 3. IV&V 4. CIO Innovation

3.2. Alignment to the Federal Business Reference Model (BRM)

The FEAFF equips OMB and Federal agencies with a common language and framework to describe and analyze investments, enhance collaboration, and ultimately transform the Federal Government. The FEAFF consists of a set of interrelated “reference models” designed to facilitate cross-agency analysis and the identification of duplicative investments, gaps, and opportunities for collaboration within and across agencies. Collectively, the reference models comprise a framework for describing important elements of federal agency operations in a common and consistent way. Through the use of this common framework and vocabulary, agency investments can be better managed and leveraged across the Federal Government.

The Business Reference Model (BRM) Lines of Business and Sub-Functions provide a framework facilitating a functional view of the Federal Government’s LoBs. The following graphic depicts the most common Federal LoBs wherein 10 or more Department investments align.

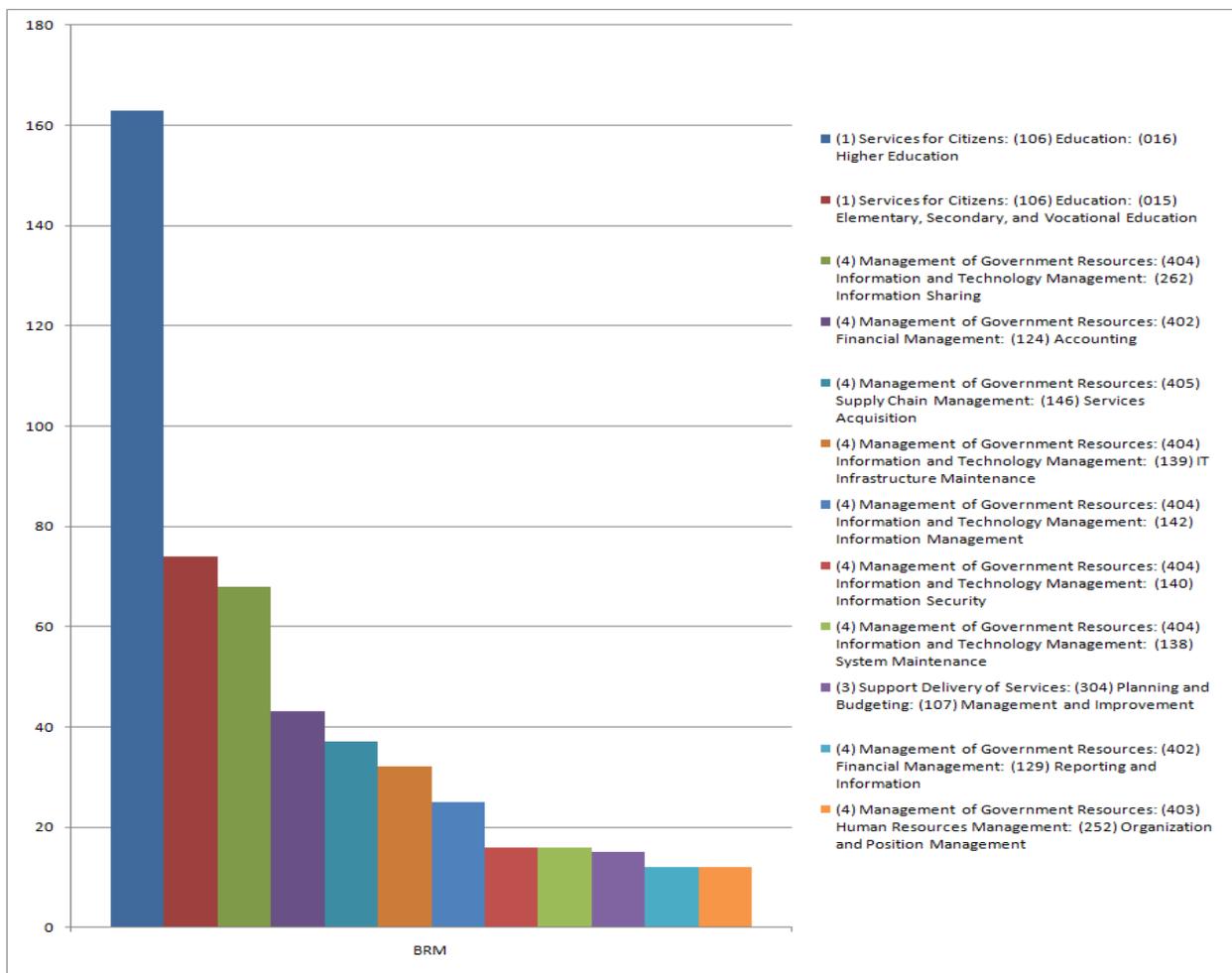


Figure: Business Reference Model Analysis of the Department's Portfolio¹⁹

3.3. Alignment to the Federal Service Reference Model (SRM)

The Service Reference Model (SRM) Service Types and Components provide a framework classifying Service Components according to the capabilities they provide to business functions. The following graphic depicts the most common SRMs wherein 10 or more Department investments align.

¹⁹ Data for this figure was derived from the Segment Modernization Plans produced by each segment

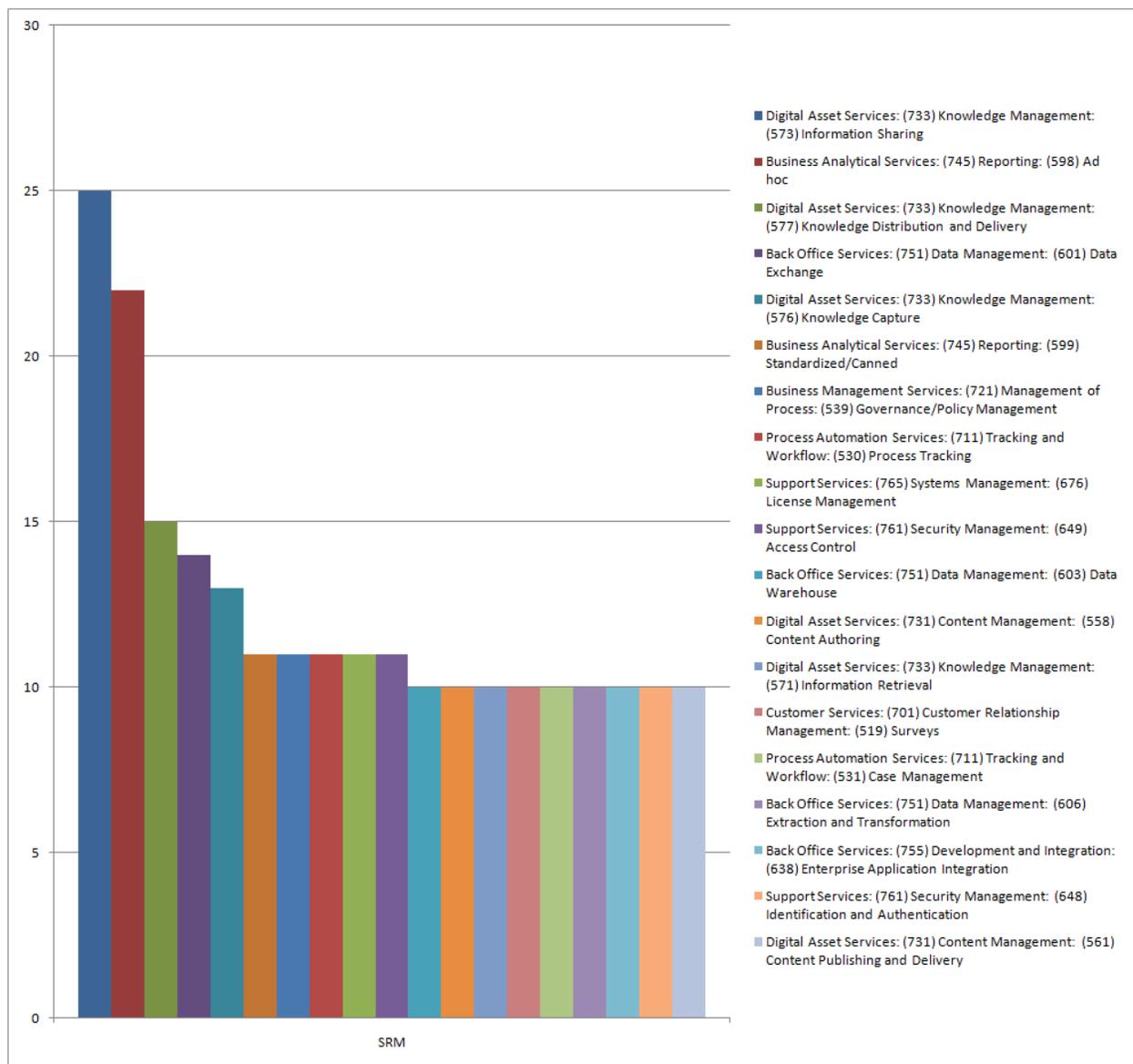


Figure: Service Reference Model Analysis of the Department's Portfolio²⁰

3.4. Simplified Department of Education Service Reference Model (SRM)

A Service Reference Model (SRM) is a business and performance-driven, functional framework that classifies services that investments provide. http://en.wikipedia.org/wiki/Federal_Enterprise_Architecture_-_cite_note-WH05-0 The SRM is used to support the discovery of enterprise-wide business and application services. The SRM provides a foundation to support the reuse of applications, application capabilities, components, and business services. The SRM is classified by the following domains:

²⁰ Data for this figure was derived from the Segment Modernization Plans produced by each segment



- Customer Services,
- Process Automation Services,
- Business Management Services,
- Digital Asset Services,
- Business Analytical Services,
- Back Office Services, and
- Support Services.

At the Department, the Federal SRM was customized to highlight the SRM components that focused on the Department’s mission. The figure below presents the Department’s process for developing the “Simplified” Department (SRM) Components where an analysis of the FEA SRM was done and those applicable to the Department were extracted.

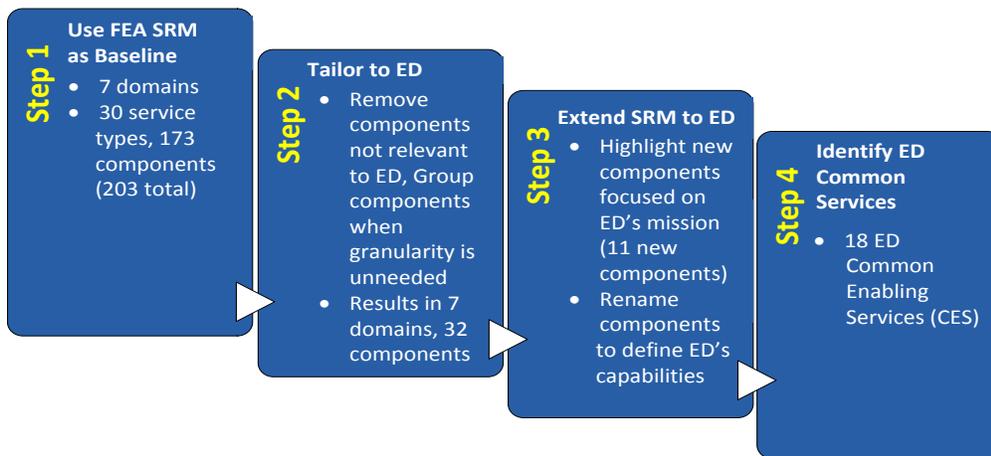


Figure: Simplified Service Reference Model at the Department

The resulting, simplified Department SRM consisted of 43 common components tailored to the Department and its business functions. The simplified SRM components are detailed in the following table.



Table: Simplified Department Service Reference Model Components

SRM Domains	Simplified Department SRM Component Types	SRM Domains	Simplified Department SRM Component Types	
Customer Services	1. Customer Management	Business Analytical Services	20. Analysis and Statistics	
	2. Portal Management		21. Report Management	
	3. Data Collection		<i>Data Warehouse</i>	
	4. Grants Application Management		<i>Performance Management</i>	
Process Automation Services	<i>Work Management</i>	Back Office Services	22. Assets Management	
	5. Correspondence Management		23. Facilities Management	
	6. Case Management		24. Mail Management	
7. Work Management	25. Data Management			
Business Management Services	8. Performance Management		26. Data Mart	
	9. Portfolio Management		27. Data Warehouse	
	10. Strategic Planning and Management		28. IT Integration	
	11. Grants Monitoring		29. IT Development	
	12. IT Change Management		30. HR Management	
	13. Program/Project Management		31. Travel	
	14. Contracts and Procurement		32. Financial Budgeting	
<i>IT Development</i>	33. Financial Management			
Digital Asset Services	15. Content Management		Support Services	34. Grants Financial Management
	16. Document Management			35. Collaboration
	17. Grants Document Management	36. Telephony		
	18. Knowledge Management	37. Web Cast		
	19. Records Management	38. Grants Review Management		
<i>Data Collection</i>	39. Legal Management			
		40. Web Information Search		
		41. IT Security		
		42. Physical Security		
		43. IT Infrastructure		
		<i>Data Collection</i>		

Note: Components in **Red** denote new service components created specifically for the Department's use.

Components that are assigned multiple domains are in *italics*. Those *italicized* components are numbered and in bold in their primary domain.



3.5. Common Enabling Services (CES) at the Department

The Department’s EA identified 18 common services representing enterprise-wide capabilities that would improve the performance of IT investments to meet business goals. These 18 common enabling services and their descriptions are listed in the table below.

Common Enabling Service	Description
Case Management	Manage the life cycle of a particular claim or investigation (include creating, routing, tracking, assignment, and closing of a case and case handler collaboration).
Collaboration Management	Allow people to work together more efficiently by enabling greater information sharing.
Customer Management	Support the retention and delivery of a service or product to an organization’s clients.
Data Management	Usage, processing, and general administration of unstructured information.
Document/Record/Content Management	Control the capture and maintenance of an organization’s documents and files.
Knowledge Management	Support the identification, gathering, and transformation of documents, reports, and other sources into meaningful information.
Mobility Tools	Tools that enable mobile computing.
Network, Storage, and Computing Platforms	Hardware and software for networking and storage.
Operations Support	IT hardware, software, and technical support for ongoing operations and maintenance.
Performance Management	Measure the effectiveness of an organization and/or its assets.
Portal Management	Allow customers to proactively seek assistance and service from an organization, personalize a user interface, and support the search of specific data from a data source.
Report Management	Support the organization of data into useful information.
Security and Privacy	Tools that support confidentiality, integrity, and availability.
SOA, Enabling Platforms	Service Oriented Architecture (Inter-operable Standards).
Statistical and Analysis Tools	Support the examination of business issues, problems, and their solutions.
Survey Design Tools	Tools enabling the collection of information from customers.
Survey Management	Collect useful information from customers.
Work Management	Allow the monitoring of activities within a business process.
Other	Services needed by your investments that can be considered as an enterprise-wide service candidate.



During the segment modernization workshops in fiscal year 2010, each segment determined capabilities (currently met and unmet by existing investments) to achieve the segment’s performance goals. The following figure shows the CES’s requested from the segments along with the number of segments requesting the need for the service.

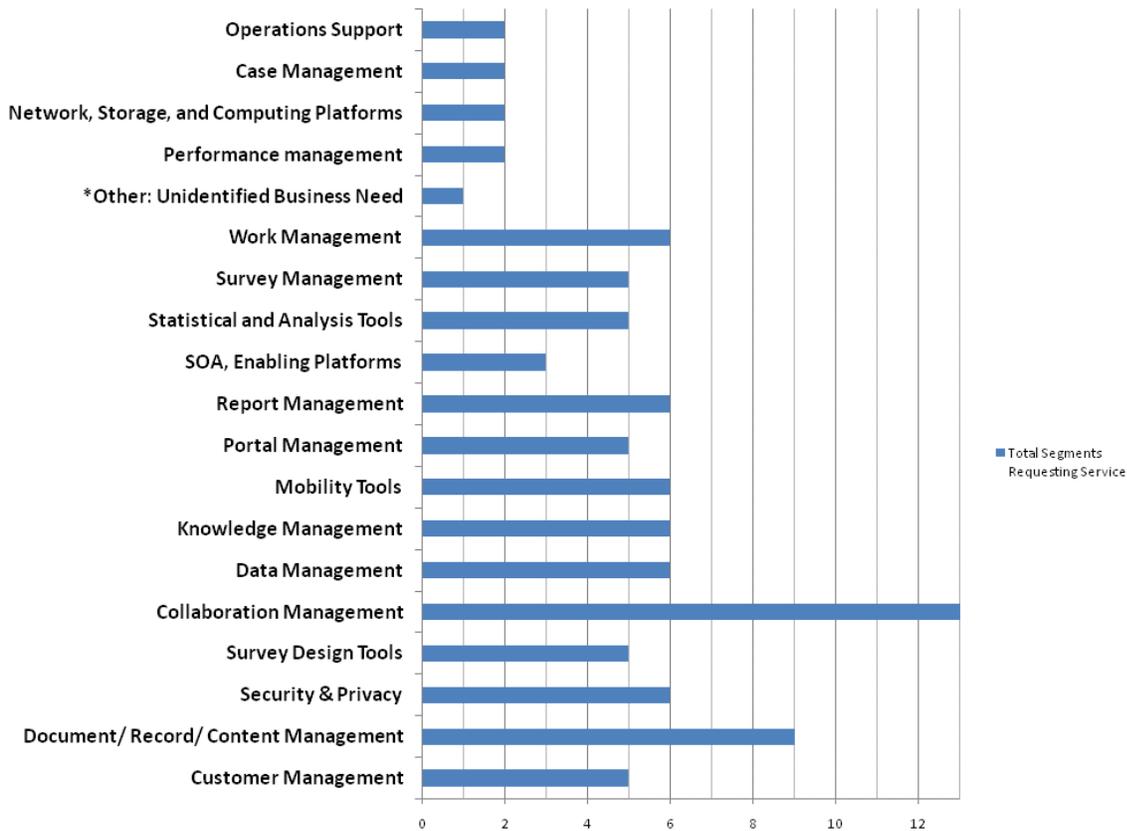


Figure: Total Segments Requesting CES

Source: EAAC Presentation, April 15, 2010

In summary, in fiscal year 2010 the Department’s business stakeholders selected work management, report management, knowledge management, data management, document/record/content management, collaboration management, security and privacy, and mobility tools as their top needs.²¹ Collaboration and document/record/content management strongly lead the list of those services requested.

²¹ Top needs are determined by the most frequently requested services across the segments. Those services requested by 6 or more segments were considered top needs.



To determine prioritization of CES requests, the EA team scored the CES requests based on

- Number of segments requesting the service,
- Priority of the request over other CES's as identified by the segment owner²²,
- Ease of integration into the Department's current network infrastructure,
- Urgency of which the service is required, and
- External Departmental drivers.

These criteria were applied based on segment owner input, resulting in a prioritized list of services. The following figure provides the prioritization ratings for each CES requested, suggesting an order for implementation. The figure suggests that Collaboration Management and Document/Record/Content Management are the highest priority services requested at the Department.



Figure: CES Prioritization Score

²² A segment owner is the Department executive identified as a sponsor for the Line of Business that the segment represents. The segment owner plans and manages the vision for a segment and ensures the segment's alignment to the Department's strategic business goals.



4. Target Architecture

A target architecture defines a vision of future business operations. The target architecture gives decision makers a better understanding of information requirements while identifying shared information opportunities. A target architecture represents enhancements to the existing baseline architecture while supporting existing business operations.

4.1. *Department Target Architecture*

The Department of Education’s target defines how future services operate and are to be delivered to stakeholders. The Department’s goal for implementing the target architectural vision has two main objectives:

- Implementing the vision outlined by the Department’s business needs—the *Departmental Architectural Vision*; and
- Compliance with Federal-driven initiatives and requirements—the *Federal Architectural Vision*.

4.2. *Implementing the Departmental Architectural Vision*

This section outlines the Department’s architectural vision and addresses the governance processes used to implement that vision.

4.2.1. **Implementing High-Priority Requested Services**

The foundation of the defined services is the management of knowledge and related documents and records that support the formulation and execution of the Department’s programs. Based on analysis of the CES’s identified by the Department’s segments, the most requested services can be grouped into two categories: knowledge-driven business and document-centric business.

Knowledge-driven and document-centric business processes are the core drivers at the Department. The Department’s vision is to use and extend existing technology where available, developing toolsets that are better, faster and cheaper. These technologies are extensions of those with which stakeholders are already familiar and would support knowledge-driven and document-centric business processes.

Knowledge-Driven Business Processes (Collaboration Management)

Information places data into a meaningful pattern. A knowledge-driven business uses that information effectively to affect change. Collecting information from the people generating it and connecting the information with the people who need it increases the speed, efficiency, and performance of business processes.

Listed below are the key capabilities required to support knowledge-driven business processes at the Department:



- Identify the key sources of information;
- Collect the information in common repositories;
- Connect users to those sources;
- Provide mechanisms to distribute information efficiently and securely to those who need it; and
- Facilitate collaboration between subject matter experts and consumers.

Document-Centric processes (Document/Record/Content Management)

Records management is, as defined by the National Institute on Standards and Technology (NIST)²³, the process for tagging information for records-keeping requirements as mandated in the Federal Records Act²⁴ and the National Archives and Records Administration (NARA)²⁵. Document management controls the capture and maintenance of an organization's documents and files.

At the Department, information enters organizations in many ways. A comprehensive system must be able to accommodate that information, regardless of format, and integrate that information into existing business process workflows. These processes and workflows must be scalable and build on an open architecture that supports efficient and systematic control of organizational documents and records to include their creation, collection, use, management and preservation. The target architecture utilizes the existing document management systems to ensure the most efficient use of hardware, databases, content/records management systems, and related network infrastructures.

4.2.2. The Department's Standardized System Development Life Cycle

Implementing these new services and the existing services provided at the Department is done through the careful management of their development lifecycle. The Department's Life Cycle Management (LCM) Framework²⁶ provides the foundation for the implementation of standards, processes, and procedures for acquiring and developing IT solutions. The Framework is a structured approach of required stages, key activities, and core deliverables that provides a foundation for aligning existing interrelated processes such as, the OCIO's IT Governance and Capital Planning and Investment Control (CPIC) processes, OCFO's Acquisition process, and processes associated with project management, used in delivering IT solutions. The Framework is composed of six stages:

²³ <http://csrc.nist.gov/publications/nistir/ir7298-rev1/nistir-7298-revision1.pdf>

²⁴ <http://www.archives.gov/about/laws/fed-agencies.html>

²⁵ <http://www.archives.gov/about/laws/nara.html>

²⁶ <http://www2.ed.gov/fund/contract/about/acs/acsocio1106.doc>



- 1) Vision;
- 2) Definition;
- 3) Construction and Validation;
- 4) Implementation;
- 5) Support and Improvement; and
- 6) Retirement

Each stage consists of required key activities and core deliverables that must be completed for entry into the next stage. A stage gate review is conducted by the EA review board at designated points in the LCM Framework to ensure the key activities, core deliverables, and any additional deliverables required for that stage have been completed. Any deviations from this process must be approved in writing by the CIO.

The Framework is flexible concerning core deliverable length and the addition of deliverables to accommodate solutions with varying cost, complexity and time constraints. By using this Framework directive, the Department will realize the following benefits:

- A single reference to inform Department employees of expectations, activities, and core deliverables associated with IT solutions acquisition and development;
- Improved product quality and reduced rework by establishing standard business and technical reviews throughout the development of IT solutions;
- Improved oversight by encouraging and enabling integrated and coordinated reviews;
- Improved performance management of projects through review of project cost and schedule in alignment with the Department’s mission or objectives.

This is a mechanism by which projects can define their deliverables against the scope of the IT solution and improve the quality of information used in the IT investment process.

Detailed information about the LCM framework can be found in the Administrative Communication System (ACS) Departmental Directive document OCIO 1-106.²⁷

4.2.3. IT Governance for Change Management at the Department

The key IT Governance components for Change Management for the Department’s IT processes are performed by the Enterprise Architecture Review Board (EARB) and the Change Advisory Board (CAB.)

EARB

Governing the implementation of these new and existing services at the Department occurs through the EARB. The EARB is a forum for the governance of the Department’s EA and serves

²⁷ <http://www2.ed.gov/fund/contract/about/acs/ac socio1106.doc>



as a committee supporting the Enterprise Architecture Advisory Committee (EAAC). The EAAC, composed of the Department's senior business leaders, provides initial review and approval of an IT investment's compliance with the Department's EA. The EARB is responsible for performing technical reviews to assess (1) standards compliance, (2) technical design, and (3) opportunities for service and technical component standards reuse where recommendations will be made to the EAAC. The EARB principal responsibilities are to

- Ensure that the Department's IT investments are compliant with the Department's infrastructure and technical standards by reviewing their compliance with the Department's EA standards,
- Conduct stage gate reviews of information system development projects in accordance with the Department Lifecycle Management Governance process,
- Evaluate technology requirements put forward by the Department point of contacts for inclusion in the EDUCATE IT Services Catalog and use within the EDUCATE IT Infrastructure,
- Maintain a comprehensive service catalog that Departmental business owners can use to identify and implement common services to address common business needs. The Service Catalog will be developed in compliance with the FEA SRM,
- Develop and maintain the Department's technical standards in compliance with the FEA TRM. Each TRM component must map to the appropriate SRM component(s) clearly demonstrating the technology enabling the services identified in the Service Catalog, and
- Ensure interoperability of Department IT systems through compliance with Department Enterprise Architecture standards.

Detailed information on the EARB and its processes can be found on the Department's intranet in the following documents: EARB Charter and Purchasing Hardware/Software (Process).

Change Advisory Board (CAB)

The CAB meets weekly to assess changes with a focus on

- Assessing proposed changes for impact,
- Providing a mechanism for review, approval, and communication of changes,
- Ensuring appropriate scheduling of changes and resource availability for implementation and validation, and
- Supporting adherence to change management policies and procedures.

4.3. *Implementing the Federal Architectural Vision*

This section articulates Federal requirements that affect the planning and direction of the Department's architectural vision.



4.3.1. The Department's ETP Alignment With FEA LoB Initiatives

The FEA Program has three core principles:

- Strategic plans and executive level directions achieve business driven objectives;
- FEA success depends on proactive involvement and collaboration across the Federal Government; and
- Improvements in efficiencies and effectiveness of government information resources are through architecture.

The Department's ETP and its segments reflect many of the Federal LoB initiatives and are in support of the FEA core principles. The following Federal LoB initiatives align with the Department's lines of business indicated in parentheses.

Financial Management (Financial Management)

Improve the cost, quality, and performance of an organization's financials by reducing non-compliant systems by leveraging common standards, shared service solutions, and implementing other Government-wide reforms that foster efficiencies in Federal financial operations.

Grants Management (Grants Management)

Provide a common solution to support end-to-end grants management activities that promote citizen access, customer service, and agency financial and technical stewardship.

Human Resources Management (Human Capital Management)

The Government-wide, modern, cost effective, standardized, and interoperable Human Resource solutions provide common core functionality to support the strategic management of Human Capital.

Information Systems Security (Information Assurance)

The Federal Government's information systems security program enables agencies' mission objectives through a comprehensive and consistently implemented set of risk-based, cost-effective controls and measures that adequately protects information contained in Federal Government information systems.

Budget Formulation and Execution (Budget Formulation and Execution)

Modern, interoperable, flexible, cost effective, and optimized solutions support all phases of the formulation and execution of the Federal Budget and link budget formulation, execution, planning, performance, and financial information.



IT Infrastructure (IT Infrastructure)

An effective and efficient IT infrastructure enables Government-wide customer-centric services. The IT Infrastructure LoB identifies opportunities for IT infrastructure consolidation and optimization, and develops Government-wide common solutions. This LoB defines specific common performance measures for service levels and costs, identifies best practices, and develops guidance for transition plans within agencies and/or across agencies. Consolidation and optimization of IT infrastructure represents a significant opportunity to realize future cost savings by taking a more coordinated approach to spending on commodity IT infrastructure. IT infrastructure consolidation and optimization case studies also demonstrate how agencies could improve IT service levels and, when relieved of the burden of managing these non-core functions, can concentrate more on mission priorities and results.

4.3.2. Cloud First

The NIST defines cloud computing as a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.²⁸ This cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models.

The Federal CIO has also published a directive²⁹ that requires agencies to identify within three months three “must move” IT services to be moved to a cloud computing environment. The directive also states that the Department move one of those services to the cloud within 12 months and the remaining two within 18 months.

The Department is actively evaluating a number of cloud computing opportunities. Among those are: the Civil Rights Data Collection (CRDC) in the Office of Planning, Evaluation and Policy Development (OPEPD); Infrastructure as a Service (IaaS); and cloud-based e-mail by way of Messaging as a Service (MaaS).

4.3.3. Internet Protocol Version 6 (IPv6)

Use of the Internet is critical to performing the Department of Education’s mission and delivery of its services to citizens. The current communications protocol of the Internet, IPv4, has run out of unique addresses and is being replaced by a new protocol, IPv6.

On September 28, 2010, the Federal CIO issued a memo instructing all agencies to transition to native IPv6 according to the following schedule³⁰.

²⁸ <http://csrc.nist.gov/groups/SNS/cloud-computing/cloud-def-v15.doc>

²⁹ 25-Point Implementation Plan to Reform Federal IT; Kundra, Vivek; December 09, 2010, p. 7

³⁰ <http://www.cio.gov/documents/IPv6MemoFINAL.pdf>



1. Upgrade public/external facing servers and services (e.g. web, email, DNS, ISP services, etc.) to operationally use native IPv6 by the end of FY 2012
2. Upgrade internal client applications that communicate with public Internet servers and supporting enterprise networks to operationally use native IPv6 by the end of FY 2014
3. Designate an IPv6 Transition Manager to serve as the person responsible for leading the agency's IPv6 transition activities, and liaison with the wider Federal IPv6 effort as necessary
4. Ensure agency procurements of networked IT comply with FAR requirements for use of the USGv6 Profile and Test Program for the completeness and quality of their IPv6 capabilities

The Department is deploying IPv6 across its networks, applications, systems, and services to ensure its ability to operate on the Internet of the future.

4.3.4. Homeland Security Presidential Directive 12 (HSPD-12)

HSPD-12 is a Presidential directive requiring all Federal executive departments and agencies to implement a Government-wide standard for secure and reliable forms of access for employees and contractors to Federal facilities and information systems and designates the major milestones for implementation.³¹ HSPD-12 is a component of a federated Identity, Credential, and Access Management (ICAM) framework.

The Department is progressing in the implementation of HSPD-12. The Department has met the goals of HSPD-12 physical access and is currently on schedule with implementing mandatory HSPD-12 logical access by September 30, 2011.

4.3.5. 25-Point Implementation Plan to Reform Federal Information Technology Management

The Federal CIO has published a plan for productivity improvements in IT to achieve operational efficiency and manage large-scale IT programs effectively.³² The table below describes the objectives of that plan.

³¹ http://www.dhs.gov/xabout/laws/gc_1217616624097.shtm

³² <http://cio.gov/documents/25-Point-Implementation-Plan-to-Reform-Federal%20IT.pdf>



Table: 25-Point Implementation Plan to Reform Federal Information Technology Management

Apply “Light Technology” and Shared Solutions

Point	Explanation	Owner(s)
1	Complete detailed implementation plans to consolidate 88 data centers by 2015	OMB, Agencies
2	Create a Government-wide marketplace for data center availability	OMB, GSA
3	Shift to a “Cloud First” policy	OMB, Agencies
4	Stand-up contract vehicles for secure IaaS solutions	GSA
5	Stand-up contract vehicles for “commodity” services	GSA
6	Develop a strategy for shared services	Federal CIO

Strengthen Program Management

Point	Explanation	Owner(s)
7	Design a formal IT program management career path	OPM, OMB
8	Scale IT program management career path	OPM, Agencies
9	Require Integrated Program Teams	OMB
10	Launch a best practices collaboration platform	Federal CIO Council
11	Launch technology fellow program	Federal CIO
12	Enable IT program manager mobility across Government and industry	OMB, CIO Council, OPM

Align the Acquisition and Budget Processes with the Technology Cycle

Point	Explanation	Owner(s)
13	Design and develop cadre of specialized IT acquisition professionals	OMB, Agencies
14	Identify IT acquisition best practices and adopt Government-wide	OFPP
15	Issue contracting guidance and templates to support modular development	OFPP
16	Reduce barriers to entry for small innovative technology companies	SBA, GSA, OFPP
17	Work with Congress to create IT budget models that align with modular development	OMB, Agencies
18	Develop supporting materials and guidance for flexible IT budget models	OMB, CFO Council, CIO Council
19	Work with Congress to scale flexible IT budget models more broadly	OMB, Agencies
20	Work with Congress to consolidate Commodity IT spending under Agency CIO	OMB, Agencies

Streamline Governance and Improve Accountability

Point	Explanation	Owner(s)
21	Reform and strengthen Investment Review Boards	OMB, Agencies
22	Redefine role of Agency CIOs and Federal CIO	Federal CIO, Agency CIOs
23	Rollout “TechStat” model at bureau-level	Agency CIOs

Increase Engagement with Industry

Point	Explanation	Owner(s)
24	Launch ‘myth-busters’ education campaign	OFPP
25	Launch an interactive platform for pre-RFP agency-industry collaboration	GSA

The Department is complying with the 25-point implementation plan by identifying implementation dates and artifacts of agency-owned items in the *Recommendations* section of this document.



5. Recommendations

This section defines transitional steps to approach the Department’s target architecture that supports the 25-Point Implementation Plan to Reform Federal Information Technology Management.³³

5.1. Addressing the Department’s Target Vision

In summarizing the 2010 CES requests by the Department’s business stakeholders, the following common services were the most requested by the Department’s LoBs.

- document/record/content management
- collaboration management
- knowledge management
- work management
- report management
- data management
- security and privacy
- mobility tools

Through the prioritization process outlined in the *Baseline Enterprise Architecture* section of this document, collaboration and document/record/content management strongly lead the prioritized list of those services most requested.

5.1.1. Knowledge-Driven Business Productivity

A unified productivity platform provides a set of common services that integrate and work together on a common platform. A unified collaboration solution is the most effective way to connect people, processes, and information across an organization. A unified productivity platform will enable stakeholders to quickly adapt, scale, and extend the platform in response to shifting business needs.

To provide a unified productivity platform, the Department recommends extending the collaboration and document management solution—Microsoft Sharepoint—that was put in place in fiscal year 2011. By integrating SharePoint with Microsoft Office, the Department can improve its ability to collaborate and develop work products using tools that are already in place.

5.1.2. Document and Records Management

To provide an enterprise records management capability the Department recommends expanding the use of HP TRIM. HP Trim is a Department of Defense (DoD) 5015.3-standard Compliant Records Management Application (RMA). The DoD 5015, Ver. 3, Electronic RMA Design Criteria Standard serves as the required RMA standard for DoD agencies and is recommended by NARA for Executive level agencies. HP/TRIM, Autonomy Corporation, and ORACLE are the only three Joint Interoperability Test Command (JITC) certified RM platforms certified to handle Privacy Act and Freedom of Information Act records management. HP TRIM is

³³ <http://cio.gov/documents/25-Point-Implementation-Plan-to-Reform-Federal%20IT.pdf>



currently being used by the GEMS and TRIM TRIO systems in the Grants Management segment, and there are plans to expand its use.

SharePoint, Microsoft Office Productivity Suite, and HP TRIM create the foundation for a unified productivity platform that can be used to build and support LoB applications such as GEMS, TRIM TRIO, and others. An example of using the integration of the Microsoft Office Productivity Suite and TRIM can be found in Office of Special Education and Rehabilitative Services' TRIO application, which uses Microsoft Outlook folders to manage grant correspondence documents and grant folders containing email, word processing documents and PDF files that are all stored in HP TRIM. Using the proposed productivity platform, the Department will be able to utilize the various common enabling services that are provided to create other automated business support applications. The diagram below illustrates this unified productivity platform followed by a table that links each LoB-requested CES to the proposed technology that meets that need.

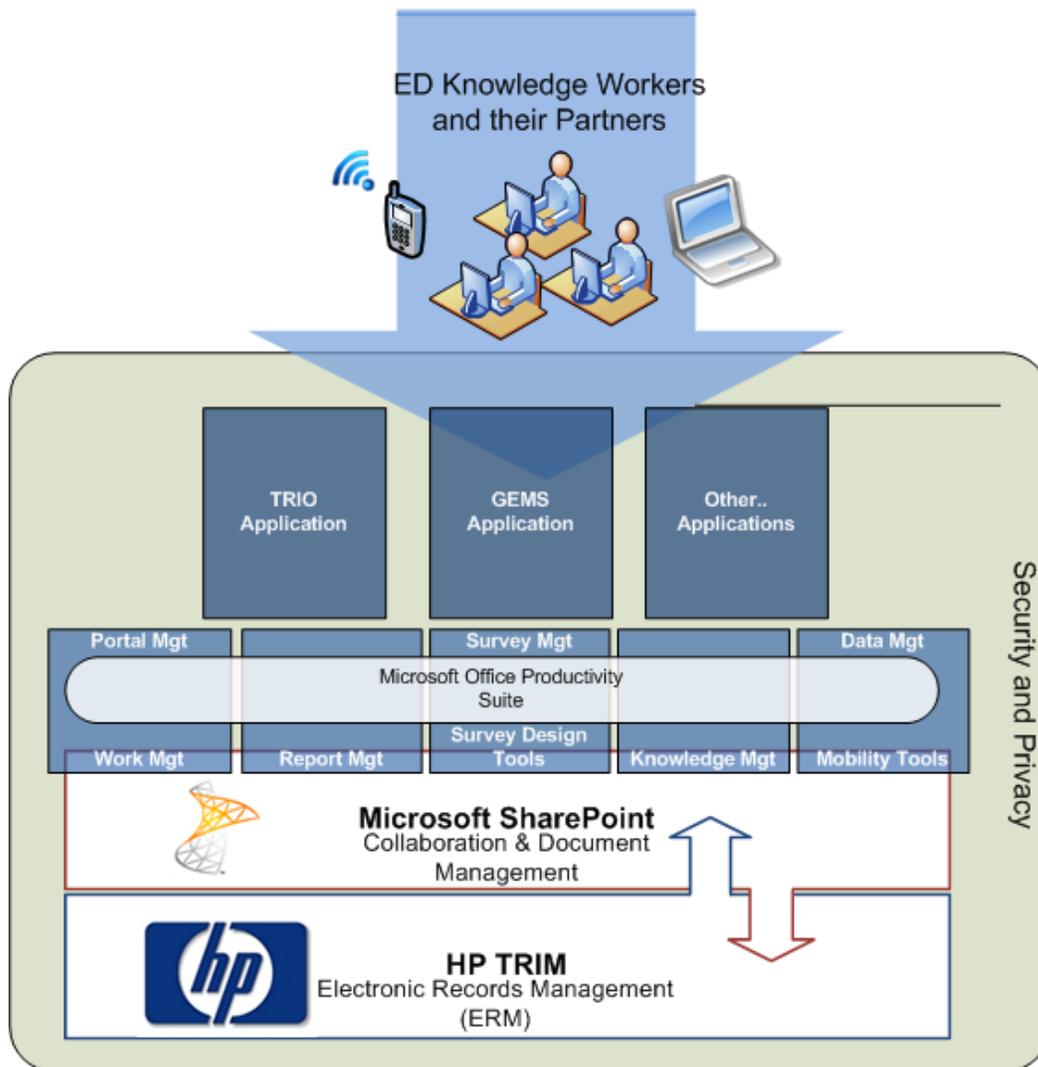


Figure: Unified Productivity Platform



Table: The Department’s Technology Vision

Technology	Supported Business Functionality
Microsoft Office	Work Management, Mobiliy Tools, Survey Design Tools
Microsoft SQL Server	Data Management, Report Management
Microsoft SharePoint	Collaboration Management, Document/Record/Content Management, Survey Management, Portal Management
Microsoft OS Software	Security and Privacy, Mobiliy Tools
Microsoft Exchange, Outlook	Work Management, Knowledge Management, Data Management, Collaboration Management
Microsoft InfoPath	Report Management, Work Management, Knowledge Management, Data Management, Document/Record/Content Management
HP TRIM	Document and Records Management

5.2. Addressing Federal Requirements

This section identifies the steps the Department uses to address key Federal requirements while achieving the Department’s target vision. Also, this section details how the Department is adhering to the agency level directives to achieve operational efficiency and program effectiveness.

5.2.1. Cloud First

The Cloud First objective in the Federal CIO directive³⁴ is to apply light technology and shared solution services at the Department. All segment investments will explore the use of shared services, and consideration will be given to using cloud as an alternative.

To address the Federal CIO Directive requiring agencies to identify three “must move” IT services to be hosted in a cloud computing environment, the Department has recommended the services in the following table:

Table: Recommended Cloud Computing Services

Identified Service/System	Federal Directive Move-By Date	Move-By Date Status	Comments
OPEPD’s Civil Rights Data Collection	April 2012 (12 months from April 2011)	Currently in place	Utilizes Amazon’s EC2 Cloud using Appian Anywhere Business Process Management suite
Infrastructure as a Service (IaaS)	October 2012 (18 months months from April 2011)	Currently in place	Virtual Server Offerings via EDUCATE
Messaging as a Service (MaaS) –	October 2012	October 2012	

³⁴ <http://cio.gov/documents/25-Point-Implementation-Plan-to-Reform-Federal%20IT.pdf>



E-mail	(18 months months from April 2011)		
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5.2.2. Internet Protocol Version 6 (IPv6)

The Department’s IPv6 transition plan is a critical component of the EA practice and describes the overall plan utilizing IPv6 on the agency’s networks. The transition plan provides guidance in the areas of IT governance, security, procurement, and capital planning. It is the Department’s goal to utilize technology refresh to replace devices and applications and budget for future remediation requirements as the plan is implemented as detailed in the IPv6 transition plan.

5.2.3. Homeland Security Presidential Directive 12 (HSPD-12)

HSPD-12 will impact the Department because it has to implement the mandatory, Government-wide standard for secure and reliable forms of identification for Federal employees and contractors. The standard has been issued by the Department of Commerce—the Federal Information Processing Standard 201 (FIPS 201). The following table shows the Department’s HSPD-12 implementation milestones.

Table: HSPD-12 Implementation Milestones

Date	Implementation Milestones
6/27/2005	Implementation plans submitted to OMB
8/26/2005	Identify federally controlled facilities, information systems, and other Federal applications that are important for security that use the FIPS 201 standard in circumstances not covered by HSPD-12 directive
10/27/2005	<ul style="list-style-type: none"> ▪ Comply with FIPS 201, Part 1 ▪ Adopt and accredit a registration process ▪ Initiate the National Agency Check with Written Inquiries (NACI) or other suitable national security investigation prior to credential issuance ▪ Include FIPS 201 implementation language in applicable new contracts ▪ Develop a plan for current employees/contractors and begin the required background investigation
10/27/2006	<ul style="list-style-type: none"> ▪ Begin compliance with FIPS 201, Part 2 ▪ Deploy products and operational systems to issue and require the use of identity credentials for all new employees and contractors ▪ Implement the technical requirements of the FIPS 201 ▪ Risk based facility access ▪ Use of digital certificates
10/27/2007	Verify and/or complete background investigation for all current employees and contractors
10/28/2008	Complete background investigations for all employees employed over 15 years
1/15/2009	Issue personal identification verification (PIV) cards to Department employees
6/15/2009	Conduct PIV card pilot for physical access
1/15/2010	Conduct PIV card pilot for logical access
3/15/2010	Begin production use of PIV card for physical and logical access



06/2010-09/2011	Continue to enhance physical and logical access controls Mandatory PIV LAC Full Deployment 4Q 2011 Two-Factor Authentication (Application Level) Proof of Concept 3Q 2011 PIV MAC 3Q 2011
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5.2.4. 25-Point Implementation Plan

The table below contains a recommendation of agency-owned action items from the “25 Point Implementation Plan to Reform Federal Information Technology Management”³⁵ and details the Department’s artifacts and implementation dates.

Table: Department Alignment with 25-Point Implementation Plan

Point	Explanation	Artifact	Implementation Date
1	Complete detailed implementation plans to consolidate 88 data centers by 2015	U.S. Department of Education Data Center Consolidation Plan	08/31/2010
3	Shift to a “Cloud First” policy	Through modernization planning, all IT investments will identify cloud and shared service opportunities	03/30/2010
21	Reform and strengthen Investment Review Boards	Implement “TechStat” model at Agency	03/2011
22	Redefine role of Agency CIOs and Federal CIO	Implement “TechStat” model at Agency	03/2011
23	Rollout “TechStat” model at bureau-level	Implement “TechStat” model at Agency	03/2011

5.3. Enterprise Sequencing Plan

The Department’s sequencing plan spans five calendar years (2011-2015) and attempts to align key segment objectives and major investments with their relative completion dates. This sequencing plan enables a high-level impact assessment of investment decisions and programmatic changes on the Department’s overall plan for moving toward the Department’s target enterprise architecture.

The sequencing plan is provided in two parts. First, the goals and objectives of the Department’s segments are outlined with their projected completion dates. Second, the Department’s major investments—used to support the segment goals and objectives—are listed along with the planned LCM status dates.

³⁵ <http://cio.gov/documents/25-Point-Implementation-Plan-to-Reform-Federal%20IT.pdf>



5.3.1. Segment Goals and Objectives Sequencing

The following table identifies the projected completion date for each segment goal's objective. A completion date can be defined as either:

- a) The date the objective is projected to be achieved; or
- b) The next date the objective is to be measured.

In the instance that the objective is to be measured, the segment's modernization plan will provide further detail as to the measurement indicator used for measurement.



Table: Consolidated Sequencing Plan for Segments Goals and Objectives

Segment	Segment Goal Completion Milestone	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Compliance	Goal 1: More efficient use of information resources.					
	Objective: Ensure compatibility of different systems within the segment.					
	Goal 2: Streamline document-centric business processes to reduce paperwork.					
	Objective: Decrease the amount of time needed to upload documents.					
	Goal 3: Increase reliability and availability of systems while increasing overall quality control capacity.					
	Objective: Ensure availability of data within system remains at acceptable levels.					
Evaluation and Policy Analysis	Goal 1: Enable use of the Department’s Facts Data Warehouse for other segment investments.					
	Objective: Automated connection with the Department’s Data Express					
	Objective: Establish common statistical analysis tools for RMS and the Department’s Facts.					
	Goal 2: Create alternative designs for updating systems.					
	Objective: Completion of alternatives analysis for future Department Facts designs.					
	Objective: Award of contract for operations of new VPS system.					
	Objective: Requirements for online access to data from Civil Rights Data Coll.					
	Goal 3: Improve communication among investments within the segment.					
	Objective: Pre-Select Phase Meeting.					
	Objective: Post-Select Phase Meeting.					
	Goal 4: Develop linking table to fully integrate fiscal data with performance data.					
	Objective: Proof of concept ‘linking table’ with DUNS numbers and LEAIDs, NCES school IDs, or IPEDS Institution IDs.					
	Objective: Complete a proof of concept study into the development of common practices and tools to improve the quality of K-12 performance data.					
	Goal 5: Coordinate with groups drafting legal/policy changes.					
	Objective: Policy office update for investment owners.					
Grants	Goal 1: To improve the effectiveness of Grant programs across the Department.					
	Objective: Reduce grant cycle time.					
	Objective: Document and workflow management.					
	Goal 2: Leverage the Department of Education’s intellectual capital to create an end-to-end grant management solution for agency and Government wide use.					
	Objective: Grants Management COE Charter.					
	Objective: Policy and procedures defined for grants management processes.					
	Goal 3: Align Grants Management Investments to an overall plan and improve communication with Department stakeholders.					
	Objective: Align major investments with modernization activities.					
	Goal 4: Create common business processes and tools in order to: Streamline discretionary and formula grants processes; Provide common tools and technology solutions; Improve Grants risk management.					
	Objective: Document and workflow management.					
	Objective: Electronic signatures.					
	Objective: Single sign-on.					
	Objective: Grant monitoring automation.					
	Objective: Automated alerts and notifications.					
	Objective: Electronic grant folders.					



Segment	Segment Goal Completion Milestone	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Information Dissemination	Goal 1: Improve management of agency websites and social medial profiles.					
	Objective: Identify and report the universe of Department-supported websites and social media profiles.					
	Objective: Gather, analyze, and report web usage statistics across agency websites and social media profiles.					
	Goal 2: Ensure that agency-related messages on the web and social media are on-message.					
	Objective: Develop the audit plan.					
	Objective: Execute the audit plan.					
	Objective: Compile the results of the audit plan.					
	Objective: Analyze the results of the audit plan.					
	Objective: Report the results of the audit plan.					
	Goal 3: Encourage low-cost, high-yield use of syndication and related emerging technologies by demonstrating at ED.gov how it can be done.					
	Objective: Implement at ED.gov or related sites at least 3 uses of syndication or emerging technologies.					
	Goal 4: Improve management of Department program information on the web.					
	Objective: Developing and presenting to senior management a detailed vision of how program information should be managed at the Department and a roadmap or plan for how we can get there.					
	Goal 5: Increase awareness across the Department that accessibility is a requirement, along with transparency.					
Objective: Participating in meetings with senior leadership and regular meetings with the accessibility team, which has the lead on an Department-wide accessibility campaign that includes Department-wide communications, training, and support.						
Loans ³⁶	Goal 1: Provide superior service and information to students and borrowers					
	Objective: Take a data-driven approach to better understand our students and borrowers and develop insights from these customers					
	Objective: Reach out to potential students more effectively to expand access to higher education, especially for nontraditional students					
	Objective: Aggregate and distribute information on the costs and benefits of higher education programs and on funding options to support the customers' decision-making					
	Objective: Identify students for whom financial assistance can make a difference in completing a degree or credential and develop a plan to support the president's 2020 college completion goal					
	Objective: Enhance customer-facing processes to improve the customer experience					
	Goal 2: Work to ensure that all participants in the system of postsecondary education funding serve the interests of students, from policy to delivery					
	Objective: Improve Federal Student Aid (FSA) support, communications, and processes for postsecondary institutions and financial partners					
	Objective: Provide ideas, data, and analyses to inform policymakers about opportunities and challenges in higher education funding					
	Objective: Support system participants in completing the transition laid out by the Health Care and Education Reconciliation Act and other future legislation					
	Goal 3: Develop efficient processes and effective capabilities that are among the best in the public and private sectors					
Objective: Deliver funds to students accurately, promptly, and professionally, to create high levels of customer satisfaction						

³⁶ As provided in the Federal Student Aid 5-year plan:
http://federalstudentaid.ed.gov/static/gw/docs/FiveYearPlan_2011.pdf



Segment	Segment Goal Completion Milestone	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	
	Objective: Strengthen FSA's IT function to complete systems integration, modernization, and to maintain IT security	*measured yearly					
	Objective: Refine FSA's acquisition strategy, acquisition processes, and performance management	*measured yearly					
	Objective: Improve the organizational capacity to anticipate and handle external change	*measured yearly					
	Objective: Enhance the risk management organization, systems, and processes	*measured yearly					
	Objective: Evaluate administrative cost structures and streamline internal operations to increase efficiency and productivity	*measured yearly					
	Objective: Build stronger business management capabilities and increase operational transparency to improve cross-functional coordination	*measured yearly					
	Goal 4: Ensure program integrity and safeguard taxpayers' interests						
	Objective: Improve quality control and reduce errors, waste, fraud, abuse, and mismanagement on the part of postsecondary institutions and financial partners to minimize program losses	*measured yearly					
	Objective: Manage unpaid obligations and provide transparency about portfolio risk exposure	*measured yearly					
	Goal 5: Strengthen FSA's performance culture and become one of the best places to work in the federal government						
	Objective: Improve human capital processes to attract, develop, and retain talent, and help FSA employees achieve their full performance potential	*measured yearly					
	Objective: Further develop a student-centric culture among all managers and employees that will fully deliver on FSA's mission, vision, and strategy	*measured yearly					
	Research	Goal 1: Increase access to training via webinars and virtual on-line learning.					
Objective: Evaluate existing solutions.							
Objective: Increase the number of users while decreasing cost.							
Goal 2: Provide secure remote access to restricted-use data via secure technology.							
Objective: Develop a plan to identify conditions in which a Restricted Use dataset can be released in a secure online environment.							
Objective: Develop a secure electronic environment for the download and analysis of restricted use survey/evaluation data.							
Objective: Make restricted use datasets available.							
Goal 3: Increase use of technologies/methodologies for electronically collecting survey/evaluation data.							
Objective: Submit a plan for how surveys, evaluations, and/or assessments will utilize electronic methodologies for collecting data.							
Objective: Increase the utilization of electronic technologies for IES surveys, evaluations, and/or assessments over prior administrations.							
Goal 4: Electronically track grants awarded by IES.							
Objective: Develop and submit a statement of work to adapt the GEMS system.							
Goal 5: Improve access to and dissemination of education information to practitioners, scholars, and agency staff and contractors.							
Objective: Promote and provide enhanced online access to selected education resources.							
Objective: Expand ERIC capacity to support service to mobile, hand-held devices.							
Objective: Apply Web 2.0 technologies to support ERIC users in virtual communities.							
Objective: Apply digital and archival technologies to preserve and make accessible documents.							



Segment	Segment Goal Completion Milestone	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
	Objective: Create and maintain digital collections of journals, Government documents, and other print resources.					
Budget Formulation and Execution	Goal 1: Publicize BFE LoB products, tools, and services across major agencies and components to encourage/stimulate usage.					
	Objective: Update marketing and outreach plan.					
	Objective: Execute the marketing plan in at least 10 new agencies/components.					
	Goal 2: Develop and enhance BFE tools and capabilities for Government-wide use.					
	Objective: Develop a quick application to share data with MAX.					
	Objective: Ensure that at least 3 agencies actively use MAX Analytics.					
	Goal 3: Improve the administrative budget formulation process by automating the integration of budget text and numbers in budget submissions via the Budget Formulation Database.					
	Objective: Automated integration of budget text and tables functionality in the BFD.					
	Objective: Tags for integrated budget text and table for two admin accounts.					
	Goal 4: Perform analysis to identify viable automated solutions to produce the detailed budget table and State allocation table used by the Department, OMB, and congressional offices.					
	Objective: Analysis of as-is process —including strengths and limitations.					
	Objective: Requirements for detailed budget tables and State allocation tables.					
Financial Management	Goal 1: Modernize procurement systems.					
	Objective: Determine feasibility of obtaining new procurement system.					
	Objective: Award a new procurement system contract.					
	Goal 2: Improve availability/access to high quality data to managers and FMSS users.					
	Objective: Improve the availability of data to managers and other users of the FMSS.					
	Goal 3: Comply with HSPD-12 requirements.					
	Objective: Implement 2-factor authentication for CPSS.					
	Objective: Implement 2-factor authentication for FMSS.					
	Goal 4: Increase efficiency of Financial Management business processes.					
	Objective: Eliminate receipt and processing of paper invoices.					
	Objective: Develop automated processes for managing invoices.					
	Objective: Migrate CheckFree investment to a web based system.					
Goal 5: Move to a Shared Service Solution.						
Objective: Migrate to a new ETS2 contract, a Shared Service solution.						
Human Capital Management	Goal 1: Achieve cost savings/avoidance through Human Resource Line of Business participation.					
	Objective: Partner with HR LoB to achieve economies of scale.					
	Objective: Utilize HR LoB common core systems to reduce use of duplicate systems and labor resources.					
	Goal 2: Maintain satisfactory customer service rating in annual Department Organizational Assessment.					
	Objective: Leverage eGov online training to create a knowledge workforce.					
	Objective: Web access to extensive personalized and automated human resource services.					
	Goal 3: Improve operational efficiencies in the acquisition, development, implementation, and operation of human resource systems.					
	Objective: Web access to extensive personalized and automated human resource services.					
	Objective: Enhance automated system for workforce planning and on-boarding.					
Objective: Integrate systems with Federal Personnel Payroll System (FPPS).						



Segment	Segment Goal Completion Milestone	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Facilities Management	Goal 1: Streamline business processes for managing the Department's assets.					
	Objective: Develop electronic forms.					
	Objective: Develop automated asset tracking capability.					
	Goal 2: Integrate best practices in managing the Department's assets.					
	Objective: Update the Department Facility Management Guide with updates from National Property Management Association (NPMA) and General Services Administration (GSA).					
	Goal 3: Improve relationship with internal stakeholders to better manage the Department's assets.					
	Objective: Conduct meetings with the Office of Management.					
Information Assurance	Objective: Conduct periodic meetings with Regional principal office coordinators.					
	Goal 1: Establish Information Assurance Governance					
	Objective: Strengthen policy, guidelines and instructions					
	Objective: Partner for strength					
	Objective: Develop the Information Assurance workforce					
	Objective: Establish an Information Assurance metrics program					
	Goal 2: Design for a Secure Enterprise					
	Objective: Enhance the Risk Management framework					
	Objective: Design security into systems up front					
	Objective: Design and implement an integrated Identity Management System to support the enterprise					
	Objective: Establish an enterprise network defense architecture					
	Goal 3: Build a strong network defense framework					
	Objective: Establish a network defense framework					
	Objective: Understand our network environment					
	Objective: Prevent or delay attackers from getting in					
Objective: Prevent an attacker from maintaining access						
Objective: Update Department image baselines to the FDCC/USGCB baseline.						
IT Infrastructure Management	Goal 1: Implement common services to meet program office business needs.					
	Objective: Renegotiate printer service, records management, and assistive technology service components to better serve the Department technically and financially.					
	Objective: Improve service acquisition process to speed delivery by reducing the timeframe needed to add service catalog items and acquire existing service catalog items.					
	Goal 2: Reduce operational risk of the Department's operations.					
	Objective: Improve efficiency by enabling external assessments of the environment and implementing recommended changes.					
	Objective: Improve contractor technology management through comprehensive deliverable and service evaluations and feedback.					
	Goal 3: Improve the performance of the Department's operations and the ability to measure that performance and establish accountability.					
	Objective: Shift weight of service level agreements to drive performance in key operational and customer-focused service areas.					
	Objective: Renegotiate specific SLAs to better align with Department goals.					
	Goal 4: Increase the provision of common technology platforms for business applications in order to increase compliance with federal mandates.					
	Objective: Will execute the technology changes required to meet federal DNSSEC compliance.					
Objective: Will execute the technology changes required to meet federal TIC requirements.						
IT	Goal 1: Implement an integrated EA, CPIC, and IV&V data repository.					



Segment	Segment Goal Completion Milestone	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	
Management	Objective: Determine integrated data requirements for integrated data tool for the EA and CPIC teams.						
	Objective: Objective: Identify tool (integration point) for EA-CPIC data integration.						
	Objective: Migrate to integrated EA-CPIC tool.						
	Objective: EA-CPIC/K Drive Migration.						
	Goal 2: Define and implement EA, CPIC, and IV&V process integration and process automation.						
	Objective: Define process integration requirements.						
	Objective: Implement EARB process automation with collaboration tool.						
	Objective: Migrate to CPIC tool integrated to OMB Dashboard.						
	Goal 3: Initiate plan for Enterprise common enabling services.						
	Objective: Identify and implement a baseline records management solution for the Department.						
	Objective: Identify and implement a collaboration management solution for the Department.						

5.3.2. Major Investment Lifecycle Sequencing

The Department’s investments are in place to support the Department’s business goals and objectives. The Department has a set of high-priority investments known as “major investments” that are key to the success of the Department’s mission and business needs. The following table lists these major investments, identifies their related segment, and indicates the investment’s planned Lifecycle Management (LCM) stage. Each investment’s lifecycle management stage is determined by the planned funding categorization it provides as part of its CPIC business case (known as the OMB Exhibit 300). The comparison between the lifecycle management stage and the CPIC funding phase is provided in the legend immediately following the list of segments.



		2011	2012	2013	2014	2015
Education Resources Information Center (ERIC)	RESEARCH	[Orange]				[Blue]
Integrated Postsecondary Education Data System (IPEDS)	RESEARCH	[Orange]				
National Assessment of Educational Progress (NAEP)	RESEARCH	[Orange]				
ED Web	INFORMATION DISS.	[Orange]				
Migrant Student Information Exchange (MSIX)	INFORMATION DISS.	[Orange]				
NCES Web Support	RESEARCH	[Blue]				
Federal Student Aid Financial Management System (FSA FMS)	LOANS	[Blue]				
Comprehensive Security Program	LOANS	[Blue]				
Enterprise IT Services (Consolidated ITA/EAI)	LOANS	[Blue]			[Black]	[Black]
IT Infrastructure (consolidated Virtual Data Center [VDC])	LOANS	[Blue]				
Integrated Partner Management (IPM)	LOANS	[Red]	[Orange]			[Blue]
Financial Partners Data Mart	LOANS	[Orange]	[Blue]	[Orange]	[Blue]	[Blue]
GS - Grants Management Re-Design	GRANTS	[Orange]				
Grants Administration Payment System (GAPS)	GRANTS	[Blue]	[Black]	[Black]	[Black]	[Black]
Budget Formulation and Execution Line of Business	BF&E	[Orange]				
EDFacts (formerly Education Data Exchange Network (EDEN))	EVALUATION	[Orange]				
Contracts and Purchasing Support System (CPSS)	FINANCIAL MANAGEMENT	[Orange]				
Financial Management Support System (FMSS)	FINANCIAL MANAGEMENT	[Orange]				
Integrated Support Service (ISS)	FINANCIAL MANAGEMENT	[Blue]				
EDUCATE	IT INFRASTRUCTURE	[Blue]				
Central Processing System (CPS)	LOANS	[Orange]			[Blue]	[Black]
ECampus Based Systems and Operation	LOANS	[Blue]	[Orange]			[Blue]
National Student Loan Database System (NSLDS)	LOANS	[Orange]			[Blue]	[Blue]
Person Record Management Service (PRMS)	LOANS	[Green]	[Red]	[Red]	[Orange]	[Orange]
Integrated Student View (ISV)	LOANS	[Green]	[Red]	[Red]	[Orange]	[Orange]
Enterprise Data Warehouse	LOANS	[Blue]	[Orange]	[Blue]	[Blue]	[Blue]
Common Services for Borrowers (CSB)	LOANS	[Green]	[Red]	[Red]	[Red]	[Blue]
Common Origination and Disbursement System (COD)	LOANS	[Orange]				

Figure: Major Department Investments, Related Segments and Planned Lifecycle Stages³⁷

ED LCM Stage	CPIC Lifecycle Category
[Green]	Planning
[Red]	Acquisition
[Blue]	Operation and Maintenance
[Orange]	Mixed Lifecycle
[Black]	

Figure: Legend of LCM Stages and CPIC Lifecycle Categories

³⁷ Note: This information is the IRB-approved portfolio as of April 20, 2011.

