Federal Student Aid
An OFFICE of the U.S. DEPARTMENT of EDUCATION

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Technology Standards and Products Guide

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FINAL

Document Version Control

Version	Date	Description
1.0	November 2, 2001	Provided general updates under TO 55.
2.0	January 25, 2002	Reformatted document to align with the Department of Education Policy document and updated document to reflect new standards and products.
2.1	February 12, 2002	Updated document with client feedback. Renamed document title.
2.2	March 29, 2002	Included updates from 1/15/2002 to 3/15/2002 in Federal Student Aid standards, products, and policies. Added an Application Development section.
2.3	June 30, 2002	Incorporated planned ITA upgrades, added an executive summary, added Mobile Devices to Network Services section, added External Connections to External Environment section, and updated several version numbers.
3.0	September 27, 2002	Updated to include minor version number changes and other architectural changes. Reflects all updates through revision date.
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4.0	August 1, 2003	Updated to include minor version number changes and other architectural changes. Reflects all updates through revision date.
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4.2	May 2005	Introduced the Metadata management category, added products to be provided with ADvance and CSB contracts.
5.0	December 2005	Populated the Metadata management category. Revised and added the software for ADvance and CSB contracts. Removed the Data Strategy section and all references to it. Updated the EDM text as well as Data Modeling. Removed the minimum PC Specifications and all references to it. Added a new Appendix A – Reusable Common Services (RCS) and Portlets. Reflects all updates through revision date.
5.1	February 2006	Added “FileNet” as the Document Management Standard. Changed “WebSphere Application Server 6.0” to “WebSphere Process Server 6.0”.
5.2	June 2006	Updated DRM information, updated web sites, added in Common Operating Environment (COE) Diagrams, updated language.
6.0	July 2007	Document renamed to Technology Standards and Products Guide and re-organized to facilitate architecture understanding, re-categorized products and standards to align with FEA TRM. Removed version numbers from product listing to facilitate maintenance. Evergreen process will provide the current version of products in the environment.

Version	Date	Description
6.1	June 2008	Added the following to Table 3-2, “Service Access and Delivery Channels”: Documentum eRoom, BMC Control Cron, Flash, and Cisco PIX VPN. Changed text in IP Version from IPv4 to IP v6. Added the following to Table 3-3,”component Framework”: Clickcommerce (Formerly BTRADE), Siebel Analytics, WebFocus, WebTrends, Verisign, SiteScope, CA UniCenter, Oracle Enterprise Manager and, WBI Monitor. Added IIS information analyzer, Data stage, quality stage, and xml registry and repository. Added following to Table 3-4, “Service Interface and Integration Standards”: System Architect, Informatica and updated the link to Design Principles of ESB Architectural model and Application Architectural Model (Pg. 28), added Embarcadero ER/Studio Deleted the following from Table 3-4: WebSphere Datapower XML Accelerator XA 35. In Table 3-5: Removed WebSphere Business Modeler. Added the following “Service Platforms and Infrastructure”: FileNet, Interwoven Teamsite, IBM Workplace Web Content Management (WCM), IBM WebSphere Integration Developer, IBM Rational Application Developer, IBM Rational Systems Architect, Mainfarme Z Series, 990, HP, Sun, JProbe, Microsoft Office, WinZip, IBM Rational Test Manager,, Performance Testing, and Unit Testing, added “Data standardization” under the service standard, Modeling. In section 2.3.7, replaced the Operating system Open VMS with Z/OS. Added ‘WCM” to Appendix A. Deleted all intranet links in the document to void broken links.
6.2	September 2008	Deleted entire section on Information Technology Architecture Added Architecture Overview as a reference in Section 1.5 Added mystartingline.ed.gov in Table 2-2 as an intranet service standard In Table 2-2, changed the intranet service standard, “The Starting Line” from Federal Student Aid Standard to Federal Student Aid contained Added HP Portfolio and Project management in Table 2-2 Deleted CWM in Table 2-3. Added link for XMI. Added WebSphere Service Registry and Repository in Table 2-4 Renamed IBM Portal factory in Table 2-5 to IBM Portlet factory Added IBM Rational Software Modeler in Table 2-5 Added text on Architecture overview in Section 2, “Service Specifications”
6.3	July 2009	Incorporated the Technical Standards Mosaic. This version has been revamped and re-aligned using Technical Standards Mosaic as the basis for classifying technologies and products
6.4	October 2010	Updated the document to include new technology standards, classify technologies slated for phase out, as well as general document reorganization.

Version	Date	Description
7.0 Draft	April 2012	Updated draft document to incorporate the new Federal Student Aid Technology Classification Framework. Updated document based on stakeholder feedback.
7.0 Draft	August 2012	Incorporated feedback received through ECCB members.
7.0 Final	September 2012	Incorporated feedback received through ERB members.
7.1 Draft	April 2015	▪ Updated References and Related Documents. ▪ Updated the following Technology Capabilities: - Table 3: Desktop and Productivity Technology Domain Standards (Personal Productivity, Collaboration Software and, Business Intelligence and Data Warehouse Platforms) - Table 4: Application Environment Technology Domain Standards (Application Delivery Platform, Software Engines, Integration Software and, Database Management Systems) - Table 5: Hardware Devices and Systems Software Technology Domain Standards (Operating Systems and Utilities, and Storage) - Table 6: Network and Computer Accommodation Technology Domain Standards (Network) - Table 7: Management and Control Technology Domain Standards (Systems Management and Security Management)
7.2	September 2016	▪ Updated subsections 1.3 Intended Audience, 1.4 Document Organization and 1.5 References and Related Documents. ▪ Updated the following Technology Capabilities: - Table 3: Desktop and Productivity Technology Domain Standards (Collaboration Software and, Business Intelligence and Data Warehouse Platforms) - Table 4: Application Environment Technology Domain Standards (Application Development Software, Application Delivery Platform, Software Engines, Integration Software and, Database Management Systems) - Table 5: Hardware Devices and Systems Software Technology Domain Standards (Servers, and Storage) - Table 6: Network and Computer Accommodation Technology Domain Standards (Network, and Bandwidth and Connectivity) - Table 7: Management and Control Technology Domain Standards (Systems Management and Security Management) ▪ Added Section 3 FSA Technology Standards that profiles the technology standards used to support the FSA enterprise architecture.

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Executive Summary

The Federal Student Aid (FSA) Technology Standards and Products Guide (TSPG) provides an organized, systematic way of classifying technologies employed by Federal Student Aid and provides a basis for understanding the technologies supporting the development and maintenance of Federal Student Aid's information technology (IT) infrastructure.

The TSPG identifies FSA technologies through a classification framework that categorizes FSA software, services, and hardware according to their primary capabilities.

The TSPG further augments its classification framework by denoting the products and services that will help Federal Student Aid achieve its Target State Vision. The scheme identifies the status of each technology in the classification framework as follows:

- **Federal Student Aid Standard** – The technologies and products that have been approved for enterprise business use and are currently deployed.
- **Federal Student Aid Target** – The technologies and products that facilitate the achievement of the Target State Vision.
- **Federal Student Phase Out** – The technologies and products approved for specific business needs (not to be expanded by the investment beyond the identified need). These can be further defined as legacy products in use prior to the establishment of the component-based architecture and *Administrative/Internal Use Only*, which have been deemed suitable only for internal development and administrative use.

Other technology standardization classifications that have been identified and may be implemented in future versions of this document include the following:

- **Government Standard** – Standards mandated and maintained by the Federal Government.
- **ED Standard** – General use specifications maintained at the Department level or accepted de-facto within a given segment (i.e., Network standards).

The adoption of enterprise-wide standards promotes interoperability, scalability, and enables cost effective acquisition and development of systems and applications to meet Federal Student Aid's business needs. The TSPG is intended to promote a smooth transition from current to future technologies, but it does not attempt to provide a prioritized, scheduled transition plan for moving toward a desired future state.

1. Introduction

1.1 Purpose

The TSPG is a guide for Federal Student Aid architects, business stakeholders, project managers, system administrators, application developers, procurement personnel, and others who require guidance on implementing Federal Student Aid technology standards.

The primary purpose of the TSPG is to enable architects to identify opportunities to leverage technology, alleviate redundancy, and highlight instances in which technology overlaps limit the value of IT investments.

This guide addresses the fundamental technologies comprising FSA's infrastructure, and it focuses on standards and products that promote managed services within a reliable and secure environment. The TSPG is a critical component of a comprehensive effort to align government-wide investments in information technology with the needs of Federal Student Aid.

The TSPG is not intended to serve as a comprehensive list of all products in use within Federal Student Aid. Rather, it is the set of identifiable current and target technology standards, aimed at supporting achievement of the Target State Vision.

1.2 Scope

The TSPG lists the preferred technologies and products that promote transition from the current technical architecture to the envisioned technical architecture as described in the Federal Student Aid Target State Vision.

The adoption of enterprise-wide standards promotes interoperability, scalability, and enables cost effective acquisition and development of systems and applications to meet Federal Student Aid's business needs. The TSPG is intended to promote a smooth transition from current to future technologies, but it does not attempt to provide a prioritized, scheduled transition plan for moving toward a desired future state.

1.3 Intended Audience

This guide is intended for all FSA personnel, including current and potential vendors, who are involved in the management, development, and support of Federal Student Aid's general support systems and, major and minor applications. This guide is intended to assist those individuals in understanding and applying relevant technology standards to their respective systems and applications.

The table below lists the intended users for the Federal Student Aid Technology Standards and Products Guide, the document sections most relevant for each type of user, and the purpose for which the users may use the information in this Guide.

Table 1: Intended Audience and Document Usage

Users	Relevant Sections	Uses
Federal Student Aid Executives / Federal Student Aid Business Owners & Technology Office Staff	All	Facilitates and communicates an organized, systematic way of classifying the information technology infrastructure
Federal Student Aid Architects	All	Facilitates understanding of Federal Student Aid's technology infrastructure and promotes reuse by identification of standards
Vendors	All	Communicates the technology infrastructure and identifies standards, and technologies that support the construction, delivery, and maintenance of Federal Student Aid IT applications

1.4 Document Organization

This guide is comprised of the following sections:

- **Section 1. Introduction** - This section addresses the purpose, scope, audience, document organization and related references.
- **Section 2. Technology Classification Framework** – This section profiles the technologies and standards used to support Federal Student Aid Service Components classified by the Technology Classification Framework.
- **Section 3. FSA Technology Standards** – This section profiles the technology standards used to support the FSA enterprise architecture.

1.5 References and Related Documents

Federal Student Aid's Technology Standards and Products Guide was developed to support Federal Student Aid's business operations in compliance with the laws, regulations, and guidance listed below:

- Clinger-Cohen Act of 1996: Requires agencies to implement IT management processes, integrate management and budget processes, inventory IT investments, and designate a Chief Information Officer
- OMB Circular A-11: Requires agencies to submit plans and progress on their enterprise architectures
- OMB Circular A-130: Requires that Federal agencies create Enterprise Architecture and update OMB as significant changes are made
- Paperwork Reduction Act of 1995: Requires Federal agencies to be more responsible and publicly accountable for reducing the burden of Federal paperwork
- The Government Paperwork Elimination Act (GPEA): Requires agencies to leverage improved network technologies by improving electronic transactions

- The E-Government Act of 2002 (P.L. 107-347): Requires agencies to support e-Government projects and to leverage cross-agency initiatives to further e-Government. It also requires agencies to submit privacy impact assessments for all new IT investments using personally identifiable data from or about members of the public
- The Federal Records Act of 1950: Requires Federal agencies to establish and maintain a continuing program for the economical and efficient management of agency records. Electronic records created or received by the Federal Government must be managed as Federal records
- Government Performance Results Act of 2010: Requires that Federal agencies accurately employ performance metrics to measure and report performance results related to IT investments
- Federal Information Security Management Act (44 U.S.C. 3544): Specifies standards and requirements for securely managing information and information systems, with guidance provided by the Department of Commerce's National Institute of Standards and Technology (NIST).
- The Common Approach to Federal Enterprise Architecture: Requires Agency Heads to develop and maintain an agency-wide enterprise architecture that integrates strategic drivers, business requirements, and technology solutions.
- OMB Circular A-119: Requires agencies to participate in the development and use of voluntary consensus standards and in the conformity Assessment Activities

The Technology Standards and Products Guide also supports compliance with the following guidance from the Department of Education and Federal Student Aid:

- Lifecycle Management Methodology: Federal Student Aid's comprehensive end-to-end process for managing information technology projects from vision to retirement, 06/30/2015, V1.3
- Department of Education, ED Technical Standards Workbook

The classification methodology utilized by the Technology Standards and Products Guide is based on the Technology Classification Framework developed by the Queensland, Australia Government. This technology framework was selected in order to classify the Federal Student Aid standards and specifications in an industry standard manner, by organizing them into Technology Domains, consisting of Technology Capabilities and broken down further into Technology Classes. Additional details are included in Section 2.

- Queensland Department of Public Works, ICT Policy and Coordination Office and Queensland Government Chief Technology Office: *Queensland Government Technology Classification Framework*, Final, April 2015, V4.0.1

2. Technology Classification Framework

The objective of defining a Technology Classification Framework is to identify and classify standards and technologies that support the construction, delivery, and exchange of Federal Student Aid business and application components at a level of abstraction that allows principles and rules to be developed and/or followed without being confused by physical implementation details. The following graphics illustrates the FSA Technology Classification Framework:

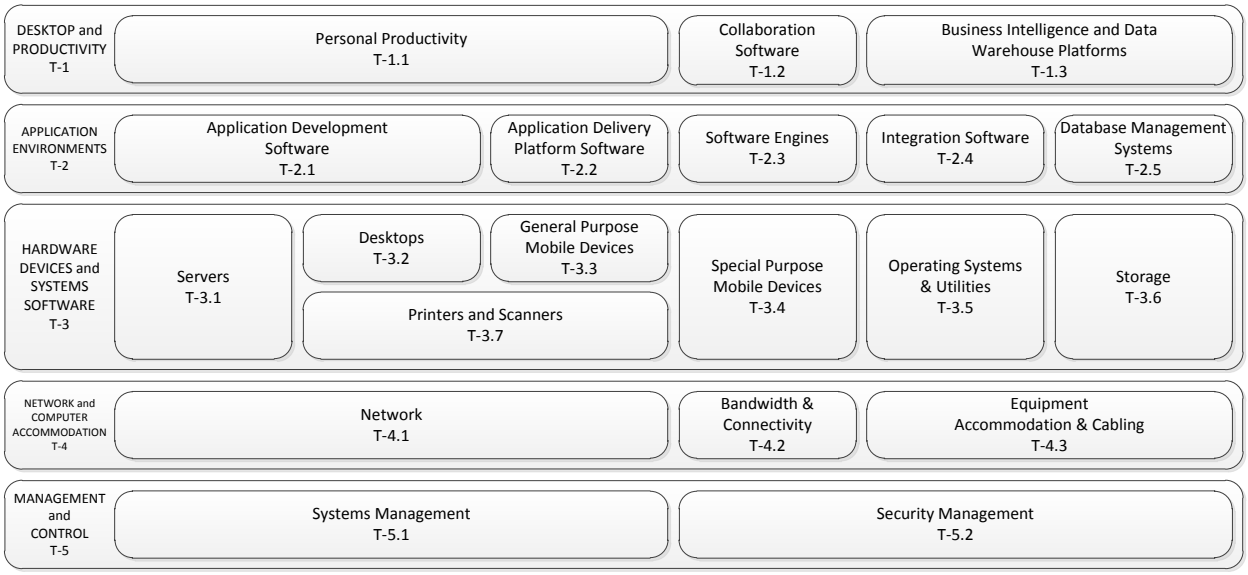

Figure 1: FSA Technology Classification Framework

Technology Domains are the topmost and define a coarse segmentation of technologies. Each of the Technology Domains is further segmented into a number of Technology Capabilities, which define a more focused set of technology functionalities. Technology Capabilities are further refined into finer classifications of Technology Classes.

Figure 2, below, illustrates how the FSA Technology Classification Framework categorizes Federal Student Aid's technologies through the following hierarchy:

- Technology Domains, which are comprised of:
  - Technology Capabilities, which are comprised of:
    - Technology Classes, which are comprised of:
      - Technology Products and Services[1]

[1] Technology Products and Services are intentionally not depicted in the FSA Technology Classification Framework in order to preserve legibility of the diagram. These items are listed in their respective Domain Standards tables throughout this document.

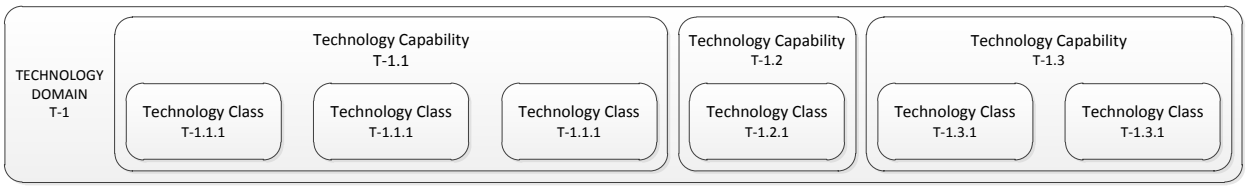

Figure 2: FSA Technology Classification Framework Hierarchy Example

The TSPG further refines the Technology Classification Framework through the use of a Standards Classification scheme to help the reader identify FSA's standards. This scheme identifies the status of technology products and services as follows:

Table 2: FSA Technology Usage Classifications

Federal Student Aid Classification	Description
Standard	Standards mandated and maintained by the Federal Government, the Department of Education, or a General Use specification accepted as De-Facto within a given segment.
Elective	Non-compulsory infrastructure or technology standards in use by the Virtual Data Center (VDC) and EDUCATE infrastructure service providers, included for reference purposes.
Target	Standard that is suitable for new application development for Federal Student Aid.
Phase Out	Technologies/Products approved in the architecture for a specific business need, without expanding the use of the standard to the entire enterprise. Includes legacy systems and products used for administrative and Internal use. Also, includes technologies to be phased out in due course of time due to system retirement or system upgrade.

2.1 Desktop and Productivity Technology Domain

The Desktop and Productivity Technology Domain covers those elements that are directly used by business users. This tier provides the structure and guidance for all Desktop and Productivity technologies and is composed of the following Technology Capabilities and Classes as depicted in Figure 3 below.

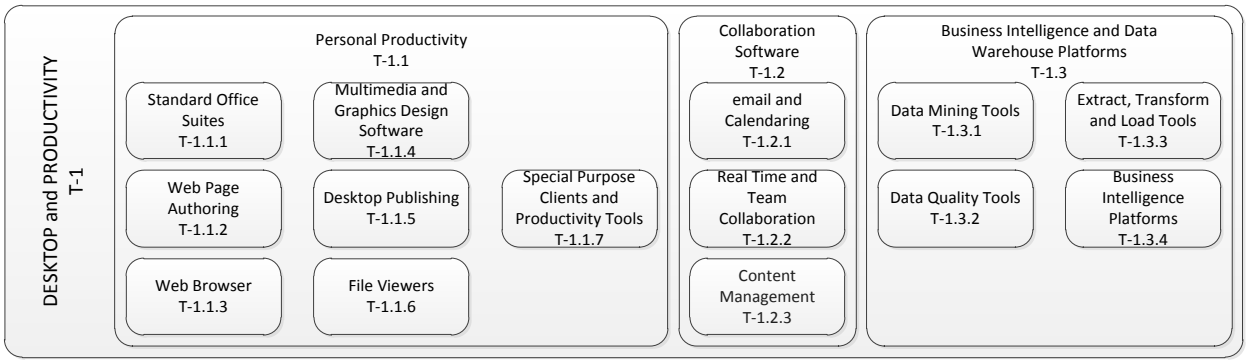

Figure 3: Desktop and Productivity Technology Domain

- **Personal Productivity (T-1.1)**: This capability comprises all technology elements that support personal productivity including office suites, multimedia graphics and design suites, web page authoring packages, publishing packages and file viewers throughout the Federal Student Aid.
    - **Standard Office Suites (T-1.1.1)**: This class describes a core desktop productivity system, which is made up of a number of tools such as a word processor and a spreadsheet. Some degree of integration usually exists between the separate tools. An example of a standard office suite is Microsoft Office, which contains the word processor Microsoft Word and the spreadsheet Microsoft Excel. The database tool MS Access, for organizing, accessing and sharing information, is included under another capability 'Desktop DBMS'.
    - **Web Page Authoring (T-1.1.2)**: This class includes technologies that allow a document creator to mark up (that is, annotate in a machine-readable way) a document to allow the document content to be presented in a format suitable for the Internet. This class typically refers to standalone authoring suites. Authoring suites integrated into content management systems would normally appear in the content management class.

      The most common example is the marking up of a plain text document, using HTML, so that it can be displayed on a screen as hypertext (that is, a web page in HTML format). An example of a web page authoring tool is Adobe Dreamweaver (for HTML).
    - **Web Browser (T-1.1.3)**: This class includes software programs used to locate and display information on the Internet or on an intranet. Most browsers can display graphics, photographs and text; multimedia information (such as sound and video) may require additional software, known as plug-ins. Examples include Microsoft Internet Explorer and Firefox.
    - **Multimedia and Graphics Design Software (T-1.1.4)**: This class includes products that enable users to produce and edit content in a variety of presentation formats including sound, still images, video images and, animations. Examples include Adobe Photoshop and Fireworks.
    - **Desktop Publishing (T-1.1.5)**: This class includes software that creates high-quality publications combining text and graphics in a sophisticated layout following design

standards. Desktop publishing often allows a single individual to create publications that would have previously required expensive printing equipment and a full team of publishing staff. Examples of desktop publishing tools include Adobe InDesign and QuarkXpress.

- **File Viewers (T-1.1.6)**: This class includes software products that enable users to open and display contents of files originally stored in a variety of formats including text as well as multimedia file formats such as sound, video images, photographic images, still images or animations. Examples of file viewers include IrfanView, Adobe Acrobat Reader and Macromedia Flash.
- **Special Purpose Clients and Productivity Tools (T-1.1.7)**: This class includes out-of-the-box desktop productivity tools deployed to specific users to perform specific functions not already covered in the other desktop productivity categories. Examples include mind-mapping tools such as Mind Map. This class also includes special purpose clients, such as front-end GIS products.

- **Collaboration Software (T-1.2)**: This capability comprises all technology elements within Federal Student Aid that support group productivity and interaction between participants such as email, content management, file sharing, instant messaging and team collaboration environments.
  - **Email and Calendaring (T-1.2.1)**: This class includes email tools to support electronic mail, including composing, sending and receiving messages, managing messages and managing electronic mail address lists. Calendaring tools provide support for the managing of calendars (diaries), creating appointments and events, and organizing and scheduling of meetings. An example is Microsoft Outlook. This class also includes server components, for example, Microsoft Exchange.
  - **Real Time and Team Collaboration (T-1.2.2)**: This class includes tools to support people working together even though they may be separated physically and geographically. Workers can work with each other, with clients, or with partners from their desktop, swapping ideas, resolving ideas, sharing information, marking up files or collaborating with whiteboards.

    Examples of real time collaboration tools include Microsoft's Live Communications Server which provides presence awareness and instant messaging, and Microsoft's Live Meeting, a web conferencing tool for meeting with large or small groups in different locations, with each participant working from her or his desktop. Videoconferencing software is another example of real time collaboration tools. Examples of team support tools include Microsoft Windows SharePoint Services and Lotus Quickplace.
  - **Content Management (T-1.2.3)**: This class generally refers to applications for managing content intended to be published, typically over the Web or to the processes and workflows involved in organizing, categorizing and structuring information resources so that they can be stored, published and reused in multiple ways. A Content Management System (CMS) is used to collect, manage and publish content, storing the content either as components or whole documents, while maintaining the links between components.

    A CMS may include integrated authoring tools that support the design, creation, capture, editing, and integration of information from discrete multi-media components, often to produce a website. An example of a content management system is the Interwoven product suite.

- **Business Intelligence and Data Warehouse Platforms (T-1.3**): This capability includes software tools that allow the storage, access and analysis of data in a data warehouse. They include online analytical processing tools (OLAP), data mining tools, executive information systems, data extraction, query and reporting tools, multidimensional tools and decision support systems.
  - **Data Mining Tools (T-1.3.1):** This class includes tools to support the process of extracting patterns and trends from data. Often it refers specifically to the processing of

large amounts of data stored in specific data mining repositories or data warehouses. SAS Enterprise Miner is an example.

- **Data Quality Tools (T-1.3.2):** This class includes tools to support the analysis, cleansing and standardization of data to improve its utility for data mining by identifying and rectifying problems such as duplicate records, erroneous data, redundant data, inconsistent data and different instances of names and addresses for the same data entity. An example of a data quality tool is the SAS Data Quality Solution.
- **Extract, Transform and Load Tools (T-1.3.3):** This class includes tools which support the conversion and transformation of data and its associated metadata from one source to another. Often used for migrations from an old system to a new one, or for moving data from an operational system to a data warehouse or other analysis repository.

  SAS Enterprise ETL Server is an example of an Extract, Transform and Load (ETL) tool.
- **Business Intelligence Platforms (T-1.3.4):** This class includes software that provides an integrated set of enhanced query, reporting, and possibly, OLAP tools. This includes the platforms on which the enterprise Business Intelligence (BI) capability is built. An example of BI software includes SAS BI Suite and SAP Business Information Warehouse.

Table 3, below, identifies the products and services that comprise FSA's current Desktop and Productivity Technology Domain.

Table 3: Desktop and Productivity Technology Domain Standards

Technology Capability	Technology Class	Product or Service	Classification
Personal Productivity	Standard Office Suites	Microsoft Office 2010	Standard
Personal Productivity	Standard Office Suites	Microsoft Project Standard 2010	Standard
Personal Productivity	Standard Office Suites	Microsoft Project Professional 2010	Standard
Personal Productivity	Standard Office Suites	Microsoft Visio 2010	Standard
Personal Productivity	Web Page Authoring	Adobe CS Dreamweaver	Standard
Personal Productivity	Web Browser	Microsoft Internet Explorer	Standard
Personal Productivity	Web Browser	Mozilla Firefox	Phase Out
Personal Productivity	Web Browser	Google Chrome	Standard
Personal Productivity	Multimedia and Graphics Design Software	Adobe Creative Suite	Standard
Personal Productivity	Desktop publishing		
Personal Productivity	File Viewers		

Technology Capability	Technology Class	Product or Service	Classification
Personal Productivity	Special Purpose Clients and Productivity Tools		
Collaboration Software	Email and Calendaring	Outlook Exchange	Standard
Collaboration Software	Real Time and Team Collaboration	Microsoft SharePoint	Standard
Collaboration Software	Real Time and Team Collaboration	Microsoft Project Server	Standard
Collaboration Software	Real Time and Team Collaboration	Office Communication Server (OCS)/Lync	Standard
Collaboration Software	Real Time and Team Collaboration	Skype for Business	Target
Collaboration Software	Content Management	OpenText Teamsite	Standard
Collaboration Software	Content Management	Microsoft SharePoint	Standard
Collaboration Software	Content Management	Drupal	Standard
Business Intelligence and Data Warehouse Platforms	Data Mining Tools	MicroStrategy	Standard
Business Intelligence and Data Warehouse Platforms	Data Mining Tools	SAS	Standard
Business Intelligence and Data Warehouse Platforms	Data Mining Tools	Cognos Query	Target
Business Intelligence and Data Warehouse Platforms	Data Quality Tools	IBM IIS Information Analyzer	Standard
Business Intelligence and Data Warehouse Platforms	Data Quality Tools	IBM Quality Stage	Standard

Technology Capability	Technology Class	Product or Service	Classification
Business Intelligence and Data Warehouse Platforms	Data Quality Tools	IBM Interactive Data Dictionary	Standard
Business Intelligence and Data Warehouse Platforms	Extract, Transform and Load Tools	IBM DataStage	Standard
Business Intelligence and Data Warehouse Platforms	Extract, Transform and Load Tools	Oracle Golden Gate	Standard
Business Intelligence and Data Warehouse Platforms	Business Intelligence Platforms	MicroStrategy	Phase Out
Business Intelligence and Data Warehouse Platforms	Business Intelligence Platforms	Business Objects	Standard
Business Intelligence and Data Warehouse Platforms	Business Intelligence Platforms	Cognos Suite	Standard
Business Intelligence and Data Warehouse Platforms	Business Intelligence Platforms	Pivotal Greenplum	Standard

2.2 Application Environment Technology Domain

The Application Environment Technology Domain covers framework and other supporting software for the development and deployment of application software within Federal Student Aid. Products that service this domain typically offer significant bundled functionality, but are not used directly by business end-users.

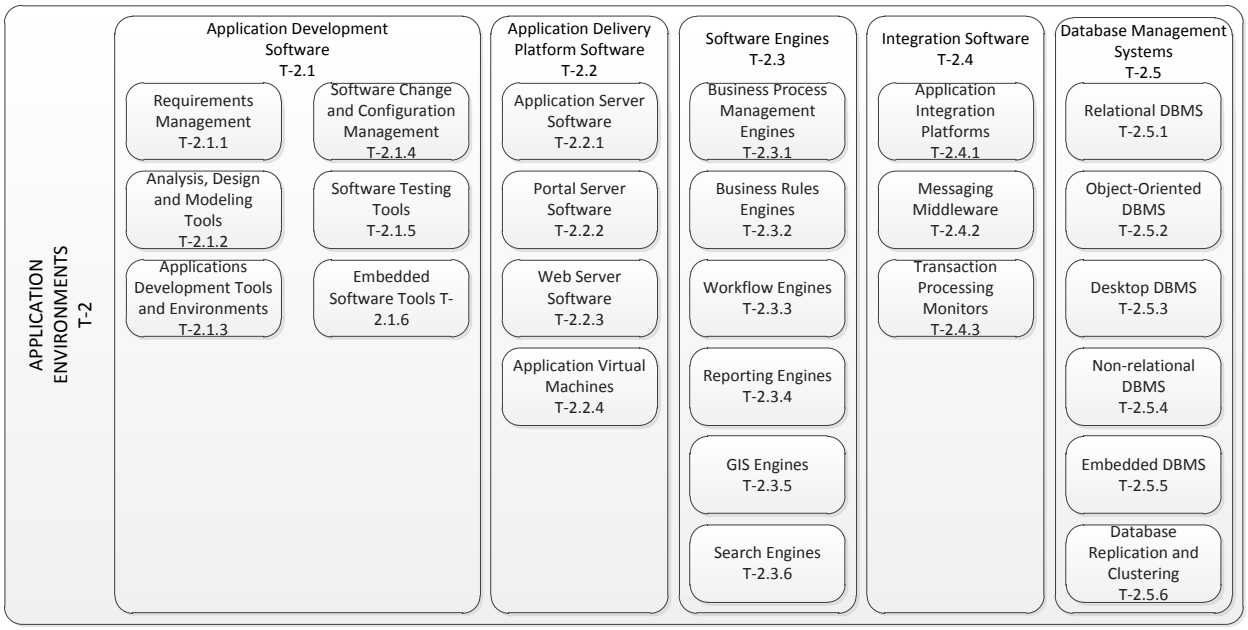

Figure 4: Application Environment Technology Domain

The Application Environment Technology Domain is composed of the following Technology Capabilities and Classes:

- **Application Development Software (T-2.1):** This capability comprises all those elements within the Federal Student Aid that relate to the specification, design, construction, implementation and lifecycle management of software applications.
    - **Requirements Management (T-2.1.1**): This class includes tools that support the requirements gathering phase of the application development life cycle, the purpose of which is to record the stakeholders' requirements for the system which is to be developed. Tools may assist with the capture of requirements, management of requirements changes, tracing of the initial requirements to individual pieces of functionality in the final system, and management of the document lifecycle for requirements generally. Borland's CaliberRM is a requirements management tool.
    - **Analysis, Design and Modeling Tools (T-2.1.2):** This class includes tools that support the analysis and design phases of the traditional software development life cycle. Examples are IBM's Rational Rose Data Modeler (a visual modeling tool for database analysts and designers) and IBM Rational Rose XDE Modeler (a model-driven development tool for analysts and designers, based on UML – the Unified Modeling Language).
    - **Applications Development Tools and Environments (T-2.1.3):** This class includes integrated sets of tools that enable software programming, packaging, testing, and

distribution. These tools are used by software developers in building software applications in an integrated development environment. Examples include Borland's Jbuilder, Microsoft's Visual Studio .NET and Sybase PowerBuilder.

- **Software Change and Configuration Management (T-2.1.4):** This class includes tools that provide automated support for managed change, configuration or version control of software assets. An example is IBM's Rational ClearCase.
- **Software Testing Tools (T-2.1.5):** This class includes tools that provide automated support for the software testing cycle and include such facilities as the management of the overall test process, test development, capture/development of test scripts, replay of test scripts and test case generation for various kinds of testing including unit testing, system testing, regression testing, and integration testing. An example is HP's Business Process Testing, and Functional Testing software.
- **Embedded Software Tools (T-2.1.6):** This class includes software development tools that manage the embedded software development lifecycle: analyzing, designing, documenting, writing, compiling, debugging, testing, optimizing and verifying software. An example is the multi-embedded software development environment from Green Hills Software Inc.

- **Application Delivery Platform Software (T-2.2):** This capability includes the essential software infrastructure products that enable the running of business applications. Types of application delivery platform software include application server software, portal server software and web portal software.
  - **Application Server Software (T-2.2.1):** This class includes system software used to host the business logic tier of applications, or to host application services. BEA WebLogic Server is an example of an application server.
  - **Portal Server Software (T-2.2.2):** This class includes software to support the development, deployment and operation of a portal environment, supplying aggregation and presentation capabilities that enable users to see relevant information and personalize their environments to best meet their needs and facilitate ease of use. It provides such capabilities as centralized identity services that manage users, roles, policies, and aggregation and presentation capabilities. IBM WebSphere Portal and Microsoft SharePoint are examples of portal server software.
  - **Web Server Software (T-2.2.3):** This class includes servers that centrally host and serve web pages. The web server software uses the client/server model and the Hypertext Transfer Protocol (HTTP) and serves the files that form web pages to web users (whose computers contain HTTP clients that forward their requests). An example is the Apache HTTP Server.
  - **Application Virtual Machines (T-2.2.4):** A process Virtual Machine (VM), sometimes called an application virtual machine, runs as a normal application inside an Operating System (OS) and supports a single process. It is created when that process is started and destroyed when it exits. Its purpose is to provide a platform-independent programming environment that abstracts away details of the underlying hardware or operating system and allows a program to execute in the same way on any platform.

    A process VM provides a high-level abstraction – that of a high-level programming language. This type of VM has become popular with the Java programming language, which is implemented using the Java virtual machine. Another example is the .NET Framework, which runs on a VM called the Common Language Runtime.
- **Software Engines (T-2.3):** This capability includes software that enables the delivery of components of an application system through a software engine that interprets configuration information (sometimes created through an associated development tool like a business process modeling tool associated with a business process engine) in order to provide the functionality required for the application.

- **Business Process Management Engines (T-2.3.1):** This class includes servers that centrally host and serve web pages. The web server software uses the client/server model and the Hypertext Transfer Protocol (HTTP) and serves the files that form web pages to web users (whose computers contain HTTP clients that forward their requests). An example is the Apache HTTP Server.
- **Business Rules Engines (T-2.3.2):** This class includes software engines used to record, track, manage and revise enterprise business processes, without having to modify the software application itself. Rules are set to stipulate and outline processes and the Business Rule Engine (BRE) externalizes these rules for quick and easy modification.

  BREs (also known simply as rule engines) are tools that manage the rules that define processes. BREs can be used in conjunction with other business-oriented tools such as Business Activity Monitoring (BAM), workflow engines and Business Process Management (BPM) tools.

  Examples include ILOG's Business Rule Management System (BRMS) and Blaze Advisor.
- **Workflow Engines (T-2.3.3):** This capability includes software engines that support workflow management which can be of two types:
  - Internal and external process integration – a workflow approach that allows for the definition of business processes that span applications, including those that come from different vendors. This usually requires a standards-based commercial workflow development environment.
  - Workflow engines automate, manage and execute business tasks and processes and events by executing a defined sequence of tasks which can include saving, modifying or generating files, sending, responding and receiving emails, and escalating or progressing approvals.

  Enhydra Shark and OpenSymphony OSWorkFlow are examples of Open Source workflow engines written in Java.
- **Reporting Engines (T-2.3.4):** This class includes software engines for the generation of reports. Reports are usually defined through a report modeling tool and their execution can be triggered either through direct interaction with the reporting tool or through an Application Programming Interface (API) call from other software in which the engine is embedded. An example of a reporting engine is Crystal Reports.
- **GIS Engines (T-2.3.5):** This class includes server and desktop engines that combine relational databases with spatial interpretation and produce outputs in the form of maps. Geographic Information System (GIS) engines capture, store, integrate, analyze and display data that is spatially referenced.
- **Search Engines (T-2.3.6):** This class includes tools to support both searching and indexing capabilities. A search engine is a tool used to help find information on the Internet, intranet or in databases and file servers. Each search engine has its own way of gathering, classifying, and displaying information to the user. An example of an indexing search engine is Oracle Ultrasearch.

- **Integration Software (T-2.4):** This capability includes platforms and other software for integrating the Federal Student Aid applications and systems.
  - **Application Integration Platforms (T-2.4.1):** This class includes middleware products (also known as an Integration Broker Suite or IBS) that combine the core functionality of an integration broker (an engine that provides message transformation and intelligent routing services) with additional features to deliver comprehensive integration capabilities. These additional features may include various interface and integration adapters, communication middleware, orchestration, choreography, business process management and message warehousing.

This class also includes adaptors and connectors that combine design tools and runtime software that link applications to the enterprise messaging infrastructure, and ORBs (Object Request Broker) that allow objects to communicate with other software. An example is the Oracle/BEA WebLogic Integration Suite.

- **Messaging Middleware (T-2.4.2):** This class includes integrated Message-Oriented Middleware (MOM) that covers applications that manage the asynchronous delivery of messages and message replies. This differs from other forms of program-to-program middleware, which are connection oriented and synchronous in nature. MOM receives messages and then ensures the delivery to the appropriate receivers independently of the message originator. IBM WebSphere MQ is an example.
- **Transaction Processing Monitors (T-2.4.3):** This class includes applications that manage transactions end to end, ensuring integrity and performance usually in complex distributed environments. They are often used to monitor information processing that must occur within a defined, predictable and near real time manner.Examples include Oracle/BEA's Tuxedo and IBM's CICS.

- **Database Management Systems (T-2.5):** This capability includes different types of database management systems and related technologies within the Federal Student Aid.
  - **Relational DBMS (T-2.5.1):** This class includes Database Management Systems (DBMS) in which the data is organized according to relationships between data entities as defined in a relational data model. Relational DBMS systems normally support a Structured Query Language (SQL) application programming interface.An example is Oracle's 11g Database.
  - **Object-Oriented DBMS (T-2.5.2):** This class includes DBMS that apply an Object-Orientated (OO) paradigm to the storage, retrieval and management of data and are usually used to support object-oriented programming languages. ObjectDB is an example.
  - **Desktop DBMS (T-2.5.3):** This class includes DBMS that run on a desktop operating system such as Microsoft Windows. To be classified as a desktop DBMS, a product would need to be designed for single-user access only and, in particular, not for remote access. An example is Microsoft Access.
  - **Non-Relational DBMS (T-2.5.4):** This class includes any DBMS that is not a relational DBMS as defined above. It may, for example follow the hierarchical or network database models. Examples are IBM Lotus Notes and Cassandra.
  - **Embedded DBMS (T-2.5.5):** This class includes software that is embedded within an application or a device and acts as a component of that application or device. Typically, embedded DBMSs are high-performance, have a small footprint and require no administration. The DBMS is transparent to the user, and customers for the embedding application or device do not have to purchase a separate DBMS license. An example is Oracle Berkeley DB.
  - **Database Replication and Clustering (T-2.5.6):** This class includes DBMS architectures that support high-availability and fault-tolerant systems. In general, clustering means that multiple servers are arranged to access a single copy of the database. Each server is able to carry part of the application workload – if one fails, the workload is shared across the remaining servers. Replication achieves similar objectives by implementing multiple instances of the database; database objects are copied and maintained in multiple databases that make up a distributed database system. An example of a system that implements replication and clustering is Oracle Real Application Cluster (RAC).

Table 4 below, identifies the products and services that comprise FSA's current Application Environment Technology Domain.

Table 4: Application Environment Technology Domain Standards

Technology Capability	Technology Class	Product or Service	Classification
Application Development Software	Requirements Management	IBM Rational RequisitePro	Phase Out
Application Development Software	Requirements Management	IBM Rational Requirements Composer	Standard
Application Development Software	Analysis, Design and Modeling Tools	Oracle SQL Developer	Standard
Application Development Software	Analysis, Design and Modeling Tools	TOAD (Query)	Standard
Application Development Software	Analysis, Design and Modeling Tools	Balsamiq	Standard
Application Development Software	Analysis, Design and Modeling Tools	Embarcadero ER/Studio	Standard
Application Development Software	Analysis, Design and Modeling Tools	IBM Rational Software Modeler	Target
Application Development Software	Application Development Tools and Environments	Oracle Financials IDE	Standard
Application Development Software	Application Development Tools and Environments	IBM Rational Application Developer	Standard
Application Development Software	Application Development Tools and Environments	Visual Studio	Standard
Application Development Software	Software Change and Configuration Management	IBM Rational ClearCase	Standard
Application Development Software	Software Change and Configuration Management	IBM Rational ClearQuest	Standard

Technology Capability	Technology Class	Product or Service	Classification
Application Development Software	Software Change and Configuration Management	IBM Rational Team Concert	Standard
Application Development Software	Software Change and Configuration Management	IBM WebSphere Network Deployment	Standard
Application Development Software	Software Change and Configuration Management	Ant	Standard
Application Development Software	Software Change and Configuration Management	CVS	Standard
Application Development Software	Software Testing Tools	Mercury LoadRunner	Standard
Application Development Software	Software Testing Tools	JUnit	Standard
Application Development Software	Software Testing Tools	IBM Rational Test Manager	Phase Out
Application Development Software	Software Testing Tools	IBM Rational Functional Tester	Standard
Application Development Software	Software Testing Tools	IBM Rational Quality Manager	Standard
Application Development Software	Embedded Software Tools		
Application Delivery Platform	Application Server Software	IBM WebSphere Application Server	Standard
Application Delivery Platform	Application Server Software	Microsoft SharePoint	Standard
Application Delivery Platform	Application Server Software	K2 Blackpearl	Standard
Application Delivery Platform	Application Server Software	Serena Business Manager	Standard
Application Delivery Platform	Application Server Software	Microsoft Project Server	Standard

Technology Capability	Technology Class	Product or Service	Classification
Application Delivery Platform	Portal Server Software	Microsoft SharePoint	Standard
Application Delivery Platform	Web Server Software	IBM HTTP Server	Standard
Application Delivery Platform	Web Server Software	Microsoft Internet Information Server (IIS)	Standard
Application Delivery Platform	Web Server Software	Microsoft SharePoint	Standard
Application Delivery Platform	Application Virtual Machines	.NET	Standard
Application Delivery Platform	Application Virtual Machines	Java Virtual Machine (JVM)	Standard
Application Delivery Platform	Application Virtual Machines	VMWare EXS1	Standard
Software Engines	Business Process Management Engines	IBM Business Process Manager	Target
Software Engines	Business Rules Engines		
Software Engines	Workflow Engines	K2 Blackpearl	Standard
Software Engines	Workflow Engines	Serena Business Manager	Standard
Software Engines	Workflow Engines	Microsoft SharePoint	Standard
Software Engines	Reporting Engines	SQL Server Reporting Services (SSRS)	Standard
Software Engines	Reporting Engines	SQL Server Analytical Services (SSAS)	Standard
Software Engines	Reporting Engines	IBM Information Server (IIS)	Standard
Software Engines	Reporting Engines	IBM InfoSphere	Standard
Software Engines	GIS Engines		
Software Engines	Search Engines	Google Search Appliance	Standard
Software Engines	Search Engines	FastSearch	Phase Out
Software Engines	Search Engines	SharePoint 2013 Search	Target
Integration Software	Application Integration Platforms	OpenText Data Integrator	Phase Out
Integration Software	Application Integration Platforms	IBM WebSphere Adapters	Standard
Integration Software	Application Integration Platforms	IBM Information Server	Standard
Integration Software	Application Integration Platforms	IBM Connect:Direct	Standard

Technology Capability	Technology Class	Product or Service	Classification
Integration Software	Application Integration Platforms	IBM WebSphere MQ MFT	Standard
Integration Software	Application Integration Platforms	IBM WebSphere MQ FTE	Standard
Integration Software	Application Integration Platforms	bTrade TDAccess	Standard
Integration Software	Messaging Middleware	IBM WebSphere MQ	Phase Out
Integration Software	Messaging Middleware	IBM Integration Bus	Standard
Integration Software	Transaction Processing Monitors	CICS	Standard
Database Management Systems	Relational DBMS	Oracle	Standard
Database Management Systems	Relational DBMS	DB2	Standard
Database Management Systems	Relational DBMS	MS SQL Server	Standard
Database Management Systems	Relational DBMS	MySQL	Standard
Database Management Systems	Object-Oriented DBMS		
Database Management Systems	Desktop DBMS	MS Access	Standard
Database Management Systems	Non-Relational DBMS		
Database Management Systems	Embedded DBMS		
Database Management Systems	Database Replication and Clustering		

2.3 Hardware Devices and Systems Software Technology Domain

The Hardware Devices and Systems Software Technology Domain comprises base level system functionality across Federal Student Aid. Business applications may run directly on technology elements from this domain, or they may run on technology elements from the Application Environments domain which in turn run on technology elements from this domain.

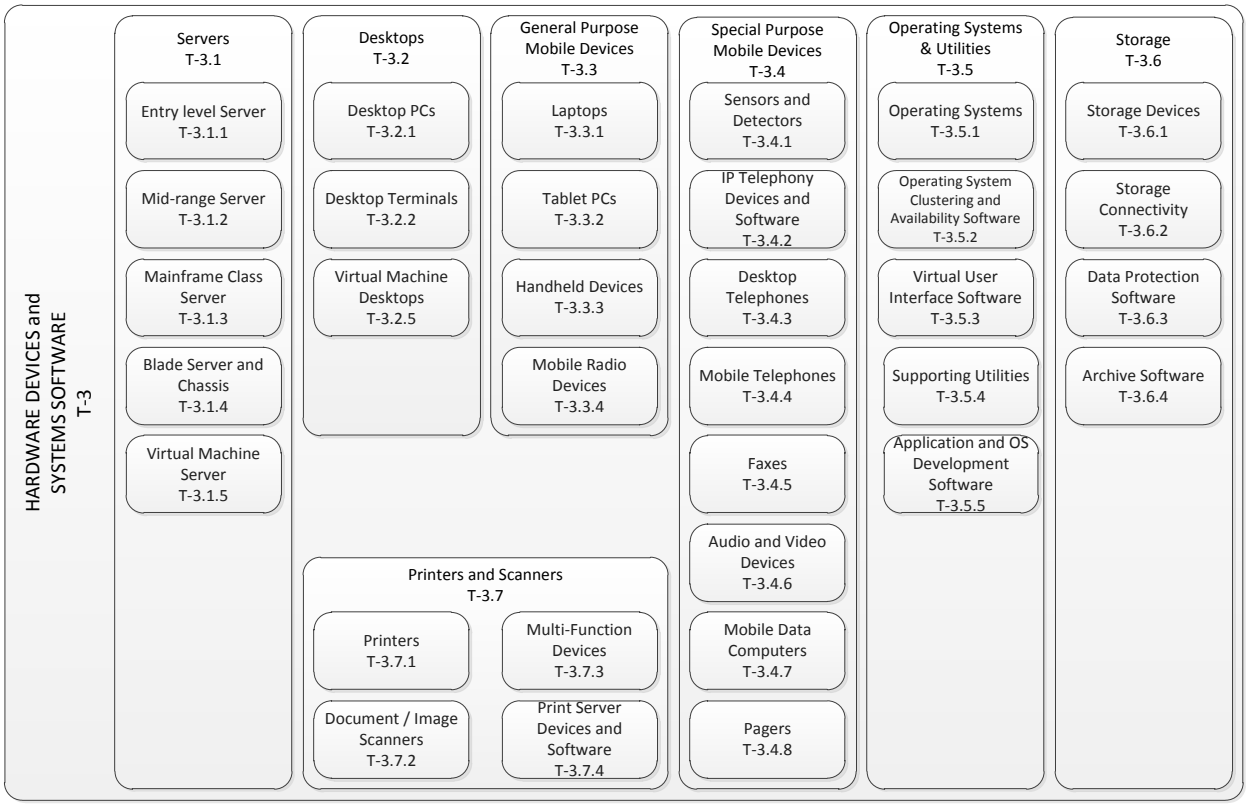

Figure 5: Hardware Devices and Systems Software Technology Domain

The Hardware Devices and Systems Software Technology Domain is composed of the following Technology Capabilities and Classes:

- **Servers (T-3.1):** This capability includes server hardware including entry-level server, mid-range server, mainframe class server and blade servers, as well as virtual servers.
    - **Entry Level/Development Server (T-3.1.1):** These are desktop or workgroup servers that provide services to desktop workstations including the hosting of email, hosting of directories and authentication mechanisms, provision of application and operating system development infrastructure, provision of file storage services and provision of print services. These are server class machines that typically feature multiple high-throughput processors, large memory capacity, large capacity high-speed storage, redundant components for high availability, fast bus speeds and high transfer rates. Examples include IBM Intel based xSeries servers.
    - **Mid-range Server (T-3.1.2):** This class includes computers or servers that fall into the range above entry-level servers on the low end and below mainframe servers at the high

end. Mid-range systems may or may not run proprietary operating systems. Examples include IBM's pSeries P7-740. Blade servers and chassis are not considered to be midrange servers.

- **Mainframe Class Server (T-3.1.3):** This class includes large-capacity computer systems designed to serve large numbers of multiple users, and are typically deployed in a centralized manner to handle enterprise-wide applications. They may require specialized and specific cooling and power. Mainframe servers will be defined as such by the manufacturer. Examples include IBM's zEnterprise 114.
- **Blade Server and Chassis (T-3.1.4):** Blade servers are self-contained all-inclusive computer servers with a design optimized to minimize physical space. A blade enclosure, which can hold multiple blade servers, provides services such as power, cooling, networking, various interconnects and management.
- **Virtual Machine Server (T-3.1.5):** Virtual machines (sometimes called hardware virtual machines) allow the sharing of the underlying physical machine resources between different virtual machines, each running its own operating system. The software layer providing the virtualization is called a virtual machine monitor or hypervisor. A hypervisor can run on bare hardware or on top of an operating system. Examples include VMware's ESXi.

- **Desktops (T-3.2)**: This capability includes desktop PC and alternative technologies that provide a similar capability within the Federal Student Aid.
  - **Desktop PCs (T-3.2.1):** This class includes microcomputers designed primarily for individual use, which remain more or less permanently on an office worker's desk; sharing resources with another computer is optional. It is not designed for portability and is usually permanently linked to the enterprise network.
  - **Desktop Terminals (T-3.2.2):** This class includes terminals with little or no software of their own that rely on a mainframe or another computer (such as a PC server) for its intelligence. This class includes dumb terminals and thin client network computers.
  - **Virtual Machine Desktops (T-3.2.3):** A virtual desktop is a running instance of a desktop operating system that has its own BIOS, chipset, disk drives and network. Although these devices are all virtual devices, they look, act and function just like their real counterparts. The operating system running on a virtual desktop has no idea what sort of machine it is running on www.sarcom.com. Examples include VMware's Workstation product.
- **General Purpose Mobile Devices (T-3.3):** This capability includes portable and mobile generic computing devices. These generally have some capability to install applications to provide specialist functions.
  - **Laptops (T-3.3.1):** A laptop computer, also known as a notebook computer, is a small personal computer designed for mobile use. A laptop integrates all of the typical components of a desktop computer, including a display, a keyboard, a pointing device (a touchpad, also known as a trackpad, or a pointing stick) and a battery into a single portable unit. The rechargeable battery is charged from an AC/DC adapter and has enough capacity to power the laptop for several hours.

    A netbook is a lightweight, low-cost, energy-efficient, highly portable laptop suitable for web browsing, email and general-purpose applications. To achieve its small form factor, low weight and affordability, netbooks offer fewer features, less processing power and a reduced ability to run resource-intensive operating systems.
  - **Tablet PCs (T.3.3.2):** This class includes computing devices that are operated by direct screen contact via a pen or touch interface. An example is the Lenovo ThinkPad X200t.
  - **Handheld Devices (T.3.3.3):** This class also includes computing devices that can be held in the palm of the hand and that offer advanced capabilities, often with PC-like

functionality. They typically use a touch screen or stylus device for data entry and navigation. Examples include the BlackBerry series of smart phones, or TomTom GPS navigation systems.

Modern mobile phones may also be considered a handheld device if they incorporate networking capability and support mobile productivity applications, email, and Internet access. Classification of the asset should be based on its dominant use.

- **Mobile Radio Devices (T.3.3.4):** This class includes two-way radio devices that are manufactured to be installed in vehicles. They may be analog or digital radio devices that can communicate via a radio repeater or directly between devices on select licensed frequencies. Mobile radios are also often installed in a fixed site location such as a building.

- **Special purpose Devices (T-3.4):** This capability includes various other special purpose devices that don't fit under the other more generic classes. These include remote sensors, dedicated IP telephony video devices, desktop telephones, mobile telephones, faxes and other audio and video devices.
  - **Sensors and Detectors (T-3.4.1):** This class includes dedicated devices that are used for the measurement of some phenomena such as temperature, precipitation or water level. In general, as well as a data capture facility, the device has some means of storage to allow the recording of data, and a telecommunications capability for reporting the captured data back to either a central location or data capture device. This class would also include Radio Frequency Identification tags and detectors (scanners), as well as GPS based tracking systems.
  - **IP Telephony Devices and Software (T-3.4.2):** This class includes devices that support voice and video communications by means of the Internet Protocol (IP), bypassing the public switched telephone network (PSTN) and its associated charges. Examples include various softphones, the Cisco 7900 series IP phones and Cisco's Unified Video Advantage software.
  - **Desktop Telephones (T-3.4.3):** This class relates to the familiar everyday stand-alone telephone handset that is used for voice communications. It is stand-alone in the sense that it is not incorporated into another device such as a personal computer.
  - **Mobile Telephones (T-3.4.4):** This class includes portable wireless telephones that allow voice communication via radio signals through special ground stations that cover areas known as cells and are linked with the public telephone system. Most mobile telephones offer Short Messaging Service (SMS) for sending and receiving brief text messages.

    Modern mobile phones may also be considered a 'handheld device' if they incorporate networking capability and support mobile productivity applications, email, and Internet access. Classification of the asset should be based on its dominant use.

    This class also includes SMS gateways that transform messages to mobile network traffic. Typical use of a gateway would be to forward simple email to a mobile phone recipient.
  - **Faxes (T-3.4.5):** This class includes devices for the telephonic transmission of scanned-in printed material (text or images), usually to a telephone number associated with a printer or other output device.

    This class also includes fax gateways that transform messages to faxes and transmit them over fax-capable modems. Fax gateways also receive faxes, and transmit them as attachments to emails over the IP network. Examples include Kofax (Topcall) software.
  - **Audio and Video Devices (T-3.4.6):** This class includes devices not captured by the above headings including projectors, cameras, and teleconferencing equipment.

- **Mobile Data Computers (T-3.4.7):** The Mobile Data Computer or terminal is a vehicle-mounted device that facilitates messaging, electronic dispatching, vehicle monitoring, and GPS-based vehicle tracking.
- **Pagers (T-3.4.7):** This class relates to pagers, which are a simple personal telecommunications device for receiving (and sometimes sending) short messages. Pagers mainly support the critical messaging markets, such as emergency service personnel, medical personnel, and information technology support staff. Examples include the Apollo range of paging devices and systems.

- **Operating Systems and Utilities (T-3.5):** This capability includes operating systems and related software.
  - **Operating Systems (T-3.5.1):** This class includes the main control programs that manage the operation of the computer hardware including memory, storage, networking and input and output, and interfaces the hardware to the applications and users.

    This class is primarily focused on general or multi purpose operating systems, such as IBM's AIX mid-range server operating system, Novell Netware, and Microsoft Windows for personal computers.
  - **Operating System Clustering and Availability Software (T-3.5.2):** This class refers to software systems that manage a group of loosely coupled servers so as to maximize availability or up time and/or share the workload; the clustered servers often share common disk storage. Cluster Manager from Red Hat is an example.
  - **Virtual User Interface Software (T-3.5.3):** This class includes software that enables an enterprise to provide application access for many desktops from one centralized location, reducing the cost of provisioning desktops individually and allowing configuration and management from the central site, under the thin client model. An example is the Citrix MetaFrame Access Suite.
  - **Supporting Utilities (T-3.5.4):** This class includes tools that work together with the core operating system to provide certain functions to users of a computer. Examples include WinZip, a file compression utility, and terminal emulation software such as PuTTY, or Reflections.
  - **Application and OS Deployment Software (T-3.5.5):** This class includes facilities that are designed to allow the distribution and deployment of software and the associated upgrades, from a central site to a number of remote installations. This is done in a managed way so that the central site has tight control over the particular software configurations and versions loaded onto the remote machines. An example is Microsoft's System Center Configuration Manager.

- **Storage (T-3.6):** This capability includes storage devices and related connectivity and software.
  - **Storage Devices (T-3.6.1):** This class includes physical storage resources and devices that are part of storage architecture and are attached to a storage interconnection network. Physical storage resources often have a high degree of redundancy, including multiple network connections and data redundancy functions (via RAID), all aimed at delivering highly available storage services. The devices typically provide a means to persistently retain data over a long time period. Examples include disk drives, disk arrays, storage controllers, array controllers, tape drives, tape libraries and a wide range of storage appliances such as Network Attached Storage (NAS) appliances.

    This class should also include firmware and similar operating software, such as the Brocade Fabric OS.
  - **Storage Connectivity (T-3.6.2):** This class includes the infrastructure and embedded software that connects elements of the storage environment. These technologies may be primarily used for access to storage devices or shared with other functions. The important

characteristic is that they provide rich, high-performance, scalable connectivity upon which a storage environment can be based.

The Storage Connectivity class often provides the ability to implement multiple connections from a host, thus providing another element of redundancy for high availability environments by enabling the use of multi-path I/O software on the host, which may also provide load balancing among the redundant paths. The physical-layer network technologies that are typically (or have been) used to provide this capability include Fiber Channel, Fast and Gigabit Ethernet, InfiniBand and VAX CI network.

- **Data Protection Software (T-3.6.3):** Data protection software will produce, through some method, a collection of data stored on (usually removable) non-volatile storage media for purposes of recovery, in case the original copy of data is lost or becomes inaccessible. This is often called a backup copy.

  To be useful for recovery, a backup must be made by copying the source data image when it is in a consistent state. Software in This class can support methods such as: tape backup, restore; disk backup, restore; snapshots, search and retrieval; synthetic backup, roll back; real time replication; instant recovery.

  Enabling technologies can assist in the above methods and include de-duplication software, virtual tape libraries and continuous data protection technology.

- **Archive Software (T-3.6.4):** This is software to automate the migration, storage and retention of both structured and unstructured information in accordance with business policies. The software supports the primary purposes of archiving, which are the long-term preservation, retention and retrieval of that data.

  The differentiator between archive and data protection rests in a number of attributes, including:

  - The length of retention
  - Granularity of retention: the retention and control is more granular acting on objects or entities specifically identified by the business, compared with data protection which acts at a higher level of aggregation on the same objects without concern for filtering any of those objects
  - Associating metadata with the objects, which among other things will authenticate its originality verifying that no change has occurred
  - The ability to search on the data stored in a richer context than typically achievable in the data protection class.

- **Printers and Scanners (T-3.7)**: This capability includes printers, scanners and hybrid multi-function devices.

  - **Printers (T-3.7.1):** This class includes devices that provide dedicated printing services. Typically these include large laser printers, shared by many people, but may also include personal desktop printers such as ink-jets.
  - **Document/Image Scanners (T-3.7.2):** This class includes dedicated scanning devices, often small enough to sit on the desk of an office worker. Its purpose is to scan paper documents, producing a digitized facsimile of the document on the personal computer to which it is connected.
  - **Multi-Function Devices (T-3.7.3):** This class includes peripheral devices that perform a variety of functions that would otherwise be carried out by separate peripheral devices. Multi-function devices include at least two of the following: a printer, a scanner, a copier and a fax machine.

    Common examples include:

- Digital copy machine: Creates copies digitally, by scanning and printing. In addition to scanning and printing, may include fax, sorter and office hardware, such as a stapler.
- Fax machine: Looks like a normal fax but connects to a PC for data input/output, printing, scanning and copying.
- Printer/Scanner/Copier MFP: Performs all three functions and sometimes faxing as well.

o **Print Server Devices and Software (T-3.7.4):** This class includes software that manages and controls network printing. Examples include the Levi Ray and Shoup Enterprise Output Management suite for the IBM z/OS. Also included are dedicated devices that connect one or more printers to a local area network. Such devices typically have a single LAN connector, such as an RJ-45 socket, and one or more physical ports (e.g. serial, parallel or USB) to provide connections to printers. An example is Hewlett Packard Print Server Appliance 4200.

Table 5 below, identifies the products and services that comprise FSA's current Hardware Devices and Systems Software Technology Domain.

Table 5: Hardware Devices and Systems Software Technology Domain Standards

Technology Capability	Technology Class	Product or Service	Classification
Servers	Entry Level Server	Dell PowerEdge M610	Elective
Servers	Mid-range Server	Dell PowerEdge R710	Elective
Servers	Mid-range Server	Dell PowerEdge M820	Elective
Servers	Mid-range Server	Dell PowerEdge R720	Elective
Servers	Mid-range Server	Dell PowerEdge R820	Elective
Servers	Mid-range Server	Dell PowerEdge R910	Elective
Servers	Mid-range Server	HP 3440	Elective
Servers	Mid-range Server	IBM P7-740	Elective
Servers	Enterprise Server	HP rp7440	Elective
Servers	Mainframe Class Server	IBM zEnterprise 114	Elective
Servers	Mainframe Class Server	IBM zEnterprise BC12	Elective
Servers	Blade Server and Chassis	Blade Center M1000e	Elective
Servers	Virtual Machine Server	Dell PowerEdge M610	Elective
Servers	Virtual Machine Server	Dell PowerEdge R810	Elective
Servers	Virtual Machine Server	Dell PowerEdge M820	Elective
Servers	Virtual Machine Server	Dell PowerEdge R910	Elective
Servers	Virtual Machine Server	Dell PowerEdge R920	Elective
Desktops	Desktop PCs	Refer to ED Technical Standards Workbook	Elective
Desktops	Desktop Terminals	Refer to ED Technical Standards Workbook	Elective
Desktops	Virtual Machine Desktops	Refer to ED Technical Standards Workbook	Elective

Technology Capability	Technology Class	Product or Service	Classification
Printers and Scanners	Printers	Refer to ED Technical Standards Workbook	Elective
Printers and Scanners	Document/ Image Scanners	Refer to ED Technical Standards Workbook	Elective
Printers and Scanners	Multi-Function Devices	Refer to ED Technical Standards Workbook	Elective
Printers and Scanners	Print Server Devices and Software	Refer to ED Technical Standards Workbook	Elective
General Purpose Mobile Devices	Laptops	Refer to ED Technical Standards Workbook	Elective
General Purpose Mobile Devices	Tablet PCs	Refer to ED Technical Standards Workbook	Elective
General Purpose Mobile Devices	Handheld Devices	Refer to ED Technical Standards Workbook	Elective
General Purpose Mobile Devices	Mobile Radio Devices		
Special Purpose Devices	Sensors and Detectors		
Special Purpose Devices	IP Telephony Devices and Software	Refer to ED Technical Standards Workbook	Elective
Special Purpose Devices	Desktop Telephones	Refer to ED Technical Standards Workbook	Elective
Special Purpose Devices	Mobile Telephones	Refer to ED Technical Standards Workbook	Elective
Special Purpose Devices	Faxes	Refer to ED Technical Standards Workbook	Elective
Special Purpose Devices	Audio and Video Devices	Refer to ED Technical Standards Workbook	Elective
Special Purpose Devices	Mobile Data Computers		
Special Purpose Devices	Pagers		
Operating Systems and Utilities	Operating Systems	Current Minimum: zOS 2.1, HP-UX 11.23, Linux Red Hat v5.5, Win2008 R2 Enterprise, Win2008 R2 Standard, AIX 6.1	Standard
Operating Systems and Utilities	Operating System Clustering and Availability Software	HP Clustering	Elective

Technology Capability	Technology Class	Product or Service	Classification
Operating Systems and Utilities	Operating System Clustering and Availability Software	Microsoft Cluster Server	Elective
Operating Systems and Utilities	Virtual User Interface Software	Citrix XenApp	Standard
Operating Systems and Utilities	Virtual User Interface Software	VMWare	Standard
Operating Systems and Utilities	Virtual User Interface Software	XenServer	Phase Out
Operating Systems and Utilities	Virtual User Interface Software	Citrix Metaframe Access	Phase Out
Operating Systems and Utilities	Supporting Utilities	SyncSort for z/OS	Standard
Operating Systems and Utilities	Application and OS Deployment Software	BladeLogic	Elective
Storage	Storage Devices	EMC DMX	Elective
Storage	Storage Devices	EMC DLm 8100 (VTL)	Elective
Storage	Storage Devices	EMC VMAX 40K	Elective
Storage	Storage Devices	DataDomain DD4500 (VTL)	Elective
Storage	Storage Devices	IBM ATL/VTS	Elective
Storage	Storage Devices	IBM 3995	Elective
Storage	Storage Connectivity	Fiber Channel for open systems	Elective
Storage	Storage Connectivity	FICON for Mainframe	Elective
Storage	Storage Connectivity	ESCON	Elective
Storage	Data Protection Software	Tivoli Storage Manager for Open Systems	Elective
Storage	Data Protection Software	EMC TimeFinder / Clone / Snap for Mainframe	Elective
Storage	Data Protection Software	Innovation Data Processing	Elective
Storage	Data Protection Software	Fast Dump Restore (FDR) for Mainframe	Elective
Storage	Data Protection Software	Metalogix StoragePoint	Elective
Storage	Archive Software	CA DMS for Mainframe	Elective
Storage	Archive Software	Innovation Data Processing FDRABR for Mainframe	Elective

2.4 Network and Computer Accommodation

The Network and Computer Accommodation domain includes facilities used to house computer systems, and those technology elements that provide base level permanent or intermittent connectivity.

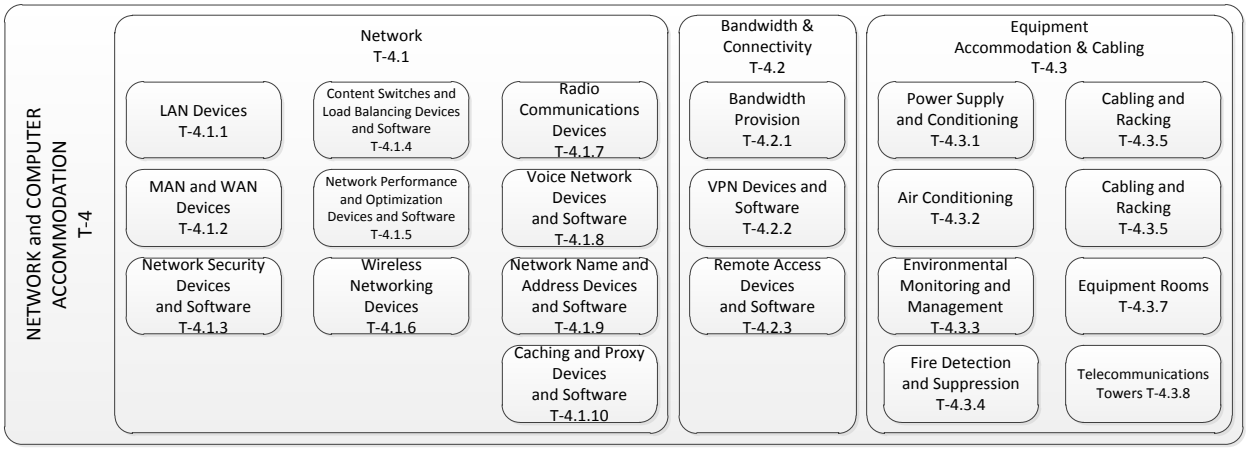

Figure 6: Network and Computer Accommodation Technology Domain

The Network and Computer Accommodation Technology Domain is composed of the following Technology Capabilities and Classes:

- **Network (T-4.1):** This capability includes those technology elements that provide base level permanent or intermittent connectivity. This includes wired and wireless modes.
    - **LAN Devices (T-4.1.1):** This class includes devices that perform an intrinsic function for a local area network. Examples include switches and hubs from Cisco.
    - **MAN and WAN Devices (T-4.1.2):** This class includes devices that perform an intrinsic function for a Metropolitan Area Network (MAN) or a Wide Area Network (WAN). Examples include routers supplied by companies such as Cisco.
    - **Network Security Devices and Software (T-4.1.3):** This class includes hardware and software whose main purpose is to provide security for a network, particularly in terms of preventing unauthorized access. Examples include firewalls such as the Checkpoint Firewall Software Blade and network access control, such as the Cisco NAC Appliance.
    - **Content Switches and Load Balancing Devices and Software (T-4.1.4):** This class includes devices that can redirect network connections to manage the performance of applications. Connection requests, and subsequent network traffic, is redirected to appropriate servers on the basis of a defined algorithm. The algorithm can be as simple as round robin or as complex as based on an evaluation of the current workload of the participating servers. Content switches, also known as layer 3 switches, have the ability to inspect the content of the network traffic and determine where to redirect the traffic. The Cisco CSS 11500 series of switches is an example.
    - **Network Performance and Optimization Devices and Software (T-4.1.5):** This class includes hardware devices whose purpose is to enable monitoring and/or improvement of activity levels (particularly traffic) on a network and its components. An example is Riverbed Appliances Devices and Cisco's Network Analysis Modules.
    - **Wireless Networking Devices (T-4.1.6):** This class includes devices that perform some intrinsic function for a wireless network. Wireless networks usually run over IP, and can

provide LAN, MAN and even WAN functionality. An example is an 802.11n wireless router.

- **Radio Communications Devices (T-4.1.7):** This class includes devices that use spectrum licensed from the ACMA, and are usually dedicated to voice communications. Radio communications can use long range high-frequency (HF) radio and short-range ultra-high-frequency (UHF) radios. Examples include two-way radio repeaters and base stations. Mobile devices, such as hand held radios, should be classified to the Mobile Radio Devices class.
- **Voice Network Devices and Software (T-4.1.8):** This class includes devices such as Private Automatic Branch Exchange (PABX) and devices that enable voice over IP (VoIP), two-way radio interfaces, and radio control console systems. A PABX is an automatic telephone switching system within a private enterprise. VoIP is an Internet protocol telephony term for a set of facilities used to manage the delivery of voice information over the Internet.
- **Network Name and Address Devices and Software (T-4.1.9):** This class includes components that manage the database of names and addresses for potential network destinations and perform the function of translating network addresses from human-readable form to machine-readable form and back again. An example is the Microsoft DNS Server. This class also includes the software that assigns network addresses to devices on request. The primary example here is a Dynamic Host Configuration Protocol (DHCP) service.
- **Caching and Proxy Devices and Software (T-4.1.10):** This class includes components provided by a proxy server. A proxy server is a device that processes and filters all IP packets that are directed to it and decides which protocols and services can be served out of its cache. An example is Microsoft's Internet Security and Acceleration (ISA) Server.

- **Bandwidth and Connectivity (T-4.2):** This capability includes services, devices and software that provide bandwidth, connectivity, virtual private network and remote access capabilities.
  - **Bandwidth Provision (T-4.2.1):** This class refers to the sourcing of telecommunications capacity through third-party providers, external to the enterprise.
  - **VPN Devices and Software (T-4.2.2):** This class includes components that support the provision of secure networking between a central network and mobile workers or remote teleworkers. Cisco offers a range of hardware and software to support VPN services.
  - **Remote Access Devices and Software (T-4.2.3):** This class includes components that provide the ability to connect to a network from a distant location. Generally, this requires a computer, a modem and remote-access software to allow the computer to connect to the network over a public communications network (such as a phone or cable network). Examples include Microsoft's RAS.
- **Equipment Accommodation and Cabling (T-4.3):** This capability includes those facilities used to house and connect systems and associated equipment.
  - **Power Supply and Conditioning (T-4.3.1):** This covers all equipment which provides and conditions power including backup power systems and generation of power.

    To prevent single points of failure, all elements of the electrical systems, including backup system, are typically fully duplicated and critical servers are connected to both the A-side and B-side power feeds. This arrangement is often made to achieve N+1 redundancy in the systems. Static switches are sometimes used to ensure instantaneous switchover from one supply to the other in the event of a power failure. Where uninterruptible power supply is required, backup power from alternative sources such as diesel generators or other uninterruptible power sources can be utilized to mitigate the impact of events such as mains power failure.

- **Air Conditioning (T-4.3.2):** The ambient temperature and humidity in equipment accommodation rooms may affect the performance of some electronic equipment, including possible malfunction. Air conditioning provides means of controlling temperature and humidity to desired levels.
- **Environmental Monitoring and Management (T-4.3.3):** This class includes software and associated sensors that control and capture information on the performance of buildings, equipment rooms, and associated infrastructure in real time.
- **Fire Detection and Suppression (T-4.3.4):** Fire suppression systems are designed for use in conjunction with other fire safety systems including smoke and heat detectors and alarm systems, to increase the level of fire protection within enclosed spaces such as data centers.

  Gaseous fire suppression is a form of suppression that uses inert gases and chemical agents to stabilize, reduce or eliminate fire propagation and resulting heat/smoke. This type of suppression system typically consists of the agent and its storage containers, release valves, piping and dispersion nozzles; as well as a system of controls linked to detection and alarm systems.
- **Cabling and Racking (T-4.3.5):** This class includes connectivity hardware that interconnects devices. This classification includes the cable types, patch panels, racks and cabling management systems.
- **Physical Access and Security (T-4.3.6):** Includes cameras (CCTV), access control systems, mantraps and other security systems used to monitor and control physical access to IT equipment rooms, racks.
- **Equipment Rooms (T-4.3.7):** A data center is a large purpose-built facility/building that provides a secure and controlled environment to support the operation of IT equipment

  A computer room is a smaller, dedicated facility (which may or may not be purpose built) that is used to house operational equipment and systems.

  Equipment and telecommunications rooms house building and floor distributors, along with other specialized equipment.

  Best practice suggests these generally include redundant or backup power supplies, redundant data communications connections, environmental controls (e.g. air conditioning, fire suppression) and security devices.
- **Telecommunications Towers (T-4.3.8):** This class includes fixed infrastructure to support the antennae of two-way radio, wireless network devices and microwave radio equipment. This may include safety fencing, lightning protection earthing systems, full protection systems, cable and antenna support arrangements. Towers are typically freestanding or have guyed cable support, but antennae can also be mounted on a range of small structures attached to buildings. Towers typically have an adjacent equipment room.

Table 6 below, identifies the products and services that comprise FSA's current Network and Computer Accommodation Technology Domain.

Table 6: Network and Computer Accommodation Technology Domain Standards

Technology Capability	Technology Class	Product or Service	Classification
Network	LAN Devices	Cisco Switches	Elective
Network	MAN and WAN Devices	Cisco Routers	Elective
Network	Network Security Devices and Software	McAfee IDS	Elective
Network	Network Security Devices and Software	Cisco Adaptive Security Appliance Service Model (ASASM)	Elective
Network	Content Switches and Load Balancing Devices	Netscaler (Limited)	Elective
Network	Content Switches and Load Balancing Devices	F5 Local Traffic Manager (LTM)	Elective
Network	Network Performance and Optimization Devices and Software	Netscaler (Limited)	Elective
Network	Network Performance and Optimization Devices and Software	F5 Local Traffic Manager (LTM)	Elective
Network	Wireless Networking Devices	Refer to ED Technical Standards Workbook	Elective
Network	Radio Communication Devices	Refer to ED Technical Standards Workbook	Elective
Network	Voice Network Devices and Software	Refer to ED Technical Standards Workbook	Elective
Network	Network Name and Address Devices and Software	IPAM	Elective
Network	Caching and Proxy Devices and Software	Cisco Adaptive Security Appliance Service Model (ASASM)	Elective
Network	Caching and Proxy Devices and Software	Akamai	Standard
Network	Caching and Proxy Devices and Software	IBM XI52 DataPower	Standard
Network	Caching and Proxy Devices and Software	IBM WebSeal	Standard
Bandwidth and Connectivity	Bandwidth Provision		

Technology Capability	Technology Class	Product or Service	Classification
Bandwidth and Connectivity	VPN Devices and Software	NetScaler SSL VPN	Elective
Bandwidth and Connectivity	VPN Devices and Software	Refer to ED Technical Standards Workbook	Elective
Bandwidth and Connectivity	Remote Access Devices and Software	Cisco TACACS	Elective
Equipment Accommodation and Cabling	Power Supply and Conditioning	50-100 watts per SF, 150 Watts per SF capable, mirrored fully redundant UPS systems (each 3600 KW).	Elective
Equipment Accommodation and Cabling	Air Conditioning		
Equipment Accommodation and Cabling	Environmental Monitoring and Management		
Equipment Accommodation and Cabling	Fire Detection and Suppression	Multi-zone dry-pipe sprinkler/smoke detector system with VESDA water detection system.	Elective
Equipment Accommodation and Cabling	Cabling and Racking		
Equipment Accommodation and Cabling	Physical Access and Security	24x7 armed guards. CCTV surveillance, multilevel security card readers with battery backup, perimeter fence, gate controls.	Elective
Equipment Accommodation and Cabling	Equipment Rooms		
Equipment Accommodation and Cabling	Telecommunications Towers	Multiple vendors, two redundant OC192's and eight redundant OC 48's.	Elective

2.5 Management and Control

The Management and Control Technology Domain comprises those technology elements that are not core to the business functionality, but nevertheless provide integrity, control and assurance that elements within the other domains are functioning correctly.

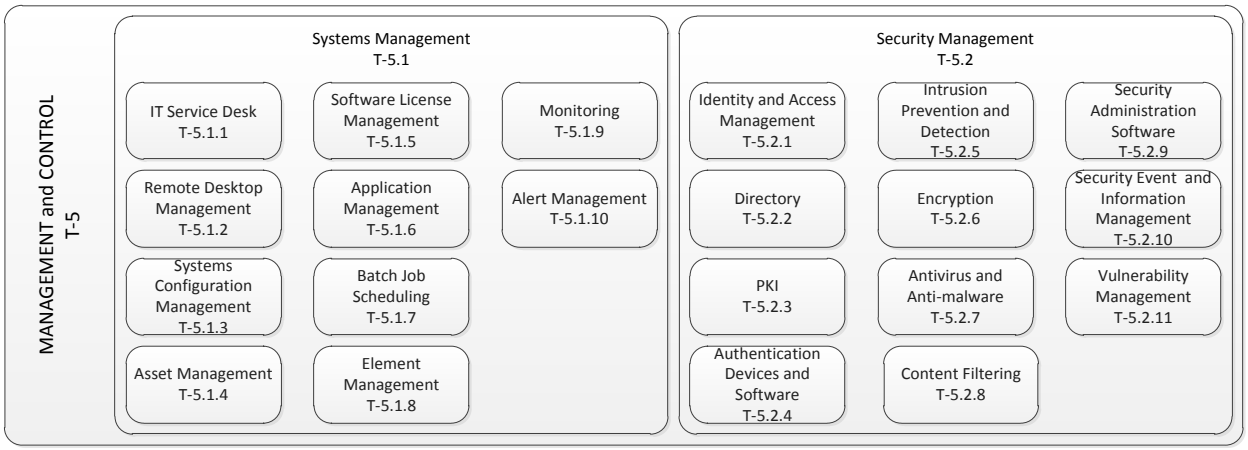

Figure 7: Management and Control Technology Domain

The Management and Control Technology Domain is composed of the following Technology Capabilities and Classes:

- **Systems Management (T-5.1):** This capability includes software that is concerned with managing the operation of an IT environment or system
    - **IT Service Desk (T-5.1.1):** This class includes software to support call management and logging activities of the IT service desk. The IT service desk is a single point of contact for end-users who need help. Having a single point of contact prevents significant losses in time spent by individual users looking for ways to fix problems and get help. The IT service desk does the following: receives all calls and emails on problems, records, classifies and prioritizes them, seeks a solution and keeps users updated. An example of software that supports this process is Computer Associates' Unicenter ServicePlus Service Desk.
    - **Remote Desktop Management (T-5.1.2):** This class includes software that supports the management of an enterprise's IT desktop from a central location. By and large, it obviates the need for support staff to attend on-site to service a desktop device. From the central location, support professionals can scan desktop devices, check the status of software licenses, download and update software and perform diagnostics. An example is EMCO's Remote Desktop Professional.
    - **Systems Configuration Management (T-5.1.3):** This class includes tools that allow an enterprise to manage and control all of the configurable elements of its IT systems, including servers, operating systems, as well as networks and their elements. An example is Novell's ZENworks.
    - **Asset Management (T-5.1.4):** This class includes systems that support the management of an enterprise's IT assets (including PCs, servers, networks, and software) throughout the lifecycle of the asset from acquisition, through servicing and support, to disposal. Computer Associates' Unicenter Asset Management is an example.

- **Software License Management (T-5.1.5):** This class includes applications that ensure compliance with vendors' software license restrictions (for example enforcing a maximum number of concurrent connections, or defined users.) An example of software that supports this process is ManageSoft from ManageSoft.
- **Application Management (T-5.1.6):** This class includes software that supports the management and administration of enterprise applications across a diverse, distributed environment. The software monitors application availability and performance, collects performance data and allows predictive analysis. An example is Computer Associates' Enterprise Management software, part of the UniCenter suite.
- **Batch Job Scheduling (T-5.1.7):** This class includes systems that monitor the status of processing activities across the complex, heterogeneous IT platforms that are characteristic of a large enterprise. Assessing and responding to predefined system states, the job scheduler effectively ensures continuous and stable IT operation across all platforms. The scheduler automatically identifies critical events and either reacts to them automatically or alerts the respective user. An example is the UC4 Workload Automation Suite.
- **Element Management (T-5.1.8):** The control consoles and utilities used by operations staff to directly manage elements such as storage areas, network devices, servers, databases etc. They are often, but not always, provided by the vendor of the element to be managed. Examples include Dell OpenManage; Cisco Works; EMC Celerra Manager.
- **Monitoring (T-5.1.9):** This class includes software and hardware platforms that enable operational staff to monitor and track the performance of components (whether hardware, software or networks), manage availability, and provide insight on service level management. Examples include HP Openview and IBM Tivoli Netcool.
- **Alert Management (T-5.1.10):** This class includes software that plans and monitors the entire alert management process, designates resources, arranges vacations, escalation plans and keeps track of all events as they occur. The alarming service has to give certainty that, if a message is issued, it will be received, acknowledged and acted upon.

- **Security Management (T-5.2):** This capability includes security management devices and software
  - **Identity and Access Management (T-5.2.1):** This class includes systems that allow an enterprise to keep track of the many user accounts throughout the enterprise – not only on in-house-designed applications but also on purchased packages such as those from SAP and PeopleSoft. Sophisticated identity management systems contain middleware that gives the ability to interoperate with many types of directory systems. An example of such a system is the IBM Tivoli Identity Manager offering.

    Access management services provide an enterprise with the ability to separate out authorized users of their systems from potentially unauthorized users and, in the case of the former, allocate to the user the pre-determined levels of access and capability. The system also provides management functions such as adding new authorized users, deleting and modifying others, and changing the levels and types of permissions associated with each user.
  - **Directory (T-5.2.2):** This class includes components that map logical names to physical addresses in a network. Directories are repositories for information about network-based entities such as applications, files, printers and people. Directory services provide a consistent way to name, describe, locate, access, manage and secure information about these resources. An example is Microsoft's Windows 2000 Directory Services.
  - **Public Key Infrastructure (PKI) (T-5.2.3):** This class includes components to manage public-key cryptography, an encryption technique that uses two mathematically related keys: a public key to encrypt messages and a private key to decrypt them. It also includes the various related systems for the issuance and accreditation of digital

certificates. An example of a PKI system is the UniCert PKI software from Baltimore Technologies.

- **Authentication Devices and Software (T-5.2.4):** This class includes multi factor authentication, whereby at least two different factors are used in conjunction to authenticate. Factors include: human (something you are), personal (something you know) and technical (something you have).

  Technologies used in multi-factor authentication include: tokens; biometrics; magnetic cards; smart cards (and card reader technology); phones.

- **Intrusion Prevention and Detection (T-5.2.5):** This class includes systems consisting of hardware and/or software that monitor events occurring in a computer system or network for signs of intrusion or other malicious activity, and that takes measures to protect the system or network from such intrusions or activity.

  An example is Computer Associates' eTrust suite.

- **Encryption (T-5.2.6):** This class includes components that encode data in such a way that an unauthorized party cannot decode it, yet the receiver can readily decode it. Encryption capability is often provided as an embedded capability in electronic messaging software, but a freestanding example is the Enterprise Encryption Suite offered by PGP (Pretty Good Privacy).

- **Antivirus and Anti-Malware (T-5.2.7):** This class includes software designed to detect, remove, and/or protect a computer system from the effects of computer viruses. Well-known examples are McAfee's VirusScan or Symantec's Norton AntiVirus.

- **Content Filtering (T-5.2.8):** This class includes components that will filter content based on organizationally defined rules. Filtering can include preventing the transmission of inappropriate language or images, malware, or security-classified information.

  Examples of content filtering software are McAfee's Privacy Service and Symantec's Web Security.

- **Security Administration Software (T-5.2.9):** This class includes software that supports an enterprise in protecting its information assets by consolidating management of accounts, passwords and resources across a broad range of intranet and extranet platforms as well as allowing applications to be centrally managed. An example is Admin, an element of Computer Associates' eTrust suite.

- **Security Event and Information Management (T-5.2.10):** This class includes tools that support an enterprise in reporting and analyzing the multitude of security alerts and event alarms that can be generated by tools from several vendors. An example is Computer Associates' eTrust suite.

- **Vulnerability Management (T-5.2.11):** This class includes security patch management tools as well as corporate security policy compliance products. This class also includes vulnerability assessment tools such as penetration testing tools. Tools in This class typically compare the configuration of network and security devices and compare these with known updates and either recommend or automatically deploy changes.

Table 7 below, identifies the products and services that comprise FSA's current Management and Control Technology Domain.

Table 7: Management and Control Technology Domain Standards

Technology Capability	Technology Class	Product or Service	Classification
Systems Management	IT Service Desk	ACD	Elective
Systems Management	IT Service Desk	BMC Remedy	Elective
Systems Management	Remote Desktop Management	LogMeIn	Elective
Systems Management	Systems Configuration Management	IBM WebSphere Network Deployment	Standard
Systems Management	Systems Configuration Management	Oracle Enterprise Manager	Standard
Systems Management	Systems Configuration Management	BMC Atrium	Elective
Systems Management	Systems Configuration Management	CA Unicenter	Standard
Systems Management	Asset Management		
Systems Management	Software License Management		
Systems Management	Application Management	Wily Introscope	Standard
Systems Management	Application Management	Webtrends on Demand	Standard
Systems Management	Application Management	Google Analytics	Target
Systems Management	Application Management	Tealium	Target
Systems Management	Batch Job Scheduling	CA ESP	Standard
Systems Management	Batch Job Scheduling	CA 7	Elective
Systems Management	Batch Job Scheduling	Autosys	Elective
Systems Management	Element Management		
Systems Management	Monitoring	Omegamon	Elective

Technology Capability	Technology Class	Product or Service	Classification
Systems Management	Monitoring	NETIQ	Elective
Systems Management	Monitoring	BMC Patrol	Elective
Systems Management	Monitoring	Wily Introscope	Elective
Systems Management	Monitoring	ConsoleWorks	Elective
Systems Management	Monitoring	DPA	Elective
Systems Management	Monitoring	Metalogix Diagnostics Manager	Elective
Systems Management	Alert Management		
Security Management	Identity and Access Management	IBM Tivoli's TIM/SAM	Standard
Security Management	Identity and Access Management	RACF (Mainframe)	Elective
Security Management	Directory	IBM Tivoli Directory Server	Standard
Security Management	Directory	Windows Active Directory	Standard
Security Management	Public Key Infrastructure (PKI)		
Security Management	Authentication Devices and Software	Symantec Token	Standard
Security Management	Authentication Devices and Software	Cisco Secure ACS (TACACS)	Elective
Security Management	Authentication Devices and Software	CyberArk	Standard
Security Management	Intrusion Prevention and Detection	McAfee Network Security Manager	Elective
Security Management	Encryption	AES 256 Encryption	Elective
Security Management	Encryption	Integrated Cryptographic Service Facility (ICSF)	Standard
Security Management	Encryption	Server side AES 256 Verisign	Elective
Security Management	Encryption	Web Services Security (WS-Security)	Elective

Technology Capability	Technology Class	Product or Service	Classification
Security Management	Antivirus and Anti-Malware	McAfee ePolicy Orchestrator (ePO)	Elective
Security Management	Content Filtering	Refer to ED Technical Standards Workbook	Elective
Security Management	Security Administration Software	Metalogix ControlPoint	Elective
Security Management	Security Event and Information Management	Refer to ED Technical Standards Workbook	Elective
Security Management	Security Event and Information Management	RSA Security Analytics	Elective
Security Management	Vulnerability Management	McAfee Vulnerability Manager	Elective
Security Management	Vulnerability Management	Qualys Vulnerability Manager	Standard
Security Management	Vulnerability Management	Qualys Policy Compliance	Standard
Security Management	Vulnerability Management	Nessus Vulnerability Manager	Standard
Security Management	Vulnerability Management	HP WebInspect	Standard
Security Management	Vulnerability Management	LogRhythm	Standard

3. FSA Technology Standards

The FSA Technology Standards covers technology standards used to support the FSA enterprise architecture. Per OMB Circular A-119, a technology standard is a common and repeated use of rules, conditions, guidelines or characteristics for products or related processes and production methods, and related management systems practices.

FSA has developed Java-based Reusable Common Services (RCS) components that application groups use to lessen programming efforts and enforce best practices that work efficiently within the FSA environments. FSA has developed Reusable Common Services for the Integrated Technical Architecture (ITA) and the Access and Identity Management System (AIMS).

- **ITA Reusable Common Services**: It is a set of reusable components to applications hosted in the ITA and FAFSA environments. Application groups can use these reusable components to lessen programming effort and enforce standard modes of business and best practices. Some examples of reusable components are Audit Tracking Framework (Audit Logger), Email, Google Search, IMAP, etc.
- **AIMS Reusable Common Services**: It is a set of web service functions to bridge communication between other FSA applications and the AIMS TIM/SAM environment. These include web services for creating an account, change password, updating a user's account, and retrieving the attributes for a given users account. The web services are secured via the ESB and access to call them is restricted based on application requirements.

Table 8 below, identifies the technical standards that comprise FSA's current Technology Standards.

Table 8: FSA Technology Standards

Technology Capability	Technology Class	Technical Standards	Classification
Application Delivery Platform	Application Server Software	ITA Reusable Common Services (RCS)	Standard
Network	Network Name and Address Devices and Software	Network Time Protocol (NTP) Stratum 1	Standard
Security Management	Authentication Devices and Software	AIMS Reusable Common Services (RCS)	Standard
Security Management	Encryption	HyperText Transfer Protocol (HTTP)	Phase Out
Security Management	Encryption	HyperText Transfer Protocol Secure (HTTPS)	Standard
Security Management	Encryption	Secure Sockets Layer (SSL) 2.0	Phase Out

Technology Capability	Technology Class	Technical Standards	Classification
Security Management	Encryption	Secure Sockets Layer (SSL) 3.0	Phase Out
Security Management	Encryption	Transport Layer Security (TLS) 1.0	Phase Out
Security Management	Encryption	Transport Layer Security (TLS) 1.1	Standard
Security Management	Encryption	Transport Layer Security (TLS) 1.2	Target
Security Management	Encryption	Rivest Cipher-4 (RC-4)	Phase Out
Security Management	Encryption	Encryption Algorithm AES	Standard
Security Management	Encryption	Cryptographic Hash Strength SHA-1 (128 bits)	Phase Out
Security Management	Encryption	Cryptographic Hash Strength SHA-2 (256 bits)	Standard
Security Management	Encryption	Certificate Standard Signing Request (CSR) (1024 bits)	Phase Out
Security Management	Encryption	Certificate Standard Signing Request (CSR) (2048 bits)	Standard