U.S. Department of Education
Federal Student Aid

Virtual Data Center Concept of Operations

Version 2.0

December 12, 2007

Document Version Control

VERSION	DATE	DESCRIPTION
1.0	01/20/2006	Initial Release
2.0	12/12/2007	Revisions to address changes in operations based on award of new data center contract.

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EXECUTIVE SUMMARY

Based on the findings of the National Performance Review (NPR) Report, " Reengineering Through Information Technology," as reported in October 1995 by OMB Bulletin 96-02 entitled, "Consolidation of Federal Data Centers," GSA awarded three contracts on February 8, 1997 for Virtual Data Center (VDC) services to Computer Sciences Corporation (CSC), Unisys, and GTE/Sungard for agencies to compete their data outsourcing needs.

In February 1997, the U.S. Department of Education, Office of Federal Student Aid (Federal Student Aid) competed task orders for outsourcing and consolidation of Federal Student Aid's data processing requirements. These task orders consolidated the multi-vendor/multi-contract operations and maintenance of systems to a single data center with a single contractor for outsourcing of the infrastructure. This first effort in streamlining and reducing costs of data processing and operations was called Band One.

In 1998, the Reauthorization of the Higher Education Act established the Office of Federal Student Aid as a Performance-Based Organization (PBO) to administer the Federal student financial assistance programs at the Department of Education. As a result of PBO legislation, Federal Student Aid developed an approach for aligning system investments with evolving business strategies to support integration of systems and data. The Federal Student Aid Target State Vision and Sequence Plan provides the foundation for moving business strategies forward. These strategies include system consolidation and/or implementation of new technical solutions to meet business objectives.

In 2006, Federal Student Aid sought to further reduce VDC costs, gain efficiencies, and gain economies of scale in a performance-based environment through award of a new data center contract. This new VDC contract provides Federal Student Aid the flexibility to maintain current systems, while developing new systems, and further reduces costs for commodity data center services. It also provides visibility into the costs of operating data center services so that opportunities for process improvements and implementation of new systems and solutions can be reviewed in order for Federal Student Aid to further its objectives for systems and data integration efforts.

The VDC Concept of Operations provides a description of the strategies for implementing changes in the data center operations and services for Federal Student Aid. These strategies are based on an IT industry approach to developing solutions based on people, processes, tools, and technologies. CIO is implementing a resource plan to obtain the skills and resources to support future operations of the data center. Processes have been implemented and continue to evolve to ensure governance and oversight of systems development, maintenance, and operations. Tools and technology are used to further reduce costs associated with maintenance and oversight of systems. The VDC is a core asset in meeting Federal Student Aid’s objectives and this document provides a description of the resources it provides.

1. PURPOSE AND SCOPE

Over the past several years, Federal Student Aid has gained substantial cost savings and efficiencies through consolidation of data center operations. The Chief Information Office (CIO) will continue to make progress in meeting Federal Student Aid Strategic Objectives by further consolidating data centers into a single VDC Solution. Additionally, CIO will improve the performance of the VDC in key areas. Through a series of meetings with business owners and support services staff, CIO has developed targeted areas for improvement. The key areas for improvement are the following:

- Effective and efficient oversight and management processes that support all aspects of IT Service Management through the adoption of IT Infrastructure Library practices (ITIL) (www.itil.org)
- Skilled and knowledgeable personnel to support both the implementation of the IT Service Management Framework and Federal Student Aid's Target State Vision
- Coordination between the VDC and application and service delivery contractors
- Monitoring of applications, systems, and networks to ensure quality IT services versus traditional platform availability
- Enterprise visibility of applications, system processing, networks, and security posture
- Responsiveness to new security policies and other government mandates
- Continuity of services versus traditional disaster recovery of applications, servers, or networks
- Continued reduction of infrastructure services costs

This Concept of Operations lays the foundation for the strategies and activities that will allow Federal Student Aid CIO to improve data center services and meet the objectives. It also provides a discipline-specific focus and context for the design, development, and vision of how the VDC will operate to support Federal Student Aid and its mission.

2. VIRTUAL DATA CENTER STRATEGIES

The VDC should be viewed as a service to Federal Student Aid system owners. It exists to support maintenance and operations of systems (applications, middleware, and infrastructure) for all of Federal Student Aid's communities, including:

- Federal Student Aid staff
- Federal Student Aid Business Areas
- Students and Parents
- Title IV Eligible Post-Secondary Institutions
- States, Lenders, and Guarantee Agencies

To improve services and meet objectives, CIO has developed several strategies by adopting an IT industry approach to developing solutions tailored to people, processes, tools, and technologies.

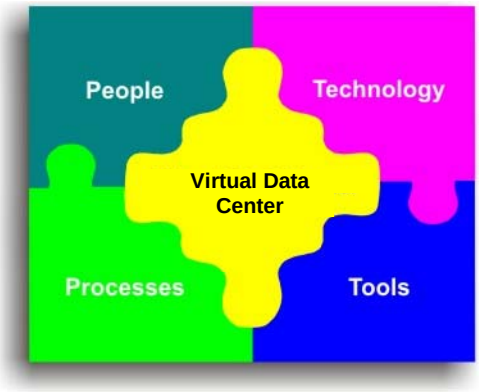

Figure 2-1, Focused Solutions for the Virtual Data Center

2.1. People

The CIO staffing plan will provide the resources and skill sets required to implement and maintain the improvements described in this document. CIO is organizing itself into a services organization with the adoption of the ITIL IT Service Management framework for VDC services. The VDC solution provider primarily interfaces with CIO staff as they strive to meet improvement goals and Federal Student Aid's Business Objectives. Additional resources are being added to CIO as well as training of current staff to ensure the knowledge and skills exist in CIO to oversee data center management and implementation of improvements.

2.2. Processes

Federal Student Aid has revised and developed several key processes to govern and support oversight and management of IT service delivery and support. CIO has worked hand-in hand with Federal Student Aid business areas to identify areas of improvements and to continually evolve processes to support integration objectives and effective, but streamlined oversight.

2.3. Tools

Federal Student Aid will procure and operate the support tools necessary for process improvements. However, the tools needed for management and oversight, monitoring, and end-

to-end visibility of Federal Student Aid's IT environment will be supplied and operated by the VDC service provider.

2.4. Technology

Federal Student Aid establishes its technology solutions through a disciplined Enterprise Architecture process. Products and standards are derived from a combination of the as-is environment and future direction of initiatives. The proposed products and technology are evaluated against the as-is and then the as-is is evolved to the proposed standard. CIO will work collaboratively with the data center service provider to stay abreast of technology and take advantage of proposed solutions to further integrate systems, reduce complexity and costs, and increase effectiveness of the operational hosting environment.

2.5. Implementation Timeline

A customer-driven focus is the key to the successful implementation of these strategies. In recognition of the number, diversity, and complexity of the many Federal Student Aid stakeholders affected by the VDC, Federal Student Aid's CIO will serve as the main, customer-driven focal point for the Federal Student Aid business owners to coordinate Federal Student Aid's computing capabilities. Implementation of the strategies will occur over the next few years.

3. PROCESSES

Oversight and review processes are an inherent component of any Federal Agency's governance structure. In order to ensure the maximum value of integration efforts and improve IT service delivery and support, Federal Student Aid reviewed and refined its approach to governance. Existing governance processes were revised to streamline the review and decision-making process while new processes were created to ensure all impacted business functions were considered. Process improvements were made in the following areas:

- Strategic - Capital Planning and Investment Control - Focuses on evaluation of investments to ensure integration of Federal Student Aid's major business systems and adherence to enterprise standards;
- Operational - Enterprise Operational Change Management - Maintains coordination and oversight of application and system changes across Federal Student Aid business areas after an investment has been approved and is in an implementation or operational stage;
- Infrastructure - IT Service Management – Provides the foundation for managing and overseeing data center operations.

The following sections provide further details on each of these areas and the reference documents they're described within.

3.1. Strategic Processes

Federal Student Aid is currently investing in modernization and integration of the applications that support the major lines of business for Federal Student Aid programs. Through its Capital Planning and Investment Control (CPIC) process, Federal Student Aid reviews all current and proposed investments. Federal Student Aid consolidated several review boards into three in order to streamline the decision-making and review process associated with investments. The Executive Leadership Team (ELT) is the strategic board that is comprised of Federal Student Aid's Executives. They provide leadership and strategic direction for systems development efforts. The second board is the Investment Management Council (IMC) which performs due diligence on current and proposed investments, on behalf of the ELT. The third board that governs the operational aspects of investments through their lifecycle is the Enterprise Change Control Board (ECCB).

3.2. Operational Processes

As applications and systems become more integrated, coordination between all impacted or affected business areas and systems is required. The Enterprise Operational Change Management (EOCM) process provides reporting, oversight, and tracking of enterprise events that affect more than one system or system component. This process is integrated with VDC operations for managing changes to the infrastructure. Additional information on the process and the ECCB can be found in the Enterprise Operational Change Management Plan.

Additionally, as integration activities occur between EOCM and the VDC, refinements will be made to other key Federal Student Aid processes. For example, Federal Student Aid has a production readiness review (PRR) process that ensures all stakeholders agree that new application releases or updates are ready for deployment. This process will evolve and change

over time to address quality issues and increased efficiencies. The current PRR process can be found in the Production Readiness Review Process Description document.

3.3. Infrastructure Processes

During discussions of improving processes, Federal Student Aid's CIO organization sought information and guidance from industry leaders and analysts concerning better approaches for managing outsourcing relationships. Upon review of all relevant information and training in IT Service Management, CIO began moving forward with implementing processes focused on IT Service Delivery and Support.

Federal Student Aid business owners and their support staff will interact directly with CIO staff to obtain VDC services. While system performance may be directly reported to a system's owner, CIO will monitor, review, and manage all performance issues with the VDC service provider. Even though CIO will oversee the VDC and coordinate VDC enterprise-level activities, Federal Student Aid system owners maintain contractor oversight of system development and service vendors to ensure the delivery of Federal Student Aid services. For new system development efforts, CIO will specify availability and performance standards that new systems or system components must meet and will work closely with the VDC contractor to determine the appropriate platform and technology to meet the performance and availability requirements. Figure 3-1, illustrates the relationship that CIO envisions for Federal Student Aid.

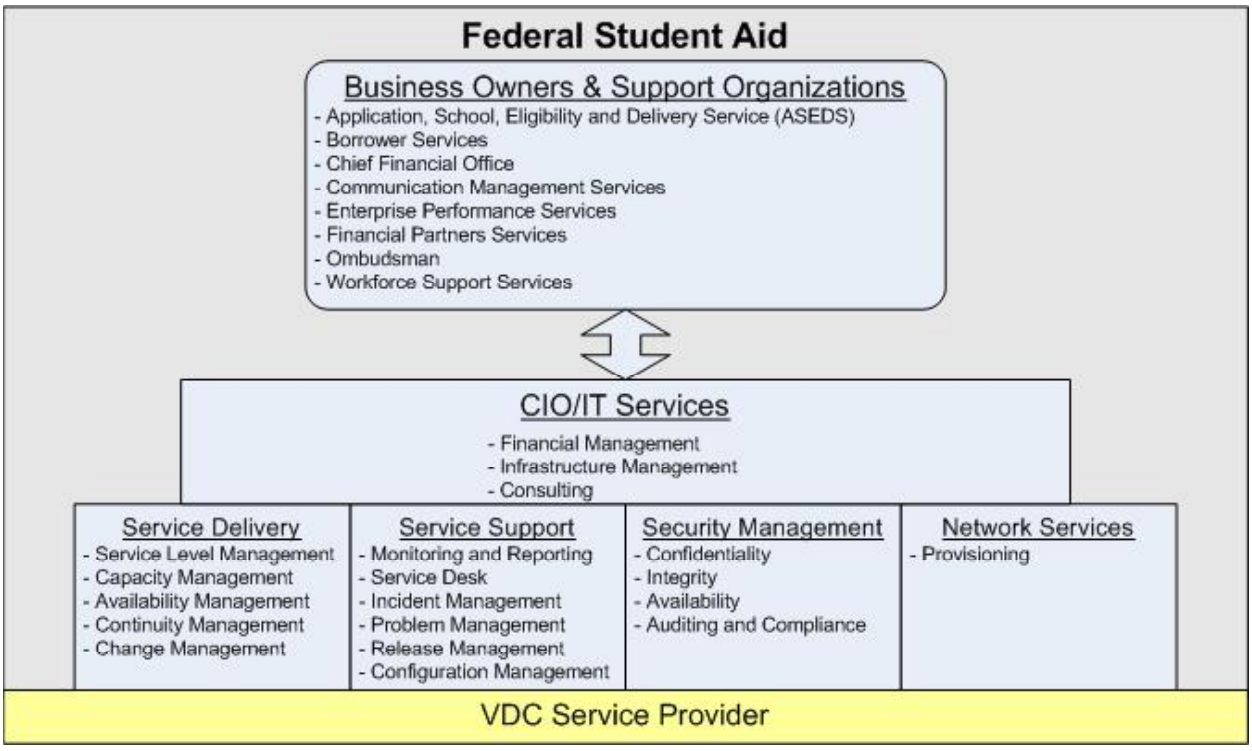

Figure 3-1, Relationship Between Business Owners, CIO and the VDC Service Provider

While CIO already has staff in place for Service Support, Security Management, and Network Services, resource plans have been developed and are being implemented for supporting Service Delivery functions.

3.4. Systems Life Cycle

In order to understand how the governance processes are used to manage systems or system components, an explanation of Federal Student Aid's systems life cycle is necessary. As illustrated in Figure 3-2, services for systems are initiated upon planning for new or modified system components during the select phase of the CPIC process. As development begins, the system or system components development efforts will reside at the VDC. Upon implementation, the system will move to the Operations and Maintenance phase. As new solutions are implemented, legacy systems will move into retirement.

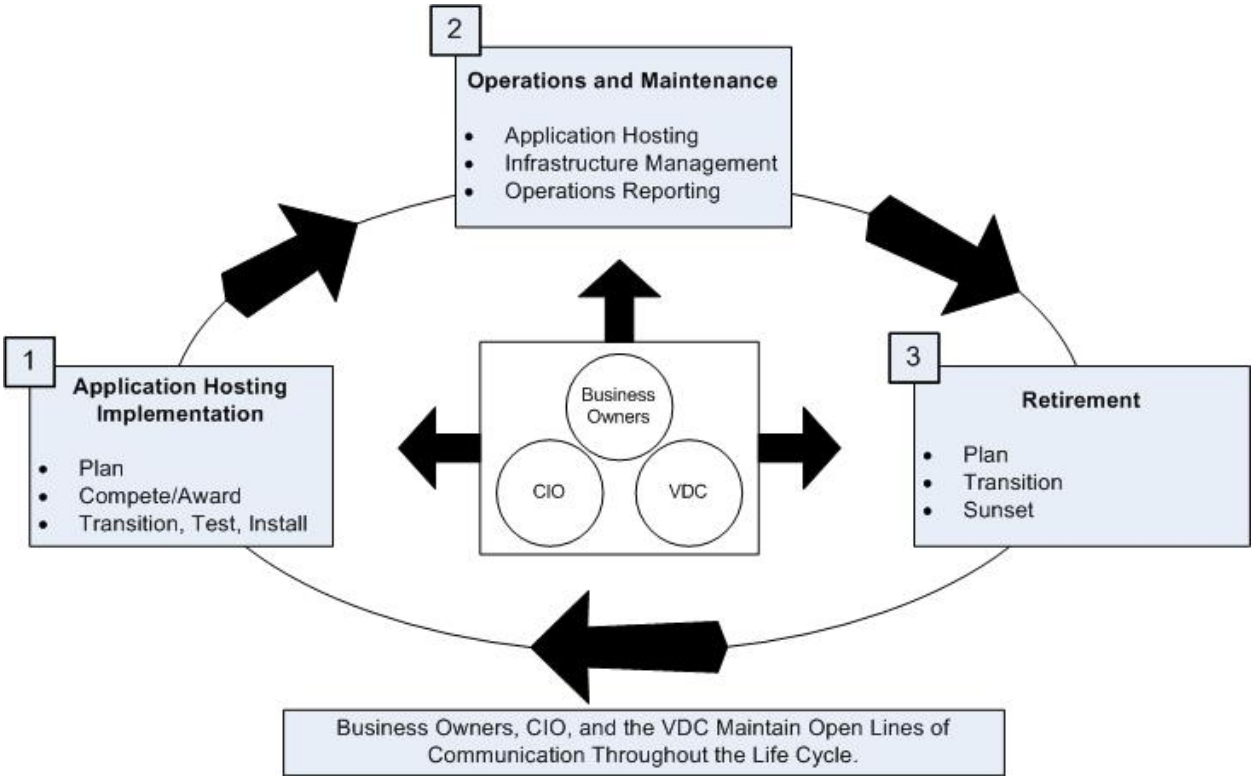

Figure 3-2, Systems Lifecycle

Federal Student Aid Business Owners, CIO, and the VDC have important roles in the management of a system's life cycle and its supporting infrastructure. Their distinct roles at each phase in the life cycle are as follows:

Phase 1: Application Hosting Implementation. Federal Student Aid CIO works closely with business owners to drive the development and implementation of new systems or the transition of existing legacy applications to new integrated solutions. During the CPIC process, business owners request CIO to assist in the development of solutions and infrastructure costs to include in their business cases for investment reviews. CIO staff review these requests and provide planning support. At times, requests are made to the VDC service provider to obtain cost or technology solution information to support their business case. Once an investment has been approved and a contract awarded for the development of the solution, CIO works closely with Business Owners to develop the security, system availability and performance, and the telecommunications requirements. The VDC service provider works with CIO to determine the appropriate platform and infrastructure solution to meet the system requirements. The VDC service provider is also involved in reviews of technical deliverables for the system as it is

developed and develops all the necessary documentation for installation, management and oversight of the system prior to its implementation.

Phase 2: Operations and Maintenance. The VDC maintains the operational environment for the system and reports on incidents and problems to CIO, business owners, and support contractors. Some support contractors are responsible for providing business services (e.g. call center support) while other support contractors are responsible for maintenance of a system after it is implemented. Regardless of the role the support contractor is performing, day-to-day interaction may be required with Federal Student Aid business owners, CIO, and the VDC service provider to ensured continued operations of the system. All parties coordinate on incident tracking, problem management and resolution. If changes to a system are required CIO coordinates implementation efforts with support contractors through EOCM (for enterprise events) and the VDC Change Management process. CIO ensures that a customer-driven (internal and external) focus is maintained at all times and coordinates, as needed, the optimal leveraging of skills and resources of all parties in management of VDC performance.

Phase 3: Retirement. As system or system components are phased out, CIO plans and coordinates the retirement with Federal Student Aid business owners and the VDC service provider to sunset the application or system and discontinuation of services. Standard procedures are used to guide the retirement process to ensure all policy, business, and technical issues are identified and addressed within the system's retirement plan.

3.5. Summary

As Federal Student Aid business functions become more and more integrated with systems or system components that rely on each other for processing data, CIO will continue to evolve its processes to support new technical solutions and their operating environment.

4. TOOLS AND TECHNOLOGY

The tools and technology included in the VDC are designed to provide services that support Federal Student Aid's entire computing infrastructure. The table below presents a cross-reference of the VDC services and common infrastructure used to support Federal Student Aid.

VDC Services Cross-reference

Virtual Data Center			Federal Student Aid Infrastructure						
			Facility	Computing Platform	Storage	LAN	WAN	Middle-ware (ITA/ESB)	Security Arch.
Services	Application Hosting	Mainframe & Non-mainframe Operating Environment		X	X	X	X	X	X
		Web and Application Servers		X	X		X	X	X
		Database Mgmt. Systems		X	X	X		X	X
		Continuity Solutions	X	X	X	X	X	X	X
	Infrastructure Management	Facility Management (Including Physical and Personnel Security)	X			X	X		
		Data Center Business Continuity	X	X	X	X	X	X	X
		Security Monitoring & Reporting	X	X	X	X	X	X	X
		Performance Monitoring & Reporting (end-to-end view)		X	X	X	X	X	X
		Capacity & Availability Management	X	X					
		Change Management		X	X	X	X	X	X
		Configuration Management		X	X	X	X	X	X

As previously stated in Section 2, products and standards are derived from a combination of the as-is environment and future direction of initiatives. As new systems are developed, CIO evaluates current products to determine their ability to meet new requirements. CIO may also review and evaluate new products to determine if they're more beneficial or economical for meeting future objectives. The products or technology are evaluated against the as-is and then the as-is is evolved to the proposed standard. Additionally, CIO works collaboratively with the data center service provider to stay abreast of technology and take advantage of proposed

solutions to further integrate systems, reduce complexity and costs, and increase effectiveness of the operational hosting environment.

Federal Student Aid's technical architecture can be found in the Federal Student Aid Technology Standards and Products Guide. The remaining sections provide an overview of the VDC's operational environment.

4.1. Platforms

The VDC currently contains mainframes, Unix, and Wintel servers. The mainframes are used to support high volume transaction based systems such as the Central Processing System and the National Student Loan Data System. Unix servers support the majority of the remaining data processing needs with Wintell servers used for a small number of internal support systems.

4.2. Network Overview

Federal Student Aid's Wide Area Network (WAN) is primarily Multi Protocol Label Switching (MPLS) based using predominately TCP/IP with AES encrypted endpoints. Federal Student Aid performs provisioning of telecommunication and voice circuits through the GSA Networx's contracts. Normal turn around time for circuit orders are 60-90 days from the day of order to first usage. The circuit request process maybe expedited, on an exception basis. An expedited request incurs additional cost and may improve the end date by approximately 30 days, based on local circuit availability. The endpoint Demarc information must be provided for all orders placed by FSA. If an extended Demarc is required, this must be identified and approved when a circuit is ordered.

There are approximately 50 primary and 50 backup virtual and dedicated circuits. The VDC provides hardware on each end of the WAN connections to supported sites. Some sites have dedicated site-to-site VPNs instead of dedicated circuits. VDC provided hardware consists of a router (with CSU/DSU, AES encryption module, remote access modem for out-of-band management), and a backup WAN connection. The router is sealed and has anti-tamper seals In Accordance With (IAW) FIPS 140-2. Optional equipment that may be provided are: an equipment rack, Sniffer brick, Ethernet patch panel, Ethernet switch/hub, and UPS. Backup circuits consist of Encrypted Broadband connections and are ~ 50% normal capacity. All WAN connections, including Internet connections, are fire walled. Additionally, these connections have IDS/IPS sensors deployed to monitor and halt network traffic based on suspicious activities. US CERT monitors all remote connections.

The VDC provides dual paths to the Internet using BGP to different ISPs. Using Internet route optimization allows traffic to travel over the quickest path, as more day-to-day traffic is off-loaded from dedicated circuits to the Internet. Application acceleration services are used for high volume Internet based applications such as Free Application for Federal Student Aid (FAFSA), PIN, and Student Aid on the Web. The use of these services helps to minimize peaks on the Internet connections into the VDC.

Federal Student Aid's domain falls under the ED.GOV domain and is managed by the Department of Education. The VDC provides IPv4 address space for systems within the VDC. Private IP address space is used for all non-public addressable devices and is used for most interconnections. IPv6 address space is provided by allocation from the GOV domain. Primary, secondary & tertiary DNS are provided by the Department, with a replica DNS at the VDC for local systems contained within the VDC. SMTP traffic is routed to the Department of Education's MS Exchange servers for distribution within the Department and for all outbound

Internet email. Certain Unix servers at the VDC act as a relay from the host applications currently handle this email interchange. The Unix email relays are registered with the MS Exchange servers at the Department.

The VDC also provides an IPsec based VPN using CISCO PIX VPN infrastructure. The VDC provisions accounts requested by Federal Student Aid and in some cases, provides remote hardware for site-to-site VPN connectivity on an as needed basis. AES encryption is a FIPS 140-2 requirement that replaced the use of DES. Client access to the Internet is the client's responsibility, and is not provided by either FSA or the VDC. Site-to-site VPN connections also include a firewall provided by the VDC in support of this type of connection. Dial in connections are not allowed, with exceptions for hardware vendors' remote use for troubleshooting on an as needed basis.

SSH is the primary connection method for all assets within the VDC. External file transfers are handled via Connect:Direct. Tape transfers are not allowed.

4.3. Security

The VDC provides a secure operating environment for Federal Student Aid systems. Maintaining the confidentiality, integrity, and availability of data are of paramount concern to Federal Student Aid. The VDC is classified as a General Support System (GSS). GSSs are required (by Federal and Departmental mandates) to provide physical, environmental, infrastructure, network, operating system, and hardware security. All contractor personnel (prime and any sub-contractors) are required to have a 5C or 6C clearance level.

Additionally, the VDC is subject to independent verification and testing of security controls. Scans of VDC systems routinely occur to identify vulnerabilities and to determine compliance with recommended patch levels. These scans are performed independent of the VDC service provider and include, operating systems, databases, and networks.

The VDC complies with the Department of Education's Certification and Accreditation process. Shared infrastructure services are included in the VDC certification and accreditation activities on a predetermined on a basis. As part of a system's implementation at the VDC, a security review is conducted to ensure that sufficient management, technical, and operational controls are in place to maintain its confidentiality, integrity, and availability.

4.4. Business Continuity

CIO is responsible for the Continuity of Operations Plan (COOP) that covers the essential functions of the Title IV Federal Student Aid programs, for meeting government-wide security and privacy standards, and for protecting critical infrastructure.

The VDC maintains a continuity of services (Disaster Recover) plan that includes both the operational aspects of the data center solution and system requirements. As part of a systems implementation, a security review is conducted that determines the importance of the system to the mission of Federal Student Aid. Based on the system importance, recovery time and point objectives are determined. To support these objectives, the VDC performs routine backups, incremental and full, and maintains a warm backup site for restoration of systems.

The continuity of services plan covers all aspects of redeploying and executing support for an application upon a major interruption of service. The plan includes disaster recovery elements of a technical and operational nature, and addresses the necessary allowances for new staff; staff location changes, switching service, maintenance, and other contractors, etc. It also includes the

processes and procedures for the full recovery of services for systems, including coordination with the Federal Student Aid business owner and application contractors, if necessary.