FSA Integration Partner

United States Department of Education

Federal Student Aid

Data Strategy Enterprise-Wide
XML Framework Team
123.1.13 XML Framework Strategic Assessment and Enterprise Vision

Task Order #123

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Executive Summary

Project Overview
The Office of Federal Student Aid (FSA) is seeking to deliver overall improvements in the areas of data quality and data consistency. FSA is focused on its overall approach towards data to ensure that accurate and consistent data is exchanged between its customers, partners, and compliance and oversight organizations. FSA will also leverage a targeted data strategy to support the enterprise-wide goals of maintaining a clean audit and removing FSA from the General Accounting Office (GAO) high-risk list.

Senior FSA leadership has created a performance plan with several action items designed to remove FSA from the GAO High–Risk List. The Data Strategies Enterprise-Wide project addresses the action items focused on data quality, storage, and exchange. The Extensible Markup Language (XML) Framework is a core technical component of the overall FSA Data Strategy Enterprise-Wide initiative.

Scope
The XML Framework Strategic Assessment and Enterprise Vision is a document that provides a detailed roadmap of the strategy and rationale behind the XML Framework. The XML Framework, as it is envisioned, will provide the technical foundations for standardizing data exchange, as FSA proceeds with implementations as recommended by the Data Strategy Enterprise-Wide initiative.

Drivers
The XML Framework has been developed to address the following strategic drivers for FSA:

- Simplify and standardize data exchange with internal and external trading partners.
- Deliver consistent and accurate data across the enterprise-level systems at FSA.
- Achieve enterprise-wide efficiencies related to better data exchange standards and policies.
- Strengthen FSA's relationship with the government and financial aid community data standards bodies, to support industry wide data exchange standards.

Vision
The XML Framework Vision is:

FSA will use XML, via a single set of enterprise and community standards, to simplify and streamline data exchange across postsecondary education.

The XML Framework will enable FSA to realize the benefits of fully integrating XML as an enterprise-wide standard for internal and external data exchange. By establishing enterprise-wide XML standards and policies, this vision represents a strategic shift in FSA's approach to data exchange and modeling and will enable FSA to take full advantage of XML's position as the industry standard for data exchange, as well as XML's more advanced technical capabilities.

Goals

By establishing XML standards and governance processes, FSA's Enterprise XML Vision will enable FSA to meet the XML Framework's strategic drivers. Specifically, the Framework will enable FSA to achieve the following nine goals.

- **Data Exchange Standard –** Standardize FSA's data exchange using XML as the data exchange technology standard.
- **Consistent and Accurate Data –** Achieve consistent and accurate data. The framework will define data standards, as XML entities, for data exchange to achieve consistent and accurate data.
- **Data Cleanup and Maintenance –** Enable data cleanup and maintenance activities. The framework will utilize commonly-defined XML Core Components and XML-based tools to enable the data cleanup and data maintenance activities, as part of the larger Data Strategy Enterprise-Wide initiative.
- **Standard Data Tools and Processes –** Establish standard data tools and processes, to support consistently performed data/XML modeling through standard tools and processes. These standards will be aligned with community and government standards initiatives.
- **System Flexibility –** Provide system flexibility to simplify future interface changes and support new application and data exchange requirements, through XML-based data modeling for system interfaces.
- **Data Modeling Best Practices –** Use XML and Data Modeling best practices in order to model key business data for exchange and storage.
- **Governance –** Establish an XML governance process to maintain and refresh FSA's XML capabilities.
- **Communication –** Define processes to ensure timely and accurate communications with FSA's business partners (e.g., Schools, Guaranty Agencies, Third Party Servicers, Software Providers, etc.) regarding XML implementations and changes.
- **Service-Oriented Architectures –** Develop an XML infrastructure that supports usage of advanced capability, such as Service Oriented Architectures (SOA) and real-time transactions.

Approach

FSA's Enterprise XML Framework approach is presented in an Integration Partner developed model, called the XML Maturity Model. This model provides a sequencing plan for FSA to incrementally standardize and improve its usage of XML across the enterprise. The activities and sequence are aligned with FSA's key business objectives. The XML Maturity Model is based on previous XML development at FSA, XML case studies, general industry trends, and key principles from Carnegie Melon's Software Engineering Institute (SEI) Capability Maturity Model (CMM). The resulting XML Maturity Model provides a phased approach to implementing XML as an enterprise standard within FSA. The model also provides a roadmap against which FSA can measure its progress.

Amendment History

DATE	SECTION/ PAGE	DESCRIPTION	REQUESTED BY	MADE BY
6/30/03	All	Document submitted for FSA-wide review.	N/A	H. Sibunruang

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1 Introduction

1.1 Overview

Project Overview
The Office of Federal Student Aid (FSA) is seeking to deliver overall improvements in the areas of data quality and data consistency. FSA is focused on its overall approach towards data to ensure that accurate and consistent data is exchanged between its customers, partners, and compliance and oversight organizations. FSA will also leverage a targeted data strategy to support enterprise-wide goals of maintaining a clean audit and removing FSA from the General Accounting Office (GAO) high-risk list.

Senior FSA leadership has created a performance plan with several action items designed to remove FSA from the GAO High–Risk List. The Data Strategy task order specifically addresses Action Item # 16. This action item identifies the need to define an enterprise-wide data strategy and high-level implementation approach that addresses the business flow of data across the enterprise, architecture, primary ownership, standards, management, access methods, and quality. The end result of the Data Strategy task order will be an overall enterprise data framework that integrates the following components that address FSA's major data-related areas:

- Consistent Data Framework
- Technical Strategies
- Extensible Markup Language (XML) Framework
- Common Identifiers
- Enrollment and Access Management

The XML Framework is an underlying component of the overall FSA Data Strategy solution. The XML Core Components approach to modeling key data entities will be used throughout the Data Strategies Framework. The XML Framework will focus on improving the Access Methods and Data Quality segments, as well as emphasize the benefits of using XML for Data Sharing and Data Exchange Interfaces. This document does not attempt to define all possible XML internal processes for each system within FSA, but rather is a vision created with the enterprise as a whole in mind.

The XML Framework Strategic Assessment and Enterprise Vision provides the foundation and roadmap for FSA's expanded use of XML to achieve its business objectives. The document analyzes the current state of XML usage by FSA and its trading partners along with XML industry case studies to identify an Enterprise XML Vision for FSA.

Background

Historically, FSA has exchanged data predominantly using proprietary flat files. Many different types of data, from student application data, to financial aid origination and disbursements, to historical student aid information have been formatted this way. Today, XML represents only 1% of internal and 5% of external electronic data transfers by FSA. (These percentages represent the FMS internal exchange and the COD Common Record external exchange.)[1]

FSA initially implemented XML for external data exchange in a strategic, application-specific manner. When the Common Origination and Disbursement (COD) system was being designed and developed, XML was rapidly becoming the industry standard for data exchange. At that time, there was no FSA enterprise, organized standard for using XML. In order to take advantage of the benefits of XML, FSA made the strategic decision to use XML for the COD data exchange with schools.

The COD implementation has led FSA into the XML world. The successful implementation of XML in COD has made XML well positioned to become an enterprise data exchange standard at FSA. The CPS ISIR is currently being drafted as an XML schema, following the same structure used to create the COD Common Record. With additional XML initiatives within FSA and the Postsecondary Financial Aid Community on the near horizon, FSA recognized the need to formalize its structure and governance for using XML in data exchange interfaces. As part of the Data Strategies Enterprise-wide initiative, FSA is developing an Enterprise Vision for using XML.

Just as FSA has recognized the benefits and need to implement XML, so too have other federal government agencies. The pilot implementations of XML have expanded within government agencies, as evidenced by the activities of the CIO Council's XML Working Group and postings on the XML.gov site.

Enterprise Vision

The enterprise vision for the XML Framework, simply stated, is:

FSA will use XML, via a single set of enterprise and community standards, to simplify and streamline data exchange across postsecondary education.

This vision is necessary to move FSA from the single implementation of XML to more widespread usage across the enterprise. This vision will enable FSA to proactively manage and guide its usage of XML and take full advantage of XML's benefits through an incrementally phased approach. By establishing XML standards and processes, FSA will be able to simplify and standardize its development of data exchange interfaces.

[1] Data Strategy Enterprise Wide Technical Strategies Statement of Focus (Deliverable 123.1.6), June 30, 2003.

The XML Enterprise Vision was developed based on a Strategic Assessment that consists of: 1.) FSA's Current State usage of XML, and 2.) XML Case Studies. The Current State provides a description of FSA's current capabilities for implementing XML while the XML Industry Case Studies span the use of XML by the industry as a whole, to set reasonable goals for FSA and determine the timelines and efforts necessary to meet those goals.

FSA's Enterprise XML Vision consists of the XML Maturity Model that provides a sequencing plan for FSA to incrementally standardize and improve its usage of XML across the enterprise in order to meet key business objectives. The XML Maturity Model is based on previous XML development at FSA, XML case studies, general industry trends, and the key principles identified by Carnegie Melon's Software Engineering Institute (SEI) Capability Maturity Model (CMM). The resulting XML Maturity Model provides a phased approach to implementing XML as an enterprise standard within FSA.

The following diagram illustrates the maturity stages for XML usage in an organization, along with the corresponding FSA activities, either already conducted, in progress, or planned for the future.

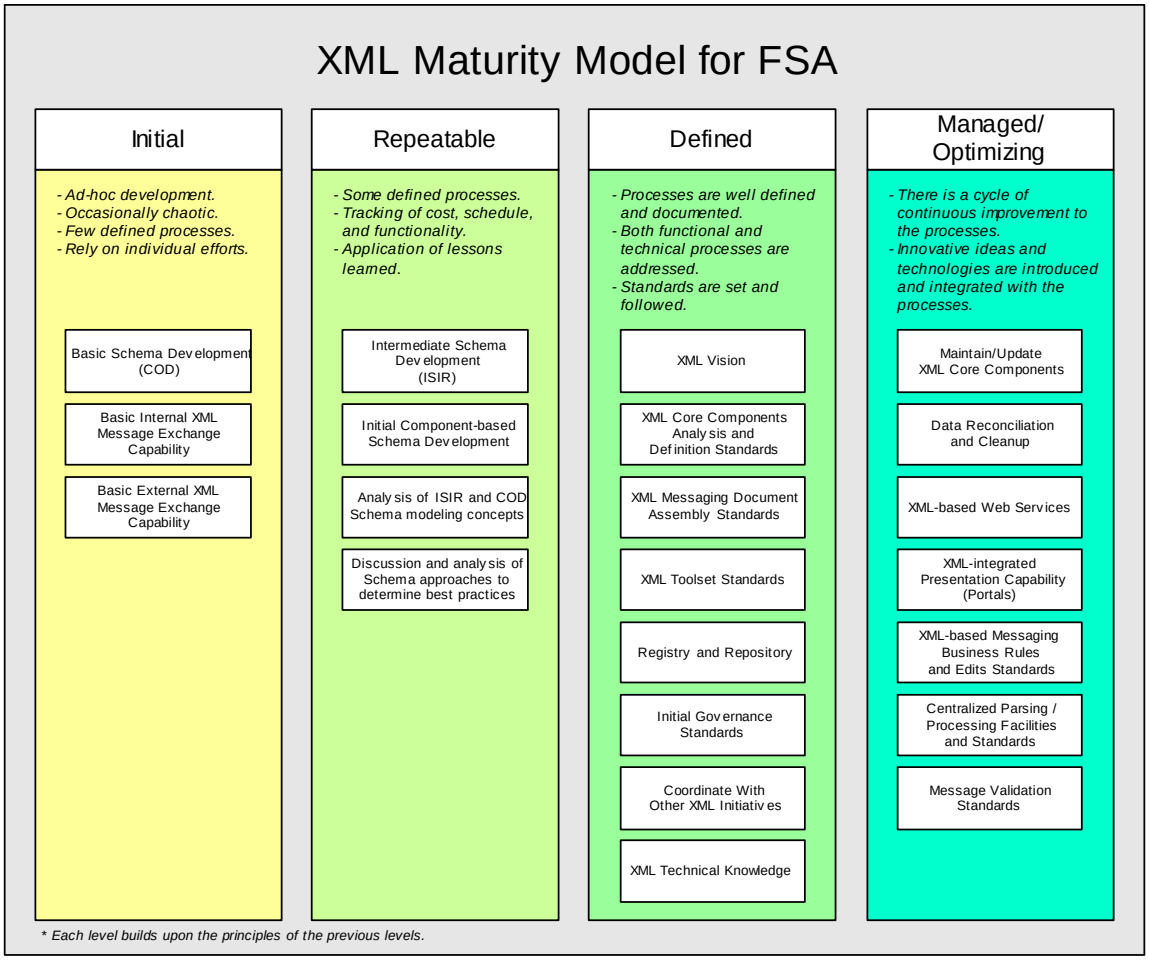

Figure 1 - XML Maturity Model

FSA's XML Enterprise Vision consists of the following five key messages:

1. Enable the Data Cleanup and Data Maintenance Activities, as part of the larger Data Strategies initiative.
2. Consistently perform data/XML modeling through standard tools and processes.
3. Establish an XML governance process to maintain and refresh FSA's XML capabilities.
4. Use XML and Data Modeling Best Practices in order to model key business data for exchange and storage.
5. Transform the organization to using XML for all new and updated internal and external interfaces.

These key messages will reiterate the importance and benefits in creating and implementing an enterprise-wide XML vision.

XML Benefits

By achieving this vision, FSA will be able to take advantage of the following seven benefits of using XML:

- **Simplify Interface Changes** - XML provides flexibility to simplify future interface changes.
- **Build Community-Wide Standards –** By participating in community-wide XML standards development, FSA can show technical leadership to ensure standards are robust, and receive feedback from the community to ensure that standards are well received and can be implemented by all of its business partners.
- **Increase System Flexibility** - XML-based data modeling for system interfaces provides flexibility for supporting new application and data exchange requirements.
- **Leverage COTS Technologies** - An XML standardized infrastructure will enable smoother integration of Commercial-Off-The-Shelf (COTS) technologies
- **Conduct Data Clean-up** - Commonly defined XML Core Components will provide the foundation for FSA's Data Clean-up efforts, by enabling the comparison of data between systems.
- **Leverage Industry Standards** - XML is becoming the industry standard for data exchange.
- **Service-Oriented Architectures –** XML provides the building blocks for moving to Service-Oriented Architectures.

XML Challenges
While there are many benefits associated with using XML as a data exchange format, the following three challenges should be recognized:

- **Learning Curve –** There is a learning curve to become familiar with XML.
- **Size –** XML files are larger than their equivalent flat files.
- **Change –** Implementing XML is a change from previous data exchange conventions.

Data Strategies Context
The XML Framework is an enabling component of the overall FSA Data Strategies Enterprise-work. The initial activities defined in the Enterprise Vision will develop a modeling approach for XML documents. This modeling approach using standardized enterprise Core Components to model key data entities will be utilized throughout the data strategies framework going forward.

The XML Framework will enable the Data Quality layer by providing the principle mechanism for identifying and correcting data quality issues. The different Data Quality areas will use the XML Core Components to map data between the different systems to the Core Components. Once the systems being compared are mapped to the XML Core Components, scripts may be run to identify data discrepancies between the systems. With discrepancies identified, FSA's system owners can then update the data, as identified by the data correction and reconciliation reports.

Conclusion
The XML Maturity Model provides a roadmap for FSA to achieve its Enterprise XML Vision. In order to move from the Initial level of the XML Maturity Model to the Repeatable then Defined levels, FSA needs to take strategic, planned steps. By following the activities proposed in this model, FSA can establish an XML infrastructure that will provide the basis for consistent, enterprise-wide and more advanced XML usage.

1.2 Business Objectives

The XML Framework Strategic Assessment and Enterprise Vision has been developed based on meeting the following high-level business objectives:

- Define and utilize a standards-based approach to XML development.
- Provide timely communication to FSA's business partners (e.g., Schools, Guaranty Agencies, Third-Party Servicers, Software Providers, etc.) regarding XML implementations and changes.
- Establish a governance process for XML development within FSA.
- Align FSA's XML strategy with Government-wide XML direction and initiatives.
- Align with Postsecondary Education Financial Aid community to aid in the development of a community-wide data exchange standard.

1.3 Document Approach

Specifically, the XML Framework Strategic Assessment and Enterprise Vision defines the Enterprise Vision for XML usage at FSA by presenting information in the following areas:

- Current State
- XML Case Studies
- Future State

The XML Enterprise Vision has been developed based on the information presented in the Current State and XML Case Studies, as well as the general industry direction.

Current State
The Current State analysis documents the XML work that has been completed or is in progress within FSA, the Department of Education, and the Financial Aid community (including the Postsecondary Electronic Standards Council [PESC]). Within FSA, there have been several schema development efforts. The COD XML Common Record was implemented in 2002-2003 and is in the second year of production. The CPS XML ISIR is being drafted for implementation in production in 2005-2006.

There are other schema development efforts currently underway. Within the Financial Aid Community, PESC is collaborating with FSA to develop the CommonLine XML schema for Federal Family Education Loan Program (FFELP) and Alternative Loans. PESC is also currently working on the Postsecondary Academic Transcript. The National Council of Higher Education Loan Programs (NCHELP) sponsors the Meteor project, which uses the Common Record

schema as its basis for XML messaging and has publicly agreed to conform to the PESC standard once stabilized. In addition, the Department of Education is beginning development for an XML K-12 Academic Transcript, which is based on PESC's work on the Postsecondary Academic Transcript.

XML Case Studies

The XML Case Studies section outlines industry case studies, giving specific examples of the successful use of XML in U.S. federal government and foreign government projects, Accenture firm experiences, and private sector business cases across multiple industries. The case studies illustrate a common technology shift towards implementing XML, as a means of successfully targeting various key business integration areas. These cases have been chosen based on their relevance to FSA.

Future State

The Future State Vision outlines the recommended approach to effectively support the managed growth of XML capability within FSA. It identifies the areas for expanded use of XML at FSA and describes a viable sequencing plan so that FSA can leverage new XML technologies and standards, as appropriate. The Future State vision has been developed based on the Current State assessment, Industry Case Studies, and analysis of relevant XML technologies.

1.4 Scope

The XML Framework Strategic Assessment and Enterprise Vision describes FSA's current state of XML usage, industry XML case studies, and a future state vision.

The XML Framework Strategic Assessment and Enterprise Vision (Del. 123.1.13) is one of ten deliverables that together form FSA's XML Framework. The XML Framework Strategic Assessment and Enterprise Vision provides FSA with a roadmap for using XML across its enterprise, upon which the other pieces will build. As part of the overall XML Framework project within Data Strategies, many of the concepts identified in the FSA XML Future State Vision will be implemented and expanded on in more detail in these other deliverables. Specifically, these other deliverables include:

- XML Technical Reference and Usage Guidelines (Del. 123.1.14).
- XML Core Component Dictionaries (Del. 123.1.15).
- XML Registry and Repository (Del. 123.1.16).
- XML Framework Communications Strategy (Del. 123.1.17).
- XML ISIR Performance Test and SAIG Capacity Plan (Del. 123.1.19).
- Draft XML ISIR Schema (Del. 123.18a) and Final XML ISIR Schema (Del. 123.18b).
- XML ISIR Technical Reference Support (Del. 123.1.20).
- Community XML Technical Architecture Support (Del. 123.1.21).

These deliverables are described in more detail in the XML Maturity Model Activities in Sections 2 and 3.

1.5 Organization of the Document

The XML Framework Strategic Assessment and Enterprise Vision consists of the following sections:

- Section 1, Introduction, provides the high-level overview, scope, business objectives, and assumptions for the XML Framework Strategic Assessment and Enterprise Vision.
- Section 2, Functional Description, provides an overview of the current state of XML usage by FSA, cases studies identifying key areas that FSA can leverage in its XML strategy, and FSA's XML future state.
- Section 3, Detailed Description, follows the same structure as the functional description, while providing a greater level of detail on the main subject areas.
- Appendix A, References, provides an introduction to XML.
- Appendix B, Glossary, provides a definition of terms and acronyms.
- Appendix C, XML Overview, provides an introduction to XML.
- Appendix D, XML Technologies, provides a description of leading XML specifications and technologies.
- Appendix E, Case Studies, provides detailed descriptions of XML case studies relevant to FSA.

1.6 Assumptions

- The XML ISIR Performance Test and SAIG Capacity Plan (Del. 123.1.19) will assess SAIG's infrastructure to support the implementation of the XML ISIR. The XML Framework and Strategic Assessment will not assess the hardware and infrastructure requirements necessary to support increased usage of XML on SAIG.
- The XML Framework Communications Strategy (Del. 123.1.17) will define FSA's strategy for communicating the XML Framework and Vision to its trading partners. The XML Framework and Strategic Assessment will not describe the Communications Strategy for FSA's trading partners.
- The CPS XML ISIR schema will be implemented for 2005-2006 Award Year processing.
- As the XML community continues to develop and improve its standards, FSA must continue to monitor these updates and revise the Enterprise Vision.

2 Functional Description

2.1 Functional Description Section Overview

This functional description section provides a high level overview of FSA's XML Framework Strategic Assessment and Enterprise Vision. Specifically, the section includes information on the following XML areas:

- Current State
- Case Studies
- Future State

2.2 Current State

2.2.1 Overview

This section reviews the Current State of XML implementations that impact FSA. These initiatives are occurring in the following areas:

- FSA Initiatives
- Department of Education Initiatives
- Postsecondary Financial Aid Community Initiatives
- Government Agency Initiatives

FSA initially implemented XML in a strategic, application-specific way. At the time the COD solution was being designed and developed, XML was rapidly moving to becoming the industry standard for data exchange. However, there was no FSA enterprise, organized standard for using XML, at the time. In order to take advantage of the benefits of XML, FSA made the strategic decision to use XML for the COD data exchange with schools.

The successful usage of XML in COD has made XML well positioned to become an FSA enterprise standard. The COD deployment demonstrated XML was a potentially powerful tool, but one that needed some additional thought and consideration before FSA should continue to use it through the enterprise. Based on the need for structured and consistent guidelines for implementing XML across the enterprise, FSA has begun developing an XML Framework, which will provide additional context, research, and analysis.

Today, FSA has only three XML interfaces in production – the COD Common Record, DLSS eServicing's Siebel interface, and an FMS to COD financial transactions interface. Several new initiatives that will leverage XML are also currently being developed.

The following table summarizes these different XML initiatives.

Num	Owner	System/Area	XML Usage	Status	Production Date
1	FSA	COD	XML Schema (Common Record Standard)	Production	Since 2002-2003
2	FSA	CPS	XML Schema (Common Record Standard)	Draft	2005-2006
3	FSA	DLSS eServicing	Siebel XML template	Production	Since 2001
4	FSA	FMS	XML message transfer between FMS and COD	Production	Since 2002
5	Department of Education	K-12 Academic Transcript	XML Schema (Common Record Standard)	Draft	TBD
6	Community/ PESC	CommonLine	XML Schema (Common Record Standard)	Draft	TBD
7	Community/ NCHELP	Meteor Project	XML Schema (Common Record Standard)	Production	Since 2001
8	Community/ ELM	ELMNet	XML Schema (Common Record Standard) (Proprietary layout)	Draft Production	TBD 1999
9	Community/ PESC	Postsecondary Academic Transcript	XML Schema (Common Record Standard)	Draft	TBD

Table 1 - XML Initiatives (as of June 2003)

2.2.2 FSA Initiatives

To date, the key initiatives at FSA that are using or planning to use XML as a data exchange format are:

- Common Origination and Disbursement Common Record
- Central Processing System Institutional Student Information Record (ISIR).
- Direct Loan Servicing System eServicing application.
- Financial Management System to Common Origination and Disbursement system interface.

These XML records facilitate structured data exchange between FSA systems and schools.

Common Origination and Disbursement Common Record

The COD System, and its specification of the Common Record, represents the first large-scale implementation of XML at FSA. As it was a leading-edge implementation for FSA, the development of COD provided many lessons learned relative to XML.

The COD system was implemented in April 2002 by FSA as a common process for administering Title IV funds by integrating the functionality of the existing Pell Recipient Financial Management System (RFMS) and Direct Loan Origination System (DLOS) systems into one system. In general, the COD Process is a simplified process for requesting, reporting, and reconciling Federal Pell Grants and Direct Loans. Beginning award year 2002-2003, all schools participating in Title IV Federal Student Aid are using the COD System to process Federal Direct Loans and Federal Pell Grants using one of two processing models (Full Participation and Phase-In Participation). Full Participants use a Common Record to submit Pell Grant and/or Direct Loan origination and disbursement data from the institutions to the COD System.

COD chose XML to represent this Common Record, which consolidates sixteen flat files into one new file. The use of XML in COD has provided the following benefits:

- Simplified files and documentation.
- Simplified processes.
- Increased business capabilities.

However, the COD implementation has also produced some issues, primarily related to misconceptions about XML technology:

- XML files are smaller than flat files.
- XML is synonymous with real-time processing.
- XML is too unwieldy to process.
- XML is difficult to implement.

Central Processing System XML ISIR

The CPS XML ISIR is currently being developed by FSA. The XML ISIR message specification represents the first data exchange that will be able to leverage the XML Framework being developed within the Data Strategies Enterprise-Wide initiative.

Currently, the ISIR is sent to schools as a fixed-length, flat file. As part of its modernization effort, FSA is converting the ISIR from a fixed-length, flat file to XML schema. FSA is currently in the process of developing an XML version of this record format. A draft of the XML ISIR schema was published to the Information for Financial Aid Professionals (IFAP) website in March 2003. This version of the XML ISIR will be revised to incorporate the modeling standards and XML Core Components that will be defined as part of the XML Framework. The ISIR schema will also be revised, based on comments from the community. FSA is planning to use the XML ISIR schema in production for the 2005-2006 Award Year.

Direct Loan Servicing System (DLSS) eServicing
Prior to establishing a standardized approach to XML, FSA implemented an XML interface for eServicing. This interface had to be developed in XML in order to support the eServicing's Siebel interface and architecture. The file simply maps data from the Siebel-defined XML structure to the legacy data structures. DLSS is the System of Record (SOR) and the owner of all Direct Loan borrower information. XML allows the Siebel electronic customer relationship management platform to communicate with the Direct Loan Servicing System (DLSS), using MQSeries as the middleware for all on-line interface activity. MQSI components are used for data format and transformation into XML between MQSeries and Siebel.

Financial Management System (FMS) to COD Interface
Presently 1% of all FSA internal data transfer is XML enabled. This specific internal XML data exchange occurs between the FMS and COD systems. When FMS initiates a financial transaction, an adapter converts the transaction data into an XML file for placement into an MQSeries Queue, where it is transferred to the EAI bus. Once on the EAI bus, the file is then converted back into fixed-length file format, for retrieval by COD.

2.2.3 Department of Education Initiatives

The Department of Education is leveraging FSA's collaborative XML work with the community, as it begins its usage of XML. The Department is currently working with NCHELP and PESC to develop a K-12 Academic Transcript.

2.2.4 Postsecondary Education Financial Aid Community Initiatives

The Postsecondary Education Financial Aid Community has been working in a number of areas with XML. PESC has established the XML Forum for Education to promote the use of XML in higher education.

NCHELP has also been promoting the use of XML within the financial aid community. NCHELP represents a nationwide network of guaranty agencies, secondary markets, lenders, loan servicers, collection agencies, schools, and other organizations involved in the administration of the FFELP program.

CommonLine Schema
The CommonLine file is the industry-standard file format created by the NCHELP and used by schools and service providers to exchange loan data. Collaborating with FSA, PESC is currently developing an XML schema for the CommonLine record. PESC plans to release a draft of the CommonLine XML specification in July 2003.

The Meteor Project
The Meteor Project is an open online resource that aggregates FFELP financial aid information for schools, students, and their families. Meteor's XML schema is based on the COD 2002-2003 Common Record, with additional tags and information.

ELM Resources and ELMNet

ELM was established in 1994 by a group of FFELP providers who wanted to improve loan processing for their customers by using technology and cooperation to create a uniform data exchange network. By pooling resources, lenders could deliver services without having to create separate systems. ELM is a network that provides customers a single point of data exchange. Going forward, ELMNet will be further expanded to support both batch and real-time processing of the Common Record – CommonLine transactions.

Postsecondary Academic Transcript

PESC's XML Forum has been developing the XML Postsecondary Academic Transcript. PESC has been collaborating with AACRAO's SPEEDE Committee. At the February 2003 American National Standards Institute (ANSI) Accredited Standards Committee (ASC) X12 meeting, representatives of PESC, the XML Forum for Education, and the higher education community submitted the XML Postsecondary Transcript for review and approval to become an X12 standard.

2.2.5 Government Agency Initiatives

As XML has become an increasingly prevalent technology, the United States Federal Government has started to identify resources to help coordinate the development and implementation of XML standards. The XML Work Group, a sub-committee of the Chief Information Officers Council (CIOC) is leading the way for this effort.

Some federal agencies have also started to explore using XML in a more concerted manner to improve and simplify their business processes. As these federal agencies develop XML standards and implementations, FSA may be able to leverage these to exchange data with the agencies.

FSA currently exchanges data with several other federal government agencies. Many of these agencies are actively implementing XML for their inter-agency data exchange, while others are now beginning to move towards using XML. FSA should monitor their progress in order to identify opportunities for leveraging the interfaces they are implementing, which may provide simpler and more-timely access to data. Section 3.2.1.4 - Government Agency Initiatives describes both the FSA interfaces, as well as each of the Agency's XML efforts, in more detail.

Presently the Departments of Treasury, Justice, Defense, and Health and Human Services, as well as the Bureau of Citizenship and Immigration Services, and the Census Bureau, are actively working towards implementing XML as part of their enterprise. These initiatives will prove beneficial as groundwork for developing XML interfaces with these agencies.

2.3 Case Studies

2.3.1 Overview

The XML Case Studies section provides a review of current industry proven practices of XML usage within the federal government and private organizations. These case studies provide references for how companies have implemented XML standards, tools, and policies in order to meet their business objectives. As FSA implements and refines its Enterprise XML Vision, these case studies should serve as a reference for what has been successful in this arena to date.

The case studies provide context for the myriad of XML-related technologies that have been developed in recent years. They show the relevance of those technologies to real-world applications. The W3C proposed the first version of its XML specification in February of 1998. The XML 1.0 Recommendation was the first step towards the next generation Web, allowing each community to design languages that suited their particular needs and integrated them harmoniously into a general infrastructure based on XML. Companies quickly adopted the specification and have been using it in a wide variety of ways since then.

Each of the specifications, developed since the release of XML 1.0, has set the pace for further standardization among independent working groups, and encouraged widespread use of XML in industry, across multiple business integration areas. Although FSA has just begun to use XML as part of its integration efforts, other companies and government agencies have adopted the technology and are using it on a more wide-scale basis.

The table below provides a high-level list of the current state of advanced XML implementations, and how other companies and government agencies are implementing XML as part of their business strategies. The case studies have been grouped by the strategic area of implementation, to provide examples of applications across the range of key business integration areas. These key business integration areas are defined in greater depth in Section 3.2. In addition, Appendix E: XML Case Studies provides detailed information on the case studies.

Table 2 – Business Integration Areas below identifies the key business integration areas that utilize XML, a short description of each area, and a list of the case studies detailed further in Appendix E.

Areas	Description	Case Studies
XML Vocabulary Efforts	Create an agreed upon XML element set (i.e., Core Component Library) and corresponding data models.	• Chemical eStandards • Interactive Financial eXchange • Catalogue XML
XML Education Initiatives	Create distributed learning environments for students by allowing content from multiple authors and developers to interoperate.	• Schools Interoperability Framework • IMS Global Learning Consortium
Business-to-Business (B2B) Distributed Transactions	Constitute business events that occur between two or more business partners with disparate systems and distinct networks.	• Visa International • Korala Associates Limited
Business-to-Consumer (B2C) Portal Integration	Facilitate business transactions and information presentation between business partners, customers and employees.	• Vizzavi (Vodaphone)
Business-to-Business (B2B) Marketplace/Exchange	Offer businesses the opportunity to buy, or sell, goods and services via a common web site.	• ChemConnect • Covisint
Internal Application to Application - EAI	Allows for the unrestricted sharing of data and business processes between applications or data sources across an organization.	• EnergyAustralia
Internal Data Quality	Provides a means of ensuring data integrity across an enterprise	• Osaka Securities eXchange
Government-to-Business (G2B) Enterprise Initiatives	Cross departments and implementation business strategies, but all reiterate the governments' push towards using XML.	• IRS.gov • Department of Navy

Table 2 - Business Integration Areas

2.4 Future State

2.4.1 Overview

In order for FSA to move from using XML in isolated application-specific implementations to an enterprise-wide standard, FSA has developed an Enterprise XML Vision. This vision represents a strategic shift in FSA's approach to XML technology. This vision will enable FSA to proactively manage and guide its usage of XML and take full advantage of XML's benefits through an incrementally phased approach. By establishing XML standards and processes, FSA will be able to simplify and standardize its development of data exchange interfaces. The Future State section describes specifically how this shift in approach should be executed.

The XML Enterprise Vision was developed based on a Strategic Assessment that consists of: 1.) FSA's Current State usage of XML, and 2.) XML Case Studies. The Current State provides a description of FSA's current capabilities for implementing XML while the XML Industry Case Studies span the use of XML by the industry as a whole, to set reasonable goals for FSA and determine the timelines and efforts necessary to meet those goals.

FSA's Enterprise XML Vision consists of the XML Maturity Model that provides a sequencing plan for FSA to incrementally standardize and improve its usage of XML across the enterprise in order to meet key business objectives. The XML Maturity Model consists of the following four levels that describe an organization's usage and management of XML:

- Initial
- Repeatable
- Defined
- Optimized

An analysis of FSA's current XML capabilities and initiatives demonstrates FSA is currently operating at the Initial Level and is working on the activities associated with the Repeatable Level. Once FSA establishes the XML Framework, it will be well positioned to implement these standards. By implementing these standards FSA will be able to move from operating at the Initial Level to the Repeatable and then Defined Levels of the XML Maturity Model.

The goal of the XML Framework is to enable FSA to operate at the Defined Level. In order to reach this goal, FSA must first complete the activities associated with the Repeatable Level and then begin performing the activities that will enable it to operate at the Defined Level of the XML Maturity Model. Levels below Defined are inherently unstable; there is not enough rigor to the processes and standards to ensure that the capability can be sustained in the organization. Furthermore, being in a Defined Level will position FSA to start on the Managed/Optimizing Level activities, where their XML Framework investment will begin to provide greater benefits.

2.4.2 Business Objectives

The XML Framework Strategic Assessment and Enterprise Vision has been developed with the aim of providing an XML framework that will support FSA's business objectives for enterprise data exchange. The future state of XML usage at FSA should be directly tied to the business objectives of FSA, to prevent XML from being used solely because it is the latest technology. XML is only an enabling technology, albeit a powerful one, that can be leveraged to support enterprise business goals.

The XML Framework defined in this Future State section fits into FSA's Data Strategies work and will provide the following benefits:

- XML Core Components will be the foundation for FSA's Data Clean-up effort.
- XML-based interface modeling provides improved support for new application and exchange requirements.
- XML is leveraged by a majority of standard COTS technologies.
- XML is founded on Open Standards.
- XML is becoming the industry standard for data exchange.

2.4.3 XML Maturity Model

The XML Maturity Model is based on previous XML development at FSA, XML case studies, general industry trends, and the key principles identified by Carnegie Melon's SEI-CMM. The resulting XML Maturity Model provides a phased approach to implementing XML as an enterprise standard within FSA. The following diagram illustrates the main stages in maturity for XML usage in an organization, and maps specific FSA activities, either already conducted, in progress, or projected for the future, to the stages of maturity.

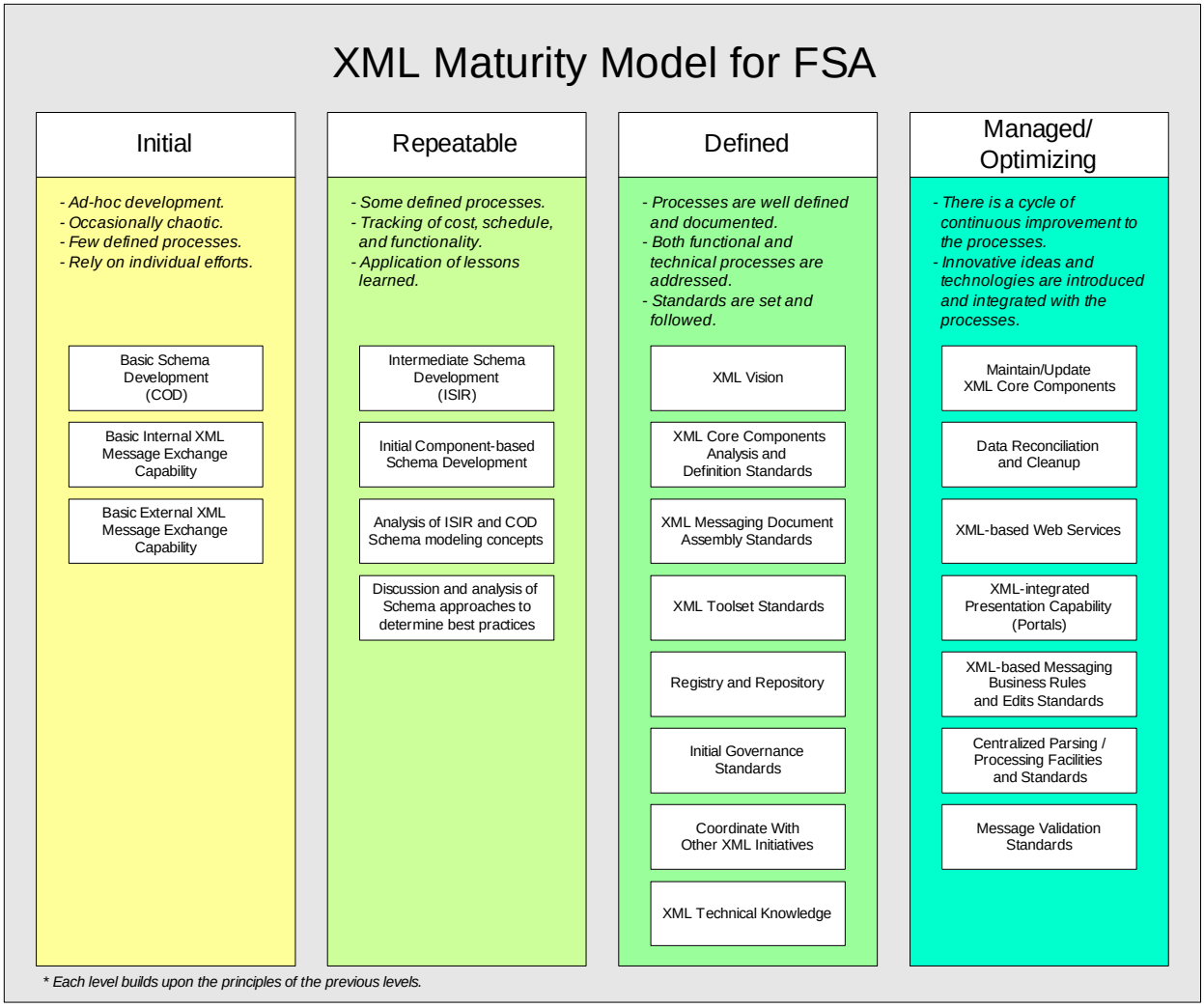

Figure 2 - XML Maturity Model

The following table provides a description of the XML Maturity Model Levels.

	Maturity Level	Maturity Level
1	Initial	The Initial Level of the XML Maturity Model describes organizations that implement XML for a single application and have no defined standards or governance processes.
2	Repeatable	The Repeatable Level describes organizations that have implemented multiple applications using XML. While there are no defined standards or governance processes, organizations at the Repeatable Level follow the general guidelines and lessons learned from their initial XML activities.

	Maturity Level	Maturity Level
3	Defined	The Defined Level describes organizations that have documented their standards and governance processes. These organizations also consistently apply the standards they have developed to all of their development activities.
4	Managed/Optimizing	Once organizations have defined standards and governance processes for managing their XML usage, they are able to take full advantage of XML benefits and may begin to implement more advanced XML technologies that build upon the basic infrastructures they have in place. Many of the Case Studies defined in this document represent organizations that are operating at the Managed/Optimizing XML Maturity Model.

Table 3 - XML Maturity Model Levels

FSA currently operates at the Initial Level of the XML Maturity Model, based on its current documented standards and processes for XML usage. Presently, FSA's institutional knowledge resides with a few individuals who have been involved in FSA's initial XML efforts. As FSA moves from using XML in one application to multiple applications, there is an increasing need to clearly document enterprise XML standards and processes and perform the activities that characterize the Repeatable and Defined Maturity Model Levels. As FSA expands its use of XML to additional interfaces and usages, it is necessary to establish guidelines for consistency.

2.4.4 Sequencing Plan

The following section provides an overview of the sequencing plan that FSA should follow in order to progress in the XML Maturity Model. This sequencing plan is organized by activities within each Maturity Model level. By performing the activities associated with each Maturity Model level, FSA will be able to move from operating at the Initial Level to the Repeatable and then Defined Levels. Once FSA is operating at the Defined Level, it can then take advantage of the activities associated with the Managed/Optimizing Level.

2.4.4.1 Initial Level

The Initial XML Maturity Level consists of the following activities:

- Basic Schema Development (COD)
- Basic Internal XML Message Exchange Capability
- Basic External XML Message Exchange Capability

FSA has already completed these activities defined for the Initial Level of the XML Maturity Model.

Basic Schema Development (COD)
XML is structured by nature, and there are supporting specifications for XML that serve to formalize the rules around the structure of a particular document. Those specifications include the Document Type Definition (DTD) and the XML Schema. XML Schema is the newer specification and is far more powerful than the DTD in how it can describe document structure. The term, basic schema development, therefore means specifying a file layout, in XML Schema format, to describe the structure of the file. The development was basic at this stage because there were no formal Schema development standards to base this on. It was simply done as it best fit the needs and technology at the time. Schema modeling did not accommodate for robust usage, and did not contain work such as component development, standards, and guidelines that ensure consistency, or tiered architectures with namespace utilization. The maturity of the XML Schema specification now allows these features to be considered.

Basic Internal XML Message Exchange Capability
Basic internal XML message exchange consists of systems being able to format, send, and receive XML messages. The software needed for such activities consists of XML parsers to construct and read XML files, and some sort of transport mechanism to send and receive these files. Implementing basic capability for XML message exchange in existing systems involves conducting an analysis of the systems for the hardware and software platforms they use, and mapping the needed XML tools (such as parsers) to these platforms. Since XML itself is platform-neutral, as long as the tools communicate standard XML, they can then enable the systems to communicate with each other. More advanced XML exchange, such as Web Services, build on this basic infrastructure. Internal XML message exchange occurs, for one example, in COD between the COD system and the EAI bus. Those communications occur over MQ Series and Data Integrator.

Basic External XML Message Capability
Basic external XML message exchange is functionally similar to internal exchange, with the additional integration and security requirements for systems communicating over the Internet. As a result, Internet connectivity must be enabled (with components such as firewalls in place), authentication approaches must be agreed upon and built, and security layers such as encryption must be built into the networking software. FSA had to address all of these concerns for COD communications between the system and the schools. The platform to support those requirements is the SAIG mailbox system.

2.4.4.2 Repeatable Level

The Repeatable XML Maturity Level consists of the following activities for FSA:

- Intermediate Schema Development (ISIR)
- Initial Component-Based Schema Development
- Analysis of ISIR and COD Modeling Concepts
- Discussion and Analysis of Schema approaches to determine best practices

FSA is currently working on completing the tasks characterized by the Repeatable XML Maturity Level.

Intermediate Schema Development (ISIR)
With additional experience in Schema development, improvements to both the technology and the business process can be gained. This was evident in the development of the XML ISIR. For this development effort, there were clearer timelines and end goals, better definition of the requirements collection, review, and sign off processes, and better focus on how to make the XML development more standardized and reusable. As a result, the process was smoother and there was more confidence in the end product. The XML ISIR Schema, however, does not currently reflect being the results of an enterprise-wide XML development program. That is why this effort can only be categorized as intermediate in ability. With the development of the XML Framework Core Components and Standards guidelines, and their application to the ISIR, the development effort can then be considered advanced.

As part of the Intermediate Schema Development activity, FSA is creating the Draft XML ISIR Schema (Deliverable 123.1.18a) and Final ISIR Schema (Deliverable 123.1.18b).

Initial Component-based Schema Development
As discussed above, the XML ISIR Schema incorporated some intermediate level Schema design principles. One of those principles is component-based development. As it was developed, the ISIR was analysed and built as components, assembled together in growing levels of aggregation. However, the components were not considered or modeled to work on an enterprise basis, so while the ISIR components were a step in the right direction, they are not yet truly usable across the enterprise. The Core Components specifications and the Registry/Repository in the XML Framework will raise those components to enterprise-class reusability.

As part of the Initial Component-based Schema Development activity, FSA is creating the XML Core Component Dictionaries (Deliverable 123.1.15).

Analysis of ISIR and COD Schema modeling concepts
The business processes surrounding the development of the ISIR schema was greatly improved over those during COD. More functional expertise was brought to the table early on, and therefore the data models in the ISIR Schema reflected a better business understanding of the data. It is because of the improved modeling as well that the components built for the ISIR will be closer to their enterprise wide specifications than they would have been otherwise.

Discussion and Analysis of Schema approaches to determine best practices
The XML Schema specification is a very powerful one, but with that power comes a fair amount of complexity. When the COD Schema was built, the final W3C Recommendation for XML Schema had just been released. Therefore, there was not a sophisticated body of understanding on best practices within the language. In the time that has passed, by the time the ISIR was developed, much analysis had been conducted, and guidelines developed, to point developers to best practices for schema modeling. The ISIR reflects those practices at this stage. A level of

improvement to the current state of development would be tailoring the development community standards to FSA specific needs. This will be address as well by the XML Framework.

2.4.4.3 Defined Level

The Defined XML Maturity Level consists of the following activities:

- XML Vision
- XML Core Components Analysis and Definition Standards
- XML Messaging Document Assembly Standards
- XML Toolset Standards
- Registry and Repository
- Initial Governance Standards
- Coordinate with Other XML Initiatives
- XML Technical Knowledge

FSA is currently working on completing the tasks characterized by the Defined XML Maturity Level.

XML Vision
An XML vision is necessary to move FSA from narrowly-focused, system-specific implementations to more widespread usage across the enterprise. This vision will enable FSA to proactively manage and guide the procedures surrounding XML usage and take full advantage of XML's benefits through an incremental development approach. By establishing XML standards and processes, FSA will be able to simplify and standardize its development of data exchange interfaces.

As part of the XML Vision activity, FSA has developed this document, the XML Framework Strategic Assessment and Enterprise Vision (Deliverable 123.1.13).

XML Core Components Analysis and Definition Standards
The Core Component work is the foundation for developing a Postsecondary Education Financial Aid Community Vocabulary/Markup Language. By defining key core concepts in the Core Components, FSA and the Postsecondary Education Community are developing the industry standards that can be used for their information exchange.

As part of the XML Core Components Analysis and Definition Standards activity, FSA is creating the XML Core Component Dictionaries (Deliverable 123.1.15).

XML Messaging Document Assembly Standards
The Schema Modeling Standards will be based on the following industry-wide approaches:

- The United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) Unified Modeling Methodology (UMM)

- The current ebXML working group specifications on Core Components
- The Object Management Group UML standard for modeling notation

As part of the XML Messaging Document Assembly Standards activity, FSA is creating the XML Technical Reference and Usage Guidelines (Deliverable 123.1.14).

XML Toolset Standards
There are a wide variety of tools and technologies built around the core XML specification. These include

- Supporting specifications, such as XQuery and XPath
- Software libraries for tools such as XML Parsers
- XML productivity tools, such as XML Spy

These tools and technologies are continually evolving. It is important to stay abreast of developments so appropriate technology decisions can be made in implementing these tools. The approach should not be, however, of an "approved list" of XML tools that can be used. Rather it should be a catalogue of research on available tools, with recommendations, so that the standards can be flexible to evolve with the evolving marketplace.

As part of the XML Toolset Standards, FSA is creating the XML Technical Reference and Usage Guidelines (Deliverable 123.1.14).

Registry and Repository
A Registry provides a stable store where information developed by FSA is made persistent and readily available to all interested parties. The Registry FSA implements should be compliant with the ebXML Registry and Repository specification v2.0. The Registry/Repository will store XML schema and documents XML Core Components, and, Unified Modeling Language (UML) models.

Implementing this capability will provide a central location for FSA's design artifacts, eliminating confusion and ambiguity over what is available. It will be a very large step in bringing the technical community in line with FSA as it expands its own capability.

As part of the Registry and Repository activity, FSA is creating the XML Registry and Repository (Deliverable 123.1.16).

Initial Governance Process
XML Governance simply indicates the process by which XML-related technology decisions are raised, considered, and decided within FSA. Currently there is no formal process for these decisions, which leads to ineffective decision-making and communication within FSA with regards to XML. The establishment of a clear governance process will be a great step towards ensuring all XML-related activities are well understood and agreed upon by a group of appropriate stakeholders.

As part of the Initial Governance Process activity, FSA is creating the XML Technical Reference and Usage Guidelines (Deliverable 123.1.14).

Coordinate with Other XML Initiatives
FSA should develop its XML strategy and framework to align with other related XML initiatives. Currently, FSA is working with:

- Department of Education
- PESC and community
- NCHELP

FSA will achieve greater adoption of XML technologies by its trading partners, if it works in conjunction with PESC and the Postsecondary Education Financial Aid Community.

XML Technical Knowledge
With the XML Framework and its component pieces in place (i.e., XML Strategic Assessment and Enterprise Vision, Core Component Dictionaries, Technical Reference and Usage Guidelines, and Registry and Repository) FSA will have the infrastructure needed for implementing XML solutions.

Based on this work, FSA will need to have a solid base of knowledgeable XML resources that can help identify new components, modify existing schemas, etc., as new XML implementations and modifications are identified. It will also need the documentation and process needed to train new resources. In addition to building the XML Framework for projects to leverage, FSA should develop additional XML technical knowledge in order to provide support to applications, schools, and trading partners, as they begin to use XML to communicate with FSA.

As part of the XML Technical Knowledge activity, FSA is creating all of the XML Framework deliverables. Collectively, these deliverables will provide a good foundation for educating resources on XML.

2.4.4.4 Managed/Optimizing Level

The Managed/Optimizing XML Maturity Level consists of the following activities:

- Maintain/Update XML Core Components
- Data Reconciliation and Cleanup
- XML-based Web Services
- XML-integrated Presentation Capability (Portals)
- XML-based Messaging Business Rules and Edits Standards
- Centralized Parsing/Processing Facilities and Standards
- Message Validation Standards

Maintain/Update XML Core Components

The Core Components library is not a static item. It will need to be continually updated as business and data requirements change. FSA will need to be able to integrate these changes into the Core Components library and manage the ripple effects on schemas that incorporate changed components. The synchronization requirements and the proper process for upgrades should be determined and agreed upon beforehand so that FSA can manage and plan for changes. FSA needs to establish processes for maintaining and updating the XML Core Components, in order to keep systems and data synchronized.

Data Reconciliation and Cleanup
One of the key benefits of a standardized Core Component data model is the Data Reconciliation capability it will enable. The exact approach and tools for data reconciliation have not yet been determined, but it will leverage the common, platform-neutral representation of data entities that XML Core Components will provide. Systems will be able to map their individual data models to a common XML representation, and data can then be compared on that common level. This common approach eliminates point-to-point mappings for data cleansing, making the solution more robust and enterprise-ready.

XML-based Web Services
The Initial capability level discussed basic internal and external XML communications for data exchange. XML-based web services are the next generation of that model. Web services support basic data exchange processes, or system-to-system remote procedure calls (XML-RPC). Web Services architectures are now being built into major Java 2 Enterprise Edition (J2EE) application servers, so the core capability is in place and available for FSA and its trading partners to leverage. The benefit of this is that, due to a base XML investment, FSA can move from basic XML message exchange capability to Web Services without building all of the software "plumbing" involved. Also, the standardization of Web Services and XML means that integrating with trading partners should be easier than with a proprietary tool such as SAIG.

XML-Integrated Presentation Capability (Portals)
One key benefit of XML-represented data is that supporting technologies, such as XML Transformations and XML Stylesheets, support the conversion of that "raw" XML data into a variety of presentation formats. Therefore system development can be separated into two levels, data requirements and presentation requirements. Data requirements can be determined once and then used in a variety of presentation formats. Web Portals are one example of this, where data can be displayed as HTML pages, PDF documents, or downloaded as delimited text files when and where it is needed, based on the common XML data definition.

XML-based Messaging Business Rules and Edits Standards
The standardization of XML as a data description language, lends itself to further standardizations. If the data itself has a standard, common representation, then business rules and edits on that data should be able to be standardized as well. A common representation and approach to business rules and edits on enterprise data can help streamline and simplify processing of the data as it moves across systems during the student aid lifecycle.

Centralized Parsing / Processing Facilities and Standards

It is possible that if various systems at FSA are processing the same basic data components in the messages they send or receive, that processing can be consolidated into one place, either as an available service or a shared library. This would then decrease development effort across the systems. This would be a fairly advanced implementation, even under the Managed/Optimizing Level of capability, but it illustrates the types of efficiencies that can be gained when data is looked at as an enterprise asset, in a common representation format.

Message Validation Standards

Standardized XML modeling specifications will lead to messages that are structured in the same way and therefore subject to the same basic validation rules. FSA will achieve greater consistency in the way it communicates with external parties if their expectations for message validation are the same across XML messages that it exchanges. Furthermore, if there are additional business rule validations that FSA would hope to provide across systems, they can be consolidated, either as a service or as a shared library, which performs those validations consistently. This would be a fairly advanced implementation, even under the Managed/Optimizing Level of capability, but it illustrates the types of efficiencies that can be gained when data is looked at as an enterprise asset, in a common representation format.

3 Detailed Description

3.1 Detailed Description Section Overview

The detailed description section provides a detailed description of the XML Framework Strategic Assessment and Enterprise Vision. Specifically, the section includes information on the following areas:

- Current State
- Case Studies
- Future State

3.2 Current State

3.2.1 Overview

This section expands upon the information presented in Section 2 and provides more detailed information on the current state of XML usage at FSA and within the financial aid community.

The following table summarizes the percentages of different data exchange transfer formats currently used by FSA for internal and external data exchanges, based on analysis performed by the Technical Strategies Team,.

Type	Internal	External
Flat File	86%	77%
Web	N/A	16%
Database Records	3%	N/A
Other	3%	3%
Spreadsheet	3%	N/A
Paper	2%	N/A
Tape	2%	N/A
XML	1%	5%

Table 4 - Data Exchange Transfer Formats

3.2.2 FSA Initiatives

The following FSA Initiatives currently use XML:

- COD Common Record
- CPS XML ISIR
- DLSS servicing
- FMS

Common Origination and Disbursement Common Record

Overview
The COD Common Record Current State information is organized in the following sections:

- Background
- XML Usage
- Benefits
- Challenges
- Background Data

Background
The Common Origination and Disbursement System was implemented in April 2002 by FSA. The COD System is FSA's first step toward achieving two of the organization's enterprise wide goals: to increase customer satisfaction and reduce costs by modernizing business processes. COD has re-engineered the former process of delivering and reporting Federal Pell Grants and Direct Loans from two processes into one Common Origination and Disbursement Process.

COD provides a common process and an integrated system that enables efficient delivery of Title IV Funds. In general, the COD Process is a simplified process for requesting, reporting, and reconciling Title IV funds. Beginning award year 2002-2003, all schools participating in Title IV Federal Student Aid are using the COD System to process Federal Direct Loans and Federal Pell Grants using one of two processing models (Full Participation and Phase-In Participation). The difference in the two models is driven by the data transmissions between the institutions and the COD System.

Full Participants use the XML Common Record to submit Pell Grant and/or Direct Loan origination and disbursement data to the COD System.

The Common Origination and Disbursement Process for Full Participants utilizes one single record across programs for both origination and disbursement. In the interest of simplification, the RFMS and the DLOS systems have been integrated into one system. Full Participants use a Common Record, one that uses common data elements, definitions, edits, and structure for Pell Grants and Direct Loans. Although the record has the same layout for all programs, not all data elements are required for each transmission. This new record layout is defined in XML.

The Common Record is a new standard within the student financial aid community. Not only is the Common Record applicable to Pell Grant and Direct Loan, it is also flexible and can be used in the future for state grants, FFEL, alternative loans, etc., if desired by program administrators.

The Common Record was developed in partnership with members of NCHELP and PESC. This collaborative effort enables the Common Record to bring consistency and standardization to the transmission of student financial aid data. The Common Record provides a structure to allow for the addition of FFEL data and other FSA data. Thus, the inherent processing efficiencies of

the COD process will also be available to FFEL schools as the FFEL trading partners adopt this format.

For the 2002-2003 award year, COD had 22 Full Participant schools. An additional 2350 schools have signed up as full participants for the 2003-2004 award year. This increase is primarily due to the fact that EDExpress software has been modified to send XML to COD in 2003-2004. Therefore, all schools that use EDExpress to submit Pell Grant and Direct Loan data must be Full Participants in the 2003-2004 Award Year. For Award Year 2005-2006, all schools will be required to become full participants using XML.

XML Usage

Until the implementation of the COD system in April 2002, FSA had used proprietary flat files almost exclusively for data exchange across its enterprise and with its trading partners.

Flat files had several limitations in their ability to adequately reflect data for all business transactions, but at the time it was the best approach available. These limitations were generally accepted and worked around where necessary. Systems were built and optimized around the flat file approach. People also became familiar and somewhat comfortable with looking at flat file layouts.

Technology has evolved however, and XML has demonstrated itself to be a better way to represent data for business transactions. There are several reasons for this:

- XML is hierarchical in nature, and therefore can represent more complex relationships than flat files, such as parent-child, for example.
- XML blocks can be repeated as often as necessary, making the information sharing process more flexible.
- XML blocks can be nested in different ways, as necessary, which again, makes information sharing more flexible.
- Through supporting technologies such as XML Schema, advanced relationships can be defined between XML blocks that are not possible to represent in standard flat files.

It is important to note, flat files do have various work-arounds that address these shortcomings to some extent. However, these work-arounds, are, in fact, non-standard solutions to many problems that XML is inherently built to solve.

As a means for reducing operational costs, COD re-engineered the former processes of reporting and delivering Federal Pell Grants and Direct Loans from two distinct processes into one common process. In doing so, the RFMS and the DLOS systems were replaced by one integrated Common Origination and Disbursement system.

RFMS and DLOS employed sixteen different flat file formats to exchange data for their core processes. Since the processing for these systems was being consolidated into one system, the flat files were going to need to be consolidated in some manner as well. After some analysis, it was decided that the sixteen legacy flat files would be consolidated into one new file, and that

this file would be represented in XML. This one consolidated file became known as the Common Record.

XML was chosen for the new file layout for two main reasons:

- *Better data modeling capability.* The first reason was that in consolidating the existing 16 file layouts, XML seemed to have the most power to effectively map all that data into a structure that supported all of the existing business processes. This reason goes back to the hierarchical nature of XML, and its ability to represent complex relationships as described in the section above.

- *Pervasiveness of the technology.* The second reason was more general. It was clear to the architects of the new system that XML was becoming the default file format for data exchanged on the Internet. A myriad of powerful new tools and technologies were in development to support XML. Based on the massive growth of XML and its relative maturity in a short timeframe, COD's architects felt that it was the appropriate direction for the file format. They felt that an XML implementation would be a step toward the future, and its technology support and capabilities would only grow.

Both of these potential benefits are being realized as COD, and its user base, matures. Details of the benefits are described in the next section.

Benefits

This section details the impacts of how XML technology provides savings, efficiencies, and greater capability for COD. It relates these benefits to the criteria, described in the section above, that were used to decide on XML as the file format for the Common Record.

Using XML for data modeling provides the following benefits:

- Simplified Files and Documentation.
- Simplified Processes.
- Improved Business Capabilities.

Simplified Files and Documentation

The following chart documents the legacy flat files that were combined in the common Record. It illustrates the vast simplification of the file layouts into the Common Record. Accounting for a learning curve in understanding the new approach, the overall simplification of file layouts should save system analysts at schools and vendors hundreds of hours a year in figuring out layouts and reading technical documentation.

	DLOS	RFMS	Legacy Files Combined (DLOS and RFMS)	COD Common Record
Distinct file layouts	*10*	*6*	16	1
Individual elements for all layouts combined	*518*	*125*	643	135
Edit codes for the file layouts.	*87*	*187*	274	101
Pages in the Technical Reference Manuals	*544*	*358*	902	156
Total size of all record lengths (bytes)	3196	1050	4246	N/A

Table 5 - COD Common Record Comparison

An important point to keep in mind is that some of this simplification would have been possible simply through the consolidation of the legacy systems, even if flat files were used. However, the simplification was drastically increased by the use of XML. In fact, some of the workarounds that would have been required in flat files might have led to *increased* complexity in areas. These flat file workarounds were, of course, avoided through the use of XML.

Simplified Processes

In DLOS, changing data in a record after it had been submitted once required the use of a separate file type, called the Change Record. This was a completely separate file that was fairly cumbersome to code to, with its own set of codes for fields and edits. Using the Common Record, updating data for a Direct Loan does not require a separate file layout. Furthermore, the process for updating a Direct Loan is the same as for updating a Pell Grant. It no longer requires the tracking of dozens of change codes and coding of an entirely different processing.

In both DLOS and RFMS, sending a disbursement required the use of a separate disbursement record. Again, with the Common Record, when funds are disbursed, the same file format can be used. Additional disbursement files are no longer required. This is due in large part to the flexibility of the XML layout.

Error reporting is now consistent across Direct Loans and Pell Grants. Error codes are consolidated as much as possible for certain errors across the file layouts. This is enabled in part because XML can handle variations in error reporting across the programs. For example, Direct Loans do not use the <Value> tag, but Pell Grants may use it where appropriate. The flexibility of the XML layout allows both to still use the same basic error reporting structure. This would have been clumsy if attempted in a flat file.

Improved Business Capabilities

The clearest example of increased capability is in the error reporting in COD. It is far superior to what DLOS and RFMS provided. Those legacy systems could only report errors by sending edit codes, out to a maximum amount, for each record. The edit codes couldn't be directly tied to the specific field they were reporting on, in most cases. The Common Record structure provided edits in the form of Response blocks. Those blocks were strategically nested under each of the major information blocks in the Common Record: the Reporting School, Attending

School, Student, Award, and Disbursement. Each block provides an error code, a field name, and a correcting value (used for Pell). In this way the *exact* field that an edit corresponded to can be known. Also, the Edit block can be repeated as many times as necessary. As a result, *all* the edits on a record can be reported, rather than the first 5, for example.

As far as schools are concerned, the major function COD performs is editing on the data they submit. As a result, the increased edit capabilities represent vastly increased capabilities of the system as a whole.

Challenges
As the first major XML implementation by FSA, the COD Common Record implementation experienced a number of challenges. One of the key challenges faced during the implementation of the COD Common Record were misconceptions regarding XML's benefits and problems. These misconceptions are listed below:

- FSA misconceptions regarding XML's benefits:
  - XML files are smaller than flat files.
  - XML directly enables real-time processing.
- Schools misconceptions regarding their XML problems.
  - XML is unwieldy in size, too big to process.
  - XML is a difficult technology to implement.

FSA misconceptions regarding XML's benefits.
While XML was well understood by those directly implementing the systems, some misconceptions on the technology seemed to form and propagate, and were sent out to the community. These assumptions affected the choice for XML, as well as the message sent to schools and vendors. The assumptions included:

XML files are smaller than flat files.
It was thought that XML would require less disk space and network bandwidth than flat files. This assumption arose from the fact that the flat files were fixed length – even if a field was not being used in a record, the space for the unused field would still have to be padded with spaces to preserve the layout of the record. Since XML tags do not have to be sent if there is no data, there was some efficiency gained, but it was completely overshadowed by the overhead of all of the tags.

XML directly enables real-time processing.
XML is associated with advanced Internet technologies, such as SOAP and Web Services. These technologies typically are used in real-time processing scenarios, such as on-line shopping and on-line stock trades. Therefore XML was directly associated with having real-time processing capabilities. This association isn't completely accurate however.

Schools misconceptions regarding their XML problem.
Some other general COD problems were attributed to XML. It is important to address these problems for their root cause. A better understanding of these issues will increase our

understanding of the scope of what XML does, and allow us to actually fix the problems incorrectly attributed to XML, at their respective root causes.

XML is unwieldy in size, too big to process.
During the initial release of COD, schools were having issues loading XML data into their systems. They then concluded that XML files were simply too big for their systems to handle. It turned out that their systems were not properly set up to load the file, resulting in an unnecessary overrunning of their resources (i.e., disk space). Proper loading of their files would have resulted in roughly 95 % less disk space utilization.

XML is a difficult technology to implement.
XML was a new technology for many schools, and there was a learning curve. This curve would have been present for the introduction of any new technology. All new technologies should not be avoided simply because they have learning curves. FSA should be very careful to distinguish between valid complaints of problems implementing XML versus problems arising from the XML learning curve.

Background Data
The following table provides additional detail on the raw data used for Table 5 – Common Record Comparison.

Flat File Type	Flat File Size in Bytes (per record)	Flat File Size in Fields (per record)
Direct Loan Origination (Sub/Unsub)	1064	146
Direct Loan Origination (Sub/Unsub) Response	95	10
Direct Loan Origination (PLUS)	1064	146
Direct Loan Origination (PLUS) Response	95	10
Direct Loan Change	614	35
Direct Loan Change Response	614	35
Direct Loan Disbursement	152	26
Direct Loan Disbursement Response	152	26
Direct Loan Booking Notification	152	26
Direct Loan Payment to Servicing Notification	152	26
Direct Loan Credit Decision Acknowledgement	80	4
Direct Loan Promissory Acknowledgement	190	28
Pell Origination	300	46
Pell Origination Response	450	57
Pell Disbursement	100	9
Pell Disbursement Response	200	13
Total	4246	643

Table 6 - RFMS and DLOS Legacy File Size

Central Processing System XML ISIR

Background
To be considered for federal student aid, a student must complete a Free Application for Federal Student Aid (FAFSA). Students can fill out a paper FAFSA, apply electronically through their school (Electronic Data Exchange or EDE), or complete the FAFSA on the Web. Students who have applied in previous years can complete a paper Renewal FAFSA or Renewal FAFSA on the Web. Additionally, students and schools can submit corrections to the data reported on the original FAFSA either through EDE or the Web.

The Central Processing System uses the information on the FAFSA to calculate the student's expected family contribution (EFC) and to match the student's data against the Social Security Administration, Immigration and Naturalization Service, Selective Service System, and Department of Veterans Affairs to confirm student eligibility. After processing is complete, CPS produces two output documents: the Student Aid Report (SAR), which is sent to the student, and the Institutional Student Information Record, which is sent to schools. The ISIR shows the data the student originally provided, the EFC, the results of the student eligibility check, and information about any inconsistencies identified through the CPS edits. CPS sends the ISIR to all schools that the student listed on the FAFSA (up to six). Other schools may request an ISIR for a student through EDE with CPS. CPS sends an ISIR to the school for each paper FAFSA, Renewal Paper FAFSA, FAFSA on the Web, Renewal FAFSA on the Web, or Corrections on the Web that it receives.

XML Usage
Currently, the ISIR is sent to schools as a fixed-length, flat file. As part of its modernization effort, FSA is converting the ISIR from a fixed-length, flat file to XML. FSA is currently in the process of developing an XML version of this record format. A draft of the XML ISIR schema was published to the IFAP website in March 2003. This version of the XML ISIR will be revised to incorporate the modeling standards and XML Core Components that will be defined as part of the XML Framework. The ISIR schema will also be revised, based on comments from the community. The XML Framework and modeling standards will be completed by September 2003, at which point the final ISIR schema may be published. FSA is planning to use the XML ISIR schema in production for the 2005-2006 Award Year.

Direct Loan Servicing System (DLSS) eServicing

Background
XML is used as part of the DLSS eServicing application. DLSS is the system of record (SOR) and the owner of all borrower information. XML allows the Siebel electronic customer relationship management platform to communicate with the Direct Loan Servicing System (DLSS), using MQSeries as the middleware for all on-line interface activity. MQSI components will be used for data format and transformation into XML between MQSeries and Siebel.

XML Usage

The Siebel application uses pre-defined EAI business service components to perform XML message creation and translation for use by MQSI. The EAI XML Converter, one such business service component, uses a self-defined XML template for all messages between Siebel and MQSI. MQSI is responsible for transforming the Siebel XML data into the format needed by DLSS and vice versa. MQSeries then places the file in a queue, where a COM adapter is responsible for interpreting the message and calling the appropriate Visual Basic application COM object. Likewise, data returned from DLSS is packaged by the COM adapter and put on the MQSeries queue for MQSI to process and return to Siebel.

The diagram below illustrates the existing application architecture, and the possible routes for data transfer between the DLSS database and the Siebel application server.

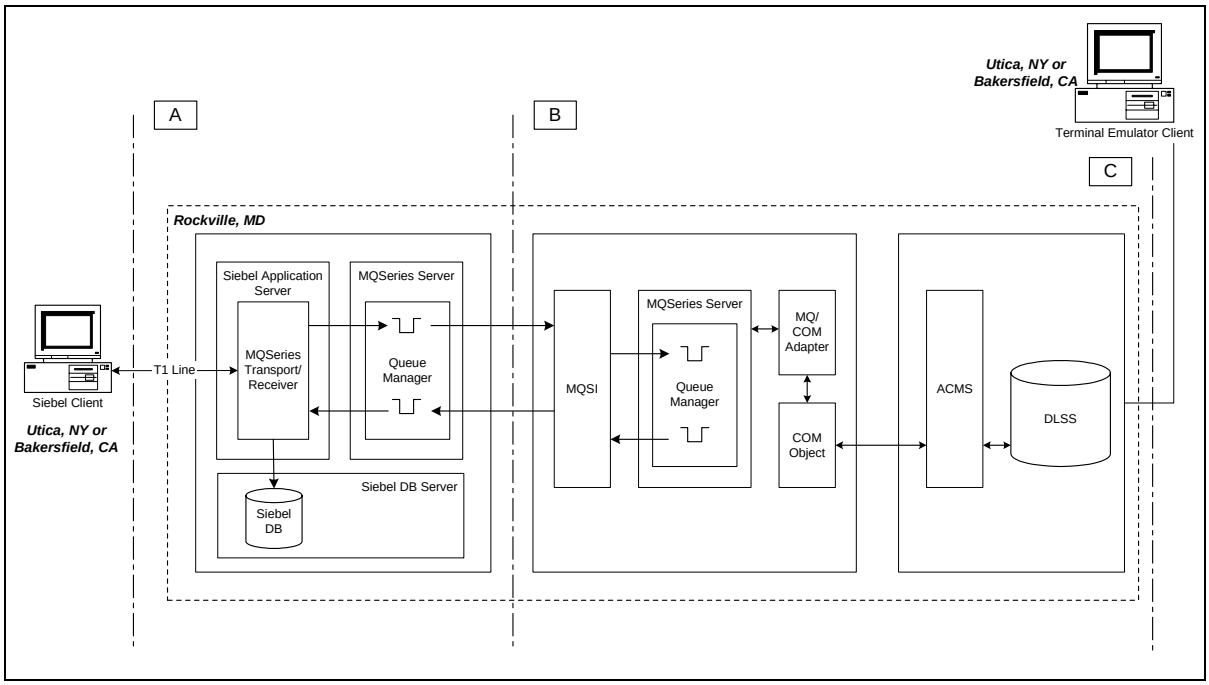

Figure 3 - Application Architecture

Transactions:

There are four specific types of transactions that exist between DLSS and Siebel:

1) Replicated asynchronous updates from Siebel to DLSS
2) Replicated asynchronous updates from DLSS to Siebel
3) Non-replicated, synchronous financial transaction
4) Non-replicated request/response of read-only virtual data

Each type of message transaction consists of one or more individual interfaces that perform a specific business function.

For transaction types 1-3, XML is used for message translation between application interfaces. In the area between A to B in Figure 3, Siebel's predefined business services components translate Siebel messages into XML for use by the DLSS application. Figure 4 below outlines the workflow process carried out by the three Siebel business services workflow components.

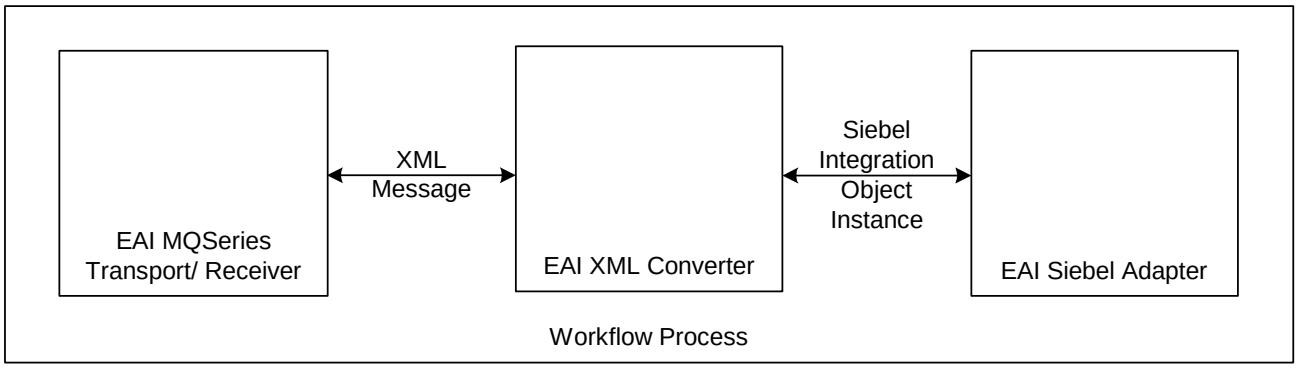

Figure 4 - Siebel Workflow Process

The EAI MQSeries Transport/ Receiver components send or receive messages to and from MQSI, which in turn gathers them from the EAI MQSeries queues. The EAI Siebel Adapter maps the records in the Siebel Database to the appropriate Siebel Business Integration Objects, and either retrieves or updates information. The EAI XML converter, converts an XML string to a Siebel integration object instance, or vice versa, depending on whether the XML message will be sent to, or has been received by, MQSeries. Each of the three components in this workflow process, reside on the Siebel Application Server.

For the fourth transaction type, Non-replicated request/response of read-only virtual data, XML is used for message transfer between the Siebel client and the Siebel Application Server. This internal messaging system is part of the Siebel software application, and allows for communication between the Siebel Object layer on the client and the EAI MQSeries Transport component on the Siebel Application Server, described in the workflow diagram above. The XML Gateway business service allows a Siebel business object (Client) to communicate with the EAI MQSeries Transport (Application Server) via XML messaging. The messages are transported via a custom built XML Gateway Interceptor business service that consists of a Send/Receive method that initiates the transport.

In the area between B and C in Figure 3, the XML message produced by the Siebel system (as described above), is pulled from the input message queue by MQSI, reformatted and key data is extracted and replaced on the DLSS queue. The MQ COM Adapter connects to the MQSeries Queue Manager and calls the appropriate Visual Basic Application COM object, which either retrieves data from the DLSS system or updates the database based on the XML message. The

IBM XML4c XML parser is used by the COM adapter to parse incoming requests. If data has been retrieved it is placed back in the DLSS queue, where the MQSI message flow reformats it for use by Siebel. Figure 5 below shows this process.

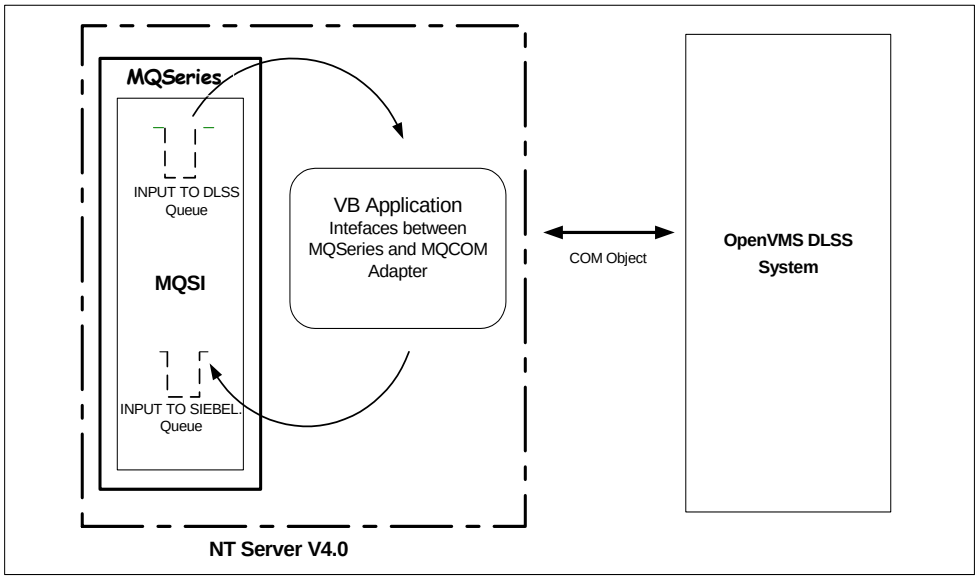

Figure 5 - MQSeries Workflow Process

Financial Management System (FMS) to COD Interface

XML Usage

Presently only 1% of all internal data transfer is XML enabled. This specific FSA internal XML data exchange occurs between the FMS and COD systems. When a message is an FMS initiated financial transaction, FMS places all transactions in a transition table in Oracle. The FMS-MQSeries Adapter, which resides on FMS, is initiated by the Oracle concurrent manager, and selects the transactions from the table. The data is then formatted into an XML message and placed in an MQSeries message. The messages in the MQSeries Queues on the FMS System are transferred to the EAI Bus. Upon arriving at the EAI bus, the MQSI message flow converts the XML string to a COD fixed length format and places the file in the appropriate queue to be retrieved by COD. In July 2003 the MQSI component that performs this service will be replaced by a custom built component, eliminating the need for MQSI.

3.2.3 Department of Education Initiatives

The Department of Education is currently analyzing the use of XML for its K-12 Academic Transcript. PESC has been working with the Department of Education to develop a K-12 Academic Transcript, since August 2002. Specifically, PESC has contracted Andy Wheeler through a contract through The National Center for Educational Statistics. The focus of the

contract is on the electronic transmission of K-12 student data. The major goals of the initiative are:

- Facilitate the electronic transmission of student transcripts.
- Develop comprehensive XML schemas for K-12 data.
- Establish a process for communication between PESC and other XML standards bodies.
- Participate in ANSI ASC X12 Subcommittee A.

3.2.4 Postsecondary Financial Aid Community Initiatives

Organizations

The Postsecondary Education Standards Council
PESC encourages the use of XML in higher education through the creation of the XML Forum for Education. The XML Forum for Education serves as an industry group focused on XML standards in the education space. In addition to monitoring global XML specification initiatives and developing standards appropriate to education, the Forum provides the community with information on XML applications and their potential.

In February of 2002, FSA joined the PESC organization in promoting the use of common information technology standards by FSA and the schools and organizations participating in Federal Student Aid.

XML Forum for Education
The XML Forum for Education was organized in August 2000 on the recommendation of a PESC study group. The XML Forum's mission is to collaboratively establish XML standards for the Education Community. In addition to monitoring global XML specification initiatives and developing standards appropriate to education, the Forum provides the community with information on XML applications and their potential. The Technology Work Group was charged with performing research on existing XML specifications and best practices and providing technical guidance to XML developers in the Education space.

The XML Forum for Education's Technology Work Group created the *XML Technical Specification for Higher Education v. 1.00.* The document is periodically updated as XML standards are established and modified. The most recent version of the document is v. 2.11 (published August 2002). The document provides guidance in the development and maintenance of a data dictionary and XML schemas. The scope of the specification includes the data which institutions and their partner's exchange in support of the existing business processes within Higher Education (e.g., administrative applications for student financial aid, admissions, and registrar functions).

The National Council of Higher Education Loan Program
NCHELP represents a nationwide network of guaranty agencies, secondary markets, lenders, loan servicers, collection agencies, schools, and other organizations involved in the

administration of the FFELP Program. NCHELP members promote student access and choice for post-secondary education and training. Over the past 35 years, FFELP lenders have provided $291 billion in student loans.

NCHELP has been active in promoting and developing interfaces and applications that leverage XML formats to improve accessibility and interoperability among its network of guaranty agencies, secondary markets, lenders, loan servicers, collection agencies, schools, and other organizations. Specifically, NCHELP has been involved in the development of the CommonLine Schema for use in its network and the development of the Meteor project.

ELM Resources

ELM was established in 1994 by a group of FFELP providers who wanted to improve loan processing for their customers by using technology and cooperation to create a uniform data exchange network. By pooling resources, lenders could deliver services without having to create separate systems. ELM is a network that provides you with a single point of data exchange.

Projects

CommonLine Schema

The NCHELP CommonLine Network for FFELP and Alternative Loans represents the nationally- recognized standard for FFELP and alternative loan applications and disbursements. The CommonLine Network is a process developed by the NCHELP community of service providers and schools to facilitate the electronic processing of FFELP and Alternative Loans. This process, which has been implemented across the country, enables schools to communicate with multiple service providers, in a standardized format.

CommonLine offers flexibility by allowing schools and service providers to control their level of participation in CommonLine electronic file transfers and procedures. For example, the financial aid office of a college may choose to use CommonLine for the loan origination process while the bursar's office maintains its manual disbursement system.

The CommonLine file is the industry-standard file format created by the NCHELP and used by schools and service providers to exchange loan data. PESC is, with FSA assistance, currently developing an XML schema for the CommonLine record. PESC plans to release a draft of the CommonLine XML specification in July 2003.

The Meteor Project

The Meteor Project is an open online resource to serve schools, students, and their families. The concept of Meteor began in spring 2000, when NCHELP organized and sponsored a meeting with a number of chief executive officers and chief information officers from guaranty agencies and related institutions to discuss the marketplace related to customers and competitors. By the end of the meeting, the participants recognized the need for a common, timely, student-specific financial aid resource. The group concluded that the community of participants in the FFELP

should work together to create an information network to provide aggregated financial aid information to their customers.

Meteor's XML schema is based on the COD 2002-2003 Common Record, with additional tags and information.

ELMNet

ELMNet uses XML for both real-time loan retrieval and real-time loan transaction processing. Utilizing an index of approximately 12 million borrowers, ELMNet applies messaging and XML to retrieve in real-time loan origination and servicing information from most of the major originators and servicers participating in the FFEL Program. Utilizing messaging and XML in conjunction with industry-standard CommonLine transactions, ELMNet is connected to major FFEL and private loan originators to process loan origination, change, and disbursement transactions in real-time. This service is now available to hundreds of schools utilizing the ELMNet system. Going forward, ELMNet will be further expanded to support both batch and real-time processing of the Common Record – CommonLine transactions.

Postsecondary Academic Transcript

PESC's XML Forum has been developing the XML Postsecondary Academic Transcript. PESC has been collaborating with AACRAO's SPEEDE Committee. At the February 2003 American National Standards Institute (ANSI) Accredited Standards Committee (ASC) X12 meeting, representatives of PESC, the XML Forum for Education, and the higher education community submitted the XML Postsecondary Transcript for review and approval to become an X12 standard.

3.2.5 Government Agency Initiatives

As XML has become an increasingly prevalent technology, specific federal agencies have started to explore using XML in a more concerted manner to improve and simplify their business processes. As these federal agencies develop XML implementations, FSA may be able to leverage their standards to facilitate data exchange with these agencies.

The following table lists the federal agencies with which FSA currently exchanges or plans to exchange data, and are, therefore, candidates for using XML as data interfaces. Along with the name of the Agency a short description describing the state of XML usage within the Agency is included. A more detailed list of the table can be found in Appendix F: Government Agency Initiatives.

Agency	Description
United States Department of Treasury - FMS	The Pay.gov portal and transaction engine uses XML to offer a package of electronic financial services to assist federal agencies.
Internal Revenue Service (IRS)	IRS e-file system uses XML for electronic submission of tax forms. Some electronic forms are presently available for e-file on IRS.gov, while others will be available in future years.

Agency	Description
Social Security Administration (SSA)	XML used to establish common electronic processes for federal & state agencies to collect, process, analyze, verify and share birth and death record information
Department of Justice (DOJ)	Have begun assessing and assimilating a variety of XML-based standards that are appropriate for use in the justice and public safety communities. Recent recommendations to the Global Advisory Committee have resulted in actions aimed at establishing a Standards Registry that will be web enabled.
Census Bureau	Use XML to facilitate form redesign. Census forms need strict visual fidelity, s that a document will be rendered identically on any output device
Department of Veteran Affairs (VA)	N/A.
Bureau of Citizenship and Immigration Services (formerly Immigration and Naturalization Services [INS])	Use XML as part of SEVIS an Internet-based system that maintains accurate and current information on non-immigrant students, exchange visitors, and their dependents. SEVIS allows for data exchange between, schools, program sponsors and the Department of State
United States Department of Health and Human Services (HHS)	As part of a joint effort between the Federal Office of Child Support Enforcement - OCSE, National Center for State Courts - NCSC, State CSE IV-D agencies and local courts, XML is used to improve the electronic exchange of information between State IV-D agencies and local courts.
Department of Defense (DoD) - Navy	The DOD is adopting an array of XML technology consisting of individual XML elements, XML schemas, XML Stylesheets, and other XML components.

Table 7 - Federal Agency Interfaces with FSA

3.3 Case Studies

3.3.1 Overview

This section provides a high-level overview of the current state of advanced XML implementations, and how other companies and government agencies are implementing XML as part of their business strategies.

The XML 1.0 Recommendation released by the W3C consortium in 1998, was the first step towards the next generation Web, allowing each community to design languages that suited their particular needs and integrated them harmoniously into a general infrastructure based on XML. Companies quickly adopted the specification and have been using it in a wide variety of ways since then. Since XML 1.0, a number of W3C Recommendations have been added to the XML infrastructure. XML Namespaces was published in January 1999. Associating Style Sheets with XML documents was published in June 1999. Extensible Style Language Transformation (XSLT), for XML transformations, and its companion XPath, were published in November 1999: using these technologies an XML file can be transformed into any other type of XML file, for the purpose of presentation. XLink and XML Base, both published in June 2001, define a general hyperlinking vocabulary to XML. A major step forward was made with the publication of XML Schema structures and datatypes in May 2001. XML Schemas provide functionalities above and beyond what is provided by DTDs and are essential in defining complex XML applications.

The case studies have been grouped by the strategic area of implementation, to provide examples of applications across the range of key business integration areas. These case studies are organized into the following key business integration areas:

- XML Vocabulary Efforts
- XML Education Initiatives
- Business-to-Business (B2B) Distributed Transactions
- Business-to-Consumer (B2C) Portal Integration
- Business-to-Business (B2B) Marketplace/Exchange
- Internal Data Quality
- Government-to-Business (G2B) Enterprise Initiatives

This section provides an overview of the case studies. Appendix E: XML Case Studies provides more detailed descriptions of these areas, including case studies that outline industry and corporate initiatives to implement systems that support the business integration strategy. These cases demonstrate the overall industry movement towards XML for data exchange, and its various benefits and applications. These cases have been selected based on their pertinence to possible FSA XML implementation efforts.

3.3.2 XML Vocabulary Efforts

Developing an industry or community XML standard is one of the first activities industries and communities perform as they progress in the XML Maturity Model. Developing such standards is the first step in moving from single, point-to-point interfaces to multiple implementations and usages of XML for data exchange among multiple parties.

An XML vocabulary includes an agreed upon XML element set (i.e., Core Component Library) and corresponding data models (i.e., schemas, DTDs, etc.). XML vocabularies are traditionally created for a specific problem domain (e.g., financial services [FSML]), or a vertical market/industry (e.g., Chemical Industry Data Exchange [CIDX]), or a defined set of functions and requirements (e.g., catalogue XML [catXML]).

For FSA, XML vocabularies lay the groundwork for implementing an enterprise data exchange strategy. They establish the standards for business integration between trading partners and allow the companies to communicate and exchange data. However, the standard vocabulary an organization builds must be flexible enough to allow for gradual implementation across the entire enterprise.

3.3.3 XML Education Initiatives

There are presently several XML initiatives underway in the Education industry sector. Many of these efforts use XML as a means of integrating instructional and tutorial software applications for education purposes. The ultimate goal is to create distributed learning environments for students by allowing content from multiple authors and developers to interoperate. The first step to achieving this goal is to create standards that allow for interoperability. Two examples of industry groups working in this area include the Schools Interoperability Framework (SIF) and the IMS Global Learning Consortium. Both of these initiatives display the commitment to implementing XML, among international education partners and groups.

The Schools Interoperability Framework (SIF) is a non-profit membership organization made up of software vendors, school districts, state departments of education and other organizations, tasked with developing an open specification for ensuring that K-12 instructional and administrative software applications work together more effectively. SIF is essentially an industry-supported technical XML blueprint for K-12 software that allows for disparate applications to interact and share data seamlessly.

IMS Global Learning Consortium, Inc. (IMS) is an international organization actively developing and promoting open specifications for facilitating online distributed learning activities such as locating and using educational content, tracking learner progress, reporting learner performance, and exchanging student records between administrative systems. In February of 2003, final Version 1.0 specifications for *IMS Learning Design* and *IMS Digital Repositories* were published by the organization, together with XML schemas. The ultimate goal of the Instructional Management Systems (IMS) project is the widespread adoption of a set of open standards for Internet-based education. Twenty-eight international organizations have

made substantial investments in the IMS project and continue active involvement in the technical work.

3.3.4 B2B Distributed Transactions

B2B distributed transactions are business events that occur between two or more business partners with disparate systems and distinct networks. XML offers a way to self-describe data, enabling business partners to readily standardize data in a form that the receiver of the data can easily interpret, so long as the receiver has access to the same XML vocabulary. By standardizing the way organizations represent information, and incorporating those standards across all systems, a common approach can be adopted by anyone wishing to exchange data.

Systems that support distributed transactions can also perform various real-time transactions. For example an ATM machine that immediately records a cash withdrawal by updating the bank's database records can also offer non-banking services such as travel bookings and weather information through trading partners. Because the data transferred is represented in standardized format, multiple transactions between disparate systems can take place.

Similarly, a credit card company can allow a merchant system to update the customer's itemized charges directly into the credit card's subscriber system. Some examples of potential data elements would be hotel charge, hotel tax, and meal charge. This offers corporate clients the ability to automate their expense reporting process, by electronically transmitting these tagged itemized charges to their appropriate corporate cost centers.

3.3.5 B2C Portal Integration

B2C portal integration encompasses both business-to-consumer and business-to-employee portals. Portals facilitate business transactions and information presentation between business partners, customers and employees.

Some advanced portals use XML to render content to the website, as well as to offer an integration tool for accessing enterprise applications. XML can push content to the presentation layer, using XSLT, the language used in XSL style sheets to transform XML documents into other XML documents. Essentially, an XSL processor reads the XML document and follows the instructions in the XSL style sheet, then outputs a new XML document or XML-document fragment. This process is extremely useful for portal implementations, where the same data may need to be converted into different representations of XML across multiple devices. In addition, many portal products can be also integrated with Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), and e-procurement enterprise applications, often using XML interfaces.

As a result, companies are deploying portals to support strategic business initiatives by using them as a tool for customer and/or employee to access information and as a means of managing enterprise applications.

The technologies surrounding transformation and presentation of XML make the application of XML to portals particularly desirable. In an integrated XML environment, FSA can achieve greater system capability and customer satisfaction by building portals that are linked to its core system infrastructure through XML interfaces.

3.3.6 B2B Marketplace/Exchange

B2B exchanges or marketplaces offer businesses the opportunity to buy, or sell, goods and services via a common web site. Some exchanges also offer billing, logistics and payment services, which help members complete transactions online. Exchanges may also support dissemination of corporate information, such as distributing industry news, sponsoring online discussions and providing research on customer demand or industry forecasts for components and raw materials.

With the rapidly increasing acceptance of XML as the standard for e-business, many of the traditional industry challenges relating to disparate system communication can be overcome. XML can, not only, render data for presentation on the marketplace site, it can also be transformed using XSLT into a different representation of an XML document, for presentation across different devices. In addition, if a single XML vocabulary has been established for the exchange, the disparate systems can interchange data freely using common interfaces. Presently several XML vocabularies are used for e-marketplace B2B exchanges, these include Catalogue XML (CatXML), Interactive Financial eXchange (IFX) and the Chemical Industry Data eXchange (CIDX).

For FSA, the core lesson from this section is that XML can help enable transactions between disparate systems belonging to different companies. The open-text, platform-neutral nature of XML makes such integration possible. However, an investment has to be made up front to define the data that is exchanged. Fortunately, the modeling facilities for XML, the XML Schema language, make this process easier as well.

3.3.7 Internal Application to Application – EAI

Enterprise Application Integration (EAI) allows for the unrestricted sharing of data and business processes between applications or data sources across an organization. Prior to the creation and introduction of EAI technologies, applications within different departments were designed to run independently with no interaction between the disparate systems. Presently, organizations recognize the need for data exchange between systems within their enterprise, and are investing in EAI software to streamline processes and keep all the elements interconnected.

Once EAI is up and running, integration can be greatly facilitated. However, the process of getting EAI to work properly can be tedious. EAI is difficult to implement and post-implementation it remains complicated to administer, which results in significant consulting, customization and maintenance costs. Extensive work is involved in creating and resolving data definition compatibility issues. Although it does not eliminate maintenance and support, XML can be useful when creating common interfaces, and can be extremely useful if a data

dictionary or core components have been created. It can also be used in conjunction with XSLT, the language used in XSL style sheets to transform XML documents into other XML documents, for data transformation between systems.

Similarly XML is an essential building block for EAI software companies that are presently rebuilding their technology on top of a web services foundation. Web services can be depicted as a standards-based pipe between systems. Simple Object Access Protocol (SOAP), a lightweight XML-based messaging protocol, is essential to encoding the information in Web service request and response messages before sending them over the network. With EAI implemented above the pipe, functionality such as routing, transformation, and publishing can be enabled. A web services based EAI framework will help to eliminate much of the complexity presently involved in the technology. This type of approach is evolving into what the industry is generally referring to as a Service Oriented Architecture (SOA). The complete details on what constitutes a SOA are still under discussion/debate, but these are the general components.

Many off the shelf EAI and CRM software companies realize the necessity to communicate between applications and have worked to create XML interfaces that allow for exactly that. One such case is EnergyAustralia, where the company needed to facilitate the integration of a CRM product, namely SAP, with the rest of its' back-office systems. After a vendor selection process, EnergyAustralia chose TIBCO's ActiveEnterprise suite (EAI), because of the ease with which its adapters integrated with a wide range of off-the-shelf applications. TIBCO adapters provide shared XML metadata definitions, while SAP uses a proprietary CA-XML as its XML vocabulary, which allows for conversion of any middleware data format into an XML document for eventual document transfer. Given that both products allowed for communication using XML, the implementation provided the capability for real-time messaging between the CRM application and the rest of the enterprise.

FSA is presently implementing EAI in increments to allow for reduced risk, by modernizing components one at a time. FSA uses several products as part of its EAI architecture, these include IBM's MQSeries to transport messages between systems, OAG's AMI for simplified messaging API for business application programs, IBM's MQ System Integrator (MQSI) for transformation, routing, and formatting of messages between systems, and Commerce Quest's Data Integrator, for large volume data transportation (i.e., larger than 100Mb).

FSA can expect to use XML in its EAI layer more and more, as most COTS systems are moving to XML for the format of their interfaces. They are already exposed to this for eServicing, as their Siebel system shares its data through an XML Gateway. However, this linkage isn't completely XML; as soon as the data exits the Gateway, it is converted into a flat file to be read by DLSS. Full XML capability in the EAI layer would simplify the transformations needed in this interface. This example illustrates why examining the XML capabilities of their EAI architecture can ease integration challenges for FSA in the future.

3.3.8 Internal Data Quality

XML, through the use of various tools, can provide a means of ensuring data integrity across an enterprise. These tools (e.g., BEA Liquid Data) allow IT departments to easily aggregate data from many sources inside and outside of the enterprise, and tailor it for different business users. By using a data-view abstract layer, to make it appear that multiple underlying heterogeneous data resources are a single logical database, these tools, which leverage XML standards, can provide real-time access to current data, and thus avoid the potential for inconsistency that comes from duplication in a data warehouse.

The Osaka Securities Exchange Company used a standard XML format for Data Exchange that helped dramatically improve the data quality in reports distributed by the company. By eliminating what was a labor-intensive data entry and verification process, through the adoption of an XML data format, the company was able to effectively develop a more efficient automated system that demonstrated improved data quality.

For FSA, XML will play an immediate role in data quality efforts. The XML Framework Core Components and its Modeling Standards will be used with the output of the Data Strategy findings when data quality solutions are implemented in the future.

3.3.9 Government - G2B Enterprise Initiative

There is a growing awareness among government agencies of the potential use of XML across their respective enterprises. In fact, the Bush administration's E-Government Strategy, published in 2001, documents the use of XML in some of its more driven initiatives. G2B initiatives apply specifically to a government agency's dissemination and collection of data from citizens, businesses and other government agencies.

Government XML initiatives cross departments and implementation business strategies, but all reiterate the governments' push towards using XML. As recently as December of 2002, the Navy released an XML policy to coordinate its efforts to adopt the language and establish an enterprise-wide XML vocabulary. The policy outlined how the Navy will implement XML to better find, retrieve, process, and exchange data. The Air Force uses XML to Web-enable its massive collection of technical manuals for use by soldiers and contractors. The Census bureau collects data from various internal and external data feeds and makes the information available in a variety of formats to other government agencies and citizens. As this trend continues federal agencies will increasingly turn to XML, especially as the demand for data sharing rises to meet homeland security and other needs.

In light of these developments, it will be critical for FSA to track all government-wide XML initiatives, as they mature, to make sure its efforts are in compliance with the broader government community. Also, as mentioned in Section 2.2.1.4 Government Agencies Initiatives, there are several government agencies with which FSA exchanges data. Until the government-wide standards are completely, and given that some of these agencies are presently working without FSA to implement XML across their enterprise (i.e., Census Bureau, DoD, and

IRS), it would be beneficial to both agencies to work together with these initiatives to adopt a common XML interface.

3.4 Future State

3.4.1 Overview

This section expands upon the information presented in Section 2.4 and provides more detailed information on the future state of XML usage at FSA. In addition to providing descriptions of the activities associated with each level of the XML Maturity Model, this section also provides more detailed descriptions of the business objectives, each Maturity Level, and XML usage scenarios.

3.4.2 Business Objectives

The future state of XML usage at FSA should be directly tied to the business objectives of FSA, to prevent XML from being used solely because it is the latest technology. XML is only an enabling technology, albeit a powerful one, that can be leveraged to support enterprise business goals.

The XML Framework defined in this Future State section fits into FSA's Data Strategies work and will provide the following benefits:

- XML Core Components will be the foundation for FSA's Data Clean-up effort.
  - The components will enable the comparison of data between systems, by providing internal data standards.
  - A single set of carefully modeled components will help eliminate ambiguities in data definitions across messages.
  - XML Core Component definitions will facilitate access to data from other systems as needed for data clean-up.
  - The core components can facilitate analysis and reporting on data quality across systems.

- XML-based interface modeling provides improved support for new application and exchange requirements.
  - It will make developing new interfaces faster and more cost efficient.
  - Through reuse of components in interface specifications, it can ensure consistency in the representation of data across systems.
  - It provides faster development times for defining messages, because of its standardized, robust XML Schema syntax.
  - It provides easier coding of interfaces to send/receive data.
  - It allows for messages and interfaces that are more flexible to change.

- XML is leveraged by a majority of standard COTS technologies.
  - FSA can be virtually assured that any COTS technology it uses is either moving to enhance its XML capabilities, or is already there.

- FSA will be able to leverage its XML infrastructure to use COTS technologies for mapping, querying, and presenting data.

- XML is founded on Open Standards.
  - All core XML specifications are maintained as open standards, maintained by public standards bodies.
  - Open standards should alleviate FSA concerns about being locked into a proprietary technology.
  - Because open standards are available to all vendors, competition is great which drives down the cost of tools.
  - Many core XML tools, such as parsers, are available for free.

- XML is becoming the industry standard for data exchange.
  - Many of FSA's trading partners/vendors are moving towards using XML for their interfaces.
  - With some thought and planning, and use of component-based message specification development, XML can help ensure consistency across the industry for conducting transactions.

3.4.3 XML Usage Scenarios

Next, in order to effectively discuss the future state of XML usage at FSA, we should first consider what is meant by the term "XML usage". This term can be broken out into several components:

	XML Usage Components
1	Basic awareness of XML as an available technology. Use of XML technologies as embedded in COTS products.
2	Definition of custom XML message formats via XML Schema.
3	Implementation of XML data exchange in core business systems.
4	Implementation of advanced XML specifications, such as XPath and XSLT, in core business systems for more sophisticated processing.
5	Implementation of XML and its advanced specifications to meet complex business and technical goals, such as data clean-up, or self-describing interfaces.

Table 8 - XML Usage Components

The use scenarios are cumulative; that is, one further down the list builds on the capabilities above it. Each of the components of XML usage can play a role, either by itself or in concert with other components, in building solutions that meet a particular business objective. A

mapping of prioritized objectives, to potential solutions, to use components, provides a good picture of a potential future state for XML for FSA.

3.4.4 XML Maturity Model

The following diagram illustrates the main stages in maturity for XML usage in an organization, and maps specific FSA activities, either already conducted, in progress, or projected for the future, to the stages of maturity. The XML Maturity Model is based on the lessons learned at FSA, the case studies identified in this assessment, and general industry trends.

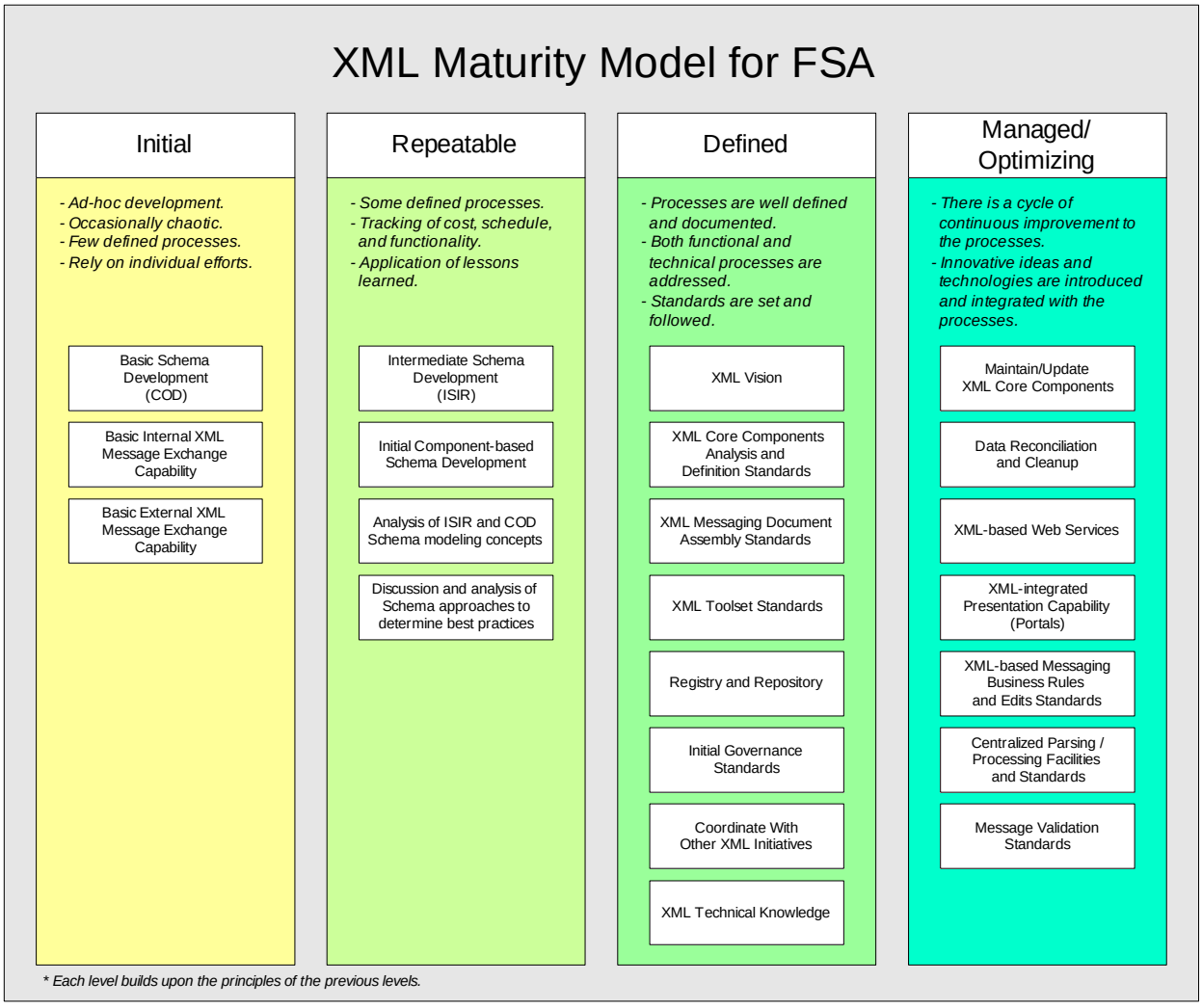

Figure 5 - XML Maturity Model

FSA is currently operating at the Initial Level of the XML Maturity Model, based on its current XML usage.

As FSA expands its use of XML to additional interfaces and usages, it is necessary to establish guidelines for consistency. As the opportunity arises, FSA should begin to take advantage of XML by progressively adding to its XML capabilities.

The following sections provide more detail on the characteristics of the XML Maturity Model Levels. The Initial Level is not characterized by any activities to improve the process, but is documented to serve as a baseline for comparison. The Repeatable, Defined, and Managed/Optimizing Levels are discussed in terms of how the activities conducted are aimed and building or enhancing ability to implement XML based solutions in the enterprise.

3.4.4.1 Initial

Characteristics
The Initial XML Maturity Level is characterized by the following:

- Unclear direction for technology decisions.
- Lack of planning / reactionary decision-making.
- Ad-hoc development, which is undermined by poor management.
- A result of frequently chaotic work efforts.
- There are few defined processes.
- Success completely depends on individual efforts.
- As a result, quality levels are generally unpredictable.
- Schedule, budget, and product functionality are also impossible to gauge.

Activities
When adopting an entirely new approach for handling enterprise data, as XML is, it is possible to have less than optimal initial implementations, but there really is no need to operate at an Initial Level of maturity. Generally speaking, basic processes and project management should always be in place for any effort. There should, at a minimum, be clear direction on the activities at hand, at requirements analysis, and metrics for successful completion of the project.

An easy way to fall into the Initial Level of maturity is to let the technology overshadow the business and functional objectives of the project. It is important to remember that XML is simply an enabling technology and is not going to change the landscape of software development. That is, there still will be requirements, analysis, coding, testing, and documentation to be done, and project plans should account for such activities.

3.4.4.2 Repeatable

Characteristics
The Repeatable XML Maturity Level is characterized by the following:

- Basic controls in place.
- Some effectively defined processes.
- Tracking of cost, schedule, and functionality.
- Application of lessons learned.
- Requirements are understood.

- Realistic commitments can be made.

Activities

When a well-run project is evaluated, most often cost and schedule are discussed as indicators of its success. While this is true, it does not touch on the root cause of what makes a project successful. The most telling characteristic of the Repeatable Level is the process definition. It is said that a process is effective when it is practiced, documented, enforced, trained, measured, and able to be improved. When all individual processes are well understood along these lines, the overall budget and schedule become much easier to digest.

Of course, in some ways these activities support each other. That is, it is through an understanding of cost and schedule impacts that one can fully understand what occurs in a process, and how to effectively define it. But the bottom line is that it is the process definition that builds success in this maturity level.

FSA's current XML activities exist somewhere between the Initial and Repeatable Maturity Levels. There are many controls and processes in place that are focused on improving quality of development efforts. Among these are:

- An improved approach to project management for schema development.
- Up-front level of effort estimates for development activities.
- Tracking of progress against original estimates.
- Organized requirements gathering cycles.
- Organized functional review cycles.
- Managed release cycles, with version control.
- Peer review of technical work with feedback.
- Documentation of lessons learned and best practices.
- Some training of junior project resources.

All of these activities did not exist in FSA's first XML Schema development activities.

However, some areas are not completely well managed, and chaotic periods still occur. Furthermore, the controls and processes that do exist are built to rely on several key individuals, and haven't been transitioned with much success to others. Some of this is simply attributed to the talent and ability of the people involved, but some of it can certainly be improved, and the improved processes and lessons learned can be shared, and capability built, across a larger group.

One of the major goals of this XML Framework, in fact, is to enable this process improvement and knowledge transfer, making the improved management and process knowledge more institutionalized, to solidify FSA's capabilities as an organization.

3.4.4.3 Defined

Characteristics

The Defined XML Maturity Level is characterized by the following:

- Processes are well defined and documented.
- Both functional and technical processes are addressed.
- Standards are set and followed.
- A particular group is established to create and maintain standards.
- Standards cover things such as requirements definition, development tools and procedures, review processes, and end state criteria.
- Project status can be monitored on a detailed level, with minimal lag time.
- The relationships between cost, schedule, and functionality are well understood.
- There is a common understanding of activities, roles, and responsibilities across the project.

Activities
Reaching the Defined Maturity Level is a fairly significant accomplishment, because it reflects a serious commitment of time and resources to build up a truly powerful set of XML related capabilities. Even more importantly, as the term 'capability' implies, it means that there is a solid foundation on which some sophisticated implementations could be built. That is, it sets the stage for doing work in the Optimized Level of Maturity (described in the next section).

In the Defined Level, organizations should complete development of the following activities:

- Core Component Analysis and Definition Standards.
- Core Component Usage Standards.
- XML Message Document Assembly Standards.
- XML Toolset Standards.
- Registry and Repository
- Governance Standards.

The main focus of the XML Framework efforts are squarely in line with positioning FSA in the Defined Maturity Level, with an eye on how it should approach working in the next Maturity Level, Managed/Optimizing.

3.4.4.4 Managed/Optimizing

Characteristics
The Managed/Optimizing Level is characterized by the following:

- There is a cycle of continuous improvement to the processes.
- Productivity and quality are measured within development cycles.
- Innovative ideas and technologies are intelligently introduced and integrated with the processes, with a good understanding of risks and learning curves.
- Boundaries and targets are set for development processes.
- Data can be captured and evaluated for continuous improvement.

Activities
Within the context of an XML Maturity at FSA, a Managed/Optimizing Level of maturity means that essentially, FSA:

- Has a firm hold on XML and its related technologies.
- Understands resource impacts for various XML related tasks.
- Has firmly defined standards along all their standard XML development channels.
- Is looking to use its base of XML knowledge to build increasingly sophisticated solutions that utilize XML.

The improvement that FSA seeks to attain in this level is in realizing all of the benefits that XML offers in the areas of:

- Data Quality
- Web Services
- Portals
- Messaging

Essentially, to effectively use these tools that are built in the XML marketplace by leading vendors, FSA's internal XML capability must be ready to accept it. Careful tracking of FSA progress through the earlier levels will ensure that when it seeks to implement a package for a solution such as XML-based data auditing and reconciliation, it will see the benefits that this tool provides.

3.4.5 Sequencing Plan

The following section provides an overview of sequencing plan of activities that FSA should perform in order to move up in the XML Maturity Model.

3.4.5.1 Initial Level

This section will describe the activities associated with the Initial XML Maturity Level in greater detail. These are:

- Basic Schema Development (COD)
- Basic Internal XML Message Exchange Capability
- Basic External XML Message Exchange Capability

FSA has completed the activities defined for the initial level of the XML Maturity Model.

Basic Schema Development (COD)

XML offers the capability to establish the rules for structuring a particular document via two distinct rule specifications, namely Document Type Definitions (DTDs) and XML Schemas. An XML Schema, the newer technology of the two, is far more powerful when compared to a DTD, because of its ability to more robustly describe a document's structure. Because schemas themselves are created in XML, they not only describe the XML data but also set constraints for an XML document's content in an extensible format. Schemas define the elements present in the document and the order in which they appear, as well as any attributes that may be associated with an element.

At the Initial level, Common Record schema development was considered rudimentary because there were no formal Schema development standards on which to base development. The schema was completed with solely the needs of the system and the state of the technology in mind, and with no long-term vision for enterprise implementation. The schema modeling approach did not accommodate for robust usage, and did not envision improvements such as component development, standards and guidelines that ensure consistency, or tiered architectures with namespace utilization. The maturity of the XML Schema specification now allows these factors to be considered.

Basic Internal XML Message Exchange Capability
Basic internal XML message exchange occurs when disparate systems are able to format, send, and receive XML messages. The software needed to perform this transfer, consists of XML parsers to construct and read XML files, and some form of transport mechanism to send and receive these files. Implementing basic functionality for XML message exchange in existing systems involves conducting an analysis of the systems for possible hardware and software platforms, and mapping the needed XML tools (such as parsers) to these platforms. Since XML itself is platform-neutral, as long as the tools communicate standard XML, they can then enable the systems to communicate with each other. More advanced XML exchange, such as Web Services, builds on this basic infrastructure.

One example of internal XML message exchange is the message transfer between the COD system and the EAI bus. EAI allows for the unrestricted sharing of data and business processes between applications or data sources across an organization. Prior to the creation and introduction of EAI technologies, applications within different departments were designed to run independently with no interaction between the disparate systems. Presently, organizations recognize the need for data exchange between systems within their enterprise, and are investing in EAI software to streamline processes and keep all the elements interconnected. FSA has specifically invested in communicating with MQ Series and Data Integrator.

Basic External XML Message Capability
Basic external XML message exchange performs functionality very similar to internal messaging, with an additional level of complexity that must be considered because of increased integration and security requirements for systems communicating over the Internet. Because Internet connectivity is the most likely means of communicating with outside partners, an added concern is raised about maintaining security over outside connections. Network

hardware components such as firewalls must be enabled with pre-determined authentication approaches, and security layers with encryption to ensure an organization's network safety.

FSA began to address these concerns when considering communication between the COD system and schools. The platform developed and used to support this communication is the SAIG mailbox system.

3.4.5.2 Repeatable Level

This section will describe the activities associated with the Repeatable XML Maturity Level in greater detail. These are:

- Intermediate Schema Development (ISIR)
- Initial Component-Based Schema Development
- Analysis of ISIR and COD Modeling Concepts
- Discussion and Analysis of Schema approaches to determine best practices

FSA is currently working on completing the tasks characterized by the Repeatable XML Maturity Level.

Intermediate Schema Development (ISIR)
With an existing exposure to schema development, gained from working with the Common Record, an increased level of understanding contributed to both improvements in design and the business process analysis. Similarly improvements in the technology itself over the last few years, make developing schemas a much easier process than earlier iterations. This was evident when developing the XML ISIR.

For the ISIR development effort there were clearer timelines and end goals, better definitions for requirements collection, review, and sign off processes, and clearer focus on how to make the XML development more standardized and reusable. However, the XML ISIR Schema does not represent development based on the results of an enterprise-wide XML implementation. Thus the end product is not yet at an advanced level. With the development of the XML Framework Core Components and Standards guidelines, and their application to the ISIR, the development effort can then be considered advanced.

Initial Component-based Schema Development
The XML ISIR Schema incorporates some intermediate level Schema design principles, including component-based development. As it was being developed, the ISIR was analysed and built with basic components assembled together in growing levels of aggregation. However, these components were defined from an ISIR specific perspective, not from an enterprise-wide vision. While the ISIR components can be seen as an improvement in understanding and design, in that they were assembled from a level of improved technical and business experience, they are not yet truly enterprise-wide core components. The Core Components specifications, and the Registry/Repository in the XML Framework will raise those components to enterprise-class reusability.

Analysis of ISIR and COD Schema modeling concepts
Because it was evident that the business process understanding used in developing the ISIR schema was greatly improved since developing the Common Record. With established core components and a documented modeling standard, the discovery process will only continue to improve. More functional expertise was effective in defining the components, making the data models in the ISIR Schema reflect the improved business understanding of the data. It is because of the enhanced modeling process that the components built for the ISIR will be closer to the enterprise wide specifications than would have otherwise been achieved. In addition, analysis of these two schemas can assist in looking for common components across systems.

Discussion and Analysis of Schema approaches to determine best practices
The XML Schema specification is both powerful and complex. When the COD Schema was built, the final W3C Recommendation for XML Schema had just been released. Because it was relatively new, a widespread body of understanding on best practices was not yet demonstrated within the XML language, which was evident when creating the COD schema. Since the standard's release, much analysis has been conducted, and guidelines developed, to point developers to best practices for schema modeling. By the time the ISIR was developed a much clearer methodology was defined. The ISIR reflects those practices as part of this repeatable stage.

The XML framework will allow these improvements to continue, by creating a better understanding of XML while defining more detailed FSA standards. This can be achieved by tailoring the development community standards to FSA specific needs.

3.4.5.3 Defined Level

This section will describe the activities associated with the Defined XML Maturity Level in greater detail. These are:

- XML Vision
- XML Core Components Analysis and Definition Standards
- XML Messaging Document Assembly Standards
- XML Toolset Standards
- Registry and Repository
- Initial Governance Standards
- Coordinate with Other XML Initiatives
- XML Technical Knowledge

FSA is currently working on completing the tasks characterized by the Defined XML Maturity Level.

XML Vision
An XML vision is necessary to move FSA from a small-scale narrowly focused implementation to more widespread broad usage across the enterprise. This vision will enable FSA to

proactively manage and guide the procedures surrounding XML usage and take full advantage of XML's benefits through an incremental development approach. By establishing XML standards and processes, FSA will be able to simplify and standardize its development of data exchange interfaces.

In order to be certain that trading partners are ready to use XML with FSA, FSA's future state vision and timeframes for using XML should be communicated to the XML community. This thorough communication and outreach plan will be developed to address the following issues:

- Technical education
- Technical support
- Recommended tools and technologies

In the past, FSA has sometimes raced ahead in its XML capability while failing to involve the rest of the community. A carefully designed education and outreach process for the community can strengthen the impact of XML technology for FSA's community.

XML Core Components Analysis and Definition Standards
The Core Component work is the foundation for developing a Postsecondary Education Financial Aid Community Vocabulary/Markup Language. We will define the basic building blocks that can be used across the community. By defining key core concepts in the Core Components, FSA and the postsecondary education community are developing the industry standards that can be used for their information exchange.

XML Messaging Document Assembly Standards
The Schema Modeling Standards will be based on the following industry-wide approaches:

- The UN/CEFACT UMM
- The current ebXML working group specifications on Core Components
- The Object Management Group UML standard for modeling notation

XML Toolset Standards
There are a wide variety of tools and technologies built around the core XML specification. These include:

- Supporting specifications, such as XQuery and XPath
- Software libraries for tools such as XML Parsers
- XML productivity tools, such as XML Spy

These tools and technologies are continually evolving. It is important to be familiar with developments in technology to allow for proper decision-making with regard to these tools. However, the approach should not be to create an 'approved list' of XML tools that can be used. Rather it should be a catalogue of research about available tools and case based recommendations, so that the standards can provide enough flexibility to evolve with the ever-

changing marketplace. Appendix D: XML Technologies defines many of these tools in more depth, but does not constitute an approved list.

Registry and Repository
A Registry provides a stable store where information developed by FSA is made persistent and readily available to all interested parties. The Registry FSA implements should be compliant with the ebXML Registry and Repository specification v2.0. The Registry/Repository will store XML schema and documents XML Core Components, and, UML models.

Implementing this capability will provide a central location for FSA's design artifacts, eliminating confusion and ambiguity over what is available. It will be a very large step in bringing the technical community in line with FSA as it expands its own capability.

Initial Governance Process
XML Governance simply indicates the process by which XML-related technology decisions are raised, considered, and decided within FSA. Currently there is no formal process for these decisions, which leads to ineffective decision-making and communication within FSA with regards to XML. The establishment of a clear governance process will be a great step towards ensuring all XML-related activities are well understood and agreed upon by a group of appropriate stakeholders.

Coordinate with Other XML Initiatives
FSA should develop its XML strategy and framework to align with other related XML initiatives. Currently, FSA is working with:

- Department of Education
- PESC and community
- NCHELP

FSA will achieve greater adoption of XML technologies by its trading partners, if it works in conjunction with PESC and the Postsecondary Education Financial Aid Community. In developing its own XML standards, FSA should work closely with PESC.

XML Technical Knowledge
With the XML Framework and its component pieces in place (i.e., XML Strategic Assessment and Enterprise Vision, Core Component Dictionaries, Technical Reference and Usage Guidelines, and Registry and Repository) FSA will have the infrastructure needed for implementing XML solutions.

Based on this work, FSA will need to have a solid base of knowledgeable XML resources that can help identify new components, modify existing schemas, etc., as new XML implementations and modifications are identified. It will also need the documentation and process needed to train new resources. In addition to building the XML Framework for projects to leverage, FSA should develop additional XML technical knowledge in order to provide support to applications, schools, and trading partners, as they begin to use XML to communicate with FSA.

3.4.5.4 Managed/Optimizing Level

This section will describe the activities associated with the Managed/Optimizing XML Maturity Level in greater detail. These are:

- Maintain/Update XML Core Components
- Data Reconciliation and Cleanup
- XML-based Web Services
- XML-integrated Presentation Capability (Portals)
- XML-based Messaging Business Rules and Edits Standards
- Centralized Parsing/Processing Facilities and Standards
- Message Validation Standards

FSA is currently working on completing the tasks characterized by the Managed/Optimizing XML Maturity Level.

Maintain/Update XML Core Components
The Core Components library is not a dynamic entity, but will evolve as data evolves and business and data requirements change. FSA must be able to integrate these changes in the Core Components library and manage the ripple effects on schemas that come from component updates. The synchronization requirements and the proper process for upgrades should be determined and agreed upon beforehand so that change can be managed and planned for. Smooth transitions are key to keeping systems in line, and data models from fragmenting.

The governance model previously determined in the Defined stage plays a major role in properly maintaining and updating XML Core Components. While it is true that components will evolve is it important that only appropriate changes and improvements are made.

Data Reconciliation and Cleanup
One of the driving factors for creating a standardized Core Component data model is the associated capability for Data Reconciliation with which it is attributed. The exact approach and tools for data reconciliation have not yet been determined, but it will leverage the common, platform-neutral representation of data entities that the XML Core Components will provide. All systems will be able to map their individual data models to a common XML representation, and data can then be compared on that common level. This common approach eliminates point-to-point mappings for data cleansing, making the solution more robust and enterprise-ready.

XML-based Web Services
The Initial capability level discussed basic internal and external XML communications for data exchange. XML-based web services are the next generation of that model. Web services support basic data exchange processes, or system-to-system remote procedure calls (XML-RPC). Web Services architectures are now being built into major J2EE application servers, so the core capability is in place and available for FSA and its trading partners to leverage. The benefit of

making a base XML investment is that FSA can move from basic XML message exchange capability to Web Services without building all of the software 'plumbing' involved. Also, the standardization of Web Services and XML means that integrating with trading partners should be easier than with a proprietary tool such as SAIG.

The possibilities surrounding web services implementation are only beginning to be realized, yet unfortunately so are its shortcomings. However one intrinsic component necessary to achieve some of the already realized benefits of web services implementation is the basic XML building blocks.

XML-Integrated Presentation Capability (Portals)
One key benefit of XML-represented data is that supporting technologies, such as XML Transformations and XML Stylesheets, can convert 'raw' XML data into a variety of presentation formats. Therefore system development can be separated into two levels, data requirements and presentation requirements. Data requirements can be determined once and then used in a variety of presentation formats. Web Portals are one example of this, where data can be displayed as HTML pages, PDF documents, or downloaded as delimited text files when and where it is needed, based on the common XML data definition.

XML-based Messaging Business Rules and Edits Standards
The industry standardization of XML as a data description language, lends itself to further business specific standardizations. If the data itself has a uniform, common representation, then business rules and edits on that data should be able to be standardized as well. A common representation and approach to business rules and edits on enterprise data can help streamline and simplify processing of the data as it moves across systems during the student aid lifecycle.

Centralized Parsing / Processing Facilities and Standards
It is possible that if various systems at FSA are processing the same basic data components in the messages they send or receive, that processing can be consolidated into one place, either as an available service or a shared library. This would then decrease development effort across the systems. This would be a fairly advanced implementation, even under the Managed/Optimizing Level of capability, but it illustrates the types of efficiencies that can be gained when data is looked at as an enterprise asset, in a common representation format.

Message Validation Standards
Standardized XML modeling specifications will lead to messages that are structured uniformly and therefore subject to the same basic validation rules. FSA will achieve greater consistency in the way it communicates with external parties if message validation remains consistent across all XML messages that it exchanges. Furthermore, if there are additional business rule validations that FSA would hope to provide across systems, they can be consolidated, either as a service or as a shared library, which performs those validations consistently. This would be a fairly advanced implementation, even under the Managed/Optimizing Level of capability, but it illustrates the types of efficiencies that can be gained when data is looked at as an enterprise asset, in a common representation format.

Appendix A: References

Refer to the Appendix_A_References.doc file.

Appendix B: Glossary

Refer to the Appendix_B_Glossary.doc file.

Appendix C: XML Overview

Refer to the Appendix_C_XML_Overview.doc file.

Appendix D: XML Technologies

Refer to the Appendix_D_XML_Technologies.doc file.

Appendix E: Case Studies

Refer to the Appendix_E_XML_Case_Studies.doc file.

Appendix F: Government Agency Interfaces

Refer to the Appendix_F_Governement_Agency_Interfaces.xls file.