ARC101 – Architectural Overview for

Department of Energy

iManage Program – STARS Project

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Approvals

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Distribution

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Architectural Overview for iManage/STARS Systems

1. Purpose and Objectives

      1.1.   The Architectural Overview provides a comprehensive description and a series of schematic diagrams that represent the Department of Energy's iManage Standard Accounting and Reporting System (STARS) E-Business systems. The diagrams provide an overview of the main conceptual elements and relationships in the architecture. The elements included in the diagrams are: enterprise data servers; applications servers; subsystems for backup services and Fiber SAN storage; external interface systems; users; and specific application software by Oracle Corporation. Version control software by Serena Software will also be included in the diagram.

The main purpose of this Architectural Overview is to communicate how the Department's servers and software integrate as a corporate E-Business solution. An important aspect of this diagram is to be simple, clear, and understandable in its details. The diagram uses an informal rich picture notation to present a visual depiction of the architecture. The diagram includes supporting text to explain the main concepts of the architecture.

1.2. The objectives of this document are to:

    1.2.1. Provide an overview of the enterprise servers used:

        1.2.1.1. A description of the enterprise data servers

        1.2.1.2. A description of the application servers

    1.2.2. Provide an overview of the application software used:

        1.2.2.1. Describe the core Oracle Applications E-Business suite.

        1.2.2.2. Describe the Oracle 9i Applications Server.

        1.2.2.3. Describe the Enterprise Management software.

        1.2.2.4. Describe the third party software used in the environment.

    1.2.3. Provide an Overview of the Enterprise Server Backup Configuration

        1.2.3.1. Describe Tivoli Storage Manager Backups

        1.2.3.2. Describe AIX P561 Tape Backups

        1.2.3.3. Describe On-Line Backups to Storage Area Network

    1.2.4. Present the Systems that Interface with iManage/STARS

        1.2.4.1. DISCAS/MARS Interface Systems

        1.2.4.2. iManage/STARS Interface Systems

    1.2.5. Provide Overview of the development environment

        1.2.5.1. Describe Oracle Applications 11i enhancements

        1.2.5.2. Describe Interface development and usage of the Oracle 9iAS Integration Server technology

        1.2.5.3. Describe the PVCS version manager control process

    1.2.6. Present the Issue Tracking System used by the project.

2. Overview

2.1. iManage/STARS Enterprise Servers

The enterprise data and application servers consist of servers purchased by the Office of Management Budget and Evaluation (OMB) for the iManage/STARS project and hosted services provided by the Department's Applications Hosting Environment (AHE). Figure 1 depicts the iManage servers, data subsystems, and user access from within/outside (LAN/WAN) the DOENet network.

2.1.1. iManage/STARS Enterprise Data Servers

2.1.1.1. Two IBM P561 Servers are used to host the STARS Financial System. One IBM P561 is dedicated to production STARS and production support applications. The other IBM P561 is dedicated to supporting the STARS development and testing environments.

2.1.1.2. An IBM DS8100 Data Server, IBM Shark Data Server, and two FastT 900 Data Servers, and two IBM 7133 SSAs are used in the storage solution provided by AHE for the STARS Financial System. The fiber array network is located in Level 4 of the Department's Germantown Maryland computer center. One of the FastT 900 Data Servers and the two IBM 7133 SSAs are located at the Department's Forrestal computer center for disaster recovery purposes.

2.1.1.3. Figure **2** shows the P561 servers with their built in network cards, tape drive and DVDROM.

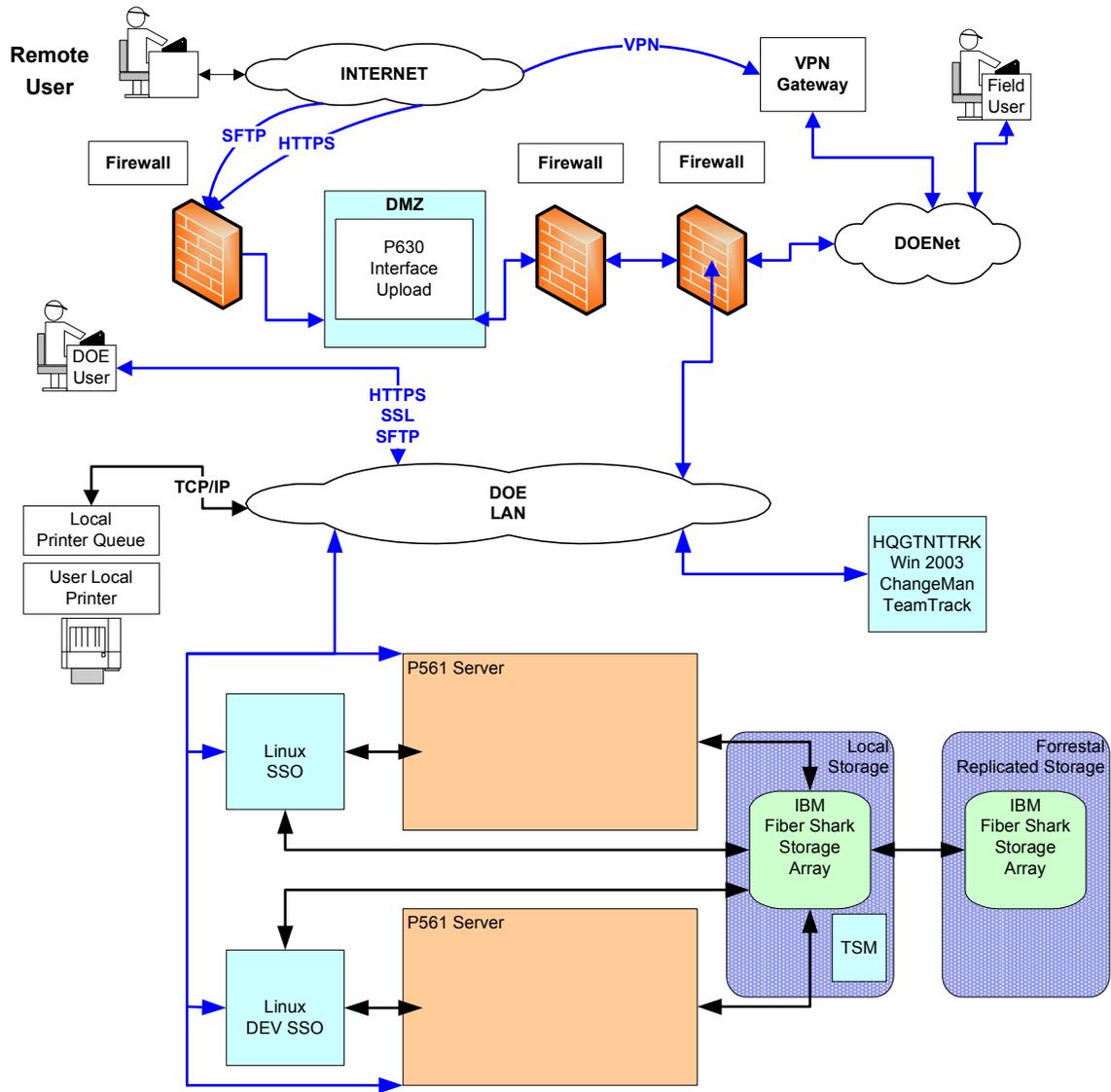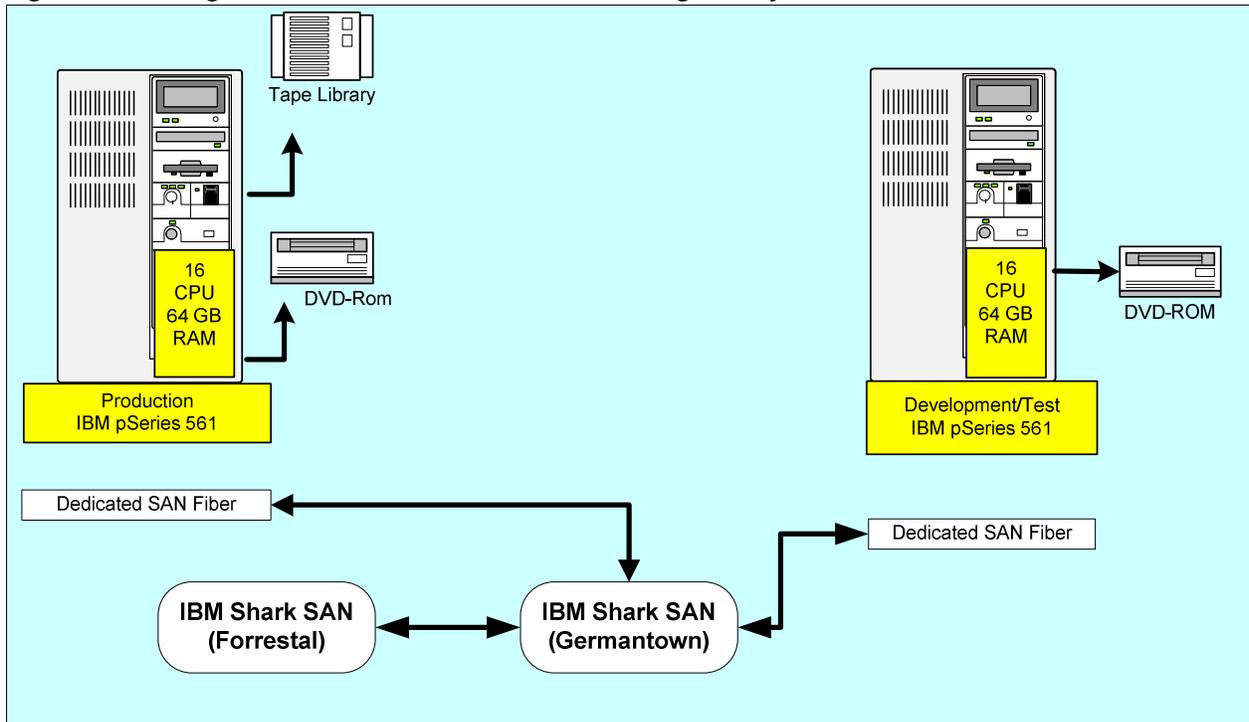**Figure 1: iManage Systems Architecture with User Integration and Access**

Figure 2**: iManage STARS IBM AIX Servers and Storage Arrays**

The AIX servers are used to run multiple Oracle eBusiness Suite Environments for development, quality test, and production[1] environments. Table 1 lists the project servers, the operating system version, and a description of their purpose and usage.

Table 1: iManage/STARS Data and Applications Servers

Server Name	Model	OS Version	Description
	IBM P561	AIX 5.3	Production STARS Server Partition
	IBM P561	AIX 5.3	Quality/Test STARS Server Partition
	IBM P561	AIX 5.3	Development STARS Server Partition
	IBM P561	AIX 5.3	Production Grid Control and Support Server
	IBM P630	AIX 5.2	Production Secure FTP Server
	Dell	Win2K	Serena TeamTrack and ChangeMan Server

The project acquired 1.5 Terabytes of disk storage on the Department's Fiber Array network. The fiber array is located in Level 4 of the Germantown Maryland Computer Center.

Each iManage STARS P561 server has Host Bus Adapter (HBA) fiber network cards installed that are connected to the fiber array network. The Production IBM P561 server has four individual HBA cards installed.

2.1.2. iManage/STARS Enterprise Applications Servers

2.1.2.1. The architecture includes additional application servers in addition to the data servers mentioned above. A windows server for project support software and an IBM P630 server, which is located in the Department's Demilitarized Zone (DMZ). This server provides STARS with file upload capabilities for the application interface files that are processed through the system. Users have the ability to either upload the files via Secure FTP (SFTP) or a secure web browser (HTTPS).

2.1.2.2. The Windows server runs multiple application software, these include:

2.1.2.3. Serena's PVCS Professional software suite

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[1] The iManage/STARS Production system will be created for the October 2004 *Go-Live* Production Date.

- TeamTrack - Issue Tracking systems

- ChangeMan - Version Control Management software.

2.1.3. The iManage/STARS E-Business system will utilize additional application services made available by the Application Hosting Environment (AHE) Group under the CIO's Office.

2.2. iManage/STARS Application Software: Oracle Applications E-Business 11i Financials software

2.2.1. The STARS accounting and reporting financials system is designed and configured based upon Oracle Corporation's COTS financials application, Oracle Applications E-Business 11i Financials Release 11.5.10.

2.2.2. The Oracle Applications Release 11.5.10 systems will be setup as single node environments[2]. The application will be setup according to the iManage/STARS, "*APP306: System Administrator Setup of Oracle APPS 11.5.9 for Department of Energy iManage Stars Project, Date: April 2004*" document.

2.2.3. The Oracle E-Business Suite is a set of business applications that utilize a single business system that shares a unified and open architecture to efficiently manage customer interactions, manufacture products, ship orders, and collect payments. Figure 3 represents Oracle's 11i E-Business suite Unified Data Model concept with embedded data warehouse.

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[2] A single node environment means that all Oracle Applications technological products reside on a single server.

Figure 3 : Oracle Applications 11i E-Business Suite Unified Data Model
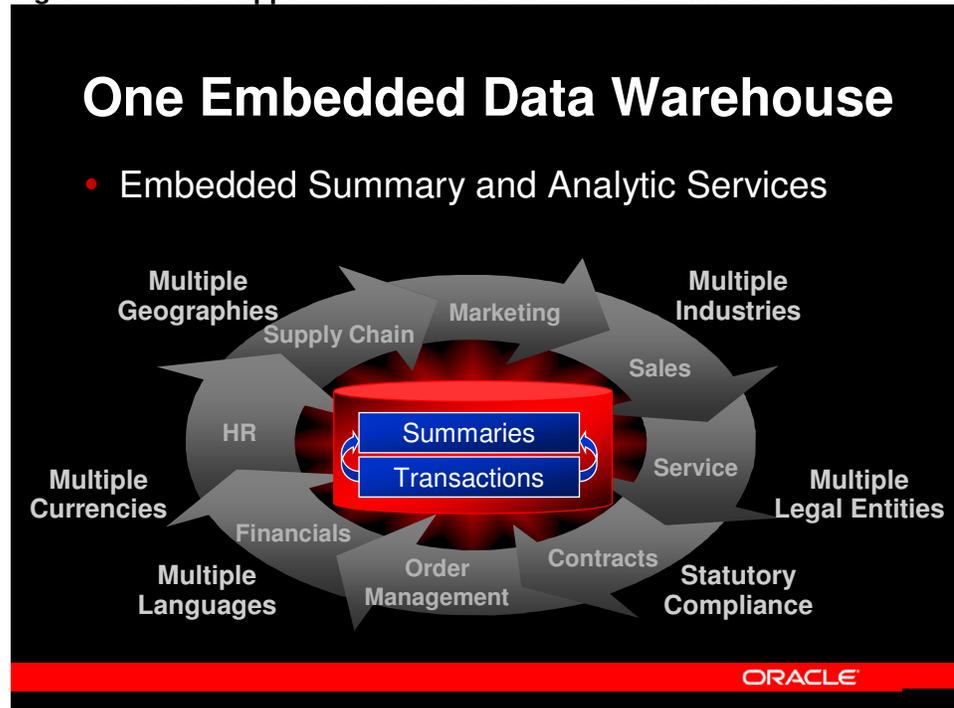
2.2.4. Oracle's Global Single Schema organizes hundreds of thousands of attributes into 165 major schema objects supporting the 180 business application modules contained in the Oracle Applications E-Business suite Release 11.5.10. It is designed for international operations, and extensibility.

2.2.5. The schema is delivered with a full set of public Application Programming Interfaces (APIs) to enable the Department's Interface systems to be integrated into the iManage heterogeneous IT environment. All key tables are constructed with additional user defined fields with processes to connect them to a User Interface. This enables model extensions that reflect business entities unique to the Department.

2.2.6. The global schema is multi-organization enabled so data manipulation can be controlled along organizational boundaries. The Oracle Applications Release 11.5.10 uses variable byte Unicode (UTF8) to support over 29 languages. It encodes flexible date and flexible address formats for easy localizations.

2.2.7. The Oracle Single Data Model has been optimized for Oracle's Daily Business Intelligence provided by the Oracle9i Application Server. The open standards provided in the Oracle 9i Applications Server architecture and usage of Oracle's Warehouse Builder provide multiple methods to

integrate with all of the Department's systems both Oracle or non-Oracle alike.

2.2.8. Oracle Applications Release 11.5.10 is built upon a Trading Community Architecture (TCA) to model all participants in their daily business operations. The customer schema is defined in the Oracle Customer Model and includes a full set of APIs and Web Services.

2.2.9. TCA models people, organizations, groups, customers, contacts, employees, and suppliers. It models their accounts, locations, classifications, and preferences. The model logically separates people and organizations from their relationships and accounts. A benefit of TCA is a true Customer Hub that includes data load, data cleansing and data enhancement capabilities.

2.2.10. The STARS project has configured the core modules of the Oracle Applications Financials Release 11.5.10 system. The core modules configured are:

    2.2.10.1.   Applications Object Library (AOL)

    2.2.10.2.   Federal Verticals (FV)

    2.2.10.3.   Fixed Assets (FA)

    2.2.10.4.   Public Sector Accounts Payable (AP)

    2.2.10.5.   Public Sector Accounts Receivable (AR)

    2.2.10.6.   Public Sector General Ledger (GL)

    2.2.10.7.   Purchasing (PO)

    2.2.10.8.   Workflow (WF)

2.2.11. Additional Applications modules have been created:

    2.2.11.1.   STARS Custom (CUSTOM)

2.2.12. Each of the iManage/STARS Oracle Applications Release 11.5.10 environments that have been created were setup similarly[3]. The Design/Configure/Test team has implemented a detailed Accounting FlexField for the Department.

2.2.13. The CUSTOM module was created for developed enhancements to the COTS system. The few enhancements to be created by the development team will be registered as application programs through the System Administrators Responsibility[4].

2.2.14. Oracle Enterprise Manager Grid Control

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[3] The iManage/STARS, "*APP306: System Administrator Guide, Date: July 10, 2003*" lists the steps required to setup an Oracle Applications Financials Release 11.5.8 environment for the Department of Energy.

[4] The iManage/STARS, "*ENG023: Concept of Operation, Date: December 2003*" will define the installation and operation of the STARS Oracle Applications Release 11.5.9 Account and Reporting System.

2.2.14.1. Oracle Enterprise Manager Grid Control (OEM) offers real-time monitoring for events for multiple Oracle Database Instances and Application environments from a centralized management console.

2.2.14.2. OEM is highly scalable for distributed database administration. The Department has purchased the Oracle Applications Tuning Pack, which allows database administrators to monitor and tune Oracle Applications components like the concurrent manager. The console offers data collection tools with analysis of performance and instance availability.

2.2.14.3. Automated tuning for 7x24 support can be configured with email and pager notification support notification for events. OEM offers reporting capabilities for performance and system health.

2.2.15. The Oracle Enterprise Manager Grid Control Server and database repository reside on the server partition.

2.2.16. Oracle Enterprise Manager Grid Control (OEM) uses a web based client, eliminating the need for client side application installs. Oracle Applications System Administrators will be given accounts with limited responsibilities for security purposes[5]. The System Administrators will monitor and control Oracle Applications server processes from the OEM console.

2.3. Third Party Software

2.3.1. PVCS Professional is Serena Software's foundation offering for software configuration management (SCM), including version control, bug tracking, change management and build capability in a single integrated suite.

2.3.2. PVCS Professional includes PVCS ChangeMan to manage the project's development process. The STARS development team uses version manager to check-in their developed code and scripts. ChangeMan protects against the common development errors that waste time and money. ChangeMan is a web-based tool; therefore, users do not have to install client-side software. Server security is enhanced by using the web-based tool, since developers do not need to log on or map connections to the AIX P561 servers.

2.3.3. PVCS Professional also includes an issue tracking software, TeamTrack. TeamTrack is also a web-based service that allows all team members access to creating, assigning, and resolving project issues. An advantage of the web-based TeamTrack solution is remote team members also have access without having to setup complicated remote shares.

2.4. iManage/Stars Enterprise Server Backup Configuration

2.4.1. The Department of Energy's corporate backup solution is IBM's Tivoli Storage Manager (TSM). The TSM backup solution is provided as a hosted

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[5] Refer to the iManage/STARS, "*ENG023: Concept of Operation, Date: December 2003*" for a detailed list of user defined roles and responsibilities.

service to the iManage/STARS project by the Department's Applications Hosting Environment (AHE). AHE manages the complete architecture, implementation, maintenance, and operation of the TSM backup solution. Detailed information on the TSM backup architecture is documented and maintained by the AHE and can be made available on request.

2.4.2. A TSM client daemon is installed on all iManage/STARS servers. Each servers TSM client is configured to initiate a nightly incremental backup for the entire server[6].

2.5.   Systems that Interface with iManage STARS

2.5.1. iManage/STARS Architecture

The iManage Standard Accounting and Reporting System (STARS) replaced the DISCAS system in April of 2005. The STARS system is designed to reduce the complexity of DISCAS. A major advantage of the STARS system is the consolidation of the distributed accounting systems and transformation protocols. The STARS system is a centralized Oracle Applications 11i Financials system located in Department's Germantown, Maryland CAP center. The system is maintained and operated from the CAP center.

The number of transformation protocols has been reduced significantly. The main protocols will be Secure FTP (SFTP) and Host-To-Host. The STARS system will continue to use the existing Hardware Encryption devices for payments and reporting to Treasury. However, the process of connecting to the hardware encryption changed, since the Connect Direct Windows 2000 server was decommissioned in favor of hosting Connect Direct on the same server as the production STARS application.

Figure 4 diagrams the consolidated iManage STARS interfaces. The figure shows the servers and interface systems required by the STARS production environment.

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[6] Refer to the iManage/STARS *"IT010: Backup and Recovery document, June 2002"* for backup policies and procedures.

Figure 4: iManage STARS Interface Overview Diagram

STARS Architecture - Interfaces
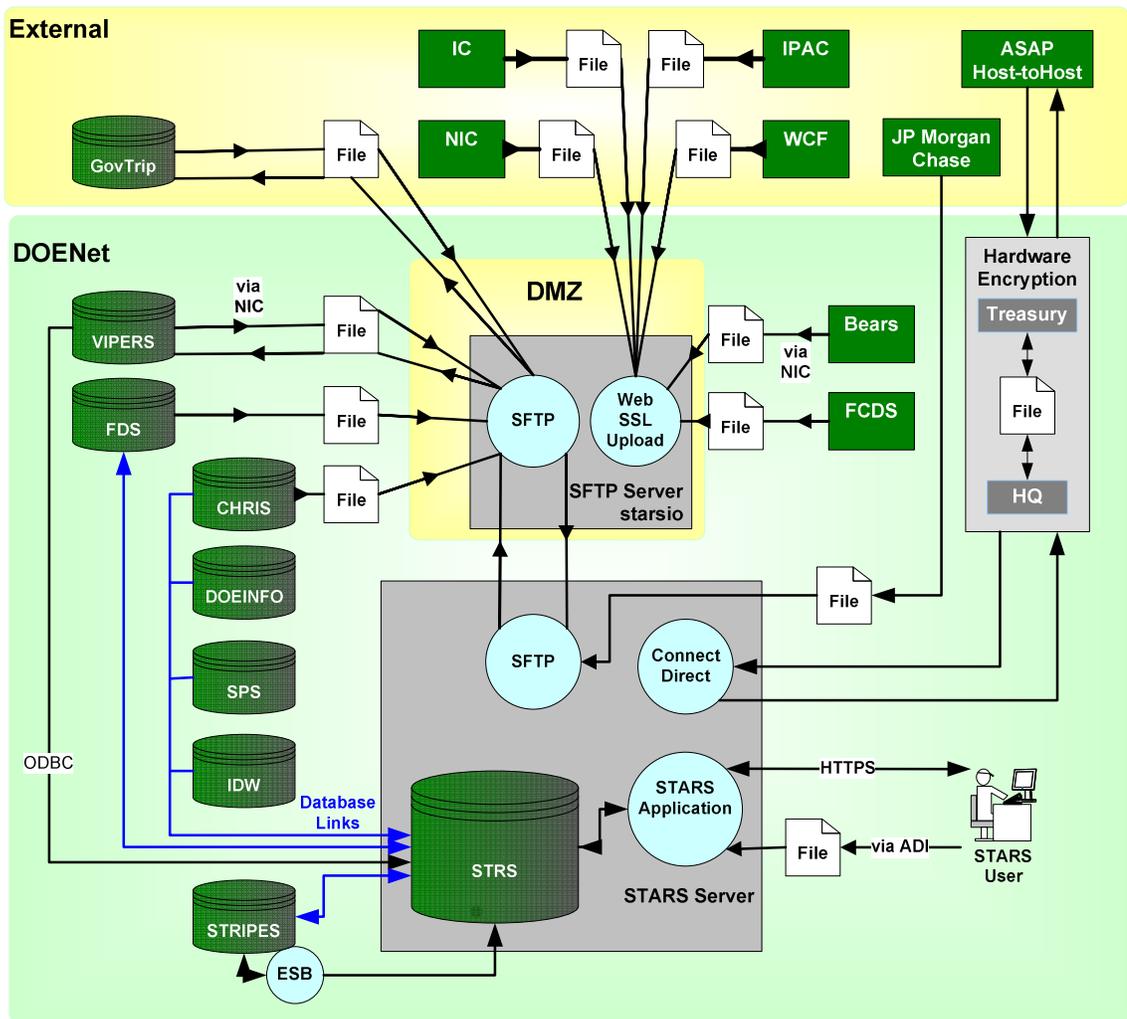
The diagram contains interface systems both local to the CAP center and remote. Interface systems displayed within the DOE*Net shaded area in the diagram are local CAP center systems. All systems above the DOE*Net shaded area are considered remote systems
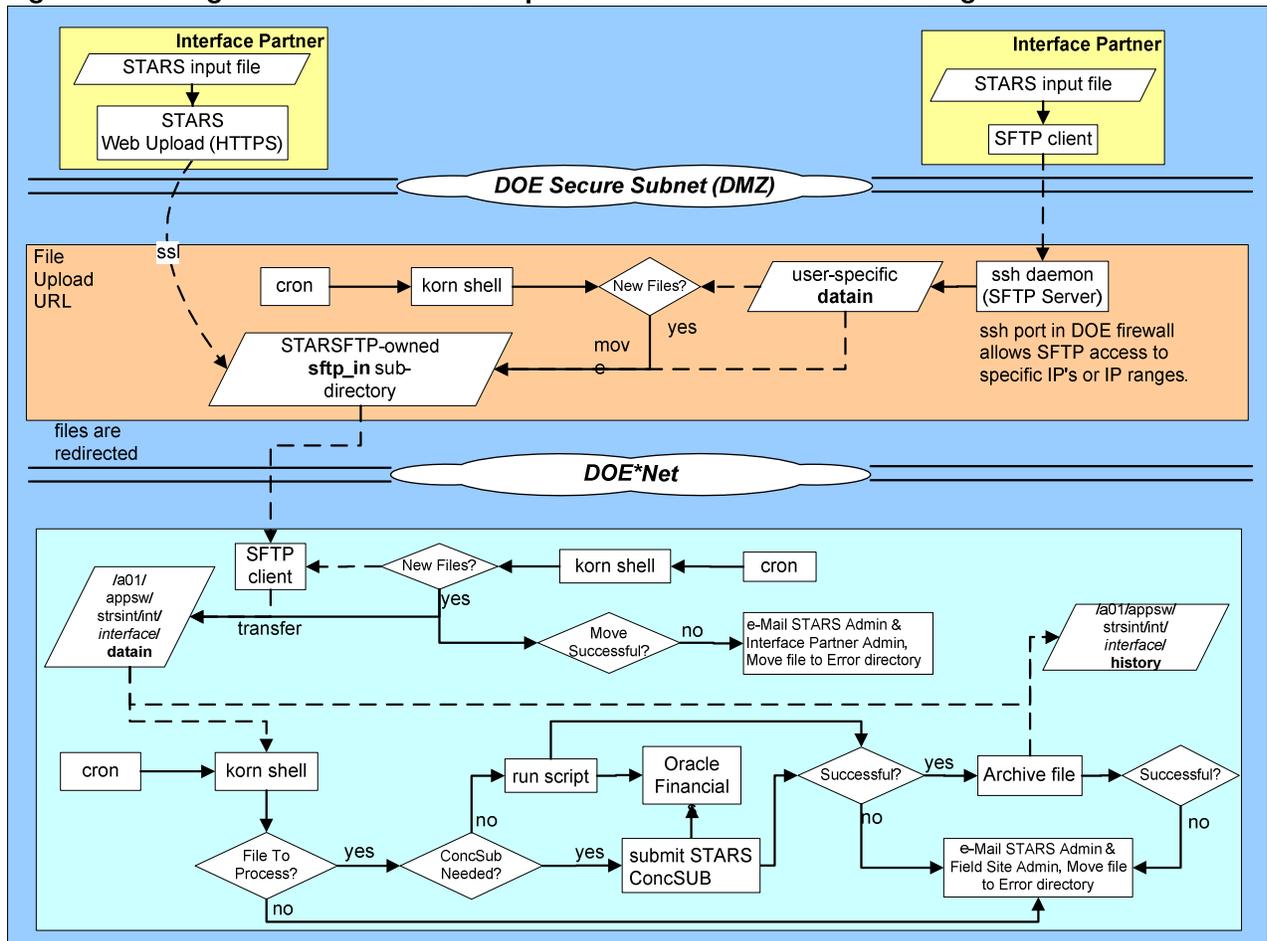
The Department's STARS Production instance (STRS) runs on the production IBM PSeries P561 server. The Production instance (STRS) is a single node environment of Oracle Applications Release11.5.10.

Users connect to the STARS Access Page from the Energy.gov web site. After the user clicks on the STARS link, they will be rerouted through the iManage Single Sign On server for authentication then to the STARS production instance (STRS). The STARS application will run in a Java Applet on their web browser. All interactions with the STARS application reside on production server.

STARS has implemented Single Sign On with IDW iPortal. All user authentication information is stored and referenced on the SSO/OID server from STARS. All STARS application level privileges and financial responsibilities are stored and maintained in STARS. When a user needs access to STARS, the access control group will initiate the user creation in STARS. STARS will automatically create an iPortal account and store the credentials within SSO/OID. The STARS users are a privileged subset of the iPortal community, therefore iPortal account creation will not automatically create STARS accounts. If an existing iPortal user needs a STARS account, the accounts will be linked within SSO/OID after STARS access has been authorized.

The interface systems that are configured to load data interface files into the STARS system will transfer the files via Secure FTP or the STARS HTTPS File Upload utility. The interface server is located in the Demilitarized Zone (DMZ) of the Department's DOENet network. End users that transmit interface files to STARS were provided user accounts for SFTP and/or file upload web access accounts depending upon their requirements. The users "Push" interface files to the interface server. The files are stored in their corresponding Interface directory Data-In directory, (e.g. /H2H/datain for the Host-to-Host interface). Files transferred to STARS via SFTP are "Pulled" from these directories via UNIX Korn Shell scripts located on the STARS server. Files uploaded to the interface server using the File Upload Web Server are also placed in the corresponding Secure FTP directories for pickup by STARS. The end result is enhanced security since End Users are unable to interface directly with the STARS application server. This approach reduces threats and vulnerabilities from outside "Hackers" attacks because they do not see the server, see Figure 5.

Figure 5: iManage Server SFTP/Secure Upload Inbound Interface Processing

Interface Partner
STARS input file
STARS Web Upload (HTTPS)

Interface Partner
STARS input file
SFTP client

DOE Secure Subnet (DMZ)

File Upload URL

ssl

cron → korn shell → New Files? ← user-specific **datain** ← ssh daemon (SFTP Server)

ssh port in DOE firewall allows SFTP access to specific IP's or IP ranges.

yes

move

STARSFTP-owned **sftp_in** sub-directory

files are redirected

DOE*Net

SFTP client ← New Files? ← korn shell ← cron

/a01/appsw/strsint/int/interface/ **datain**

transfer

yes

Move Successful? → no → e-Mail STARS Admin & Interface Partner Admin, Move file to Error directory

/a01/appsw/strsint/int/interface/ **history**

cron → korn shell

File To Process? — yes → ConcSub Needed? — yes → submit STARS ConcSUB → Oracle Financial ← run script

no

no

no

Successful? — yes → Archive file → Successful?

no

no

e-Mail STARS Admin & Field Site Admin, Move file to Error directory

The STARS interface programs will read the records and process them through the built-in APIs and interface tables. The interface programs provide messaging and audit logs for all transacted records that have been processed, for interface files that have been processed in the iManage STARS system.

## 2.6. iManage/STARS development environment

2.6.1. Oracle Applications 11i enhancements

Oracle Applications E-Business 11i Financials modules have a standard file system structure, see Figure 6. The root level of the application code objects is the application top, (APPL_TOP). Individual modules have a

corresponding module top beneath the APPL_TOP. Source objects for modules are installed into their appropriate sub-directories.

An example would be an Accounts Receivable report. The report would be created in the accounts receivable (AR) module sub-directory. Accounts Receivable module top would be equal to, (AR_TOP = APPL_TOP/ar/11.5.0). The Receivable report would be stored in the AR_TOP/reports directory.

**Figure 6: Oracle Application Module Top Level File System Structure**
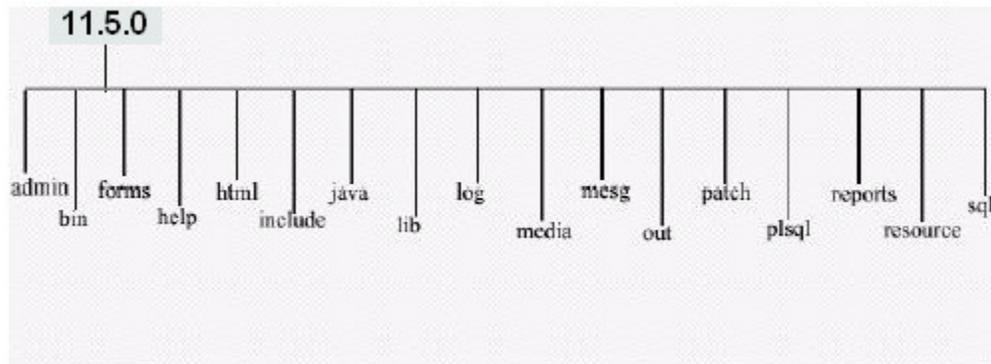
The development team enhancements will be installed into the CUSTOM module's sub-directories via a perl[7] script according to the PVCS Promotion model[8]. The CUSTOM module is the project application's customizations module. The module is registered within the applications as a standard installed module. The CUSTOM module is configured similar to the AR_TOP example described above. The CUSTOM module directory structure will follow the standard file system structure, see Figure 7.

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[7] perl - Practical Extraction and Report Language
[8] Refer to the iManage/STARS, "*ENG023: PVCS Version Control Document, Dated: July 03, 2003*", document which describes the version control process and the Perl scripts used in the promotion model.

Figure 7: CUSTOM Module File System Structure
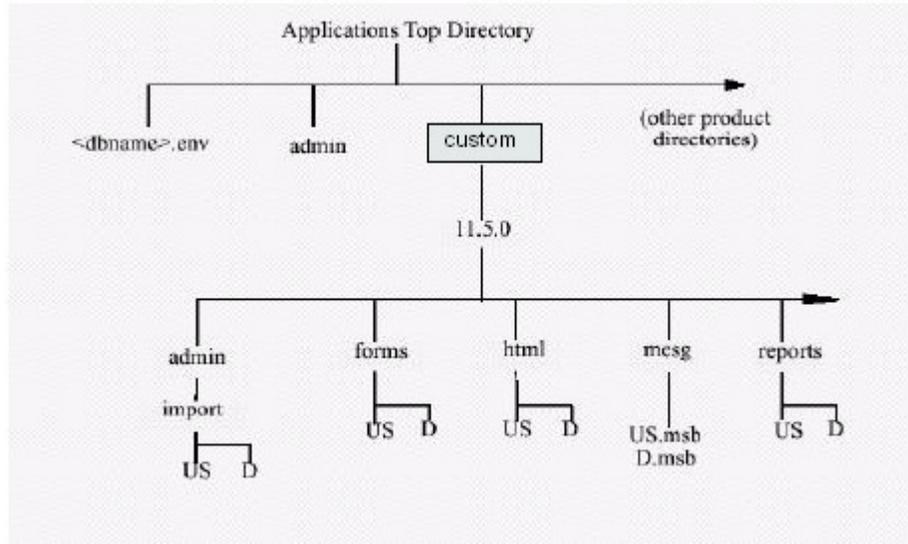
2.6.2.   Interface File Transfer using HTTPS File Upload and Secure FTP

Several Department systems will interface with the STARS application refer to*, "The iManage Development Team – APP030 documents"*, for specifics regarding interface systems to STARS. The interface infrastructure has been established using HTTPS File Upload components and Secure File Transfer Protocol (SFTP) to allow interface system users the ability upload interface files. Interface system administrators have been given SFTP and HTTPS file upload accounts for interface transfers, see Figure 8.

Figure 8: STARS Integration Server with Interface Feeds and Developer tools
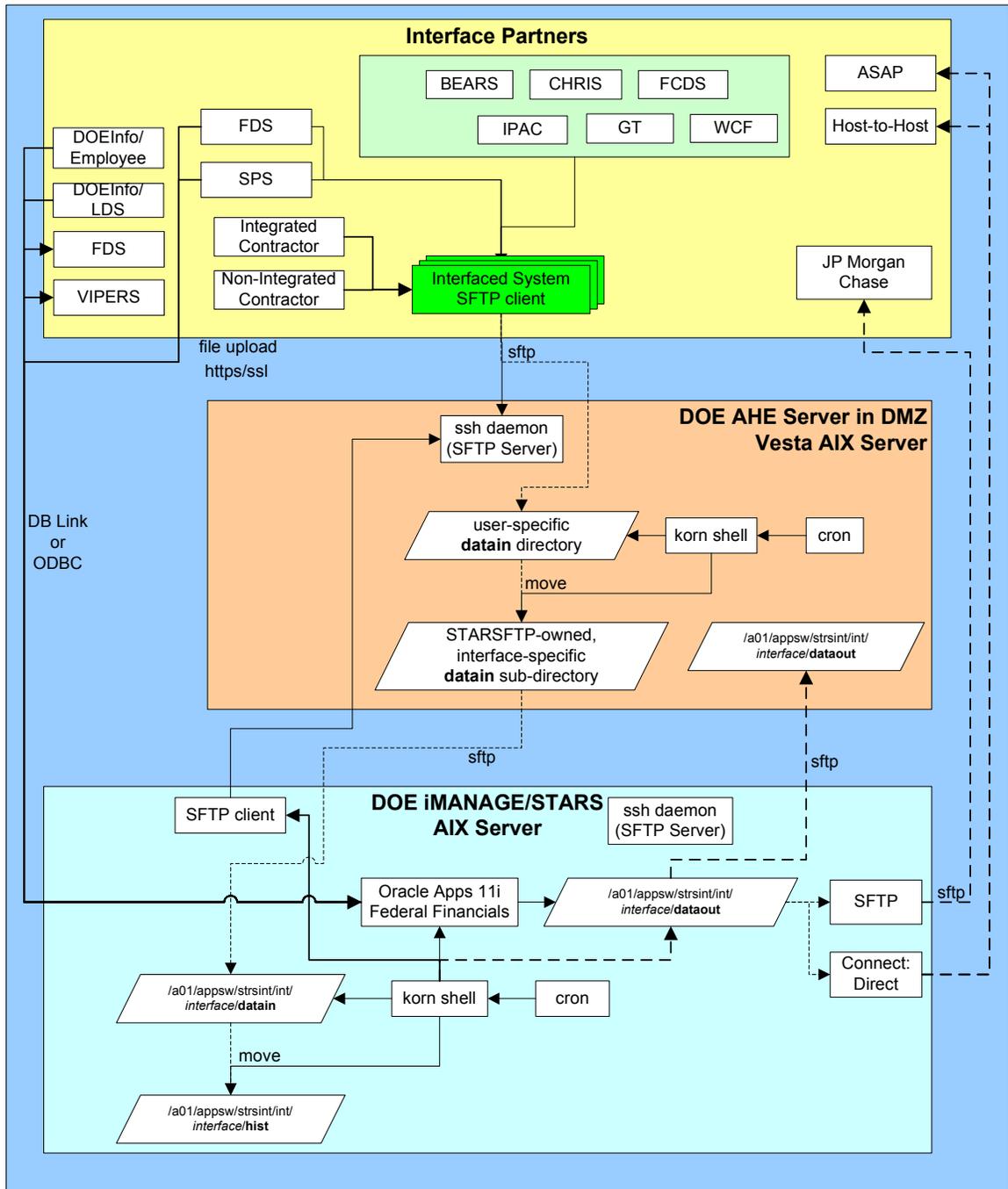
The interface records will be processed through the STARS interface programs. The STARS Development team has created specific interface

programs for each of the interface systems[9]. The interface programs will utilize standard APIs and Interface tables built into the Oracle Applications E-Business software suite. Scheduled Concurrent Requests within the financials system will be configured to process the interface records once they are loaded into the interface tables. Successful interface records that process through the interface APIs will be inserted and committed as transactional records within STARS.

2.6.3. PVCS ChangeMan version control process.

The development team will utilize the PVCS ChangeMan Version Control software to maintain the proper configuration management process. The developer is prohibited from directly copying the code objects to the production environment. The developer checks the code into the PVCS archive, which is stored on the production application server)[10]. After the appropriate sign-offs have been completed, the code is "Promoted" to the Quality Test environment (QA). After Unit Tests (UT) has been completed, the code is promoted by the perl script to the Production environment.

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[9] Refer to the iManage Interface document for a detailed list of the Department's Interface systems.
[10] Refer to the iManage/STARS, "*ENG023: PVCS Version Control Document, Dated: July 03, 2003*", document which describes the version control process and the perl scripts used in the promotion model.