FSA Modernization Partner

United States Department of Education

Federal Student Aid

Technical Architecture Services Report
3Q FY02

Task Order #69

Deliverable # 69.1.6c

Version 1.0

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1 Introduction

1.1 Executive Summary

The *Technical Architecture Services Report: Third Quarter for FY 2002* summarizes the Integrated Technical Architecture (ITA) team's tasks related to implementing Task Order 69 during the third quarter of FY 2002. The ITA provides a standardized, reusable infrastructure for enabling business capabilities within the FSA application community. The long-term vision of the ITA is to provide an integrated, enterprise-wide technical architecture that will enable FSA to reduce the number of custom-built applications that are difficult and costly to update and maintain.

The ITA team's tasks fall into the following categories:

- Core ITA Support – Provides a standard development architecture / procedures for FSA application teams.
- Technical Architecture Support – Provides infrastructure and application architecture expertise to FSA application teams.
- Provide Roll Out Support – Build out of environments (development, test, staging, and production) and system upgrades for FSA application teams.
- Product Specialist Support – Provides support for specific software products used in FSA.
- Reusable Common Services (RCS) - Provides a set of reusable basic application services based on open-source technology and Java 2 Enterprise Edition (J2EE).
- Performance Testing – Provides integrated performance management for applications to enable teams to load and stress test their web-based applications. The goal is to improve application performance, availability, reliability and scalability.

The rest of the report provides a description of the ITA team's tasks performed within these categories during the third quarter of FY 2002.

1.2 Support Areas

During the third quarter of FY 2002, the ITA team provided technical support to FSA in the following areas:

- Core ITA Support
- Technical Architecture Support
- Providing support during roll out.
- Product Specialist Support
- Performance Testing

The following sections describe the specific tasks the ITA team performed in these support areas.

2 Core ITA Support

2.1 Deliverables

The ITA team produced the following deliverables:

- 69.16b - The Technical Architecture Quarterly Services Report – 2QFY02
- 69.1.3 - The ITA Release 3.0 Technical Specification
- 69.1.4 - The ITA Release 3.0 Best Practices Guide and Standards
- 69.2.1b The Technical Architecture Application Maintenance Services Report (March)
- 69.2.1c The Technical Architecture Application Maintenance Services Report (April)
- 69.2.1d The Technical Architecture Application Maintenance Services Report (May)
- 69.2.1e The Technical Architecture Application Maintenance Services Report (June)

2.2 ITA Application Maintenance Services

The ITA's activities in the application maintenance arena during this quarter helped applications extensively and in several aspects. The ITA team troubleshoots problems and fixes bugs for applications such as IFAP, Schools Portal, Students Portal Financial Partners Portal, FAFSA and Data Marts and ensures their availability. Refer to the Technical Architecture Application Maintenance Report for March, April, May, and June for in-depth discussion of ITA's activities for operations related tasks.

2.3 Current FSA Applications and the ITA Environment

The table below shows the FSA applications running in the ITA environment with RCS components.

Application	Migration to ITA	Development	Test	Performance Test	Staging	Production	WebSphere	IBM HTTP Server	Autonomy	Informatica	Interwoven	MicroStrategy	JRun	Viador	Oracle 8i	Email	Logging	Exception	Component Factory	Search	Persistence	Logon	Registration	Personalization	Search	Headlines	Calendar	Feedback
		Environments					**Architecture**									**ITA RCS Components**						**Portlets**						
Existing Applications																												
IFAP	October 2000	X	X			X	X	X	X		X				X		X	X		X								
Intranet R2	October 2000	X	X			X	X	X	X		X				X													
FAFSA 5.X	March 2001	X					X	X							X													
FAFSA 6.0	June 2001	X	X	X	X	X	X	X	X		X				X		X											
eCampus Based Systems	June 2001	X	X	X		X	X	X							X	X	X	X			X							
Enterprise Portal	September 2001	X				X	X	X	X						X		X	X		X	X							
Program Guidance DB	October 2001	X				X	X	X	X		X						X	X		X		X						
Students.gov	November 2001	X	X			X		X	X						Y													
FP Portal	January 2002	X	X	X		X	X	X	X		X				X		X	X		X	X	X	X	X	X	X	X	X
Students Portal	January 2002	X	X	X		X	X	X	X		X				X		X	X		X	X	X	X	X	X	X	X	X
EAI	June 2001	X	X			X	X	X									X	X			X							
Exit Counseling	October 2001	X			X	X	X	X																				
Ombudsman Queries	October 2001	X			X	X	X	X																				
CFO Datamart	October 2000	X				X				X		X																
FARS Retirement	October 2001	X																										
Schools Portal	October 2000	X	X			X		X	X		X		X	X	X													
DLM	January 2001	X				X				X																		
FP Datamart	March 2001	X				X				X		X																

3 Technical Architecture Support

3.1 Technical Support

The ITA team provided technical support and change requests for the FAFSA, eCB, Consistent Answers, and Students and Financial Partners Portals application teams. Examples of this type of support include restarting servers, updating configurations, adding new configurations, and debugging problematic application code.

3.2 Architecture Operation Support

The ITA team provided the following production support for the IFAP, Schools Portal, Students.gov, eCB, Program Guidance, Students and Financial Partners Portals, and CFO & Financial Partners Data Mart:

- Troubleshooting of WebSphere, Viador, IHS, Autonomy, and Network Dispatcher issues
- Monitoring of core application processes within the production ITA
- Providing assistance with updating Autonomy to fit the application teams' needs as well as providing estimates for enhancement requests from the teams

3.3 COD/SAIG Testing

The ITA team assisted in the coordination and execution of further performance tests on the EAI adapter for the bTrade software. The SAIG servers were upgraded to L3000's instead of L2000's. Some concerns were raised regarding the performance impact and limitations of the EAI adapter on the SAIG application. Tests were executed to determine the CPU and disk utilization of the SAIG application to gain an understanding of the performance gains with these upgrades. Application limitations were also investigated with respect to the EAI adapter and the bTrade application itself. All parties agreed that the EAI adapter would not have a significant impact on the SAIG application going forward. Capacity planning will be undertaken later in the year to determine hardware needed for next fiscal year.

3.4 Additional Application Support

The ITA supported a number of teams in the third quarter of fiscal year 2002. The ITA team assisted the following teams to meet their goals, objectives, and task order requirements:

- Built and maintained Students & Financial Partners Portals performance test and production environments
- Assisted FSA Program Guidance, FSA Net, and FAFSA applications with and Interwoven development and issues
- Assisted ezAudit application with initiating build of development environment

3.5 DMCS Support

The ITA team performed a technical review of Raytheon's Data Management and Collections System (DMCS) Replacement application architecture design. DMCS is a large-scale application that will support heavy transactions; actual numbers have yet to be determined. The team

concluded that while the overall architecture is sound and Raytheon does leverage industry best practices and design patterns, there is a cause for concern with the application's persistence strategy. The current persistence strategy uses Entity EJB with local references using Container-Managed Persistence (CMP) based on the EJB 2.0 specification.

Reasons for Concern:

1. After the EJB 1.1 specification was introduced, many performance and scalability issues were found when using CMP Entity EJBs. In order to overcome these issues, Accenture best practices suggest that the use of Entity EJBs from EJB 1.1 should be avoided. However, Raytheon is using EJB 2.0 and not EJB 1.1. EJB 2.0 is a new specification that was released in early 2001. The EJB 2.0 specification tries to address these issues by implementing many performance enhancements. The ITA team still has concerns regarding Entity bean performance and reached out to other Accenture projects to find any implementation failures and/or lessons learned with this particular implementation in WebLogic 6.1. Due to the fact that EJB 2.0 is a new specification and only a few application server vendors who are compliant with the specification, there are very few (if any) projects within Accenture that has implemented this exact persistence strategy in a large-scale application environment. As a result, Accenture successes with EJB 2.0 Entity Beans using CMP and local references are not found so this is a risk.

2. Over-Engineering: There are 21 vertical functional areas and 200+ Entity EJBs in the DMCS application. This might be a symptom of over-engineering and modeling of the EJB to a level that is too fine-grained. This could lead to tremendous amount of database reads and writes and thus hinders application performance.

3. Using BEA WebLogic as the application server instead of IBM WebSphere. The lifecycle of EJBs is managed by an EJB container, which resides in the application server. Container-Management Persistence (CMP) is based on the vendor's proprietary implementation of the EJB container in compliance with the EJB 2.0 specification. Currently WebLogic 6.1, 7.0, and WebSphere 5.0 supports EJB 2.0 specification. IBM WebSphere 3.5.5 is the Modernization Partner's standard for application server but IBM WebSphere 5.0 will not be release until August 2002. This leads to the following concerns:

    a. IBM WebSphere 5.0 has not yet been adapted as an ITA standard.
    b. Use of WebSphere 5.0's implementation of CMP may be risky given the fact it has not been released yet so the performance of the EJB container is unknown and unproven.
    c. Use of WebLogic is risky as the ITA team doesn't have skills or in-house experience to troubleshoot any EJB 2.0 performance or EJB deployment issues with WebLogic and its CMP implementation.

A significant part of the DMCS Replacement project is a data conversion effort from the legacy systems to the new replacement system. The DMCS team sought the ITA team's subject matter expertise to assist with the data conversion process. On behalf of the DMCS team, the ITA

researched and developed a high level task list of actions associated with the data conversion effort. The ITA team also created a list of questions to guide the DMCS team's communication with the Raytheon DBAs for the data conversion planning process. Raytheon is the current application owner for the legacy system DMCS.

ITA assisted with the evaluation of reporting tools for the DMCS application and coordinating a MicroStrategy demonstration. ITA lent expertise in discussions about costing options for existing environment.

3.6 Roll Out Support

3.6.1 ITA Environments

The ITA team built and configured the following environments on WebSphere Application Server, IBM HTTP Server, and Oracle database:

- Development, test, performance test, and production environments for Students and Financial Partners Portals
- Development environment for the RCS Portlets Reference Implementation
- Production environment (IHS) for the FSA Coach and Program Guidance applications
- Development environment for RCS Students and Financial Partners Portals
- Performance Test environment for eCB

In addition, the ITA team:

- Provided assistance with performance issues for Program Guidance and Students.gov session problems
- Investigated and diagnosed eCampus Based performance environment
- Executed Students and Financial Partners Portals performance test plan
- Developed preliminary ITA recommendation for FAFSA 7.0 production hardware
- Investigated FAFSA production performance problems
- Worked with CSC to install digital certificates to enable Secure Socket Layer (SSL) for Students Portal
- Initiated upgrade of WebSphere 3.5.5 for Sun environment
- Initiated upgrade of Informatica, Solaris, Interwoven, and MicroStrategy

4 Product Specialist Support

4.1 FSA Application Team Support

The ITA team performed the following:

- Built development environment for FAFSA 7.0
- Initiated build of performance test environment for FAFSA 7.0

4.2 Interwoven Support

The ITA team built new Interwoven environments for the Program Guidance Database, FAFSA, FSA Net Redesign, and Students and Financial Partners Portals teams. This included configuring TeamSite to utilize templating and data records. The ITA team also provided troubleshooting support for the existing applications utilizing Interwoven, which included IFAP, Schools Portal, and the Intranet team, and assisted the application maintenance team with Interwoven enhancement requests. In addition, the ITA applied recent patches to accommodate fixes provided by Interwoven.

Some examples of support include problems occurred during deployment of content, resolving permission issues within development work areas, and adding users to appropriate groups as new applications are added to the TeamSite configuration.

4.3 Performance/Load testing tool

To bring application performance testing skills and capabilities into the ITA, the team acquired Mercury Interactive's LoadRunner software. Performance testing enables application teams to quickly identify and correct performance related problems prior to an application's migration to production. Load testing and stress testing services are now available in house thus yielding significant cost savings.

4.3.1 Direct Loan Servicing System (DLSS)

The DLSS application team experienced performance problems in production – a situation that set the stage for interaction with the ITA. The DLSS application team had been considering engaging Mercury Interactive to conduct an "Active Test" on the DLSS application. Due to the costliness of "Active Test" the DLSS team approached the ITA. The ITA team carried out four performance test cycles which were critical to identifying and resolving performance bottlenecks in the DLSS application. A number of issues were resolved as a result of the cooperation between ITA and DLSS during the performance test:

- Memory leaks were identified
- Problems that could not be recreated in the development and test environments and occurred under load, were rectified
- Some business processes supported a maximum of 20 users; this problem was corrected before performance testing was completed

The joint ITA / DLSS effort resulted in significant performance gains for the DLSS application while achieving dramatic cost savings.

4.3.2 PIN Capacity Planning

Activities for the PIN Capacity Planning effort entailed gathering PIN volume data from all FSA application teams, whereupon, the data were converted into Transactions Per Hour. Also,

information regarding existing PIN database volume was collected from NCS Pearson. This information was analyzed and condensed into the PIN Capacity Planning spreadsheet which will be used for establishing goals for PIN/FAFSA 7.0 performance test.

The ITA led bi-weekly PIN meetings with application owners NCS Pearson and CSC to gather PIN performance test requirements.

4.3.3 Free Application for Federal Student Aid (FAFSA) 7.0

Developed cost estimate for FAFSA 7.0 performance test.

4.3.4 DMCS

Working with Raytheon which is handling the development effort for the DMCS application, the ITA completed the performance test gap analysis for DMCS. Included in this analysis is the pricing of software; LoadRunner Siebel for testing the front end, RMI LoadRunner for client server performance test software, and LoadRunner EJB Virtual Users to test EJB components.

4.3.5 Lender Redesign (FMS)

The ITA task order was modified to add cost incurred as a result of conducting the LaRS performance test. The LaRS performance test plan is now complete.

4.4 IBM WebSphere

The ITA team provided troubleshooting assistance to all teams who utilize WebSphere technology. This includes code and performance issues. The ITA team's review of log files and code structures played a key role in assisting application teams to ensure the optimal performance of their applications. As applications updated their code and executed testing, a host of problems typically arose that include usage of datasources, initialization of servlets and JSPs, WebSphere and I.H.S communication problems. The ITA team assisted each application team as the problems were encountered. For example, WebSphere did not read a properties file correctly for the eCB application. The ITA team used troubleshooting techniques to isolate the problem within the code and propose a solution. Other problems included corrupt JSP files and session tracking problems for applications.

5 ITA Reusable Common Services

The design phase for RCS is now complete and the build of the following RCS components is in progress:

- Web conversation framework
- Configuration framework
- FTP framework
- User Session framework
- Object Pooling framework

- Web Services (SOAP, XML, & UDDI)
- JSP Tag Library
- XML Reader / Writer
- Scheduler framework

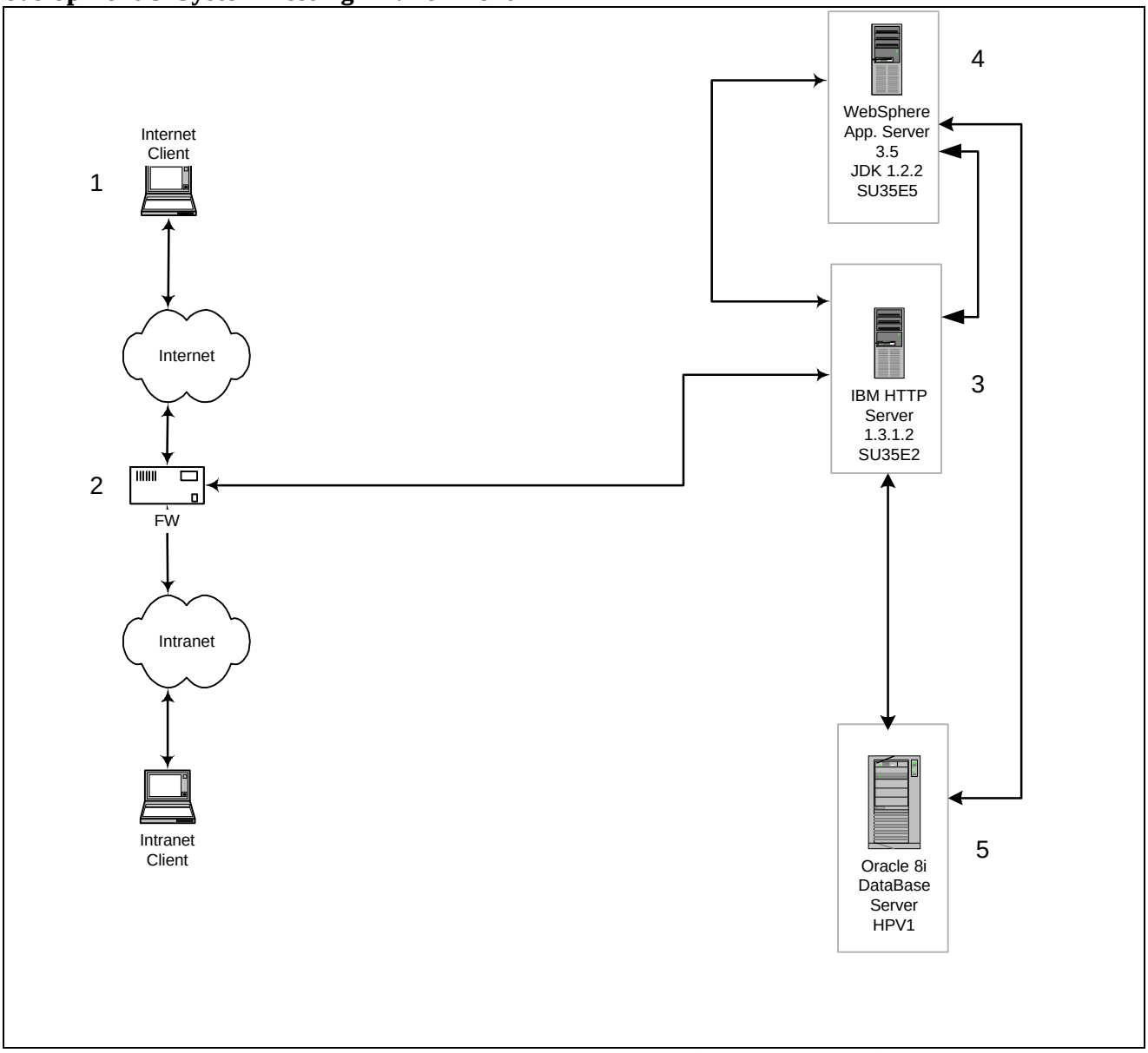
All RCS component designs was included in the 69.1.3 ITA Release 3.0 Technical Specification deliverable.

5.1 ITA Infrastructure

The ITA team extends the application teams its infrastructure services by building out application environments, as they enter the ITA. Four environments can be provided:

- Development
- Testing
- Staging
- Performance Testing
- Production

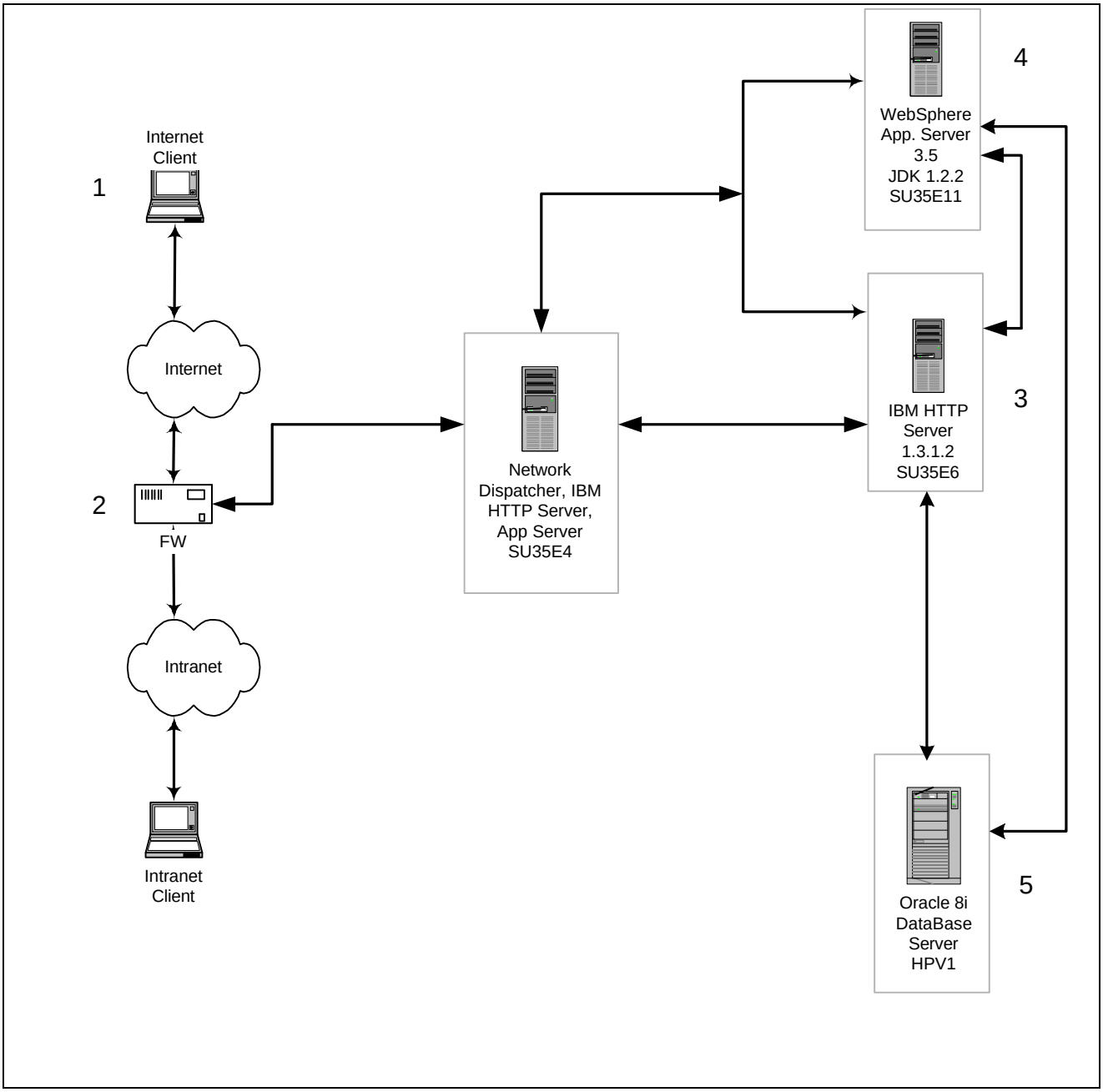
Development & System Testing Environment



Development & System Testing Environment (Logical Diagram)

The above numbering scheme traces the flow of a user request in the development and system testing environment. The request originates from the client (1), passes through the Internet, and is channeled through the firewall (2). The request follows a predetermined path to the IBM HTTP server (3) that directs it to the WebSphere Application server (4), which forwards the request to the Oracle database (5) only in cases where database information is required.

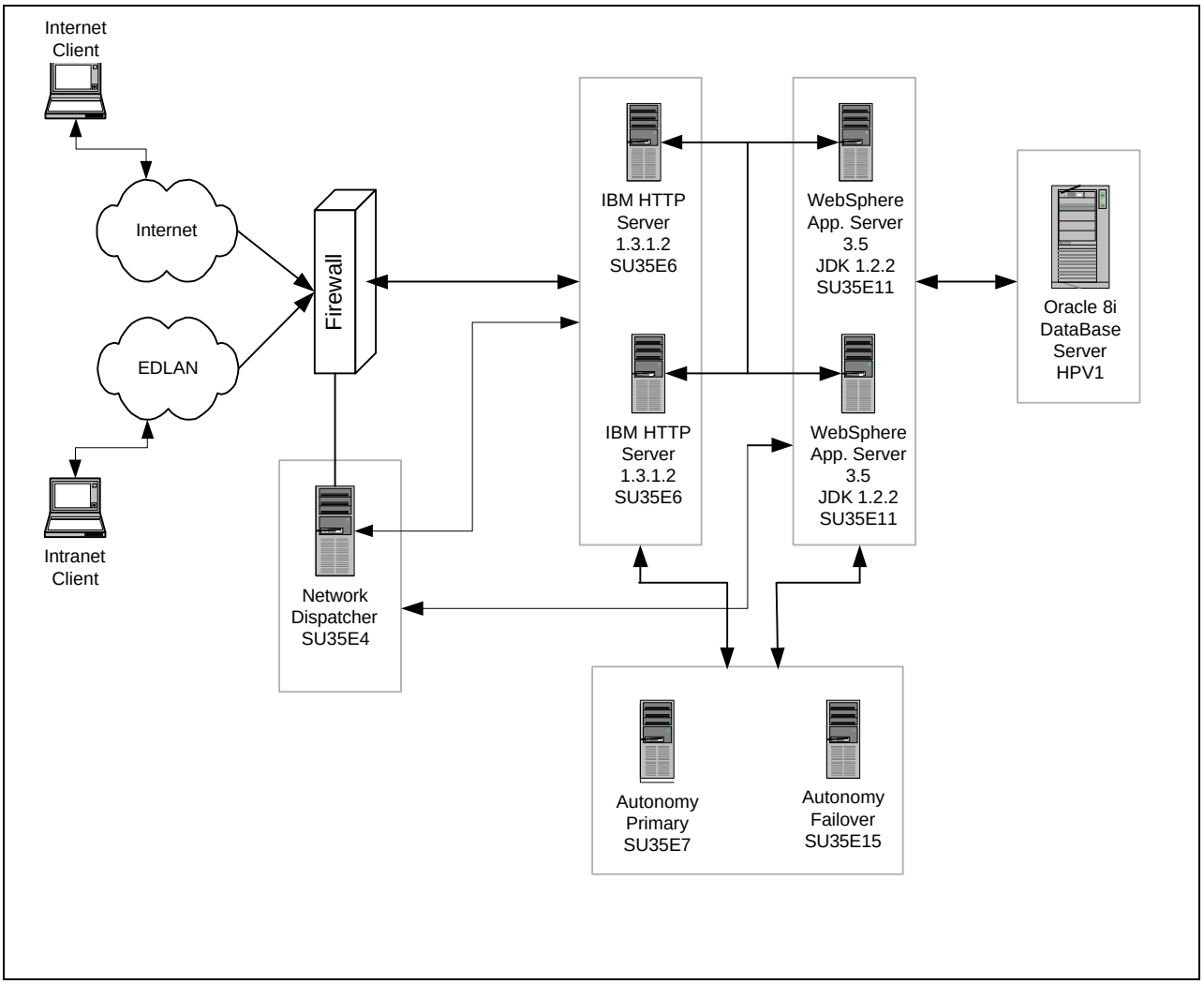
Performance Test



Performance Testing Environment (Logical Diagram)

The Performance Test environment differs from the Development & System Testing environment, in that, requests are passed to a Network Dispatcher-equipped server that distributes request load among two IBM HTTP servers. The addition of the Network Dispatcher server helps the ITA in emulating the Students and Financial Partners Portals production environment, in a cost-effective way. The purpose of performance testing is to discover and resolve any potential problems with an application prior to its launch.

Production Environment



Production Environment (Logical Diagram)

As can be seen in the diagram above, requests in the production environment can access the Students and Financial Partners Portals application via the Internet or the FSA Intranet through EDLAN. Requests pass through the Firewall and are directed to Network Dispatcher which is the load-balancing server that distributes incoming requests among the IBM HTTP servers based on specific criteria. Requests are then passed to WebSphere Application servers, where they are conveyed to the Autonomy search engine server or the Oracle database or both. Responses are delivered to the client machines through the same route as that followed by the request, only in reverse fashion.