

FSA Modernization Partner
United States Department of Education
Federal Student Aid

FAFSA on the Web 7.0
Performance Test Plan

September 30, 2002

Version 1.3

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1 Executive Summary

1.1 Introduction

The U.S. Department of Education's Office of Student Financial Assistance Programs (FSA) administers and operates the "Free Application for Federal Student Aid" (FAFSA). While available in paper form, FSA also provides this service through a web site. U.S. college students seeking student financial aid use the FAFSA program. During the academic year 2001-2002, over six million students used the web site to apply for federal financial aid. FSA anticipates that the number of users/applicants will increase by 50% during the 2002-2003 academic year, and will continue to rise in future years as the number of paper submissions decreases. This anticipated growth makes it imperative that FSA maximize the capacity and availability of the FAFSA web infrastructure while at the same time minimizing the amount of support FSA's representatives will have to provide for questions by students or difficulties with completing the form. The web FAFSA product is commonly referred to as FAFSA on the Web and incorporates all requirements related to the paper FAFSA for each school year.

The primary objectives for redesigning FAFSA on the Web are to leverage industry best practices to improve usability and accessibility by customers, performance of the web application during peak periods of FAFSA submissions, and create the foundation for efficient enhancements, as necessary.

1.2 Background

Last year, we saw a 100% increase in users and applications submitted. As the number of FAFSA on the Web users increases, the FAFSA on the Web application has to scale to be able to handle the increased capacity. FSA anticipates that the number of users/applicants will increase by 50% this year. Our N-Tiered architecture is designed to scale vertically and horizontally. It is the responsibility of the application team to validate that this architecture will be able to scale and handle growth in peak periods. Our performance test will not only verify the scalability, but also give us an update to our estimated capacity for peak 2003.

1.3 Objective

The purpose of our performance test is to:

1. Validate the n-tier architecture for FAFSA 7.0.
2. Verify that the application will scale.
3. Verify the performance capability of FAFSA 7.0 relative to users.
4. Validate the N-Tiered architecture for PIN by testing two business processes (three tests – FAFSA authentication, other application authentication, and PIN registration).

1.4 Expected Results

At the conclusion of each test cycle a test report will be prepared with the results of the test cycle and confirmation that our objectives were met. Each subsequent test cycle should get us closer to our overall goal of an optimized application and architecture performance.

2 Overview

2.1 Overview

This document provides the process and details on the performance goals that will be used through the FAFSA 7.0 and PIN test effort.

Because of the new performance test environment, web infrastructure, and application, there is no “true” baseline history to set specific application performance goals. For the FAFSA 7.0 and PIN performance tests, there will be more than twenty performance tests runs.

This document will be utilized to communicate test plans prior to each cycle execution with all key participants as outlined in Section 3. The detailed performance test goals for each test will be communicated prior to each performance test in a separate document. This is a working document and will be updated throughout the FAFSA performance test. FAFSA scope document lists all the business processes that are in scope for the FAFSA 7.0/PIN performance test.

2.2 Overall Goals

Performance Test runs will be executed with the following goals in mind:

1. Tune FAFSA and PIN applications so they are at their optimal performance at the conclusion each test cycle.
2. Run the full set of scripts to performance test key functionalities: 8 business processes for FAFSA and 2 business processes for PIN.
3. Tune hardware/environment so they are at their optimal performance at the conclusion of each test cycle.
 - Right number of connections to database.
 - eNetwork dispatcher is correctly balancing the load to the web servers.
 - Tune EAI component.
 - Tune each oracle database for optimal performance of FAFSA and PIN.
 - Review the performance of the Oracle connections and verify that the listener(s) can handle the load.
 - FAFSA and PIN Web, application, and database queues configured correctly.
 - Find web server to application server ratio.
4. Ensure that the new network infrastructure OC3 line will handle peak with new application requirements.

5. Validate performance gains of having web server caching enabled.
6. Determine saturation point for each test run in order to provide necessary bottleneck data.
7. Use results to update, if necessary, the production hardware requirements for FAFSA 7.0.
8. Provide a performance test to allow NCS to make appropriate tuning adjustments to CPS – as far as FAFSA is concerned. NCS will run the CPS scripts to generate additional load on the CPS during the FAFSA performance test.
9. Ensure that the failover tests (webserver, appserver etc.) do not impact the application significantly.
10. Resolve the four outstanding WebSphere issues.
 - Slow initialization of application server at startup (change the oracle block size from 8k to 16k and limit the size of session table).
 - Hung Process (Upgrade IHS from 1.3.12.6 to 1.3.12.5 and GSK kit to 2.67).
 - Session Table dropped (implement debug.jar).
 - Session Table filling up too quickly (Change the Oracle block size from 8k to 16k).

3 Performance Test Process

This section describes the Performance Test Process.

3.1. Performance Test Process

To achieve the overall goals, establish a FAFSA 7.0 baseline, and set specific goals for tests, a process is required. The steps below explain the process that will be taken through the performance test effort:

3.1.1. Establish a list of performance test areas that will be monitored.

Performance test areas include a wide range of items such as user response times, throughput, CPU and memory utilization, and number of concurrent users etc. These areas are established before the test so monitoring points can be derived, and teams have time to schedule the right people to monitor the tests. Specific monitoring points will be analyzed to identify issues/bottlenecks and will also provide the necessary data for analysis and response times. Table 8.1 includes all the performance test areas that need to be monitored and the responsible party for each.

3.1.2. Establish the data and parameters that need to be collected.

Data will need to be collected for analysis during and after each test cycle. Table 8.1 outlines the type of data that should be monitored, collected, and the responsible party for each monitoring point. Section 4.2 outlines the data analysis deliverables that CSC and ITA are to submit at the conclusion of each test cycle.

3.1.3. Planning for the first ten FAFSA 7.0 Performance Test.

The first ten test cycles will become the baseline for set of tests that will be run. The goal of these first ten tests is to take the necessary steps to ensure that a proper baseline is created, which will aid in setting more detailed goals for forthcoming tests. The current parameters/configuration settings on the hardware will be recorded before the first test is run. This will enable future tracking of the changes that will be made throughout the tests.

3.1.4. Fixes and Changes made to the environment and application code.

Based on the analysis and recommendations of the team, configuration changes may need to be made after each test run. These changes should provide higher performance results in the next test run.

3.1.5. Specific Goals set for the next FAFSA 7.0 test run.

Specific goals for each test cycle are outlined in Section 6. After data has been collected, and the required fixes made, there will be the opportunity to modify specific goals for the next test run.

3.1.6 Results are documented and FAFSA 7.0 environment is validated.

Final deliverable is assembled with information and data from each of the test runs. The data is used to estimate any areas that may need close attention in the future. Additionally, the data will be used for capacity planning and establishing a FAFSA 7.0 production environment.

4 Roles, Responsibilities, and Deliverables

This section outlines the roles and responsibilities of all parties involved in FAFSA 7.0 Performance testing.

4.1. Performance Test Roles and Responsibilities

The following list outlines the roles and responsibilities of the FAFSA 7.0 Performance Planning team.

Role	Assigned	Phone	Responsibility
Performance Test Lead	Roshani Bhatt	202 962-0740	<p>Coordinate with all teams and resources to ensure that the capacity planning, performance test planning and performance test execution are completed on time.</p> <p>Work with CSC to measure the performance of each component (CPU, Mem, IO, Network).</p> <p>Define the detailed goals for each test cycle/test types – stress, stability, ssl, cache, db, and mainframe.</p> <p>Analyze the application functionality to plan the right mix of tests (submit, renew, correct).</p> <p>Define the expected concurrent users per server at optimized configuration.</p> <p>Determine the length of each run and starting/stopping points.</p>
Performance Test Resource	Musab Alkateeb	202 962-0729	<p>Create the functional test scripts (Excel Format).</p> <p>Coordinate test dates with all testing resources (ITA, NCS, CSC, Mod Partner).</p> <p>Work with all the teams to verify administrator contact information and attendance.</p> <p>Set up pre-test and test day conference calls.</p> <p>Use the test results to update the expected physical and logical configuration at peak.</p>
ITA LoadRunner SME	Chi-Yen Yang Cherr Wilks Musab Alkateeb	202 962 -0758 202 962-0832 202 962-0729	<p>Record the loadrunner test scripts from functional scripts.</p> <p>Verify all test scripts and perform the calibration test.</p> <p>Fix the scripts after test cycle if necessary.</p> <p>Identify the bottleneck.</p> <p>Coordinate recording and testing of scripts.</p> <p>Document Executive Summary of test cycle results.</p>
Application Contact	Matt Kain	319-339-6902	Responsible for application changes and recommendations.

			Monitor application performance at each test cycle.
CPS Application Contact	Bill Schulte/ Dan Butler	319-339-6645 319-339-6418	Run the scripts to generate the load on CPS during FAFSA performance test. Coordinate script execution with ITA.
EAI Administrator	Scott Gray/ Julian Ackert	202 962-0795 202 962-0734	Monitor MQSeries on FAFSA and CPS. Monitor CICS DPL bridge. Capture information for MQ Series. Make recommendations on ways to improve the EAI components.
Websphere Administrator	Roshani Bhatt /Bob Wehrle	202 962-0740 202 962-0760	WAS configuration changes and updates. Monitor key areas and deliver summary results.
IHS Administrator	Roshani Bhatt / Bob Wehrle	202 962-0740 202 962-0760	IHS configuration changes and updates. Monitor key areas and deliver summary results.
eNetwork Dispatcher Administrator	Roshani Bhatt / Bob Wehrle	202 962-0740 202 962-0760	Load Balancer configuration changes and updates. Monitor key areas and deliver summary results.
HP System Administrator	Malcolm Waltz / Dave Murdy	203-317-4983 203-317-4818	Monitor hardware to ensure optimal configuration. Monitor CPU, Mem, IO, capacity levels. Record hardware capacity levels at different intervals throughout the test cycle.
Solaris System Administrator	Gary Thomas/ Joe Hala	(804) 733- 2440 ext 242 860-513-5708	Monitor hardware to ensure optimal configuration. Monitor CPU, Mem, IO, capacity levels. Record hardware capacity levels at different intervals throughout the test cycle. Coordinate dates with ITA to upgrade Solaris.
Oracle Administrator	Rich Ryan	860-701-1209	Monitor Oracle Database to ensure the optimal configuration. Monitor the Oracle Database performance throughout the test cycle. Make recommendations on ways to improve Oracle performance.
DB2 Administrator	Dian Uhl	817-762-8061	Monitor DB2 Database to ensure the optimal configuration. Monitor the DB2 Database performance throughout the test cycle. Make recommendations on ways to improve DB2 performance.
Mainframe Administrator	Tom Puddicombe / Nancy Mathisen	203-317-5839 817-762-8061	Monitor Mainframe to ensure optimal configuration. Monitor capacity levels at different intervals throughout the test cycle. Monitor MQSeries and the communication between App server and DB.
Network Administrator	Joe Lipsky/ Chad Simmons	203-317-5131 203-317-5048	Monitor Network to ensure optimal configuration.

			Monitor capacity levels at different intervals throughout the test cycle. Coordinate with Mercury Interactive to schedule Active test to test the OC3 link. Coordinate test dates with NCS and ITA.
Windows Administrator	Craig Gates	203-317-5174	Monitor the Load Generator boxes (CPU) during the performance test. Troubleshoot the issues that arise with Load Generator boxes.
CICS	Walt Barrett/ Carol Greer	937-320-7956 860-513-5860	Monitor the CPS performance. Make recommendations on ways to improve CPS performance.

4.2. Documentation

The following documents will be submitted to the FAFSA project team within the dates specified. Table 8.1 provides a guide as to the data that needs to be captured and presented to the team at the conclusion of each test cycle.

4.2.1. ITA Analysis

ITA will deliver a document that will summarize the test, problematic areas, and recommendations. The ITA Team will also be expected to monitor and document the areas outlined in Table 8.1. ITA is expected to deliver this analysis within 3 days after each test cycle is run.

4.2.2. CSC Capacity Analysis

CSC will complete a spreadsheet, which captures information on current capacity percentages as well as information from the 2002 peak period. This information will be used to better plan the performance tests and for capacity planning at the conclusion of all the test cycles.

4.2.3. CSC Performance Test Data

The Performance Monitoring Areas, Table 8.1, provides a guide as to the type of data that will need to be collected. CSC should decide on the best format for providing this data and summary of test results. The data should be collected at a 5 minute sampling points, unless otherwise suggested during the test. CSC is expected to deliver this data and summary of test results within 2 days after each test cycle is run.

4.2.4. CSC Performance Test Summary Analysis

At the conclusion of the performance tests, CSC will provide a document containing general comments, summary of capacity issues, and effective capacity.

4.2.5. FAFSA Development Team (NCS) Test Summary Analysis

At the conclusion of the performance tests, the development team (NCS) will provide a document containing a list of any recommended application changes and overall application performance comments.

4.2.6. CPS Performance Test Data

The Performance Monitoring Areas, Table 8.1, provides a guide as to the type of data that will need to be collected. CSC should decide on the best format for providing this data and summary of test results. The data should be collected at a 5 minute sampling points, unless otherwise suggested during the test. CSC is expected to monitor DB2. CSC is expected to deliver this data and summary of test results within 2 days after each CPS related test cycle is run.

4.2.7. EAI Performance Test Data

The Performance Monitoring Areas, Table 8.1, provides a guide as to the type of data that will need to be collected. EAI should decide on the best format for providing this data and summary of test results. The data should be collected at a 5 minute sampling points, unless otherwise suggested during the test. EAI is expected to deliver this data and summary of test results within 2 days after each (EAI related) test cycle is run.

4.3. Formal Deliverables

ITA would provide the following formal deliverables:

4.3.1. Functional Scripts

ITA will deliver the functional scripts. The functional scripts navigate the FAFSA and PIN business processes.

4.3.2. ITA Parameter Configuration Recommendations

The document will contain the performance test environment configuration prior to the start of the first test cycle.

4.3.3. FAFSA 7.0 Performance Test Report

ITA will deliver final deliverable with an analysis of each test cycle, a summary of the results, and a general recommendation on the performance of the FAFSA application. The ITA team will deliver their recommendations and changes made during the test.

5 FAFSA 7.0 Business Processes

These are the business processes that we will be targeting in our performance testing. These business processes will drive the creation of our scripts for the performance testing cycles.

5.1 Business Processes

The following list outlines the business processes:

1. Fill out a FAFSA and Submit- Form to fill out and submit a FAFSA.
2. FAFSA Renewal – Renew an application.
3. FAFSA Corrections – Correct an existing application.
4. Student Access - Accessing the existing application
5. Request Application Status – Check application status.
6. Electronic Signature – Electronic Signature for an application.
7. School Code Search – Search the codes for a particular school.
8. FAA Online Access – FAA entry (Renewal and Correction only).
9. Pin Authentication – Authenticating the user (FAFSA).
Pin Authentication – Web Services – DLSS.
10. Pin Registration – Register the user to get a new PIN.

5.2 Business Processes Table

The following table outlines the architecture components that make up the FAFSA 7.0 Application. These components are FAFSA web server, FAFSA application server, PIN web server, PIN application server, PIN database, and FAFSA Database servers. Each business process test scripts will test the outlined architecture components.

	Web Server	Application Server	Oracle DB	Pin DB	CPS DB2
Fill out a FAFSA and Submit	X	X	X		X
Renewal	X	X	X	X	X
Corrections	X	X	X	X	X
Student Access	X	X		X	X
Request Application Status	X	X			X
Electronic Signature	X	X		X	X
School Search	X	X			X
FAA Access- FAA entry – (Correction and Renewal)	X	X	X	X	X
Authentication (FAFSA)	X	X		X	

Authentication (web services)	PIN web server	PIN application server		X	
Registration	PIN web server	PIN application server		X	X

6 Detailed Goals per Cycle

This section will include detailed goals for each test cycle. The goals for each cycle are not static so depending on how the test cycle goes the goals for a cycle may expand for a couple of cycles and vice versa.

6.1. Performance Test Cycles

6.1.1. Performance Test Cycle 1 – Scheduled 9/24/2002

Time: 9:00 am to 12:pm EDT

Dial-in Number: 1-877-714-4777

Meeting ID: 2685

Detailed Goals for test cycle one:

- 1 FAFSA Business Process – School Code Search
- Target at least 500 Concurrent Users
- Test the performance test environment (web server, application server, EAI components, database (oracle and db2), and CPS)
- Run the test for at least an hour

Exit Criteria for test cycle one:

- Complete 1 FAFSA Business Process
- Test at least 500 Concurrent Users
- Test the performance test environment is set up correctly

6.1.2. Performance Test Cycle 2 – Scheduled 9/26/2002

Time: 9:00 am to 12:pm EDT

Dial-in Number: 1-877-714-4700

Meeting ID: 8313

Detailed Goals for test cycle two:

- 2 FAFSA Business Processes – School Code Search, Fill Out FAFSA
- Target at least 1000 Concurrent Users
- Test the hung process
- Resolve any issue that came up in test cycle 1

Exit Criteria for test cycle two:

- Complete 2 FAFSA Business Processes
- Test at least 1000 Concurrent Users
- Verify there is not any hung process
- Resolved any issues that came up in test cycle 1

6.1.3 Performance Test Cycle 3 – Scheduled 10/02/2002

Detailed Goals for test cycle three:

- 2 FAFSA Business Processes – School Code Search, Fill out FAFSA
- Target at least 2000 Concurrent Users
- Test the session table issue (table filling up too quickly)
- Resolve any issues that came up in test cycle 2

Exit Criteria for test cycle three:

- 2 FAFSA Business Processes
- Test at least 2000 Concurrent Users
- Verify Session table issue does not occur
- Resolved any issues that came up in test cycle 2

6.1.4 Performance Test Cycle 4 – Scheduled 10/08/2002

Detailed Goals for test cycle four:

- 3 FAFSA Business Processes - School Code Search, Fill out FAFSA, Renewal
- Target at least 2500 Concurrent Users
- Determine the number of users that a clone can support
- Resolve any issues that came up in test cycle 3

Exit Criteria for test cycle four:

- 3 FAFSA Business Processes
- Test at least 2500 Concurrent Users
- Determine the number of users that a clone can support
- Resolved any issues that came up in test cycle 3

6.1.5 Performance Test Cycle 5 – Scheduled 10/15/2002

Detailed Goals for test cycle five:

- 4 FAFSA Business Processes - School Code Search, Fill out FAFSA, Renewal, FAA Access business processes
- Target at least 3000 Concurrent Users
- Verify database connection limit configuration
- Obtain data points on Web/App server ratio
- Resolve any issues that came up in test cycle 4

Exit Criteria for test cycle five:

- 4 FAFSA Business Processes
- Test at least 3000 Concurrent Users
- Estimate the number of web servers and application servers needed for production
- Verify database connection limit configuration
- Obtain data points on web/app server ratio
- Resolved any issues that came up in test cycle 4

6.1.6. Performance Test Cycle 6 – Scheduled 10/22/2002 *

Detailed Goals for test cycle six:

- NCS is scheduled to make the PIN available for the performance test by second week of October. *
2 PIN Business Processes – PIN authentication, Other application (that uses Web Services PIN authentication), and PIN Registration
- Determine the maximum number of users that a clone can handle
- Resolve any issues that came up in test cycle 5

Exit Criteria for test cycle six:

- 2 PIN Business Processes (3 PIN tests)
- Determine the maximum number of users that a clone can handle
- Resolved any issues that came up in test cycle 5

6.1.7. Performance Test Cycle 7 – Scheduled 10/24/2002

Detailed Goals for test cycle seven:

- PIN would be ready for the performance test by second week of October.*
2 PIN Business Processes – PIN authentication, Other application (that uses Web Services PIN authentication), and PIN Registration
- Determine the maximum number of users that a clone can handle
- Resolve any issues that came up in test cycle 6

Exit Criteria for test cycle seven:

- 2 PIN Business Processes (3 PIN tests)
- Determine the maximum number of users that a clone can handle
- Resolved any issues that came up in test cycle 6

6.1.8. Performance Test Cycle 8 – Scheduled 10/30/2002

Detailed Goals for test cycle eight:

- 5 FAFSA Business Processes - School Code Search, Fill out FAFSA, Renewal, FAA Access, Corrections
- 2 PIN Business Processes
- Verify the number of web servers and application servers needed for the production
- Resolve any issues that came up in test cycle 7

Exit Criteria for test cycle eight:

- 5 FAFSA Business Processes
- 2 PIN Business Processes
- Estimate the number of web servers and application servers needed for the production
- Resolved any issues that came up in test cycle 7

6.1.9. Performance Test Cycle 9 – Scheduled 11/05/2002

Detailed Goals for test cycle nine:

- 6 FASFA Business Processes - School Code Search, Fill out FAFSA, Renewal, FAA Access, Corrections, Student Access).
- 2 PIN Business Processes
- Verify the four outstanding FAFSA WebSphere issues do not occur
- Resolve any issues that came up in test cycle 8

Exit Criteria for test cycle nine:

- 6 FASFA Business Processes
- 2 PIN Business Processes
- Verified the four outstanding FAFSA WebSphere issues do not occur
- Resolve any issues that came up in test cycle 8

6.1.10. Performance Test Cycle 10 – Scheduled 11/07/2002

Detailed Goals for test cycle ten:

- 7 FASFA Business Processes - FAFSA Application (School Code Search, Fill out FAFSA, Renewal, FAA Access business processes, Corrections, Student Access, Electronics Signature).
- 2 PIN Business Processes
- Come up with the right configuration for web server, application server, and database servers for PIN and FAFSA

Exit Criteria for test cycle ten:

- 7 FASFA Business Processes - Full FAFSA Application
- 2 PIN Business Processes
- Come up with the right configuration for web server, application server, and database servers for PIN and FAFSA

6.1.11. Performance Test Cycle 11 – Scheduled 11/12/2002

Detailed Goals for test cycle eleven:

- All 8 FASFA Business Processes - Full FAFSA Application (School Code Search, Fill out FAFSA, Renewal, FAA Access business processes, Corrections, Student Access, Electronics Signature, Request Status).
- 2 PIN Business Processes
- Come up with the right configuration for web server, application server, and database servers for PIN and FAFSA

Exit Criteria for test cycle eleven:

- All 8 FASFA Business Processes - Full FAFSA Application
- 2 PIN Business Processes
- Come up with the right configuration for web server, application server, and database servers for PIN and FAFSA

6.1.12. Performance Test Cycle 12 – Scheduled 11/14/2002

Detailed Goals for test cycle twelve:

- All 8 FASFA Business Processes - Full FAFSA Application
- 2 PIN Business Processes
- Failover Test (Failover Web Server)

Exit Criteria for test cycle twelve:

- All 8 FASFA Business Processes - Full FAFSA Application
- 2 PIN Business Processes
- Verify Web Server failover works

6.1.13. Performance Test Cycle 13 – Scheduled 11/19/2002

Detailed Goals for test cycle thirteen:

- All 8 FASFA Business Processes - Full FAFSA Application
- 2 PIN Business Processes
- Failover test for Application Server

Exit Criteria for test cycle thirteen:

- All 8 FASFA Business Processes - Full FAFSA Application
- 2 PIN Business Processes
- Verify Application Server failover test works

6.1.14. Performance Test Cycle 14 – Scheduled 11/21/2002

Detailed Goals for test cycle fourteen:

- All 8 FASFA Business Processes - Full FAFSA Application
- 2 PIN Business Processes
- Failover test for Network Dispatcher

Exit Criteria for test cycle fourteen:

- All 8 FASFA Business Processes - Full FAFSA Application
- 2 PIN Business Processes
- Failover test for Network Dispatcher

6.1.15. Performance Test Cycle 15 – Scheduled 12/3/2002**

Detailed Goals for test cycle fifteen:

- Infrastructure test (CSC will upgrade OC3 by 11/24).
- Determine that OC3 line can achieve 108 mb/sec throughput. CSC will schedule this test with Mercury Interactive.

Exit Criteria for test cycle fourteen:

- Infrastructure test
- Achieve more than 100 mb/sec in the new network

6.1.16. Performance Test Cycle 16 – Scheduled 12/5/2002 **

Detailed Goals for test cycle sixteen:

- Infrastructure test (CSC will upgrade OC3 by 11/24).
- Determine that OC3 line can achieve 108 mb/sec throughput. CSC will schedule this test with Mercury Interactive.

Exit Criteria for test cycle sixteen:

- Infrastructure test
- Achieve more than 100 mb/sec in the new network

6.1.17. Performance Test Cycle 17– Scheduled 12/9/2002

Detailed Goals for test cycle seventeen:

- All 8 FAFSA Business Processes - Full FAFSA Application
- 2 PIN Business Processes

Exit Criteria for test cycle seventeen:

- All 8 FAFSA Business Processes – Full FAFSA Application
- 2 PIN Business Processes

6.1.18. Performance Test Cycle 18 – Scheduled 12/12/2002

Detailed Goals for test cycle eighteen:

- All 8 FAFSA Business Processes – Full FAFSA Application
- 2 PIN Business Processes

Exit Criteria for test cycle eighteen:

- All 8 FAFSA Business Processes – Full FAFSA Application
- 2 PIN Business Processes

6.1.19. Performance Test Cycle 19– Scheduled 12/16/2002

Detailed Goals for test cycle nineteen:

- All 8 FAFSA Business Processes – Full FAFSA Application
- 2 PIN Business Processes

Exit Criteria for test cycle nineteen:

- All 8 FAFSA Business Processes – Full FAFSA Application

- 2 PIN Business Processes

6.1.20. Performance Test Cycle 20– Scheduled 12/18/2002

Detailed Goals for test cycle twenty:

- All 8 FAFSA Business Processes – Full FAFSA Application
- 2 PIN Business Processes

Exit Criteria for test cycle twenty:

- All 8 FAFSA Business Processes – Full FAFSA Application
- 2 PIN Business Processes

6.1.21. Performance Test Cycle 21– Scheduled 12/20/2002

Detailed Goals for test cycle twenty-one:

- All 8 FAFSA Business Processes – Full FAFSA Application
- 2 PIN Business Processes

Exit Criteria for test cycle twenty-one:

- All 8 FAFSA Business Processes – Full FAFSA Application
- 2 PIN Business Processes

6.1.22. Performance Test Cycle 22– Scheduled 12/23/2002

Detailed Goals for test cycle twenty-two:

- All 8 FAFSA Business Processes – Full FAFSA Application
- 2 PIN Business Processes

Exit Criteria for test cycle twenty-two:

- All 8 FAFSA Business Processes – Full FAFSA Application
- 2 PIN Business Processes

6.1.23. Performance Test Cycle 23– Scheduled 12/27/2002

Detailed Goals for test cycle twenty-three:

- All 8 FAFSA Business Processes – Full FAFSA Application
- 2 PIN Business Processes

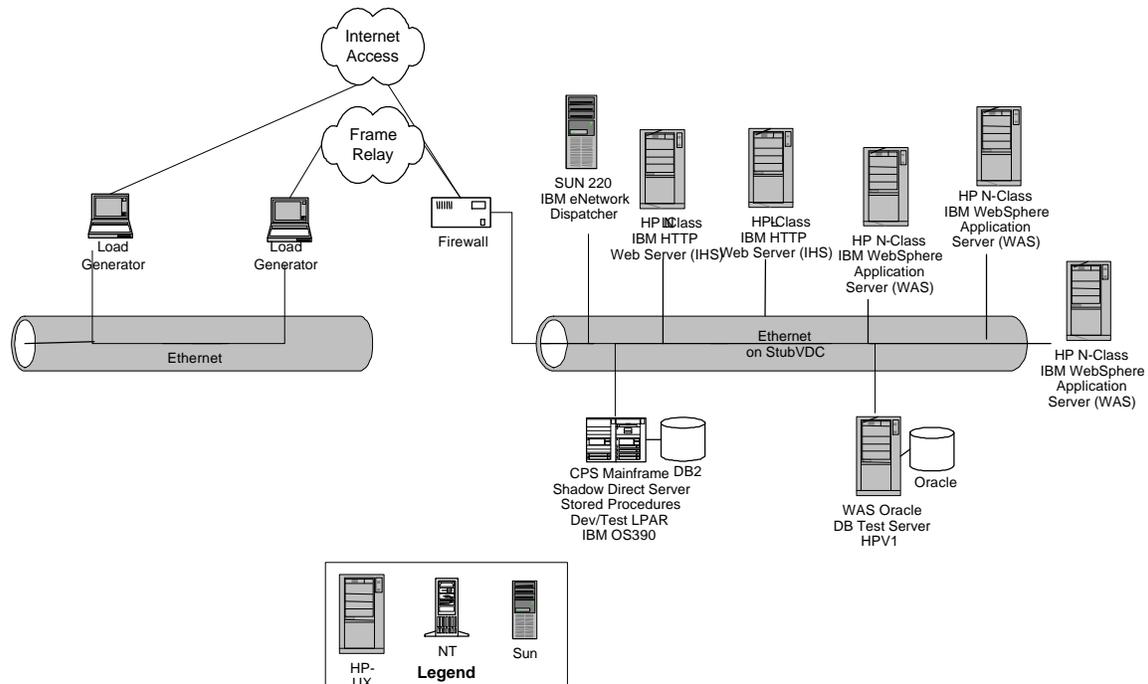
Exit Criteria for test cycle twenty-three:

- All 8 FAFSA Business Processes – Full FAFSA Application
- 2 PIN Business Processes

7 Technical Infrastructure

7.1. FAFSA 7.0 Performance Test Environment

FAFSA 7.0 Performance Test Environment Diagram



7.1.1. Performance Test Environment Requirements

- This environment mirrors the proposed production environment as closely as possible.
- Oracle Test Server should be configured to handle peak session usage.
- eNetwork Dispatcher Load Balancing will handle at least 3000 concurrent users.
- Network Bandwidth will give more than 100 mb/sec.

7.1.2 Configurations

- Network Dispatchers: Sun E220/1 CPU/1 GB RAM: SU1E7 Primary, SU1E8 Secondary. OS: Solaris 2.8 and Network Dispatcher 4.0
- Web Servers: HPL14 (4X450 CPU and 8 GB memory), HPL17 (4X450 CPU and 8 GB memory). OS: HPUX 11 and IHS 1.3.12.6
- App Servers: HPN3(8X360 CPU and 8 GB memory), HPN8(8X750 CPU and 16 GB memory). OS: HPUX11 and WAS 3.5.6

7.2 FAFSA 7.0 Production Environment

FAFSA 7.0 Production Environment Diagram <**TBD in last week of October**>

8 Performance Monitoring

Performance monitoring detailed information

8.1 Performance Monitoring Table

The table lists each performance area, its associated performance monitoring points, a general description of the performance area, and the group responsible to monitor the area. This document will be supplied to those monitoring the test. It will ensure that all required areas would be monitored.

Performance Areas	Performance Monitoring Point	Description	Monitored By:
Run Time	<ul style="list-style-type: none"> Total memory available for the JVM Amount of free memory for the JVM 	Application server - Memory used by a process as reported by the JVM.	ITA
Database connection pools	<ul style="list-style-type: none"> Average size of the connection pool (number of connections) Average number of threads waiting for a connection Average wait time in milliseconds for a connection to be granted Average time the connection was in use 	Application server - Reports usage information about connection pools for a database.	ITA
Servlet engines	<ul style="list-style-type: none"> Average number of concurrent requests for a servlet Amount of time it takes for a servlet to perform a request Average number of concurrently active HTTP sessions. 	Application server - Reports usage information for Web applications, servlets, Java Server Pages (JSPs), and HTTP sessions.	ITA
Network Dispatcher	<ul style="list-style-type: none"> Completed number of connections per web server Number of connection errors per web server Active number of connections to the web servers 	eNetwork Dispatcher is an IBM load-balancing tool. It balances http requests between web servers.	ITA

<p>CPU utilization</p>	<ul style="list-style-type: none"> • Network Dispatcher Server (SU1E7 and SU1E8) • 2 web servers (HPL14 and HPL17) • 2 application servers (HPN3 and HPN8) • Database server (HPV1) • HPV1 databases (WAS35STG, FAFSASTG, SESSSTG, EACSTG) • PIN performance test web server • CPS Mainframe DB2 database server • MQSeries and CICS 	<p>Depicts the utilization of the CPU. High CPU utilization can be an indicator of a CPU bottleneck. CPU bottlenecks may occur when Global CPU utilization exceeds 75%. However, some workloads can operate with very high CPU utilization with the CPU becoming a bottleneck.</p>	<p>CSC</p>
<p>Memory utilization</p>	<ul style="list-style-type: none"> • Network Dispatcher Server (SU1E7 and SU1E8) • 2 web servers (HPL14 and HPL17) • 2 application servers (HPN3 and HPN8) • Database server (HPV1) • HPV1 databases (WAS35STG, FAFSASTG, SESSSTG, EACSTG) • PIN performance test web server • CPS Mainframe DB2 database server • MQSeries and CICS 	<p>Indicates the utilization of memory. If memory utilization is below 95%, it is not a bottleneck. Memory can reach 100% utilization without necessarily being a bottleneck. The combination of high memory utilization and Virtual Memory reads & writes indicates that memory is a bottleneck.</p>	<p>CSC</p>

Disk I/O	<ul style="list-style-type: none"> • Network Dispatcher Server (SU1E7 and SU1E8) • 2 web servers (HPL14 and HPL17) • 2 application servers (HPN3 and HPN8) • Database server (HPV1) • HPV1 databases (WAS35STG, FAFSASTG, SESSSTG, EACSTG) • PIN performance test web server • CPS Mainframe DB2 database server • MQSeries and CICS 	<p>Illustrates the percentage of time that a disk I/O is pending on a disk device. High disk utilization can be an indicator of a disk bottleneck. Disk utilization greater than 50% may indicate a disk bottleneck. The service times, not charted, will determine if the I/O subsystem is performing poorly.</p>	CSC
Network Utilization	<ul style="list-style-type: none"> • Connections from firewall to eNetwork Dispatcher • eNetwork Dispatcher to Web Servers • Web servers to Application servers • App Servers to Oracle database servers • App servers to CPS mainframe 	<p>The bandwidth required to support an application. It can refer to the application traffic in and out of a data center, or between servers.</p>	CSC

Throughput	<ul style="list-style-type: none"> Bytes per second 	Volume processed in a specified period by the system or system component	ITA
Throughput	<ul style="list-style-type: none"> Bytes per second 	Throughput achieved in OC3 link	CSC
Hits Per Second	<ul style="list-style-type: none"> Hits per second 	The number of hits per second on the application.	ITA
User Response Times	<ul style="list-style-type: none"> Average, minimum, and maximum times for SSL pages Average, minimum, and maximum times for non-SSL pages 	Elapsed time between two events measured at specific points	ITA
Servlet Performance	<ul style="list-style-type: none"> Servlet and JSP performance 	The performance of each of the servlets and JSPs as they are accessed by the test script.	ITA
Database Optimization	<ul style="list-style-type: none"> Database performance Tables and Indexes Database calls 	The database performance should be monitored. Oracle and DB2 database should be optimized.	CSC
EAI Performance	<ul style="list-style-type: none"> Number of transactions between FAFSA and CPS Number of transaction queued in CPS Message across channel per second 	EAI component should be monitored and optimized.	EAI
CPS Performance	<ul style="list-style-type: none"> CPS performance 	NCS will generate additional load on CPS during FAFSA performance test. Monitor and optimized CPS	NCS
Application Performance	<ul style="list-style-type: none"> Application Code 	NCS will monitor the application log file(s). Monitor and optimized the application code.	NCS

9 Capacity Estimates

Capacity Planning Estimates for 2002- 2003 peak period.

9.1 Capacity Planning Estimates Table for FAFSA 7.0

Capacity Planning Estimates Table

Assuming 50% growth from FAFSA 6.0

FAFSA 7.0 Predict

Hits/day	105,000,000	
Hits Homepage/day	10,500,000	
Page Views/day	21,000,000	
Users/day	1,050,000	
User session length (min)	22	
Temp Apps/day	1,050,000	
App Submits/day	105,000	

FAFSA 7.0 Peak Hour Assumptions

Hits/hour	5,692,235	6,830,682
Hits Homepage/hour	569,224	683,068
Page Views/hour	1,138,447	1,366,136
Users/hour	55,588	66,706
User session length (min)	22	22

Column 1 -(90% of hits during 17 hour period 9am-2am, distributed equally)

FAFSA 7.0 Peak Hour Calculations

Hits/sec	1,544	1,840
Hits homepage/sec	154	184
Page views/sec	309	368
# concurrent users	20,382	24,294
Hits/user	100	100
Page views/user	20	20
User think time (sec)	66	66

9.2. Capacity Planning Estimates Table for FAFSA 6.0 and FAFSA 6.0 Actual (from the web trend reports)

	FAFSA 6.0 Predict		FAFSA 6.0 Actual
Hits/day	70,000,000		61492052.5
Hits Homepage/day	7,000,000		
Page Views/day	14,000,000		11378108
Users/day	700,000		636204.00
User session length (min)	25		14
Temp Apps/day	700,000		480000
App Submits/day	70,000		85000
Hits/hour	3,705,882	4,417,000	4136891.5
Hits Homepage/hour	370,588	441,700	
Page Views/hour	741,176	883,400	
Users/hour	37,059	44,170	37423.76471
User session length (min)	25	25	
			Column 3 represents Peak Hour of FAFSA 6.0 Actual 2/28/02 @ 21:00
Hits/sec	1,029	1,227	1149.136528
Hits homepage/sec	103	123	
Page views/sec	206	245	
# concurrent users	15,441	18,404	8733
Hits/user	100	100	
Page views/user	20	20	
user think time (sec)	75	75	

9.3 PIN Capacity Planning:

The following table shows the existing PIN database volume per hour (maximum):

Business Processes	Jan	Feb	Mar	Apr	May	Jun	July	Aug
Authentication	N/A	14882	7807	8254	9572	6949	8844	10140
Registration	N/A	2306	1688	1034	1182	973	1311	1477

After getting the predicted volume from other applications for their future releases the ITA team determined that the PIN should be performance tested with the following number of number of transactions per hour.

Registration: 3,228 transactions per hour

Authentication (FAFSA): 20,835 transactions per hour

Authentication (Other Applications): 2,358 transactions per hour