

FSA Modernization Partner
United States Department of Education
Federal Student Aid



FAFSA on the Web 8.0
in
WAS 5.0 Architecture
Performance Test Plan

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Executive Summary

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 over the Web. College bound students seeking student financial aid make use of the FAFSA program. Over 6.5 million students utilized the web site to apply for federal financial aid during the academic year 2002-2003. FSA anticipates that the number of users/applicants will increase by TBD during the 2003-2004 academic year, and will continue to rise in future years as the number of paper submissions decreases. This anticipated growth makes it imperative for FSA to maximize the capacity and availability of the FAFSA Web infrastructure while concurrently minimizing the amount of support FSA's representatives provide for questions from students or those experiencing 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.

Background

In the 2002-2003 academic year, there was a TBD increase in Web FAFSA users and applications submission. As the number of 'FAFSA on the Web' users' increases, the application must scale to accommodate the additional users. FSA anticipates that the number of applicants will increase by TBD this year. To account for the expected increase, N-Tiered architecture has been implemented for vertical and horizontal scaling. The proposed performance test will not only verify the scalability, but also confirm that the updates can withstand the estimated peak capacity for 2004.

Objective

The purpose of our performance test is to:

1. Validate the N-Tier architecture for FAFSA 8.0 and PIN.
2. Verify that the application will scale.
3. Validate that the Code changes, Production Runtime Environment and Configuration changes work under the simulated load.
4. Recommend production architecture to handle the peak load for 2003-2004.

Expected Results

At the end of each cycle a test report will be generated, using the results of the particular test cycle. This will be compared with the expected results. Each subsequent test cycle should bring the performance test one step closer to the overall goal.



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1 Introduction

1.1 Overview

This document provides the process and details on the performance goals that will guide the FAFSA 8.0 on WAS 5.0 test effort. This document will be utilized to communicate, test plans prior to each cycle execution, with all key participants as outlined in Section 3. This is an evolving document and will be updated throughout the FAFSA performance test.

1.2 Overall Goals

Performance Test cycles will be executed in consideration of the following aspects:

1. Tune FAFSA and PIN, so that the applications operate at their optimal performance level at the end of each test cycle.
2. Performance test the twelve (12) business processes identified by Department of Education/FSA during the FAFSA 8.0 performance test kick-off meeting.
3. Tune hardware/environment to perform at optimal levels, at the end of each test cycle. This tuning process includes:
 - Optimize number of database connections.
 - CSS (or 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 are configured correctly.
 - Determine web server to application server ratio.
 - Configure the CICS and DB2 region.
4. Ensure that the network infrastructure OC3 link can withstand peak application submissions with new requirements.
5. Validate performance gains the ability to handle web server caching.
6. Determine saturation point for each test in order to provide necessary bottleneck data.
7. Provide Performance Test information to Pearson and suggest appropriate tuning adjustments to CPS – with respect to FAFSA. Pearson is expected to run the CPS scripts to generate additional load on the CPS during the FAFSA performance test.
8. Ensure that the failover tests (Web-server, App-server etc.) do not impact the application significantly.
9. Ensure that the hardware is capable of supporting anticipated peak load of users during February 2004.



10. The performance test goal will include Akamai server testing. Details will be discussed among CSC, Accenture, and Department of Education/FSA.



1.3 FAFSA software matrix

The following matrix captures the major technology components of FAFSA and the changes for the application’s January 2003 release to August 2003.

No.	Component	Previous Version FAFSA 7.0	New version FAFSA 8.0
1	Akamai		
2	Application Code Changes	FAFSA 7.0	FAFSA 8.0
3	DB2	Version 6.0	Version 7.0
4	Hardware Refresh in Performance environment	Web Servers(4x450 CPU, 8 GB memory); Application Servers (8X360 CPU, 8 memory) and (8X750 CPU, 16 GB memory);	Web Servers (8X750 CPU, 8 GB memory); Application Servers (8X750 CPU, 8 GB memory and 8X750 CPU and 16 GB memory)
5	HP Operating System	HP-UX11	HP-UX11i
6	HTML vs. SSL images	Yes	Yes
7	IBM HTTP Server	Version 1.3.26	Version 2.0 - pending decision
8	IBM WebSphere Application Server	Version 3.5.6	Version 5.0 plus Fix Pack 2
9	Load Balancing	eNetwork Dispatcher (4.0.2.25)	Cisco Content Services Switch (CSS)
10	Mainframe OS	ZOS 1.2	ZOS 1.4
11	Oracle Database	8.1.72	8.1.74
12	CICS	Version 1.2	Version 2.2
13	Shared vs. Dedicated environments	Dedicated web and application server shared database and mainframe	Dedicated web and application server shared database and mainframe
14	Web Trends		5.0
15	WebSphere MQ	Version 5.2	Version 5.3.1
16	Wily Interscope	Not installed in performance test environment	Activated in performance environment

In production FAFSA 8.0 will have the following components:

- Akamai
- Web Server (IBM HTTP Server)
- Application Server (WebSphere)
- WebSphere MQ



- Oracle Databases
- Mainframe
- DB2



2 Performance Test Process

The following steps will be taken through the performance test effort:

2.1 *Performance Test Process*

To achieve the overall goals, 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:

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

Performance test areas include a wide range of measurements such as user response times, throughput, CPU and memory utilization, and number of concurrent users. These areas are established before the test so that monitoring points can be derived, and the 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 7.1 includes all the performance test areas that need to be monitored and the responsible party for each.

2.3 *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 7.1 outlines the type of data that should be monitored, collected, and the responsible party for each monitoring point. Section 3.2 outlines the data analysis deliverables that CSC and ITA are to submit at the conclusion of each test cycle.

2.4 *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.

2.5 *Results are documented and FAFSA 8.0 on WAS 5.0 environment is validated.*

The result of each test cycle will be documented and reported. A final presentation will be prepared once the performance test effort is completed.

2.6 *Success Criteria*

The performance test will validate that the FAFSA production run time environment will be able to support the anticipated peak loads of February 2004:

- Verify that application can support the peak load.
- Resource utilization of memory and CPU utilization is within the range of 80% average utilization.
- Average page response time is less than 15 seconds per page.



3 Roles and Responsibilities, and Deliverables

This section outlines the roles and responsibilities of all parties involved in FAFSA 8.0 performance testing activities.

3.1 Performance Test Roles and Responsibilities

The following table outlines the roles and responsibilities of the FAFSA 8.0 Performance Planning team.

Roles and Responsibilities Table

Role	Assigned	Phone	Responsibility
Performance Test Lead	Roshani Bhatt	202 962-0740	<p>Coordinate with all teams and resources to ensure that the preliminary capacity planning, performance test planning and performance test execution are completed on time.</p> <p>Define the detailed goals for each test cycle/test types – stress, stability, SSL, Cache, DB, and Mainframe.</p> <p>Analyze the application’s functionality to right combination (e.g. Submit, Renew, and Correct) of test.</p> <p>Determine the length of each run and starting and stopping points.</p> <p>Define the expected concurrent users per server at the optimized configuration.</p> <p>Ensure the performance test requirements are met successfully.</p> <p>Provide preliminary hardware sizing for peak.</p> <p>Communicate the performance test results (each cycle) to the involved teams.</p> <p>Provide all performance test deliverables to Department of Education.</p>
Performance Test Resource	Musab Alkateeb Diahann Butler Ashfaq Khan Matt Portolese	202 962-0729 202 962-0728 202-962-0758 202-962-0757	<p>Coordinate test dates with all testing resources (ITA, Pearson, CSC, and Integration Partner).</p> <p>Work with all the teams to verify administrator contact information and attendance.</p> <p>Execute tests and monitor test servers.</p> <p>Fix the scripts after test cycle if necessary.</p> <p>Work with CSC to measure the performance of each component (CPU, Memory, IO, and Network).</p> <p>Identify bottlenecks via Load Runner</p> <p>Collect results form CSC, Pearson.</p> <p>Publish Load Runner reports.</p>



			Document Executive Summary of test cycle results.
Application Contact	Matt Kain	319-339-6902	Responsible for application changes and recommendations. Monitor application performance at each test cycle.
CPS Contact	Dan Butler Gabe Perez Bill DeVore	319-665-7763 319-665-7748 319-665-7751	Monitor CPS performance at each test cycle. Create and execute scripts for generating load on CPS. Coordinate with ITA to run these scripts during the performance test.
EAI Administrator	Scott Gray Brian Whisnant	202 962-0795 202 962-0748	Monitor WebSphere MQ on FAFSA and CPS. Monitor CICS DPL bridge. Capture information for WebSphere MQ. Make recommendations on ways to improve the EAI components.
WebSphere Administrator	Barnet Malkin Bob Wehrle Joe Hala	202-962-0645 202 962-0760 860 861-3359	WAS configuration changes and updates. Monitor key areas and deliver summary results.
IHS Administrator	Barnett Malkin Bob Wehrle Joe Hala	202 962-0645 202 962-0760 860 861-3359	IHS configuration changes and updates. Monitor key areas and deliver summary results.
CSS	TBD		Load Balancer configuration changes and updates. Monitor key areas and deliver summary results.
HP System Administrator	Bill Gardner Paul Izzo	860-290-0871 203-317-2175	Monitor hardware to ensure optimal configuration. Monitor CPU, Memory, IO, capacity levels. Record hardware capacity levels at different intervals throughout the test cycle.
Oracle Administrator	Rich Ryan Malcolm Brown	860-425-6336 434-572-4922	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.
Mainframe Administrator	Tom Puddicombe / Nancy Mathisen	860-290- 2201 817-762-8061	Monitor Mainframe to ensure optimal configuration. Monitor capacity levels at different intervals throughout the test cycle. Monitor WebSphere MQ and the communication between App server and DB.
Windows Administrator	Craig Gates	203-317-5174	Troubleshoot the issues that arise with Load Generator boxes.
CICS	Walt Barrett Carol Greer	937-320-6629 860-513-5860	Monitor the CPS performance. Make recommendations to improve CPS performance



Akamai	Dave Yoon – Akamai; Bruce Bregozio – CSC	TBD 203-317-4909	Set Akamai in the performance test environment. Monitor and report Akamai performance
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3.2 Documentation

The following documents will be submitted to the FAFSA project team within the dates specified. Table 7.1 provides a guide to the data that needs to be captured and presented to the team at the end of each test cycle.

3.2.1 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 7.1. ITA is expected to deliver this analysis after running each test cycle. A brief high-level summary will be compiled by all involved parties and distributed to the clients by COB on the day of the tests.

3.2.2 CSC Capacity Analysis

CSC will complete a spreadsheet, which captures information on current capacity (in percentile) as well as information from the 2003 peak period. This information will be used to better plan the performance tests and for capacity planning at the conclusion of all test cycles. CSC should compile a high level summary at the end of each test cycle and forward it to ITA. ITA will provide preliminary peak hardware sizing to CSC after executing the capacity planning hardware sizing performance test.

3.2.3 CSC Performance Test Data

The Performance Monitoring Areas, Table 7.1, 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 5 minute sampling points, unless otherwise suggested during the test. CSC is expected to deliver this data and summary of test results after each test cycle. CSC should compile a high level summary at the end of each test cycle and furnish it to ITA.

3.2.4 CSC Performance Test Summary Analysis

CSC should provide a document containing general comments, summary of capacity issues, and effective capacity.

3.2.5 FAFSA Development Team (Pearson) Test Summary Analysis

At the end of each the performance tests, the development team (Pearson) will provide a document containing a list of any recommended application changes and overall application performance. The Performance Monitoring Areas, Table 7.1, provides a guide that what type of data will need to be collected.



3.2.6 CPS Performance Test Data

The Performance Monitoring Areas, Table 7.1, provides a guide that what type of data 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 after each CPS related test cycle runs. CSC should compile a high level summary at the end of each test cycle and provide it to the ITA team.

3.2.7 EAI Performance Test Data

The Performance Monitoring Areas, Table 7.1, provides a guideline to the type of data 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-interval sampling rate, unless otherwise suggested during the test. EAI is expected to deliver this data and summary of test results after each (EAI related) test cycle runs. CSC should compile a high level summary at the end of each test cycle and make it available to the ITA team.



4 FAFSA 8.0 Business Process

The following business processes will be targeted during the entire performance test effort. Utilizing the business processes that appear below, the ITA team will generate the performance test scripts.

4.1 Business Processes

The following list outlines the business processes that will be performance tested. These business processes were identified by the Department of Education/FSA during the All Hands meeting:

1. Fill out a FAFSA and Submit- Form to fill out and submit a FAFSA 8.0.
2. FAFSA Corrections - Correct an existing application.
3. FAFSA Renewal - Renew an application.
4. FAA Online Access - FAA entry (Correction only).
5. FAA Online Access - FAA entry (Renewal only).
6. Student Access - Access the existing application.
7. Request Application Status - Check application status.
8. PIN Registration - Register the user to get a new PIN.
9. PIN Authentication - Web Services - FAA.
10. ISIR Request.
11. WebSphere MQ Load Test - W12 Transaction (update/insert)
12. WebSphere MQ Load Test - W034 Transaction (lookup)

4.2 Business Processes Table

The table below outlines the architecture components that comprise the FAFSA 8.0 application. The FAFSA 8.0 application business processes will collectively test each of these components, which are listed singly:

- Akamai (planned for performance test, not yet confirmed)
- FAFSA IHS web server.
- FAFSA WAS application server.
- PIN IHS web server.
- PIN WAS application server.
- PIN Oracle database.
- FAFSA 7.0 temp save database (Oracle).
- FAFSA 8.0 temp save database (Oracle).
- FAFSA session database (Oracle).
- Mainframe (CICS, WebSphere MQ, DPL Bridge)
- WebSphere MQ
- DB2



Each business process test scripts will test the outlined architectural components.

Business Processes Table

Business Process	Akamai	Web Server	Application Server	Oracle DB	Pin DB	EAI	CPS DB2	CPS CICS
Fill out a FAFSA and Submit		✓	✓	✓		✓	✓	✓
Corrections		✓	✓	✓	✓	✓	✓	✓
Renewal		✓	✓	✓	✓	✓	✓	✓
FAA Online Access- FAA entry (Correction only)		✓	✓	✓	✓		✓	✓
FAA Online Access- FAA entry (Renewal only)		✓	✓	✓	✓		✓	✓
Student Access		✓	✓		✓		✓	✓
Request Application Status		✓	✓			✓	✓	✓
PIN Registration		PIN web server	PIN application server		✓	✓	✓	
PIN Authentication (FAFSA)		✓	✓		✓			
ISIR Request						✓		
WebSphere MQ Load Test - W12 (update/insert)			✓	✓	✓	✓	✓	✓
WebSphere MQ Load Test - W034 (lookup)			✓	✓	✓	✓	✓	✓



5 Detailed Goals per Cycle

This section will include detailed goals for each test cycle. The goals for each cycle are not static. If issues are encountered on the scheduled performance test cycle, the performance test cycle will need to be rescheduled.

All scheduled performance test cycles will make use of the following conference call telephone number and participant code: **1-800-516-9896; 82231**

5.1 Performance Test Cycles

5.1.1 Performance Test Cycle 1 - Scheduled 10/02/2003, 9:00 AM - 1:00 PM

Detailed Goals for test cycle 1:

- 1 FAFSA Business Process - Fill Out a FAFSA 8.0
- Target up to 3000 concurrent virtual users

Data requirements for cycle 1:

ITA:

- Increment Fill Out a FAFSA SSNs and create required data. 4000 records will be required assuming 45 minutes pacing time with 2000 virtual users for one hour.

Pearson:

- Review Fill Out a FAFSA functional script (9/24).
- Clean out temp save, submitted, and processed databases prior to 8:30 am
- Clean out all submitted records and all temp save records during the tests

Upon test conclusion

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need data for at least 6000 Renewal records. These records will be used for future test cycles (ITA will need this on or before 10/05).
- ITA will need to increment SSNs for Fill Out a FAFSA.

5.1.2 Performance Test Cycle 2 - Scheduled 10/07/2003, 9:00 AM - 1:00 PM

Detailed Goals for test cycle 2:

- 1 FAFSA Business Process - FAFSA Corrections
- Target up to 3000 concurrent virtual users
- Test IP spraying - Validate there are not any major issues with CSS
- Resolve any outstanding issues witnessed in test cycle 1

Data requirements for cycle 2:



Pearson:

- Review FAFSA Corrections functional script (prior 9/19).
- 6000 records will be required assuming 30 minutes pacing time with 3000 Virtual users for one hour. Provide the following data for 3000 virtual users in FAFSA Corrections from the performance test database by (10/06).
 - SSN
 - Full last name
 - DOB
 - PIN

Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need data for at least 6000 Renewal records. These records will be employed for future test cycles (ITA will need this on or before 10/08).

5.1.3 Performance Test Cycle 3- Scheduled on 10/09/2003, 9:00 AM - 1:00 PM

Detailed Goals for test cycle 3:

- 1 FAFSA Business Processes -FAFSA Renewal
- Target up to 3000 concurrent virtual users
- Test IP spraying – Validate there are not any major issues with CSS
- Resolve any unsolved issues witnessed in test cycle 2

Data requirements for cycle 3:

ITA:

- Review FAFSA Renewal functional script (prior 9/22).

Pearson:

- 6000 records will be required assuming 30 minutes pacing time with 3000 Virtual users for one hour. Provide the following data for 3000 virtual users for FAFSA Renewal from the performance test database by (10/08).
 - SSN
 - Full last name
 - DOB
 - PIN

CSC:

- Image copy of performance test database (temp save pending - CSC)



Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to increment Fill Out a FAFSA SSNs. These records will be used for future cycles.
- Image copy of performance test Database (temp save pending - CSC).

5.1.4 Performance Test Cycle 4 – Scheduled 10/14/2003, 9:00 AM – 1:00 PM

Detailed Goals for test cycle 4:

- 1 FAA Business Process – FAA Online Access (FAA entry Corrections only)
- Target up to 1500 concurrent virtual users
- Test IP spraying – Validate there are not any major issues with CSS
- Resolve any unsolved issues witnessed in test cycle 3

Data requirements for cycle 4:

ITA:

- Review FAA Online Access functional script (prior 9/24).

Pearson:

- 3000 records will be required assuming 30 minutes pacing time with 1500 virtual users for one hour. Provide the following data for 1500 virtual users for FAA Corrections from the performance test database by (10/13).
 - SSN
 - Full last name
 - DOB
 - PIN
 - DRN
 - Relationship between administrator, student, school code (not applicable with the use of DRN)

Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will require use of them. These records will be used for future cycles (ITA will need this on or before 10/15).



5.1.5 Performance Test Cycle 5** - Scheduled 10/16/2003, 9:00 AM - 1:00 PM

Detailed Goals for test cycle 5:

- 1 FAA Business Process - FAA Online Access (FAA entry Renewal only)
- Target up to 1500 concurrent virtual users
- Test IP spraying - Validate there are not any major issues with CSS
- Key date for new environment - first performance date after hardware refresh
- Resolve any unsolved issues witnessed in test cycle 4

Data requirements for cycle 5:

ITA:

- Review FAA Online Access functional script (prior 9/24).

Pearson:

- 3000 records will be required assuming 30 minutes pacing time with 1500 virtual users for one hour. Provide the following data for 1500 virtual users for FAFSA Corrections from the performance test database by (10/15).
 - SSN
 - Full last name
 - DOB
 - PIN
 - DRN
 - Relationship between administrator, student, school code (not applicable with the use of DRN)

Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to increment Fill Out a FAFSA SSNs. These records will be used for future cycles (ITA will need this on or before 10/20).



5.1.6 Performance Test Cycle 6 – Scheduled 10/21/2003, 9:00 AM – 1:00 PM

Detailed Goals for test cycle 6:

- 1 FAFSA Business Process – Student Access
- Target up to 3000 concurrent virtual users
- Test IP spraying – Validate there are not any major issues with CSS
- Resolve any unsolved issues witnessed in test cycle 5

Data requirements for Cycle:

ITA:

- Review Student Access functional script (prior 10/6).

Pearson:

- The number of records required for 3000 users will be *TBD*. Provide the following data for 3000 virtual users for FAFSA Corrections from the performance test database by (10/20).
- Provide the following data for Student Access from the performance test database by (10/20).
 - SSN
 - Full last name
 - DOB
 - PIN

Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to *TBD*. These records will be used for future cycles (ITA will need this on or before *TBD*).

5.1.7 Performance Test Cycle 7 ** - Scheduled 10/23/2003, 9:00 AM – 1:00 PM

Detailed Goals for test cycle 7:

Key date for CSS versus eNetwork Dispatcher decision

- 1 FAFSA Business Process – Request Application Status
- Target up to 3000 concurrent virtual users
- Test IP spraying – Validate there are not any major issues with CSS
- Resolve any unsolved issues witnessed in test cycle 6

Data requirements for cycle 6:



Pearson:

- The number of records required for 3000 users will be *TBD*. Provide the following data for 3000 virtual users FAFSA Corrections from the performance test database by (10/20).
- Provide the following data for Student Access from the performance test database by (10/21).
 - SSN
 - Full last name
 - DOB
 - PIN

Upon test conclusion

Pearson:

- Pearson will clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to *TBD*. These records will be used for future cycles (ITA will need this on or before *TBD*).

5.1.8 Performance Test Cycle 8 – Scheduled 10/24/2003, 9:00 AM – 1:00 PM

Detailed Goals for test cycle 8:

- WebSphere MQ Load Test – W12 Transaction (update/insert)
- Target up to 40 transactions per minute
- Resolve any unsolved issues witnessed in test cycle 7

Data requirements for cycle 8:

Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to *TBD*. These records will be used for future cycles (ITA will need this on or before *TBD*).

5.1.9 Performance Test Cycle 9 – Scheduled 10/28/2003, 9:00 AM – 1:00 PM

Detailed Goals for test cycle 9:

- WebSphere MQ Load Test – W034 Transaction (lookup)
- Target up to 40 transactions per minute
- Resolve any unsolved issues witnessed in test cycle 8

Data requirements for cycle 9:



Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to *TBD*. These records will be used for cycle (ITA will need this on or before *TBD*).

5.1.10 Performance Test Cycle 10 - Scheduled 10/30/2003, 9:00 AM - 1:00 PM**

Detailed Goals for test cycle 10 – Capacity Planning:

- 3 FAFSA Business Process – Fill out a FAFSA, FAFSA Corrections, FAFSA Renewal
- Verify Akamai performance in environment
- Target up to 3000 concurrent virtual users
- Resolve any unsolved issues witnessed in test cycle 9

Data requirements for cycle 10:

ITA:

- Increment Fill Out a FAFSA SSNs

Pearson:

- 6000 records will be required assuming 45 minutes pacing time with 3000 Virtual users for one hour. Provide the following data for 3000 Virtual users FAFSA Corrections and Renewal from the performance test database by (*TBD*).
- Provide the following data for FAFSA Corrections and FAFSA Renewal from the performance test database by (10/28).
 - SSN
 - Full last name
 - DOB
 - PIN

Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to increment Fill Out a FAFSA SSNs. These records will be used for cycle 11(ITA will need this on 10/31).

5.1.11 Performance Test Cycle 11 - Scheduled 11/04/2003, 9:00 AM - 1:00 PM**

Detailed Goals for test cycle 11 – Capacity Planning:



- 3 FAFSA Business Process – Fill out a FAFSA, FAFSA Corrections, FAFSA Renewal
- Verify Akamai performance in environment
- Target up to 3000 concurrent virtual users
- Resolve any unsolved issues witnessed in test cycle 10

Data requirements for cycle 11:

ITA:

- Increment Fill Out a FAFSA SSNs

Pearson:

- 6000 records will be required assuming 45 minutes pacing time with 3000 virtual users for one hour. Provide the following data for 3000 virtual users FAFSA Corrections and Renewal from the performance test database by (10/05).
- Provide the following data for FAFSA Corrections and Renewals from the performance test database by (TBD).
 - SSN
 - Full last name
 - DOB
 - PIN

Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to increment Fill Out a FAFSA SSNs. These records will be used for cycle 12 (ITA will need this on TBD).

5.1.12 Performance Test Cycle 12 - Scheduled 11/06/2003, 9:00 AM - 1:00 PM**

Detailed Goals for test cycle 12 – Capacity Planning:

- 3 FAFSA Business Process – Fill out a FAFSA, FAFSA Corrections, FAFSA Renewal
- Verify Akamai performance in environment
- Target up to 3000 concurrent virtual users
- Resolve any unsolved issues witnessed in test cycle 11

Data requirements for cycle 12:

ITA:

- Increment Fill Out a FAFSA SSNs

Pearson:



- 6000 records will be required assuming 45 minutes pacing time with 3000 virtual users for one hour. Provide the following data for 3000 virtual users FAFSA Corrections and Renewal from the performance test database by (TBD).
- Provide the following data for Student Access from the performance test database by (11/04).
 - SSN
 - Full last name
 - DOB
 - PIN

Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to increment Fill Out a FAFSA SSNs. These records will be used for cycle 13 (ITA will need this on 11/07).



5.1.13 Performance Test Cycle 13** – Scheduled 11/11/2003, 9:00 AM – 1:00 PM

Detailed Goals for test cycle 13 – Capacity Planning:

Key date for capacity planning at conclusion of this cycle, collected test data will determine recommendations for capacity planning

- 3 FAFSA Business Process – Fill out a FAFSA, FAFSA Corrections, FAFSA Renewal
- Verify Akamai performance in environment
- Target up to 3000 concurrent virtual users
- Resolve any unsolved issues witnessed in test cycle 12

Data requirements for cycle 13:

ITA:

- Increment Fill Out a FAFSA SSNs

Pearson:

- 6000 records will be required assuming 45 minutes pacing time with 3000 virtual users for one hour. Provide the following data for 3000 virtual users FAFSA Corrections and Renewal from the performance test database by (TBD).
- Provide the following data for Student Access from the performance test database by (11/07).
 - SSN
 - Full last name
 - DOB
 - PIN

Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to increment Fill Out a FAFSA SSNs. These records will be used for cycle (ITA will need this on 11/11).

5.1.14 Performance Test Cycle 14 – Scheduled 11/12/2003, 9:00 AM – 1:00 PM

Detailed Goals for test cycle 14:

- 1 FAA Business Process – PIN Registration
- Target up to 1500 concurrent virtual users
- Resolve any unsolved issues witnessed in test cycle 13



Data requirements for cycle 14:

ITA: *TBD*

Pearson:

- Review PIN Registration functional script (prior 10/09).
- *TBD* records will be required assuming 45 minutes pacing time with 3000 virtual users for one hour. Provide the following data for 3000 virtual users *TBD* from the performance test database by (*TBD*).
- Provide the following data for Student Access from the performance test database by (11/10).
 - SSN
 - Full last name
 - DOB
 - PIN

Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to *TBD*. These records will be used for cycle (ITA will need this on 11/12).

5.1.15 Performance Test Cycle 15 – Scheduled 11/13/2003, 9:00 AM – 1:00 PM

Detailed Goals for test cycle 15:

- 1 FAA Business Process –PIN Authentication
- Target up to 1500 concurrent virtual users
- Resolve any unsolved issues witnessed in test cycle 14

Data requirements for cycle 15:

ITA:

- Review PIN Authentication functional script (prior 10/09).

Pearson:

- *TBD* records will be required assuming 45 minutes pacing time with 3000 virtual users for one hour. Provide the following data for 3000 virtual users from the performance test database by (*TBD*).



Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to *TBD*. These records will be used for cycle (ITA will need this on or before 11/14).

5.1.16 Performance Test Cycle 16- Scheduled 11/18/2003, 9:00 AM - 1:00 PM

Detailed Goals for test cycle 16:

- 1 FAA Business Process – ISIR Request
- Target up to 1500 concurrent virtual users
- Resolve any unsolved issues witnessed in test cycle 15

Data requirements for cycle 16:

ITA: *TBD*

Pearson:

- *TBD* records will be required assuming 45 minutes pacing time with 3000 virtual users for one hour. Provide the following data for 3000 virtual users from the performance test database by (*TBD*).

Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to *TBD*. These records will be used for cycle (ITA will need this on or before *TBD*).

5.1.17 Performance Test Cycle 17 - Scheduled 11/20/2003, 9:00 AM - 1:00 PM

Detailed Goals for test cycle 17 – Failover Testing:

- Failover scenarios
- Resolve any unsolved issues witnessed in test cycle 16

Data requirements for cycle 17:

ITA: *TBD*

Pearson: *TBD*

TBD records will be required assuming *TBD* minutes pacing time with 3000 virtual users for one hour. Provide the following data for 3000 virtual users from the performance test database by (*TBD*).



Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to *TBD*. These records will be used for cycle (ITA will need this on or before *TBD*).

5.1.18 Performance Test Cycle 18– Scheduled 11/25/2003, 9:00 AM – 1:00 PM

Detailed Goals for test cycle 18 – Failover Testing:

- Failover scenarios
- Target up to 3000 concurrent virtual users
- Resolve any unsolved issues witnessed in test cycle 17

Data requirements for cycle 18:

ITA: *TBD*

Pearson:

- *TBD* records will be required assuming 45 minutes pacing time with 3000 virtual users for one hour. Provide the following data for 3000 from the performance test database by (*TBD*).

Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to *TBD*. These records will be used for cycle (ITA will need this on or before *TBD*).

5.1.19 Performance Test Cycle 19– Scheduled 12/02/2003, 9:00 AM – 1:00 PM

Detailed Goals for test cycle 19 – Remediation Cycle:

- Remediation cycle
- Target up to 3000 concurrent virtual users
- Resolve any unsolved issues witnessed in test cycle 18

Data requirements for cycle 19:

ITA: *TBD*

Pearson:

- *TBD* records will be required assuming 45 minutes pacing time with 3000 virtual users for one hour. Provide the following data for 3000 virtual users from the performance test database by (*TBD*).



Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to *TBD*. These records will be used for cycle (ITA will need this on or before *TBD*).

5.1.20 Performance Test Cycle 20- Scheduled 12/04/2003, 9:00 AM - 1:00 PM

Detailed Goals for test cycle 20 – Remediation Cycle:

- Remediation cycle
- Target up to 3000 concurrent virtual users
- Resolve any unsolved issues witnessed in test cycle 19

Data requirements for cycle 20:

ITA: *TBD*

Pearson:

- *TBD* records will be required assuming 45 minutes pacing time with 3000 virtual users for one hour. Provide the following data for 3000 virtual users *TBD* from the performance test database by (*TBD*).

Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to *TBD*. These records will be used for cycle (ITA will need this on or before *TBD*).

5.1.21 Performance Test Cycle 21- Scheduled 12/09/2003, 9:00 AM - 1:00 PM

Detailed Goals for test cycle 21 – Remediation Cycle:

- Remediation cycle
- Target up to 3000 concurrent virtual users
- Resolve any unsolved issues witnessed in test cycle 20

Data requirements for cycle 21:

ITA: *TBD*

Pearson:

- *TBD* records will be required assuming 45 minutes pacing time with 3000 virtual users for one hour. Provide the following data for 3000 virtual users *TBD* from the performance test database by (*TBD*).



Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to *TBD*. These records will be used for cycle (ITA will need this on or before *TBD*).

5.1.22 Performance Test Cycle 22- Scheduled 12/11/2003, 9:00 AM - 1:00 PM

Detailed Goals for test cycle 22 – Remediation Cycle:

- Remediation cycle
- Target up to 3000 concurrent virtual users
- Resolve any unsolved issues witnessed in test cycle 21

Data requirements for cycle 22:

ITA: *TBD*

Pearson:

- *TBD* records will be required assuming 45 minutes pacing time with 3000 virtual users for one hour. Provide the following data for 3000 virtual users *TBD* from the performance test database by (*TBD*).

Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to *TBD*. These records will be used for cycle (ITA will need this on or before *TBD*).

5.1.23 Performance Test Cycle 23- Scheduled 12/16/2003, 9:00 AM - 1:00 PM

Detailed Goals for test cycle 23 – Remediation Cycle:

- Remediation cycle
- Target up to 3000 concurrent virtual users
- Resolve any unsolved issues witnessed in test cycle 22

Data requirements for cycle 23:

ITA: *TBD*

Pearson:



- *TBD* records will be required assuming 45 minutes pacing time with 3000 virtual users for one hour. Provide the following data for 3000 virtual users from the performance test database by (*TBD*).

Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to increment Fill Out a FAFSA SSNs. These records will be used for cycle (ITA will need this on or before *TBD*).

5.1.24 Performance Test Cycle 24- Scheduled 12/18/2003, 9:00 AM - 1:00 PM

Detailed Goals for test cycle 24 – Remediation Cycle:

- Remediation cycle
- Target up to 3000 concurrent virtual users
- Resolve any unsolved issues witnessed in test cycle 23

Data requirements for cycle 24:

ITA: *TBD*

Pearson:

- *TBD* records will be required assuming 45 minutes pacing time with 3000 virtual users for one hour. Provide the following data for 3000 virtual users from the performance test database by (*TBD*).

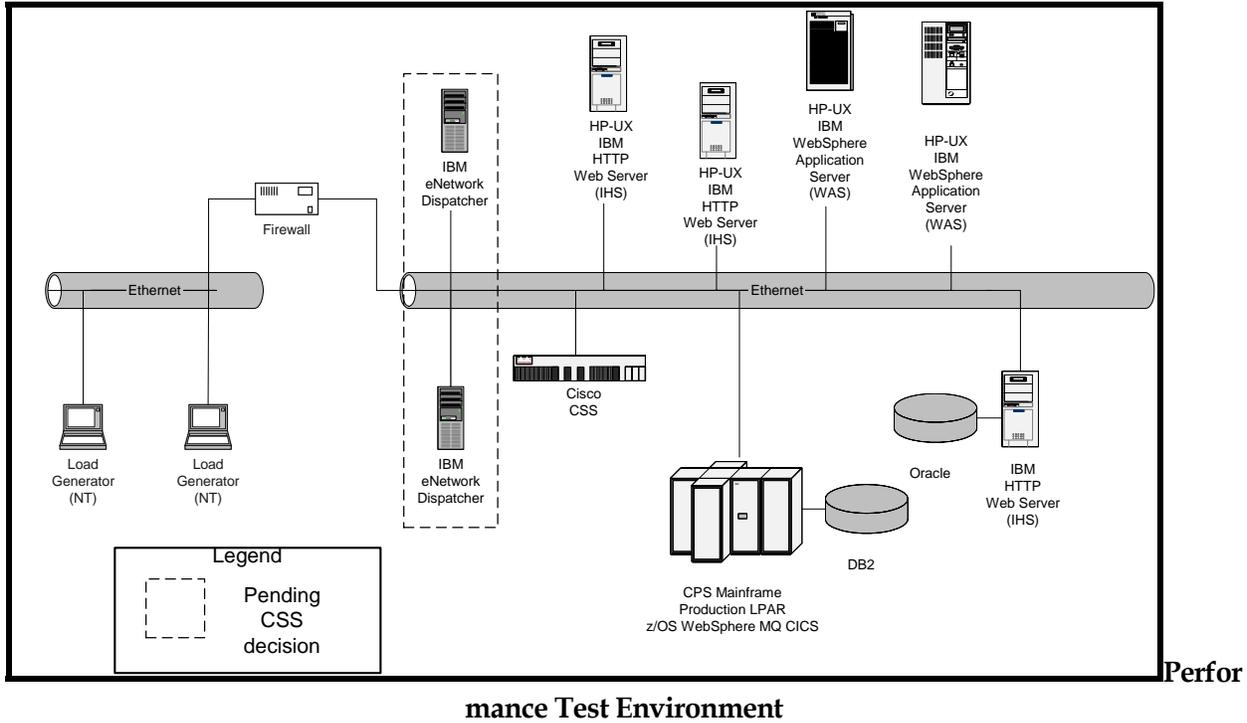
Upon test conclusion

Pearson:

- Clean out temp save databases prior to 8:30 am.
- Mainframe will process the submitted FAFSA records. Once these records are processed, ITA will need to *TBD*. These records may be used for any additional cycles deemed necessary due to complications discovered during cycle 24. (ITA will need this on or before *TBD*).

6 Technical Infrastructure

6.1 FAFSA 8.0 Performance Test Environment

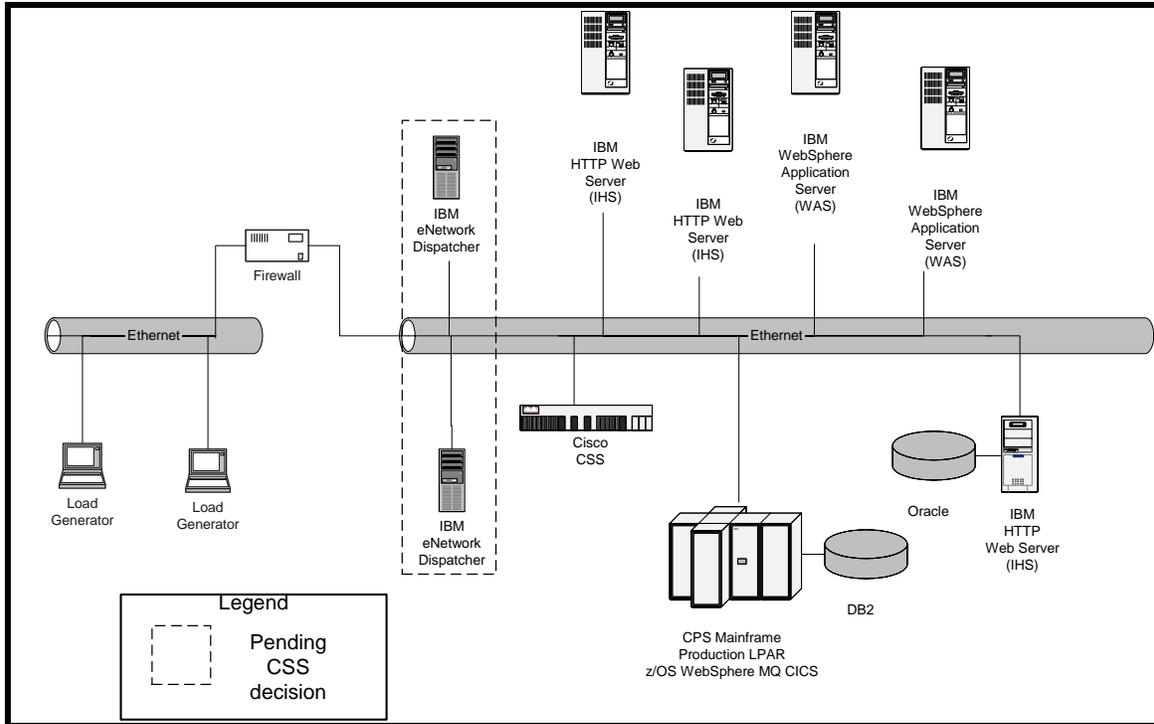


6.1.1 Performance Test Environment Requirements

- The Performance Environment mirrors the proposed Production Environment as closely as possible.
- CSS load balancing will handle 3000 concurrent virtual users.
- Network bandwidth will provide more than 100 MB/sec.

6.1.2 Configuration -- 9/15/2003 to 10/15/2003

- Network Deployment: Sun E220/1 CPU/1 GB RAM: SU22E20 Primary, SU22E24 Secondary. OS: Solaris 2.8 and CSS
- Web Servers: HPL14 (4X450 CPU and 8 GB memory), HPL17 (4X450 CPU and 8 GB memory). OS: HP-UX 11i and IHS 1.3.26
- App Servers: HPN3 (8X360 CPU and 8 GB memory), HPN8 (8X750 CPU and 16 GB memory). OS: HP-UX 11i and WAS 5.0



Modified Performance Test Environment- post 10/15/2003

6.1.3 Configuration -- After 10/15/2003 (3 HP machines will arrive to allow the performance environment to mirror production environment)

- Network Deployment: Sun E220/1 CPU/1 GB RAM: SU22E20 Primary, SU22E24 Secondary. OS: Solaris 2.8 and CSS
- Web Servers: HPNXX (8X750 CPU and 8 GB memory), HPNXX (8X750 CPU and 8 GB memory). OS: HPUX 11i and IHS 1.3.26
- App Servers: HPNX (8X750 CPU and 8 GB memory), HPN8 (8X750 CPU and 16 GB memory). OS: HPUX11i and WAS 5.0



7 Performance Monitoring

Performance monitoring detailed information:

7.1 Performance Monitoring Table

The table 7.1 lists each performance area, associated performance monitoring points, a general description, and the group responsible to monitor the area. This document will be supplied to those responsible to monitor tests. It will ensure that all required areas would be monitored.

Table 7.1 Performance Monitoring Table

Performance Areas	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 waiting 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



<p>CSS</p>	<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. 	<p>CSS is a load-balancing tool. It balances http requests between web servers.</p>	<p>ITA</p>
<p>CPU utilization</p>	<ul style="list-style-type: none"> • 2 web servers (HPL14 and HPL17). • 2 application servers (HPN3 and HPN8) • HPN25 Databases. • CPS Mainframe DB2 database server. • WebSphere MQ 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"> • CSS servers. • 2 web servers (HPL14 and HPL17). • 2 application servers (HPN3 and HPN8) • HPN25 Database (FAFSASTG, SESSST2, EACSTG). • CPS Mainframe DB2 database server. • WebSphere MQ 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>



<p>Disk I/O</p>	<ul style="list-style-type: none">• CSS servers.• 2 web servers (HPL14 and HPL17).• 2 application servers (HPN3 and HPN8).• HPN25 Databases (FAFSASTG, SESSST2, EACSTG).• CPS Mainframe DB2 database server.• WebSphere MQ 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>	<p>CSC</p>
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<p>Network Utilization</p>	<ul style="list-style-type: none"> • Connections from firewall to CSS Dispatchers. • CSS 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>	<p>CSC</p>
<p>Throughput</p>	<ul style="list-style-type: none"> • Megabytes per second. 	<p>Volume processed in a specified period by system or system component.</p>	<p>ITA</p>
<p>Hits Per Second</p>	<ul style="list-style-type: none"> • Hits per second. 	<p>The number of hits per second on the application.</p>	<p>ITA</p>
<p>User Response Times</p>	<ul style="list-style-type: none"> • Average, minimum, and maximum times for SSL pages. • Average, minimum, and maximum times for non-SSL pages. 	<p>Elapsed time between two events measured at specific points.</p>	<p>ITA</p>
<p>Servlet Performance</p>	<ul style="list-style-type: none"> • Servlet and JSP performance 	<p>The performance of each of the servlets and JSPs as they are accessed by the test script.</p>	<p>ITA</p>
<p>Database Optimization</p>	<ul style="list-style-type: none"> • Database performance. • Tables and Indexes. • Database calls. 	<p>The database performance should be monitored. Oracle and DB2 database should be optimized.</p>	<p>CSC</p>
<p>EAI Performance</p>	<ul style="list-style-type: none"> • Number of transactions between FAFSA and CPS. • Number of transaction queued in CPS. • Message across channel per second database performance. 	<p>EAI component should be monitored and optimized.</p>	<p>EAI</p>



CPS Performance	<ul style="list-style-type: none">• CPS performance	Pearson will generate additional load on CPS during FAFSA performance test.	Pearson
CPS Performance	<ul style="list-style-type: none">• CPS performance	Monitor and optimized CPS.	CSC
Application Performance	<ul style="list-style-type: none">• Application Code	Pearson will monitor the application log file(s). Monitor and optimized the application code.	Pearson



8 Capacity Estimates

Capacity Planning Estimates for 2003- 2004 peak period. ITA relies on Web Trends reports to complete the tables below.

8.1 Capacity Planning Estimates Table for FAFSA 8.0

Capacity Planning Estimates Table

Assuming TBD growth from FAFSA 7.0

Category	FAFSA 8.0 Predict (17 hours)	FAFSA 8.0 Predict 4% Increase
Hits/day		
Hits Homepage/day		
Page Views/day		
Users/day		
User session length (min)		
Temp Apps/day		
App Submits/day		

FAFSA 8.0 Peak Hour Assumptions

Hits/hour		
Hits Homepage/hour		
Page Views/hour		
Users/hour		
User session length (min)		

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

FAFSA 8.0 Peak Hour Calculations

Hits/sec		
Hits homepage/sec		
Page views/sec		
No. of concurrent users		
Hits/user		
Page views/user		



8.2 Capacity Planning Estimates Table for FAFSA8.0

Category	FAFSA 8.0 Predict (17 hours)	(24 hours)	FAFSA 8.0 Actual (17 hours)
Hits/day			
Hits Homepage/day			
Page Views/day			
Users/day			
User session length (min)			
Temp Apps/day			
App Submits/day			
Hits/hour			
Hits Homepage/hour			
Page Views/hour			
Users/hour			
User session length (min)			
Hits/sec			
Hits homepage/sec			
Page views/sec			
No. of concurrent users			
Hits/user			
Page views/user			
user think time (sec)			



8.3 PIN Capacity Planning:

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

Business Process	Jan	Feb	Mar	Apr	May	Jun	July	Aug
Authentication	N/A							
Registration	N/A							

After acquiring 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 transactions per hour.

- Registration transactions per hour (*TBD*% growth)
- Authentication (FAFSA): *TBD* transactions per hour
- Authentication (Other Applications): *TBD* transactions per hour