

FSA Integration Partner

United States Department of Education
Federal Student Aid



**Integrated Technical Architecture
FAFSA 8.0 and ED PIN
Performance Test Results**

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Table of Contents

1 INTRODUCTION..... 3

2 EXECUTIVE SUMMARY 4

 2.1 *Current Test Results*..... 4

 2.2 *Results Achieved* 4

 2.3 *Recommendations* 4

3 PERFORMANCE TEST - HIGH LEVEL SUMMARY 5

IBM HTTP Server - Web Server: 5

4 PERFORMANCE TESTS – DETAILED DESCRIPTION..... 7

 4.1 *Performance Test – Cycle 1*..... 7

 4.2 *Performance Test – Cycle 2*..... 9

 4.3 *Performance Test – Cycle 2a*..... 11

 4.4 *Performance Test – Cycle 3*..... 12

 4.5 *Performance Test – Cycle 4*..... 14

 4.6 *Performance Test – Cycle 5*..... 16

 4.7 *Performance Test – Cycle 6*..... 18

 4.8 *Performance Test – Cycle 7*..... 20

 4.9 *Performance Test – Cycle 8*..... 23

 4.10 *Performance Test – Cycle 9*..... 24

 4.11 *Performance Test – Cycle 10*..... 25

 4.12 *Performance Test – Cycle 11*..... 29

 4.13 *Performance Test – Cycle 12*..... 31

 4.14 *Performance Test – Cycle 13*..... 32

 4.15 *Performance Test – Cycle 14*..... 34

 4.16 *Performance Test – Cycle 15*..... 36

 4.17 *Performance Test – Cycle 16*..... 37

 4.18 *Performance Test – Cycle 17*..... 39

 4.19 *Performance Test – Cycle 18*..... 41

 4.20 *Performance Test – Cycle 19*..... 45

 4.21 *Performance Test – Cycle 20*..... 47

 4.22 *Performance Test – Cycle 21*..... 48

 4.23 *Performance Test – Cycle 22*..... 49

 4.24 *Performance Test – Cycle 23*..... 52

 4.25 *Performance Test – Cycle 24*..... 54

5 CAPACITY PLANNING..... 57

 5.1 *Number of Users*..... 57

 5.2 *Extrapolations*..... 58

6 ENVIRONMENT RECOMMENDATIONS..... 59

7 FAFSA 8.0 PERFORMANCE TEST ISSUE LIST 61

 7.1 *New and Open Action Items*..... 61

 7.2 *Completed Action Items* 62



1 Introduction

The U.S. Department of Education's Office of Federal Student Aid (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 federal financial aid make use of the FAFSA program. Over 7 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 30% 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 FAFSA Web product is commonly referred to as 'FAFSA on the Web' and incorporates all requirements related to the paper FAFSA for each school year. Due to the planned increase in Internet application submissions, an intensive performance testing effort was planned and conducted, as summarized in this document.

PIN is used by Department of Education to associate students with their records. The number of applications that use PIN is growing. FSA anticipates the usage of the PIN application by FAFSA will increase by 30%. There are three major components for PIN: FAFSA PIN, HTML PIN and PIN Web Services. FAFSA PIN is the authentication functionality of FAFSA that allows users to securely access FAFSA business processes. HTML PIN authentication is used by other FSA applications. PIN Web Services is authentication used only by the DLSS application. Pin Registration and PIN Authentication - Web Services were performance tested to ensure that they could handle the FAFSA peak load.

2 Executive Summary

2.1 Current Test Results

The purpose of the Performance Test was to identify and resolve bottlenecks in the application, architecture, and infrastructure. The Performance Test also helped determine the optimal configuration for the production environment. In addition, the testing effort helped to determine capacity requirements and to prove that the application would scale and handle the 2004 peak traffic.

All of the goals outlined in the Performance Test Plan were met. There were several key bottlenecks that were identified and resolved, which improved the performance of the application.

2.2 Results Achieved

The performance problems and recommended fixes are categorized by component ranging from Web Server to Mainframe. The specific changes made are included in Section 3 of this document.

- FAFSA Application Code
- Content Switch Server - (CSS)
- IBM HTTP Server - Web Server (IHS)
- IBM WebSphere Application Server (WAS)
- WebSphere MQ
- Database Access (Oracle and DB2)
- Mainframe
- Infrastructure

In addition to these enhancements, the performance testing resulted in an optimized configuration of the environment.

2.3 Recommendations

The performance testing effort found areas for enhancements to the application, architecture, and infrastructure. Below is the high level list of items that could be evaluated in the future for potential performance improvements to the system:

- Fix-pack 2 is available for WAS 5.0 and addresses several known issues in WAS 5.01.
- IHS version 2.0 is now available and should be incorporated into the FAFSA production environment. This will require extensive testing to ensure production stability.
- Dynamic page caching on WAS is recommended because it minimizes the application server's workload. This will require in depth integration with the development team.

3 Performance Test - High Level Summary

Overall, twenty-four tests were executed from October through the end of December. Each performance test cycle was focused on a specific area of the FAFSA Application. A series of infrastructure tests were run to identify issues with the network, hardware, Web servers, and Application servers. The business process scripts focused on the backend, including WAS, Oracle, DB2, Shadow Direct, MQ, and the Mainframe. The details for each run with conclusions are outlined in Section 4 of this document.

The performance problems and recommended fixes have been outlined below. The recommended performance enhancements are categorized by component ranging from Web Server to Mainframe.

FAFSA Application Code:

- FAFSA Application Code was updated to invalidate sessions in the FAFSA Corrections business process. The code update was made to minimize memory usage and disk space in the database.
- The MYAD mainframe module was updated to use database locks more efficiently. This reduced the amount of CPU utilization required by this module.

IBM HTTP Server - Web Server:

- The maximum number of web deamons allowed per web server (max clients) is set to 768. This will allow for the most efficient use of resources.
- MaxKeepAliveRequests or maximum number of requests per daemon is set to 10,000,000 before the connection is reset.
- Keep Alive Timeout setting set to 5 seconds. This allows the web server to use web deamons more efficiently.

IBM WebSphere Application Server:

- Updated the version of WebSphere to WAS 5.01 + PQ77056 + PQ71950 +PQ72597.
- JVM Memory Size set to 1GB. This allowed us to better utilize the memory on each application server.
- Number of clones per server is set to 2, to better utilize the memory on each application server without creating problems with large number of clones.

MQ:

- Add new FAFSA 8.0 services (ISIR, Tax Calculator) to WebSphere MQ to enable those functions.



Mainframe:

- The TMON monitoring software needs a PTF applied to eliminate abends occurring on the mainframe.
- QPASA also has a PTF which will eliminate abends which occurred during the testing.
- A PTF needs to be applied which eliminates CKB4 and CKB5 abends.

DB2:

- All indexes must be properly added to the DB2 database for the most efficient database and mainframe processing.

Content Services Switch (CSS):

- The redundancy of the CSS should be set to Box-To-Box. There are known issues with Adaptive Server Redundancy which limit the number of ports available for use.
- Advanced IP should be turned off. Turning this off will disable the "sticky IP" function of the CSS and allow for more efficient use of CPU and ports.

4 Performance Tests – Detailed Description

4.1 Performance Test – Cycle 1

Test 1

- FAFSA 8.0 Performance Test Cycle 1 was executed on October 2, 2003.
- Hardware & configuration:
 - Web server – HPL14 (4-way, 450 MHz, 8 GB memory. Max web client set to 1024)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to run the Fill Out a FAFSA 8.0 script with up to 1000 concurrent users.

Summary of Results:

In total, a 700-user load was executed for Test 1.

The test commenced with a gradual ramp up of users, and the 500-user load was maintained for approximately 20 minutes. The test produced the following statistics for percentage utilization of CPU and Memory for the application server HPN8: 14% and 13%, respectively. As for the web server HPL14, the average percentage utilization of CPU and Memory was 70% and 10%, respectively. The average number of application submissions for FAFSA 8.0 was 23.4, while temporary saves averaged 37.6 per minute. CICS processed 240 transactions per minute. EAI processed 220 transactions per minute. At 500 users, the single web server was close to the 75% threshold for CPU bottlenecks. The application server showed no problems at 500 users and maintained the CPU utilization at this level. Memory was not a problem for either of the servers.

After 20 minutes, the number of users increased to 700. The server utilization statistics, on average, for the application server were: 20% CPU and 14% Memory for HPN8. The web server utilization exhibited these average statistics: 94% CPU and 14% Memory for HPL14. Errors on the session id occurred and transactions failed with the web server utilization at such a high level. 1000 users was not reached with the current configuration. The need for a load balancer and a 2 web server environment is required to test 1000 concurrent users. The application server showed no signs of problems at 700 users and will not need additional resources for the 1000 user level.

Test 1 of cycle 1 performance test of the Fill Out a FAFSA 8.0 business process ran with errors at the 700 user level.



Test 2

- FAFSA 8.0 Performance Test Cycle 1 was executed on October 2, 2003.
- Hardware & configuration:
 - Web server – HPL14 and HPL17 (4-way, 450 MHz, 8 GB memory. Max web client set to 1024)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to run the Fill Out a FAFSA 8.0 script with up to 1000 concurrent users.

Summary of Results:

In total, a 1200-user load was executed for Test 2. eNetwork Dispatcher was turned on in the performance test environment in order to achieve a two web server environment.

The test commenced with a gradual ramp up of users, and the 700-user load was maintained for approximately 15 minutes. The test produced the following statistics for percentage utilization of CPU and Memory for the application server HPN8: 22% and 14%, respectively. As for the web server HPL14, the average percentage utilization of CPU and Memory was 46% and 80%, respectively, and for HPL17, the averages were 47% and 8%, respectively. The average number of application submissions for FAFSA 8.0 was 30.8, while temporary saves averaged 31.6 per minute. CICS processed 226 transactions per minute. EAI processed 290 transactions per minute. At 700 users, the dual web servers were able to handle the load much more efficiently. The application server again showed no problems at 700 users and maintained the CPU utilization at this level. Memory was not a problem for any of the servers.

After 20 minutes, the number of users increased to 1000. The server utilization statistics, on average, for the application server were: 30% CPU and 14% Memory for HPN8. The web server utilization exhibited these average statistics: 80% CPU and 11% Memory for HPL14 and 65% CPU and 10% Memory for HPL17. The normal threshold for CPU utilization is 75% which was exceeded at the 1000 user level on one web server. However, no errors were generated and the processing continued error free. The 1000 user load was maintained for 25 minutes. The average number of application submissions for FAFSA 8.0 was 41.6, while temporary saves averaged 46.4 per minute. CICS processed 388 transactions per minute on average. EAI processed 330 transactions per minute on average.

After 1000 users were maintained for 25 minutes, 1200 users were tested. Once the 1200 user level was reached, it was maintained for 30 minutes. The server utilization statistics, on average, for the application server were: 29% CPU and 14% Memory for HPN8. The web server utilization exhibited these average statistics: 91% CPU and 12% Memory for HPL14 and 88% CPU and 11% Memory for HPL17. The capacity of the web servers in production is greater with Akamai handling most of the static content. Therefore, even though the performance test environment has reached a limit with the number of users it can concurrently test, production



can handle a greater load. No errors were seen at this level of users and overall response time increased minimally over the 7000 user load.

Conclusions - Cycle 1:

- The Fill Out a FAFSA business process was successfully tested with 1000 concurrent users.
- The need for a load balancer and a 2 web server environment is required to test 1000 concurrent users.
- The capacity of the web servers in production is greater with Akamai handling most of the static content. Therefore, even though the performance test environment has reached a limit with the number of users it can concurrently test, production can handle a greater load.
- It was noted that Tripwire kicks in every 15 minutes in the performance test and production environments. When Tripwires kicks in, a sudden spike in web server CPU occurs (one example was when CPU spiked from 60% to 85% when Tripwire kicked in).

4.2 Performance Test - Cycle 2

Test 1

- FAFSA 8.0 Performance Test Cycle 2 was executed on October 08, 2003.
- Hardware & configuration:
 - Web server - HPL14 and HPL17 (4-way, 450 MHz, 8 GB memory. Max client set to 1024)
 - App server - HPN3 and HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: FAFSA Corrections
- Goals: The goal of this test cycle was to run the FAFSA Corrections 8.0 script with up to 3000 concurrent users.

Summary of Results:

In total, a 1144 user load was executed for Test 1.

The test commenced with a gradual ramp up of users with 10 users added every 30 seconds. After 20 minutes of execution, a total of 1144 users were reached. At this time, data issues began to appear due to the unique SSN parameter. The ramp up was discontinued which prevented more of these errors. After another 30 minutes of execution, the users that were running from the SFANT031 machine began to fail. The errors generated were "No buffer space available" on the Load Generator box. At this time, HPL14 was tested and was not responsive. Matt Kain also attempted to connect and received a connection error from the database. The Load Generator box appeared to correct itself and showed a "Ready" state. This test was ended after the number of users fell to less than half of the 1144 load.

The test produced the following statistics for percentage utilization of CPU and Memory for the application servers (HPN8): 25% and 22%, respectively (HPN3): 59% and 19%, respectively. The average percentage utilization of CPU and Memory was 30% and 22% respectively for HPL14 and 31% and 22% respectively for HPL17. The average number of application submissions for FAFSA 8.0 was 15, while temporary saves was 186 averaged per minute. CICS processed 282 transactions per minute. EAI processed 250 transactions per minute. At 1144 users, the architecture showed no signs of performance implications at the current user load. All web and application servers sustained CPU and memory utilization well below the thresholds. The errors that occurred after 45 minutes did not allow accurate predictions of the sustainable user load.

Test 1 of the Cycle 2 Performance Test of the FAFSA Corrections 8.0 business process ran with errors at the 1144 user level.

No mainframe bottlenecks had been identified at the transaction volume tested thus far. DB2 support will review the size of the DB2 EDM pool to determine if the bad data is the result of a too-small EDM pool or the result of a different interpretation of measurement data due to the DB2 release upgrade. The bad data does not appear to have any bearing on DB2 service time at the FAFSA transaction volumes currently being tested.

Test 2

- FAFSA 8.0 Performance Test Cycle 2 was executed on October 08, 2003.
- Hardware & configuration:
 - Web server – HPL14 and HPL17 (4-way, 450 MHz, 8 GB memory. Max client set to 1024)
 - App server – HPN3 and HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: FAFSA Corrections and Fill Out a FAFSA
- Goals: The goal of this test cycle was to run the FAFSA Corrections 8.0 script with up to 3000 concurrent users.

Summary of Results:

Due to data constraints, Test 2 was planned for 50% of the total users running FAFSA Corrections 8.0 and the other 50% running Fill Out a FAFSA 8.0. The number of iterations was updated to five for Fill Out a FAFSA 8.0 to allow for the maximum number of users to enter the system while Corrections was kept at one iteration. The number of users was increased to 2280 and held, but users began to timeout due to a 120 millisecond timeout in the run time settings. The test was stopped and restarted with the standard 600 millisecond timeout used in most performance testing.

The number of concurrent users was ramped up to 1500 at the restart of the test and was held for approximately 30 minutes before timeout errors began occurring again; this time at 600 milliseconds. There was no immediate justification for the page timeouts. CSC confirmed the

configuration for CSS would allow approximately 65,000 connections per session between CSS and the web servers. The total number of connections was not reached.

The test produced the following statistics for percentage utilization of CPU and Memory for the application servers (HPN8): 54% and 18%, respectively; (HPN3): 65% and 19%, respectively. The average percentage utilization of CPU and Memory was 28% and 28% respectively for HPL14 and 22% and 21% respectively for HPL17. CICS processed 360 transactions per minute, and EAI processed 350 transactions per minute. Much like Test 1 of Cycle 2, this test was not run for a significant amount of time before errors began to occur. The performance architecture with CSS could not be validated due to the timeout of users even at the 1500 user level. At the conclusion of testing, the performance test teams were working on resolving the unknown issues regarding page timeouts.

Test 2 of Cycle 2 Performance Test of the FAFSA Corrections 8.0 and Fill Out a FAFSA 8.0 business processes ran with errors.

Conclusions - Cycle 2:

- The FAFSA Corrections business process was not successfully tested with 3000 concurrent users.
- The performance architecture with CSS could not be validated due to the timeout of users even at the 1500 user level.

4.3 Performance Test - Cycle 2a

Test 1

- FAFSA 8.0 Performance Test Cycle 2a was executed on October 09, 2003.
- Hardware & configuration:
 - Web server - HPL14 and HPL17 (4-way, 450 MHz, 8 GB memory. Max client set to 1024)
 - App server - HPN3 and HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: FAFSA Corrections
- Goals: The goal of this test cycle was to run the FAFSA Corrections 8.0 script with 1000 concurrent users and to successfully run a consistent load of users for 1 hour with the cumulative patch installed on IHS.

Summary of Results:

In total, a 1000 user load was executed for Test 1 for duration of 1 hour and 15 minutes.

The test commenced with a gradual ramp up of users with 10 users added every 30 seconds. After 20 minutes of execution, a total 1000 users was reached. The goal of this test was to successfully run a consistent load of users for 1 hour with the cumulative patch installed on IHS. The testing lasted over one hour and successfully sustained the user load with no problems with the new patch.

Test 1 of Cycle 2a Performance Test of the FAFSA Corrections 8.0 business process ran error free at the 1000 user level.

Test 2

- FAFSA 8.0 Performance Test Cycle 2a was executed on October 09, 2003.
- Hardware & configuration:
 - Web server – HPL14 and HPL17 (4-way, 450 MHz, 8 GB memory. Max client set to 1024)
 - App server – HPN3 and HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: FAFSA Corrections
- Goals: The goal of this test cycle was to run the FAFSA Corrections 8.0 script with 1000 concurrent users and to debug the problems experienced with CSS in previous test cycles.

Summary of Results:

In total, a 1000 user load was executed for Test 2 for duration of 1 hour and 15 minutes.

Due to the success of Network Dispatcher in the earlier test, a test of CSS was initiated. The test commenced with a gradual ramp up of users with 10 users added every 30 seconds. After 20 minutes of execution, a total 1000 users was reached. The goal of this test was to debug the problems experienced with CSS in previous test cycles. The testing lasted over one hour and was successful sustaining the user load with no problems experienced with CSS. No problems were able to be recreated.

Test 2 of Cycle 2a Performance Test of the FAFSA Corrections 8.0 business process ran error free at the 1000 user level.

Conclusions – Cycle 2a:

- The FAFSA Corrections business process was successfully tested with 1000 concurrent users.
- The testing lasted over one hour and successfully sustained the user load with no problems with the new patch.
- The testing lasted over one hour and was successful sustaining the user load with no problems experienced with CSS. No problems were able to be recreated.

4.4 Performance Test – Cycle 3

Test 1

- FAFSA 8.0 Performance Test Cycle 3 was executed on October 10, 2003.
- Hardware & configuration:

- Web server – HPL14 and HPL17 (4-way, 450 MHz, 8 GB memory. Max client set to 1024)
- App server – HPN3 and HPN8 (8-way, 750 MHz, 8 GB memory)
- Database – DB2 on CICS mainframe environment
- Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA and FAFSA Corrections
- Goals: The goal of this test cycle was to run the Fill Out a FAFSA 8.0 and FAFSA Corrections 8.0 script with up to 3000 concurrent users and 50% of the users on each process.

Summary of Results:

The first test reached about 1000 users, however we started seeing user fail at different places. After investigating this scenario, we noticed that one of the application servers (HPN3) was really high on CPU and disk usage. It was discovered that a process 'bpbkar' was running at 100% disk utilization which was causing a bottle neck on the application server HPN3. This process is associated with Veritas NetBackup. The development environment was in the process of conducting their backup procedure which was adding additional traffic on the network and adversely affecting the performance environment. This had not been encountered during other performance tests that were conducted on Tuesdays or Thursdays. The 'bpbkar' process was stopped and the test was restarted.

Test 2

- FAFSA 8.0 Performance Test Cycle 3 was executed on October 10, 2003.
- Hardware & configuration:
 - Web server – HPL14 and HPL17 (4-way, 450 MHz, 8 GB memory. Max client set to 1024)
 - App server – HPN3 and HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA and FAFSA Corrections
- Goals: The goal of this test cycle was to run the Fill Out a FAFSA 8.0 and FAFSA Corrections 8.0 script with up to 3000 concurrent users and 50% of the users on each process.

Summary of Results:

The second test was conducted with the same configuration as the first test. We were running the FAFSA Corrections script for this test. We were able to reach 1500 users with the following statistics. CPU on the web servers was 30% and 40%. CPU on the application servers was 51% and 20%. Average response time was less than 3 seconds.

We ran this test for 45 minutes. One of the Load Generator boxes experienced a problem at this point and the test was ended.

We found a minor issue in this test: The FAFSA Corrections business process was not invalidating the session. Pearson was notified of this issue.

In the previous test (Cycle 2), we had noticed that the temp save database had a long response time (500 ms response time). In today's test, we did not see this issue. The response time was less than 20 ms.

Conclusions - Cycle 3:

- The Fill Out a FAFSA 8.0 and FAFSA Corrections 8.0 scripts were not successfully tested with up to 3000 concurrent users and 50% of the users on each process.

4.5 Performance Test - Cycle 4

Test 1

- FAFSA 8.0 Performance Test Cycle 4 was executed on October 14, 2003.
- Hardware & configuration:
 - Web server - HPL14 and HPL17 (4-way, 450 MHz, 8 GB memory. Max client set to 1024)
 - App server - HPN3 and HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA and FAFSA Renewals
- Goals: The goal of this test cycle was to run the Fill Out a FAFSA 8.0 and FAFSA Renewals 8.0 script with up to 3000 concurrent users and 50% of the users on each process.

Summary of Results:

For the first test, we ran the FAFSA Renewal script with 2000 users. The application logging was turned to "INFO" which started to slow down the users because it was writing all the messages to the log file. Thus, this test was stopped and the logging level was set to "ERROR".

At the intervals ending 10:45, 12:00, and 12:15, it appeared that transaction processing through CICS was delayed. In all three of these intervals, transactions queued in CICS (were delayed in ending). It does not appear that the mainframe was overworked, only that transactions arrival rate exceeded service rate. DB2 support will look at DB2 statistics for those intervals.

Test 2

- FAFSA 8.0 Performance Test Cycle 4 was executed on October 14, 2003.
- Hardware & configuration:
 - Web server - HPL14 and HPL17 (4-way, 450 MHz, 8 GB memory. Max client set to 1024)
 - App server - HPN3 and HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA and FAFSA Renewals



- Goals: The goal of this test cycle was to run the Fill Out a FAFSA 8.0 and FAFSA Renewals 8.0 script with up to 3000 concurrent users and 50% of the users on each process.

Summary of Results:

The second test was conducted with 50% of the users running FAFSA Renewals and 50% of the users running Fill Out a FAFSA. We reached 2,772 users in this run. The users started to complete their run so we could not go higher than 2,772. We ran this test for an hour. There were 10 users that failed with a "page download time" error. We had seen this error in the previous cycles and have tracked this in the issue log. CPU on the web servers was 65% and 70%. CPU on the application servers was 65% and 33%. Memory on the web servers was 27% and 32%. Memory on the application servers was 21% and 20%. Average response time was less than 3 seconds.

Test 3

- FAFSA 8.0 Performance Test Cycle 4 was executed on October 14, 2003.
- Hardware & configuration:
 - Web server - HPL14 and HPL17 (4-way, 450 MHz, 8 GB memory. Max client set to 1024)
 - App server - HPN3 and HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA and FAFSA Renewals
- Goals: The goal of this test cycle was to run the Fill Out a FAFSA 8.0 and FAFSA Renewals 8.0 script with up to 3000 concurrent users and 50% of the users on each process.

Summary of Results:

The third test was conducted with 50% of the users running FAFSA Renewals and 50% of the users running Fill Out a FAFSA. We reached 3000 users in this run with the following statistics. CPU on the web servers was 80% and 92%. CPU on the application servers was 91% and 40%. Memory on the web servers was 37% and 47%. Memory on the application servers was 23% and 22%. Average response time was less than 3 seconds.

The 3000 user level could not be sustained for this test. There was a problem between the Load Generator boxes and CSS. We observed connection errors. CSC will investigate the network, and CSS and Accenture will investigate the Load Runner boxes before the test this Thursday.

Conclusions - Cycle 4

- The Fill Out a FAFSA 8.0 and FAFSA Renewals 8.0 scripts were not successfully tested with up to 3000 concurrent users and 50% of the users on each process.
- There were 10 users that failed with a "page download time" error. We had seen this error in the previous cycles and have tracked this in the issue log.

- There was a problem between the Load Generator boxes and CSS. We observed connection errors.

4.6 Performance Test - Cycle 5

Test 1

- FAFSA 8.0 Performance Test Cycle 5 was executed on October 16, 2003.
- Hardware & configuration:
 - Web server - HPL14 and HPL17 (4-way, 450 MHz, 8 GB memory. Max client set to 1024)
 - App server - HPN3 and HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: FAA Renewals
- Goals: The goal of this test cycle was to run the FAA Renewals 8.0 script with up to 2000 concurrent users.

Summary of Results:

For the first test, we ran the FAA Renewals script with 2000 users. We did not observe any issues in this test. Here are the statistics with 2000 users. CPU on the web servers was 4% and 4%. CPU on the application servers was 25% and 12%. Memory on the web servers was 5% and 5%. Memory on the application servers was 8% and 18%. Average response time was less than 3 seconds.

Test 2

- FAFSA 8.0 Performance Test Cycle 5 was executed on October 16, 2003.
- Hardware & configuration:
 - Web server - HPL14 and HPL17 (4-way, 450 MHz, 8 GB memory. Max client set to 1024)
 - App server - HPN3 and HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to run the short Fill Out a FAFSA 8.0 script with up to 3000 concurrent users and to try and recreate the error from previous cycles.

Summary of Results:

The second test was conducted with the short Fill Out a FAFSA 8.0 script (users will go up to the first temp save prompt, save the application, and exit). We ran this test for an hour. The purpose of this test was to build up connections (or that unknown factor which causes the test to fail after 2 hours). We ran 3000 users in this test and stopped the test. The error from previous cycles was not recreated. Here are the statistics with 1500 users. Average CPU on the web servers RP2 and RP4 was 4% and 4.5%, respectively. Average CPU on the application servers RP3 and HPN8 was 17.5% and 12.5%, respectively. Average Memory on the web



servers RP2 and RP4 was 5 and 4.5%, respectively. Average Memory on the application servers RP3 and HPN8 was 8% and 18%, respectively.

Test 3

- FAFSA 8.0 Performance Test Cycle 5 was executed on October 16, 2003.
- Hardware & configuration:
 - Web server - HPL14 and HPL17 (4-way, 450 MHz, 8 GB memory. Max client set to 1024)
 - App server - HPN3 and HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to run the normal Fill Out a FAFSA 8.0 script with up to 3000 concurrent users and to try and recreate the error from previous cycles.

Summary of Results:

The third test was conducted with the normal Fill Out a FAFSA 8.0 script with 3000 users. We ran this test for an hour and half. We saw some data errors in this test, but we did not recreate the problem we saw in Cycle 4. The CPU on the web servers RP2 and RP4 were 3 and 4, respectively. The CPU on the application servers HPN8 and RP3 were 15 and 14, respectively. These CPU statistics were taken at 1000 users.

Test 4

- FAFSA 8.0 Performance Test Cycle 5 was executed on October 16, 2003.
- Hardware & configuration:
 - Web server - HPL14 and HPL17 (4-way, 450 MHz, 8 GB memory. Max client set to 1024)
 - App server - HPN3 and HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to run the normal Fill Out a FAFSA 8.0 script with up to 3000 concurrent users and to try and recreate the error from previous cycles.

Summary of Results:

The fourth test was conducted with the normal Fill Out a FAFSA 8.0 script with 3000 users. We had a clean run this time (no errors). We ran this test for an hour. The average response time was less than 3 seconds.

We could not recreate the problem that we saw in Cycle 4 (connection ended prematurely and could not reach to "perf.fotw.ed.gov"). There were three things that were changed from Cycle 4 to Cycle 5.

1) Performance Test hardware refresh: 2 web servers and 1 application server were changed in the Performance Test environment.

2) Load Generator boxes were not utilized equally. There are two Load Generator boxes in the Performance Test environment and they were not utilized (balancing load) equally. We ended up manually balancing the load for the tests.

3) On Tuesday, we were ramping the users really fast (we had 3000 users in 15 minutes) and for this Cycle we had 3000 users in 25 minutes.

Conclusions-Cycle 5

- The FAA Renewals script was successfully tested with 2000 concurrent users.
- The normal Fill Out a FAFSA 8.0 script was successfully tested with 3000 concurrent users, but we could not recreate the problem we saw in Cycle 4.

4.7 Performance Test - Cycle 6

Test 1

- FAFSA 8.0 Performance Test Cycle 6 was executed on October 21, 2003.
- Hardware & configuration:
 - Web server - RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024)
 - App server - HPN8 and RP3 (8-way, 750 MHz, 8 GB memory)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: FAA Corrections
- Goals: The goal of this test cycle was to run the FAA Corrections 8.0 script with up to 1500 concurrent users.

Summary of Results:

For the test, the FAA Corrections script was run with 1500 concurrent users. The test was executed for approximately 1 hour. After several attempts were unsuccessful due to data related issues, this test began at 10:00 AM ET. The temp saves and mainframe data were cleared prior to the start of the test. The number of users was gradually ramped up to 1000 and maintained for 25 minutes before raising the users to 1500 at 10:25. At about this time in the test, we started seeing Load Runner users fail. We saw 2 - 10 seconds response time on MQ and over 30 seconds response time from Load Runner on some transactions. Tom Puddicombe (CSC) indicated that the CICS region on the mainframe was running 100% CPU and the arrival rate of transaction requests was faster than the completion rate, therefore requests were queuing. Scott Gray (EAI) reported that he got a page indicating a problem in the production environment. The test was stopped at this point. We experienced a FAFSA production outage for 4 minutes. CSS was not balancing the load evenly at this point - one web server had 565 connections and another had 529 connections.

The following are details of the performance test from the CICS perspective. (NOTE: all times are CPSP "system standard time" - Central Daylight Time).



The test load began at approximately 09:05. CPU demand in the CICSPTST address space increased as the workload ramped up. At 09:14 AM, the performance test represented 43% of the CPSP CPU utilization for the 15 minute statistics interval. At 09:29 AM, CPSP processor utilization was 100%. 78% of the utilization was attributed to the performance test service class, which includes CICSPTST and the MQSeries address space that supports it. DB2 CPU consumption attributed to DB2 threads originated by CICSPTST is also reflected in the 78%. RMF Monitor III reported that all address spaces received CPU service. The system appeared to be handling the load. At 09:44 AM, CICSPTST transaction service rate increased to 35 per second and performance test CPU demand increased to 82%. The system began to strain. Batch service classes CPU service was definitely being constrained. At 09:52 AM, (RMF III) service class ONLFOTWX (the WLM service class that contains the FAFSA performance test transactions) indicated that it was not meeting its goal (80% of transactions completed in .5 seconds or less). WLM attempted to help ONLFOTWX to meet its goal. Since the processor was 100% busy, WLM "robbed" batch to feed ONLFOTWX. At 09:54 AM, ONLFOTWX reported no transactions meeting goal and average response time was 3.225 seconds. ONLPRDHI (production) reported it was not meeting its goal (80% completed in .3 seconds), average response time was .626 seconds, and service rate was 3.3 per second. At around this time, timeouts were observed on the production application servers. At 09:56 AM, ONLPRDHI (production) reported meeting its goal, average response time was .059, and service rate was 8 transactions per second. ONLFOTWX reported service rate of 34.6 transactions per second with average service time of .122. At 09:58 AM, ONLPRDHI reported 9.4 transactions per second with an average service time of .162 (normal for this time of day). ONLFOTWX reported 34.6 transactions per second with a service time of .111. 09:59 AM was the end of the statistics interval. The number of users was ramped down at 10:14 AM. According to RMF III, between 9:52 AM and 10:12 AM, CPU demand from the online workloads (ONLPRDHI and ONLFOTWX) pre-empted CPU access to batch processing, at least one user was unable to log on to TSO, and TSO period 2 response time was elongated. At 10:29 AM, the ramp-down was completed.

CICSPTST was the address space consuming the most CPU time according to RMF III and TMON/MVS.

According to RMF Monitor III, the impact to production lasted less than 4 minutes. The length of the impact could not be determined based on the server logs.

The transactions in performance test used three times as much CPU and made twice as many DB2 requests as the production transactions. It is not known if the difference was merely the composition of the transaction mix. The performance test transaction script was "change FAFSA". The specific function(s) of the production transaction mix can not be determined from the measurement data.

Conclusions-Cycle 6

- The FAA Corrections 8.0 script was not successfully tested with up to 1500 concurrent users.

4.8 Performance Test - Cycle 7

Test 1

- FAFSA 8.0 Performance Test Cycle 7 was executed on October 23, 2003.
- Hardware & configuration:
 - Web server - RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024)
 - App server - HPN8 and RP3 (8-way, 750 MHz, 8 GB memory)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Student Access
- Goals: The goals of this test cycle was to run the Student Access 8.0 script with up to 3000 concurrent users, and to also try to recreate problems on the mainframe in the CICS region.

Summary of Results:

For the first test, one of the goals was to recreate the problems that have been occurring on the mainframe using the Student Access business process. This would serve multiple purposes: it would help narrow down the root cause of the problem, and if unable to recreate the errors, it would allow a successful test of this business process. When achieving 1500 users with Student Access, we began to see the "Connections ended prematurely" error and were unable to reproduce the mainframe errors. The test was ended at this point with errors.

Test 2

- FAFSA 8.0 Performance Test Cycle 7 was executed on October 23, 2003.
- Hardware & configuration:
 - Web server - RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024)
 - App server - HPN8 and RP3 (8-way, 750 MHz, 8 GB memory)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: FAA Corrections
- Goals: The goal of the test was to recreate the problems seen on the mainframe in Cycle 6.

Summary of Results:

The goal of test 2 was to recreate the problems seen on the mainframe in Cycle 6. Within five minutes of the start of the test, the problems were duplicated in the performance test environment and the test was completed. The CICS region for performance test reported a CPU utilization of 75% and abends (CKB4, CKB5, 2033, etc.) occurred. The number of CICS transactions per minute were 600 to 720.



Test 3

- FAFSA 8.0 Performance Test Cycle 7 was executed on October 23, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Student Access
- Goals: The goal of the test was to re-run the Student Access business process and achieve 1500 concurrent users.

Summary of Results:

The goal of Test 3 was to re-run the Student Access business process and achieve 1500 concurrent users. Once this test began, there were additional abends that occurred in the CICS region (OC1, OC4, 378, etc.). These occurred with CICS transactions happening at 858 per minute and 42% of the overall CPU being utilized. The region had to be restarted for the test to resume.

Test 4

- FAFSA 8.0 Performance Test Cycle 7 was executed on October 23, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Student Access
- Goals: The goal of the test was to re-run the Student Access business process and achieve 1500 concurrent users.

Summary of Results:

For the fourth test, the number of maximum clients allowed to connect to the Oracle session database was increased and the WAS application servers were recycled. At 11:57, there were 1320 users in the system. At 12:00, we began ramping up the users and reached 1630 users. At 12:01, the CICS region crashed and the following abends occurred: OC4, OC1, and 378. The abends (or abnormal end of task refers to software crash or outage) required the test to be stopped immediately to prevent additional problems in the environment. After Load Runner had been stopped, CICS could not be restarted due to the queues still sending messages. Once the queues had been flushed, the region was restarted. Prior to the end of the test, CICS transactions were occurring at 756 transactions per minute with a response time of .056 seconds.

Test 5

- FAFSA 8.0 Performance Test Cycle 7 was executed on October 23, 2003.
- Hardware & configuration:

- Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024)
- App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory)
- Database – DB2 on CICS mainframe environment
- Messaging – MQ handled traffic between app server and DB2
- Business Process: Home Page script
- Goals: The goal of this test was to perform the CSS failover testing using the Home Page script (a new script which does not touch any of the backend).

Summary of Results:

A CSS failover test was executed for test 5. A Home Page script was created so that each user was accessing the FAFSA on the Web home page and downloading all of the images on that page. The test was executed with 1000 users. The users were entering the system at rate of 10 users every 3 seconds. Between each iteration, there was no delay before starting the next iteration.

The test began at approximately 12:55. At 1:00, we had reached 1000 users and the users experienced errors of “Connection Prematurely Shut Down”. At this point, CSS began reporting Denial Of Service (DOS) attacks. The test was stopped to determine if there was a problem with the web servers that was causing the DOS attacks.

Test 6

- FAFSA 8.0 Performance Test Cycle 7 was executed on October 23, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Home Page script
- Goals: The goal of this test was to perform the CSS failover testing using the Home Page script (a new script which does not touch any of the backend).

Summary of Results:

Prior to starting the sixth test, the Load Generator boxes were configured to point to the web servers directly and bypass CSS. It was determined that the DOS attacks were more than likely coming from the dropped packets so the test was stopped and restarted with a lower number of users and with the Load Generators again utilizing CSS.

Test 7

- FAFSA 8.0 Performance Test Cycle 7 was executed on October 23, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory)



- Database – DB2 on CICS mainframe environment
- Messaging – MQ handled traffic between app server and DB2
- Business Process: Home Page script
- Goals: The goal of this test cycle was to perform the CSS failover testing using the Home Page script (a new script which does not touch any of the backend).

Summary of Results:

The seventh test began at 1:54 pm with 500 users and utilizing CSS. After 6 minutes, 500 users were in the system and 1903.17 hits per second were observed. The CSS failover began at 2:18. At 2:20, Load Runner reported 493 errors. The primary switch was brought back up and the number of errors increased to 619 at 2:23. At 2:26, the DOS attacks continued to be reported from CSS although Load Runner had stopped reporting errors. After the DOS attacks stopped, the primary CSS was brought back online. Upon bringing the primary back online, the hits per second in Load Runner began dropping drastically and quickly went to zero. After dropping to zero, the users began hitting the system again and hits per second increased to 1582. At 2:38, it was decided to attempt the failover by physically removing the connection. The connection was removed at 2:47, and this caused the hits per second to decrease immediately by approximately 100. The CSS failover test will be retested using a longer Fill Out a FAFSA script to try and avoid the denial of service attack errors.

Conclusions-Cycle 7

- The Student Access 8.0 script was not successfully tested with up to 1500 or 3000 concurrent users.
- The problems on the mainframe in the CICS region identified in Cycle 6 were recreated.
- DOS attacks were observed during CSS failover testing.

4.9 Performance Test – Cycle 8

Test 1

- FAFSA 8.0 Performance Test Cycle 8 was executed on October 24, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: WebSphere MQ Load Test W12
- Goals: The goal of this test cycle was to perform the WebSphere MQ Load Test.

Summary of Results:

Various tests were conducted to isolate whether the issues that we were seeing were related to infrastructure, application, or something else. During the test, it was discovered that DB2 was not indexed. Thus, the test was stopped and the DB2 index was added. This did not resolve the issue. Thus, more tests were conducted. The initial investigation showed that there was a

problem with the mainframe application code (MYAD module). Pearson is working to resolve this issue and they believe that they have found a fix.

Conclusions-Cycle 8

- DB2 was indexed as a result of this test.
- A problem with the mainframe application code (MYAD module) was identified and forwarded to Pearson.

4.10 Performance Test - Cycle 9

Test 1, 2, and 3

- FAFSA 8.0 Performance Test Cycle 9 was executed on October 28, 2003.
- Hardware & configuration:
 - Web server - RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024)
 - App server - HPN8 and RP3 (8-way, 750 MHz, 8 GB memory)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA (short)
- Goals: The goal of this test was to test the failover capabilities of CSS in the performance test environment.

Summary of Results:

For this test, a network sniffer was utilized for additional troubleshooting data. The script used for this test was a modified version of the Fill Out FAFSA business process. In this script, the users completed the application until the first temp save. At this point, the users saved their application, returned to the form, and exited the application completely.

We ran the CSS failover (shut down the primary CSS and let the backup CSS take control). We ramped up to 1000 users, and CSC removed the network cable from the primary CSS. Upon removing the connection, the hits per second on Load Runner quickly dropped to zero. The CSS switches were configured so that the backup switch would assume the role of primary switch when the primary switch was disabled. The backup switch did assume the primary role, however no users were able to successfully begin the application. At this point, no one could reach the FAFSA performance test website from any browsers (load generator or outside browser), and telnet to perf.fotw.ed.gov on ports 80 and 443 did not work either. The fiber connection was reconnected to the primary CSS, and four minutes later the users began successfully passing transactions. Bill Pallis reported that CSS was seeing some DOS attack messages. Thus, there were three issues that came out of this test.

- 1) Denial of Service Attacks occurred.
- 2) Framing errors on RP2 and RP4 occurred.
- 3) CSS failover is not working properly. The entire FAFSA performance site becomes unavailable once the primary CSS fails.



We ran several tests and CSC turned the tracing and sniffer on the network and collected all the necessary tracing information. This information will be sent to Cisco.

Test 4

- FAFSA 8.0 Performance Test Cycle 9 was executed on October 28, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: MQ Load Test W12
- Goals: The goal of this test was to also perform the WebSphere MQ Load Test.

Summary of Results:

In the past, W12 (edits and submits) transactions were executed, we saw about 8 CICS transactions per second with 70% CPU utilization. The resolution was that several indexes were added in the DB2 table. The MYAD module was changed (updated the SQL in the MYAD module to use locks efficiently).

Several tests were run on Monday to resolve the issue, and by the end of Monday it was believed that the issue was resolved.

Four tests were executed in the backend today. 1) W12 (only submits) transactions were run and 45 CICS transactions per seconds were observed with less than 40% CPU utilization. 2) W12 (only submits 50%) and W30 (50%) transactions were run which gave 65 CICS transactions per seconds with 30% CPU utilization. 3) W12 (submits and edits 50%), W30, W11, W14 transactions were run which gave 70 CICS transactions per seconds with 40% CPU utilization. 4) W12, W30, W11, W14, IDC, EDE etc were run. The changes that were made (e.g., indexed table) did not take effect for the batch job. Thus, the mainframe test was stopped.

Conclusions-Cycle 9

- CSS failover is not working properly. The entire FAFSA performance site becomes unavailable once the primary CSS fails.
- DOS attacks were observed during CSS failover testing.
- Framing errors on RP2 and RP4 occurred.

4.11 Performance Test – Cycle 10

Test 1

- FAFSA 8.0 Performance Test Cycle 10 was executed on October 30, 2003.
- Hardware & configuration:

- Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024.)
- App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
- Database – DB2 on CICS mainframe environment
- Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes with a two-web, two-app server architecture - CSS Testing.

Summary of Results:

The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes for CSS testing. It was conducted using two web servers and two application servers. The test was ramped up to 2,400 concurrent users. At this point, errors were observed with CSS and Denial of Service (DOS) attacks occurred.

Test 2

- FAFSA 8.0 Performance Test Cycle 10 was executed on October 30, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024.)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes with a two-web, two-app server architecture - CSS Testing.

Summary of Results:

The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes for CSS testing. It was conducted using two web servers and two application servers. The test was ramped up to 2,400 concurrent users. At this point, errors were observed with CSS and Denial of Service (DOS) attacks occurred. Also, a sniffer was attached.

Test 3

- FAFSA 8.0 Performance Test Cycle 10 was executed on October 30, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024.)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes with a two-web, two-app server architecture - CSS Testing.



Summary of Results:

The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes for CSS testing. It was conducted using two web servers and two application servers. The test was ramped up to 2,400 concurrent users, except this time the ramp up was slower than the previous tests. At this point, errors were observed with CSS and Denial of Service (DOS) attacks occurred. Also, a sniffer was attached in a different location.

Test 4

- FAFSA 8.0 Performance Test Cycle 10 was executed on October 30, 2003.
- Hardware & configuration:
 - Web server - RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024.)
 - App server - HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes with a two-web, two-app server architecture - CSS Testing.

Summary of Results:

The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes for CSS testing. It was conducted using two web servers and two application servers. The test was ramped up to 2,400 concurrent users. At this point, errors were observed with CSS and Denial of Service (DOS) attacks occurred. Also, a sniffer was attached in a different location.

Test 5

- FAFSA 8.0 Performance Test Cycle 10 was executed on October 30, 2003.
- Hardware & configuration:
 - Web server - RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024.)
 - App server - HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes with a two-web, two-app server architecture - CSS Testing.

Summary of Results:

The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes for CSS testing. It was conducted using two web servers and two application servers. The test was ramped up to 2,400 concurrent users. At this point, errors were observed with CSS and Denial of Service (DOS) attacks occurred. Also, HTTP was changed to 1.0.

Test 6

- FAFSA 8.0 Performance Test Cycle 10 was executed on October 30, 2003.



- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024.)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes with a two-web, two-app server architecture - CSS Testing.

Summary of Results:

The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes for CSS testing. It was conducted using two web servers and two application servers. The test was ramped up to 2,400 concurrent users. At this point, less errors compared to previous tests were observed with CSS and Denial of Service (DOS) attacks occurred. Also, the WAS idle timeout parameter was changed from 15 seconds to 5 seconds

Test 7

- FAFSA 8.0 Performance Test Cycle 10 was executed on October 30, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024.)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes with a two-web, two-app server architecture - CSS Testing.

Summary of Results:

The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes for CSS testing. It was conducted using two web servers and two application servers. The CSS idle timeout was changed from 15 seconds to 30 seconds.

Test 8

- FAFSA 8.0 Performance Test Cycle 10 was executed on October 30, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024.)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes with a two-web, two-app server architecture - CSS Testing.



Summary of Results:

The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes for CSS testing. It was conducted using two web servers and two application servers. Also, sniffer data was collected.

Test 9

- FAFSA 8.0 Performance Test Cycle 10 was executed on October 30, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 1024.)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes with a two-web, two-app server architecture - CSS Testing.

Summary of Results:

The goal of this test cycle was to run the Fill Out a FAFSA 8.0 business processes for CSS testing. It was conducted using two web servers and two application servers. Also, the sniffer was moved to a different location to gather more data.

Conclusions-Cycle 10

- Denial of Service (DOS) attacks and errors were observed with CSS, however less errors were seen after the WAS idle timeout parameter was changed.

4.12 Performance Test - Cycle 11

Test 1

- FAFSA 8.0 Performance Test Cycle 11 was executed on November 4, 2003.
- Hardware & configuration:
 - Web server – RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA, FAFSA Corrections, and FAFSA Renewal
- Goals: The goal of this test was to run the Fill Out a FAFSA, FAFSA Corrections, and FAFSA Renewal 8.0 scripts with up to 1000 concurrent users.

Summary of Results:

For the first test, we ran the Fill Out a FAFSA, FAFSA Corrections, and FAFSA Renewal 8.0 scripts with 1000 users. Since we observed errors and failed transactions for the FAFSA Corrections script, we stopped the test and restarted the test running Fill Out a FAFSA and FAFSA Renewal 8.0 scripts. Here are some of the statistics from this test. CPU on the web



server was 7%. Memory on the web server was 32%. CPU on the application server was 26%. Memory on the application server was 43%.

Test 2

- FAFSA 8.0 Performance Test Cycle 11 was executed on November 4, 2003.
- Hardware & configuration:
 - Web server – RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA and FAFSA Renewal
- Goals: The goal of this test was to run the Fill Out a FAFSA and FAFSA Renewal 8.0 scripts with up to 2000 concurrent users.

Summary of Results:

For the second test, we ran the Fill Out a FAFSA and the FAFSA Renewal 8.0 scripts with 2000 users. It was noticed that the number of JDBC connections were at its maximum (10) and the session cache was also at its maximum (1000). It was decided for the third test to increase both of these maximums. Here are some of the statistics from this test. Average CPU on the web server was 13.5%. Average memory on the web server was 39%. Average CPU on the application server was 44%. Average memory on the application server was 45.5%.

Test 3

- FAFSA 8.0 Performance Test Cycle 11 was executed on November 4, 2003.
- Hardware & configuration:
 - Web server – RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA and FAFSA Renewal
- Goals: The goal of this test was to run the Fill Out a FAFSA and FAFSA Renewal 8.0 scripts with up to 3000 concurrent users.

Summary of Results:

For the third test, we ran the Fill Out a FAFSA and the FAFSA Renewal 8.0 scripts. The number of JDBC connections allowed was set to 20 (instead of 10) and the session cache was set to 3000 (instead of 1000). After the first 20 minutes into the test, the number of users was ramped up from 2000 to 2500. The throughput and hits per second did not increase when the number of users was ramped up. When requests were coming back from Akamai to Load Runner, saturation in the network was noticed. Here are some of the statistics from this test. Average CPU on the web server was 25%. Average memory on the web server was 35.33%. Average CPU on the application server was 19.67%. Average memory on the application server was 43.67%.

Conclusions-Cycle 11

- The Fill Out a FAFSA, FAFSA Corrections, and FAFSA Renewal 8.0 scripts were not successfully tested with up to 1000 concurrent users.
- The Fill Out a FAFSA and FAFSA Renewal 8.0 scripts were successfully tested with up to 1000 and 2000 concurrent users.
- Increasing the number of JDBC connections to 20 and the session cache to 3000 allowed a successful testing of Fill Out a FAFSA and FAFSA Renewal 8.0 scripts with 2500 users.

4.13 Performance Test - Cycle 12

Test 1

- FAFSA 8.0 Performance Test Cycle 12 was executed on November 06, 2003.
- Hardware & configuration:
 - Web server – RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA, FAFSA Corrections, and FAFSA Renewals
- Goals: The goal of this test was to run the Fill Out a FAFSA, FAFSA Corrections, and FAFSA Renewal 8.0 scripts with up to 3000 concurrent users.

Summary of Results:

The test was conducted using one web server, one application server with one clone, and CSS. Akamai was not included in the environment. This test included the Fill Out a FAFSA, FAFSA Corrections, and FAFSA Renewals business processes with the users evenly divided. In the first test, data errors occurred with Fill Out a FAFSA and the test was stopped. At 1000 concurrent users, the CPU on the web server RP2 was 29%. The CPU on the application server HPN8 was 38%. The Memory on RP2 was 43% and HPN8 was 43%.

Test 2

- FAFSA 8.0 Performance Test Cycle 12 was executed on November 06, 2003.
- Hardware & configuration:
 - Web server – RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA, FAFSA Corrections, and FAFSA Renewals
- Goals: The goal of this test was to run the Fill Out a FAFSA, FAFSA Corrections, and FAFSA Renewal 8.0 scripts with up to 3000 concurrent users.

Summary of Results:

The second test was conducted using one web server, one application server with one clone, and CSS. Akamai was not included in the environment. This test included the Fill Out a FAFSA, FAFSA Corrections, and FAFSA Renewals business processes with the users evenly divided. The number of users was ramped up gradually to 2000 users and sustained for 20

minutes. The second web server was then turned on, the test was ramped up to 2500 users and maintained for an additional 20 minutes. The CPU utilization during the test at 2500 users was 78% and the memory utilization was 47% on the application server. During this test we discovered that the number of connections to the temp save database could be set higher to potentially increase performance. The test ended after one hour and the number of connections to the temp save database was increased from 10 to 20.

Test 3

- FAFSA 8.0 Performance Test Cycle 12 was executed on November 06, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA, FAFSA Corrections, and FAFSA Renewals
- Goals: The goal of this test was to run the Fill Out a FAFSA, FAFSA Corrections, and FAFSA Renewal 8.0 scripts with up to 3000 concurrent users.

Summary of Results:

The third test was conducted using two web servers, one application server with one clone, and CSS. Akamai was not included in the environment. This test included the Fill Out a FAFSA, FAFSA Corrections, and FAFSA Renewals business processes with the users evenly divided. In the test, the number of users was gradually ramped up to 2000 once again and stabilized before going to 3000 users. The web servers averaged 25% CPU utilization and 41% Memory utilization, while the application server had 87% CPU utilization and 48% Memory utilization during the 3000 user load. The 3000 user load was sustained for 30 minutes by one clone.

Conclusions-Cycle 12

- In the first test, the Fill Out a FAFSA, FAFSA Corrections, and FAFSA Renewal 8.0 scripts were not successfully tested using a 1 web server, 1 application server with 1 clone architecture with up to 3000 concurrent users.
- In the second test, the Fill Out a FAFSA, FAFSA Corrections, and FAFSA Renewal 8.0 scripts were successfully tested using a 2 web server, 1 application server with 1 clone architecture with up to 2500 and 3000 concurrent users. The number of temp save database connections was increased to potentially improve performance.

4.14 Performance Test – Cycle 13

Test 1

- FAFSA 8.0 Performance Test Cycle 13 was executed on November 11, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048)

- App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
- Database – DB2 on CICS mainframe environment
- Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA, FAFSA Corrections, and FAFSA Renewal
- Goals: The goal for cycle 13 was to try and lower the CPU utilization for the application server with one clone.

Summary of Results:

The test was conducted using two web servers, one application server with one clone, and CSS. Akamai was not included in the environment. Over the weekend, a change was made in the cabling and configuration of all of the servers for performance test. The negotiation was set to auto instead of full duplex and we received networking errors. Once rp4 was removed from the test the errors stopped. The test continued with one web server and one application server. The test was stopped so that rp4 could be tested and brought back into the environment.

Test 2

- FAFSA 8.0 Performance Test Cycle 13 was executed on November 11, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA and FAFSA Renewal
- Goals: The goal for cycle 13 was to try and lower the CPU utilization for the application server with one clone.

Summary of Results:

For the second test, the number of users was ramped up gradually to 2000 users and sustained for 20 minutes with the number of threads changed from 100 to 50 on the application server. The goal was to see a decreased CPU utilization from prior tests. The test was ramped up to 2500 users and held for an additional 20 minutes. The test completed with 3000 running concurrent users which were maintained for an additional 20 minutes. CPU and Memory utilization for the web servers were in line with expectations, averaging 10% and 30% respectively. The application server was running at 44% CPU utilization and 49% Memory utilization.

Test 3

- FAFSA 8.0 Performance Test Cycle 13 was executed on November 11, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2

- Business Process: Fill Out a FAFSA and FAFSA Renewal
- Goals: The goal for cycle 13 was to try and lower the CPU utilization for the application server with one clone.

Summary of Results:

For the third test, the number of application server threads was reduced to 30 to see if any further decrease in CPU utilization would occur. The test was gradually ramped up to 2000 users, taken to 2500 users and finally 3000 users. The CPU and Memory utilization for the web servers and application server was similar to test two.

Conclusions-Cycle 13

- We did not see a large enough CPU utilization reduction by only changing the threads.
- One additional configuration change will be to remove SSL between the web server and the application server. In WAS 5.0 this is a new capability, WAS 3.5 used a proprietary protocol to communicate between the servers instead of HTTP.
- Initial testing indicates an improvement in the CPU utilization, but full testing in cycle 14 will be needed. Two clones will also be added to the environment in separate tests for cycle 14.

4.15 Performance Test - Cycle 14

Test 1

- FAFSA 8.0 Performance Test Cycle 14 was executed on November 12, 2003.
- Hardware & configuration:
 - Web server - RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048)
 - App server - HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA and FAFSA Renewal
- Goals: The goal for cycle 14 was to maintain a low CPU utilization for the application server.

Summary of Results:

The test was conducted using two web servers, one application server with one and two clones with 50 threads, and CSS. Akamai was not included in the environment. Testing on Tuesday, 11/11 indicated that CPU utilization would lower by removing SSL from the communication between the web server and application server. The first test with one clone on one application server was to validate this theory. The test was gradually ramped up to 1000 users and maintained for 20 minutes, then ramped up to 2000 concurrent users and maintained for 20 minutes, then ramped up to 3000 users. As expected, the CPU utilization for the application

server was reduced from the tests using SSL. The comparison at 3000 users was 50% CPU utilization with SSL on and 28% CPU utilization with SSL turned off.

Test 2

- FAFSA 8.0 Performance Test Cycle 14 was executed on November 12, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA and FAFSA Renewal
- Goals: The goal for cycle 14 was to maintain a low CPU utilization for the application server.

Summary of Results:

For the second test, a second clone was added to the environment to see the impact on CPU utilization. The test was gradually ramped up to 1000 users and maintained for 20 minutes, then 2000 and 3000 respectively. The results were similar to test 1, with 30% CPU utilization seen at 3000 users, with 50% memory utilization.

Test 3

- FAFSA 8.0 Performance Test Cycle 14 was executed on November 12, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA and FAFSA Renewal
- Goals: The goal for cycle 14 was to maintain a low CPU utilization for the application server.

Summary of Results:

For the third test, a repeat of test 2 was performed with a gradual ramp up to 3000 users and then maintaining that concurrent usage for the duration of the test. The results were very similar, with CPU and Memory utilization being 34% and 50% respectively. The statistics for the web servers at 3000 users averaged 7% CPU utilization and 31% Memory utilization.

Conclusions-Cycle 14

- Full testing confirmed that the CPU utilization was improved with SSL removed. The lower CPU utilization will allow more clones to be placed on an application server and reduce the overall number of application servers necessary.

- The next test will focus on the inclusion of Akamai, and the impact to CPU utilization on both web and application servers.

4.16 Performance Test - Cycle 15

Test 1

- FAFSA 8.0 Performance Test Cycle 15 was executed on November 13, 2003.
- Hardware & configuration:
 - Web server - RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048)
 - App server - HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA and FAFSA Renewal
- Goals: The goal of this test was to run the Fill Out a FAFSA and FAFSA Renewal 8.0 business processes with a one-web, one-app server (one clone) architecture with Akamai - Capacity Planning.

Summary of Results:

The first test was conducted using one web server, one application server, one clone with 100 threads and 1 GB memory for the JVM, CSS and Akamai. The test was gradually ramped up to 1000 users and maintained for 20 minutes, then ramped up to 2000 concurrent users and then ramped up to 2500 concurrent users. The IP address used for this test was causing problems with the DNS entries that were made to help the network issue. This test was stopped and the IP address was corrected.

Test 2

- FAFSA 8.0 Performance Test Cycle 15 was executed on November 13, 2003.
- Hardware & configuration:
 - Web server - RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048)
 - App server - HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA and FAFSA Renewal
- Goals: The goal of this test was to run the Fill Out a FAFSA and FAFSA Renewal 8.0 business processes with a one-web, one-app server (one clone) architecture with Akamai - Capacity Planning.

Summary of Results:

Test two had the same environment configuration as test 1. The test was gradually ramped up to 1000 users and maintained for 20 minutes, then ramped up to 2000 concurrent users and then ramped up to 2500 concurrent users. When reaching the 2000 user level, connection failures began to occur in the environment. CSS was showing Denial of Service attacks coming from Akamai. Prior to the denial of service attacks, no full garbage collections were seen on the application server, along with CPU utilization of 15% and memory utilization of 45%. The web server experienced CPU and memory utilization of 9% and 33% respectively.

Test 3

- FAFSA 8.0 Performance Test Cycle 15 was executed on November 13, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: PIN Registration
- Goals: The goal was to simulate 6000 transactions per hour for peak processing.

Summary of Results:

For the third test, PIN registration was tested, and the environment was two web servers, one application server, one clone with 100 threads and 512 MB of memory, and CSS. Akamai was removed from the environment pending further testing. The test was gradually ramped up to 1500 users and maintained for 30 minutes. At 500 users, the CPU and Memory utilization on the application server were 6% and 40% respectively. At 1500 users, the CPU utilization was 15% and the memory utilization was 40%. No full garbage collections were seen throughout the test.

Conclusions – Cycle 15

- The Fill Out a FAFSA and FAFSA Renewal 8.0 business processes were not successfully tested because of connection failures and CSS showing Denial of Service (DOS) attacks that occurred from Akamai.
- The PIN registration process was successfully tested at 1500 users. The goal was to simulate 6000 transactions per hour for peak processing. We exceeded our goal and submitted 13,000 transactions in 30 minutes. To achieve this, both the CPU and memory utilization were in the acceptable range.

4.17 Performance Test – Cycle 16

Test 1

- FAFSA 8.0 Performance Test Cycle 16 was executed on November 14, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:



The first test was conducted using 2 web servers, 2 application servers (4 clones) with Akamai. The goal of this test was to test network issues using Fill out a FAFSA 8.0 business process with Akamai. It was started with 4 users and then ramped up to 150 users. This was a small test to generate a trace.

Test 2

- FAFSA 8.0 Performance Test Cycle 16 was executed on November 14, 2003.
- Hardware & configuration:
 - Web server - RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server - HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

The second test was conducted using 2 web servers, 2 application servers (4 clones) with Akamai. The goal of this test was to test network issues using Fill out a FAFSA 8.0 business process with Akamai. It was started with 2000 users and then ramped up to 2500 users. Denial of Service (DOS) attacks and connection errors were seen.

Test 3

- FAFSA 8.0 Performance Test Cycle 16 was executed on November 14, 2003.
- Hardware & configuration:
 - Web server - RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server - HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

The third test was conducted using 2 web servers, 2 application servers (4 clones) with Akamai. The goal of this test was to test network issues using Fill out a FAFSA 8.0 business process with Akamai. It was started with 2000 users and then ramped up to 2500 users. Denial of Service (DOS) attacks and connection errors were seen.

Conclusions-Cycle 16

- The Fill Out a FAFSA 8.0 business processes was not successfully tested because of connection failures and Denial of Service (DOS) attacks that occurred.



4.18 Performance Test - Cycle 17

Test 1

- FAFSA 8.0 Performance Test Cycle 17 was executed on November 15, 2003.
- Hardware & configuration:
 - Web server - RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server - HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

The first test was conducted using 2 web servers, 2 application servers (4 clones) with Akamai. The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai. It was ramped up to 2000 users. This was a test to create a baseline. Max clients were hit on the web server. Dropped packets were also observed. Denial of Service (DOS) attacks and connection errors were seen.

Test 2

- FAFSA 8.0 Performance Test Cycle 17 was executed on November 15, 2003.
- Hardware & configuration:
 - Web server - RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server - HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

The second test was conducted using 2 web servers, 2 application servers (4 clones) with Akamai. The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai. It was ramped up to 2000 users. Denial of Service (DOS) attacks and connection errors were seen.

Test 3

- FAFSA 8.0 Performance Test Cycle 17 was executed on November 15, 2003.
- Hardware & configuration:
 - Web server - RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server - HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database - DB2 on CICS mainframe environment

- Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

The third test was conducted using 2 web servers, 2 application servers (4 clones) with Akamai. The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai. It was ramped up to 2000 users. Denial of Service (DOS) attacks and connection errors were seen. Sticky profile was also turned off on CSS for this trial.

Test 4

- FAFSA 8.0 Performance Test Cycle 17 was executed on November 15, 2003.
- Hardware & configuration:
 - Web server - RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server - HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

The fourth test was conducted using 1 web server, 2 application servers (4 clones) with Akamai. The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai. It was started with 2000 users and then ramped up to 2500 users. Denial of Service (DOS) attacks and connection errors were seen, but far less than before.

Test 5

- FAFSA 8.0 Performance Test Cycle 17 was executed on November 15, 2003.
- Hardware & configuration:
 - Web server - RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server - HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

The fifth test was conducted using 1 web server, 2 application servers (4 clones) with Akamai. The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai. The web server used in this test was not the same one used in the fourth test. It was ramped up to 2000 users. Denial of Service (DOS) attacks and connection errors were seen, but less than before and more than the fourth test.

Conclusions-Cycle 17

- The Fill Out a FAFSA 8.0 business processes was not successfully tested because of connection failures and Denial of Service (DOS) attacks that occurred.

4.19 Performance Test - Cycle 18

Test 1

- FAFSA 8.0 Performance Test Cycle 18 was executed on November 17, 2003.
- Hardware & configuration:
 - Web server - RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server - HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

The first test was conducted using 1 web server, 2 application servers (2 clones on each) with Akamai. The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai. CSS was removed from the environment to see if Denial of Service (DOS) attacks and connection errors would continue. The test was setup with the 198.77.203.79 address on the web server and also to have the network traffic go to Akamai and then directly to the web server. However, DOS and connection errors still occurred.

Test 2

- FAFSA 8.0 Performance Test Cycle 18 was executed on November 17, 2003.
- Hardware & configuration:
 - Web server - RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server - HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

The second test was the same as the first test. It was conducted using 1 web server, 2 application servers (2 clones on each) with Akamai. The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai. CSS was removed from the environment to see if Denial of Service (DOS) attacks and connection errors would continue. The test was setup with the 198.77.203.79 address on the web server and also to have the network traffic go to Akamai and then directly to the web server. However, DOS and connection errors still occurred.

Test 3

- FAFSA 8.0 Performance Test Cycle 18 was executed on November 17, 2003.
- Hardware & configuration:
 - Web server – RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

The third test was changed to have the network traffic run internally and directly to the web server from the Load Runner servers. It was conducted using 1 web server, 1 application server (1 clone). The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai. Nothing was setup between the web server and the Load Runner boxes. No Denial of Service (DOS) attacks and no connection errors were seen.

Test 4

- FAFSA 8.0 Performance Test Cycle 18 was executed on November 17, 2003.
- Hardware & configuration:
 - Web server – RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

For the fourth test, a firewall was added to the environment so that the load would go from the Load Runner servers, through this firewall, and directly to the web server. It was conducted using 1 web server, 1 application server (1 clone). The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai. No Denial of Service (DOS) attacks and no connection errors were seen.

Test 5

- FAFSA 8.0 Performance Test Cycle 18 was executed on November 17, 2003.
- Hardware & configuration:
 - Web server – RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA

- Goals: The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

The fifth test was changed so that the keep alive time setting was 15 seconds (instead of 5 seconds) on the web server. It was conducted using 1 web server, 1 application server (1 clone). The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai. The test was retested through Akamai.

Test 6

- FAFSA 8.0 Performance Test Cycle 18 was executed on November 17, 2003.
- Hardware & configuration:
 - Web server – RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

For the sixth test, the images setting was turned off to see if network bandwidth was the problem through Akamai. It was conducted using 1 web server, 1 application server (1 clone). The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Test 7

- FAFSA 8.0 Performance Test Cycle 18 was executed on November 17, 2003.
- Hardware & configuration:
 - Web server – RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

The seventh test was setup to capture traces using sniffers with Akamai. It was conducted using 1 web server, 1 application server (1 clone). The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Test 8

- FAFSA 8.0 Performance Test Cycle 18 was executed on November 17, 2003.
- Hardware & configuration:



- Web server – RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
- App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
- Database – DB2 on CICS mainframe environment
- Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

The eighth test was setup to have the load split between two Akamai servers. It was conducted using 1 web server, 1 application server (1 clone). The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Test 9

- FAFSA 8.0 Performance Test Cycle 18 was executed on November 17, 2003.
- Hardware & configuration:
 - Web server – RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

The ninth test was setup to have the load split between two alternate Akamai servers compared to the eighth test. It was conducted using 1 web server, 1 application server (1 clone). The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai. Since the Akamai servers in the eighth test might have experienced issues, this test ensured that a valid test was completed.

Test 10

- FAFSA 8.0 Performance Test Cycle 18 was executed on November 17, 2003.
- Hardware & configuration:
 - Web server – RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

The tenth test was setup the same as the ninth test. It was conducted using 1 web server, 1 application server (1 clone). The goal of this test cycle was to test network issues using Fill out a

FAFSA 8.0 business process with Akamai. However, it was limited to 1500 users to determine the upper threshold. Fewer errors were seen in this test compared to the ninth test.

Test 11

- FAFSA 8.0 Performance Test Cycle 18 was executed on November 17, 2003.
- Hardware & configuration:
 - Web server – RP2 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai.

Summary of Results:

The eleventh test was setup the same as the ninth test. It was conducted using 1 web server, 1 application server (1 clone). The goal of this test cycle was to test network issues using Fill out a FAFSA 8.0 business process with Akamai. However, it was limited to 1000 users to determine the upper threshold. Fewer errors were seen in this test compared to the tenth test.

Conclusions-Cycle 18

- Connection failures and Denial of Service (DOS) attacks occurred even with CSS removed from the environment.
- Various environment changes and server settings were tweaked to try to isolate the connection failures and DOS attacks.

4.20 Performance Test - Cycle 19

Test 1

- FAFSA 8.0 Performance Test Cycle 19 was executed on November 18, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Student Access
- Goals: The goal of this test was to retest the Student Access business process using 3000 concurrent users

Summary of Results:

The first test was to retest the Student Access business process using 3000 concurrent users. It was conducted using two web servers, one application server, one clone with 100 threads and 1 GB memory for the JVM and CSS. The test was gradually ramped up to 1000 users and maintained for 20 minutes, then ramped up to 2000 concurrent users and then ramped up to



3000 concurrent users. At the 3000 user level, the CPU utilization on the application server averaged 48% and memory utilization averaged 51%. The web servers averaged 15% CPU utilization and 33% memory utilization. Two full garbage collections occurred during the test about 30 minutes apart and each lasted 5 seconds. All these factors are within the acceptable ranges and this test was considered successful.

Test 2

- FAFSA 8.0 Performance Test Cycle 19 was executed on November 18, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: FAA Corrections
- Goals: The goal of this test was to retest the FAA Corrections business process using 1500 concurrent users.

Summary of Results:

The second test was to retest the FAA Corrections business process using 1500 concurrent users. It was conducted using two web servers, one application server, one clone with 100 threads and 1 GB memory for the JVM and CSS. The test was gradually ramped up to 750 users and maintained for 10 minutes, then ramped up to 1250 concurrent users and then ramped up to 1500 concurrent users. At the 1500 user level, the CPU utilization on the application server averaged less than 80% and memory utilization averaged 51%. The web servers averaged 10% CPU utilization and 34% memory utilization. Two full garbage collections occurred approximately 30 minutes apart during the test and lasted 3.8 seconds. All these factors are within the acceptable ranges and this test was considered successful.

Test 3

- FAFSA 8.0 Performance Test Cycle 19 was executed on November 18, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Request for Application Status
- Goals: The goal of this test was to test the Request for Application Status business process using 3000 concurrent users.

Summary of Results:

The third test was to test the Request for Application Status business process using 3000 concurrent users. It was conducted using two web servers, one application server, one clone with 100 threads and 1 GB memory for the JVM and CSS. Problems occurred during this test

related to either the script or the data for the script and this test was postponed to Cycle 20 to evaluate the cause of the problem and correct it.

Test 4

- FAFSA 8.0 Performance Test Cycle 19 was executed on November 18, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test was to retest the Null Pointer Exception that occurred in the Fill Out a FAFSA business process.

Summary of Results:

The fourth test was to retest the Null Pointer Exception that occurred in the Fill Out a FAFSA business process. The exception occurs when two users submit a FAFSA using the same ssn. It is highly unlikely that this would occur in the production environment. When testing this scenario, the Null Pointer Exception was seen again.

Conclusions-Cycle 19

- The Student Access and FAA Corrections business processes were successfully retested with 3000 and 1500 concurrent users, respectively.
- The Request for Student Access was unsuccessful, and will be retested in Cycle 20.
- The Null Pointer was observed again when retesting the Fill Out a FAFSA business process.

4.21 Performance Test – Cycle 20

Test 1

- FAFSA 8.0 Performance Test Cycle 20 was executed on November 20, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Request for Application Status
- Goals: The goal of this test was to test the Request for Application Status business process using 3000 concurrent users.

Summary of Results:

The first test was to test the Request for Application Status business process using 3000

concurrent users. It was conducted using two web servers, two application servers, two clones each with 100 threads and 1 GB memory for the JVM and CSS. The test was gradually ramped up to 1000 users and maintained for 20 minutes, then ramped up to 2000 concurrent users and then ramped up to 3000 concurrent users. At the 3000 user level, the CPU utilization on the application servers averaged 30% and memory utilization averaged 58%. The web servers averaged 20% CPU utilization and 44% memory utilization. No full garbage collections occurred during the test. All these factors are within the acceptable ranges and this test was considered successful.

Test 2

- FAFSA 8.0 Performance Test Cycle 20 was executed on November 20, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: PIN Authentication (Web Services)
- Goals: The goal of this test was to test the PIN Authentication (Web Services) business process using 1500 concurrent users.

Summary of Results:

The second test was to test the PIN Authentication (Web Services) business process using 1500 concurrent users. It was conducted using two web servers, two application servers, two clones each with 100 threads and 1 GB memory for the JVM and CSS. The users were gradually ramped up to 500 users and again to 1000 users. Prior to ramping up to 1500 users, errors occurred due to a lack of sufficient data to continue ramping up. The test was ended and there was not sufficient time remaining in the cycle to retry. It will be retested in Cycle 21.

Conclusions – Cycle 20

- The Request for Application Status business process was successfully tested with 3000 concurrent users.
- The PIN Authentication - Web Services process was unsuccessful, and will be retested in Cycle 21.

4.22 Performance Test – Cycle 21

Test 1

- FAFSA 8.0 Performance Test Cycle 21 was executed on November 25, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment



- Messaging - MQ handled traffic between app server and DB2
- Business Process: PIN Authentication (Web Services)
- Goals: The goal of this test was to test the PIN Authentication (Web Services) business process using 1500 concurrent users.

Summary of Results:

The PIN Authentication - Web Services business process was tested using 1500 concurrent users. It was conducted using two web servers, one application server, with two clones, each with 100 threads and 1 GB memory for the JVM and CSS. The test was ramped up to 1500 users and maintained for the duration of the test. At the 1500 user level, the CPU utilization on the application server averaged 5% and memory utilization averaged 50%. The web servers averaged 10% CPU utilization and 27% memory utilization. No full garbage collections occurred during the test. The anticipated number of transactions expected in production is 2,790 transactions/peak hour. During the test, we executed 27,148 in one hour and have exceeded the expected production traffic. All these factors are within the acceptable ranges and this test was considered successful.

Test 2

- FAFSA 8.0 Performance Test Cycle 21 was executed on November 25, 2003.
- Hardware & configuration:
 - Web server - RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server - HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: ISIR File Upload
- Goals: The goal of this test was to test the ISIR File Upload business process using 1500 concurrent users.

Summary of Results:

The next test was to test the ISIR File Upload business process using 1500 concurrent users. It was conducted using two web servers, two application servers, two clones each with 100 threads and 1 GB memory for the JVM and CSS. The users were gradually ramped up to 500 users. Prior to ramping up to 1500 users, errors occurred due to a lack of sufficient data. The test was then ended. It will be retested in Cycle 22.

Conclusion-Cycle 21

- The PIN Authentication business process was successfully tested with 1500 concurrent users. The anticipated number of transactions expected in production is 2,790 transactions/peak hour. During the test, we executed 27,148 in one hour and have exceeded the expected production traffic.
- The ISIR business process was unsuccessful, and will be retested in Cycle 22.

4.23 Performance Test - Cycle 22



Test 1

- FAFSA 8.0 Performance Test Cycle 22 was executed on December 2, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: ISIR
- Goals: The goal of this test was to test the ISIR business process using 1500 concurrent users.

Summary of Results:

The ISIR business process was tested using 1500 concurrent users. It was conducted using two web servers, two application servers, with two clones, each with 100 threads and 1 GB memory for the JVM and CSS. The test was ramped up to 500 users, then 1000 users and finally 1500 users, which was maintained for the duration of the test. At the 1500 user level, the CPU utilization on the application servers averaged 15% and memory utilization averaged 50%. The web servers averaged 9% CPU utilization and 34% memory utilization. No full garbage collections occurred during the test. No errors occurred during this test. All these factors are within the acceptable ranges and this test was considered successful.

Test 2

- FAFSA 8.0 Performance Test Cycle 22 was executed on December 2, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test was to test some of the failover capabilities of the environment.

Summary of Results:

Three tests were run to test some of the failover capabilities of the environment. IHS has the capability of assigning weights to different clones on the application servers. Changing this number to zero will cause the web server to not send any new users to a particular clone. All three tests consisted of changing the weight factor assigned to N8C1 (one of the four clones) to zero. The test began using two web servers, two application servers (with two clones each), with 100 threads and 1 GB memory for the JVM and CSS. The max client setting on the web servers was set to 2048. The test was ramped up to 3000 users and stabilized. When the weight factor was changed to zero, the memory and CPU utilization rose to 100% on the web server and it was unable to recover. The test was stopped and the max client setting was changed to 1024 on the web servers.

Test 3

- FAFSA 8.0 Performance Test Cycle 22 was executed on December 2, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test was to test some of the failover capabilities of the environment.

Summary of Results:

The goal of this test was to test some of the failover capabilities of the environment. IHS has the capability of assigning weights to different clones on the application servers. Changing this number to zero will cause the web server to not send any new users to a particular clone. During the test, the weight factor change to 0 caused CPU to spike to 100%, but the web server recovered. Changing the weight to again send traffic to N8C1 caused the web server to go to 100% CPU utilization and 100% memory utilization and not recover.

Test 4

- FAFSA 8.0 Performance Test Cycle 22 was executed on December 2, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test was to test some of the failover capabilities of the environment.

Summary of Results:

A third test was run with 768 as the max clients setting and the web server still experienced 100% CPU utilization spike for several minutes and 95% memory utilization peak, but it was able to recover slowly. The amount of memory per web daemon normally is 8 – 12 Mb. The test began this way, but after the weight factor was changed, the memory climbed to 24 Mb per web daemon. This caused the high memory utilization during the tests. This behavior was also seen during the failover testing for FAFSA 7.0 on WAS 5.0, when 1000 users were tested. Based on the test results, this is not a recommended approach for the production environment. Other recommended failover approaches will be tested in Cycle 23.

Test 5

- FAFSA 8.0 Performance Test Cycle 22 was executed on December 2, 2003.

- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The goal of this test was to retest the Null Pointer Exception that occurred in the Fill Out a FAFSA business process.

Summary of Results:

The goal of this test was to retest the Null Pointer Exception that occurred in the Fill Out a FAFSA business process. The Null Pointer Exception was tested in the final test using Fill Out a FAFSA 8.0 and attempting to submit multiple application using the same SSN. No Null Pointer Exceptions occurred and the test was considered successful.

Conclusion-Cycle 22

- The ISIR business process was successfully tested with 1500 concurrent users.
- All three tests consisted of changing the weight factor assigned to N8C1 (one of the four clones) to zero, and this is not a recommended approach for the production environment.
- No null pointers occurred when testing the Fill Out a FAFSA business process and the test was considered successful.
- The new CSS machines were included in the performance test environment for the test. No errors were seen on the CSS machine during the test.

4.24 Performance Test - Cycle 23

Test 1

- FAFSA 8.0 Performance Test Cycle 23 was executed on December 4, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA, PIN Registration, Request for Application Status, Student Access, MQ Load Test W12, FAFSA Renewal, FAA Corrections, and FAFSA Corrections
- Goals: The goal of this test was to test many processes at once to simulate production, and monitor the system for problems with the efix that was applied to address a memory leak.

Summary of Results:

The first test was a combination of multiple business processes using 3000 concurrent users.

The purpose of the test was to test many processes at once to simulate production, and monitor the system for problems with the efix that was applied to address a memory leak. It was conducted using two web servers, two application servers, with two clones, each with 100 threads and 1 GB memory for the JVM and CSS. There was also additional load created using a WebSphere MQ stub. The test was ramped up to 1500 users, and finally 3000 users, which was maintained for the duration of the test. At the 3000 user level, the CPU utilization on the application servers averaged 20% and memory utilization averaged 50%. The web servers averaged 14% CPU utilization and 34% memory utilization. No full garbage collections occurred during the test. All these factors are within the acceptable ranges and this test was considered successful.

Test 2

- FAFSA 8.0 Performance Test Cycle 23 was executed on December 4, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA, PIN Registration, Student Access, MQ Load Test W12, FAFSA Renewal, and FAFSA Corrections
- Goals: The purpose of the test was to introduce runtime errors by disabling a necessary stored procedure for a small amount of the 3000 users.

Summary of Results:

The second test was a repeat of the first test. The purpose of the test was to introduce runtime errors by disabling a necessary stored procedure for a small amount of the 3000 users. Runtime errors could potentially create additional objects which would impact the garbage collection. It was conducted using two web servers, two application servers, with two clones, each with 100 threads and 1 GB memory for the JVM and CSS. There was also additional load created using a WebSphere MQ stub. The test was ramped up to 3000 users and maintained for the duration of the test. At the 3000 user level, the CPU utilization on the application servers averaged 20% and memory utilization averaged 50%. The web servers averaged 13% CPU utilization and 35% memory utilization. No full garbage collections occurred during the test. All these factors are within the acceptable ranges and this test was considered successful.

Test 3

- FAFSA 8.0 Performance Test Cycle 23 was executed on December 4, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA

- Goals: The purpose of the test was to test the failover capabilities of the environment.

Summary of Results:

The third test was a test of the failover capabilities of the environment. The test began using two web servers, two application servers (with two clones each), with 100 threads and 1 GB memory for the JVM and CSS. The max client setting on the web servers was set to 2048. The test was ramped up to 3000 users and stabilized. The cable connecting rp-3, an application server, was pulled from the machine, disconnecting it from the performance test environment to simulate an application server going down. The traffic dropped rapidly as expected and stabilized at a lower level. The number of web daemons initially rose on both web servers as well, but returned to a normal level. The CPU and memory utilization remained fairly constant, averaging 8% and 40% respectively after several minutes. The application servers also remained stable with 5% average CPU utilization and 50% average memory utilization. The cable was returned to the application server without a restart, and the traffic resumed to the server. Traffic did not resume at the level seen prior to the removal of the cable. The results of the test were expected based on IBM documentation. Other recommended failover approaches will be tested in Cycle 24.

Conclusions-Cycle 23

- The first test to test many processes at once to simulate production, and monitor the system for problems with the efix that was applied to address a memory leak was successful.
- The second test to introduce runtime errors by disabling a necessary stored procedure for a small amount of the 3000 users was successful. No full garbage collections occurred.
- The third test to test the application server going down was successful.

4.25 Performance Test - Cycle 24

Test 1

- FAFSA 8.0 Performance Test Cycle 24 was executed on December 9, 2003.
- Hardware & configuration:
 - Web server - RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server - HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database - DB2 on CICS mainframe environment
 - Messaging - MQ handled traffic between app server and DB2
- Business Process: FAA Corrections
- Goals: The goal of this test was to try and replicate the problems that occurred in previous test cycles using TMON.

Summary of Results:

The first test was a test of the TMON CICS patch using FAA Corrections with 1500 concurrent users. The purpose of the test was to try and replicate the problems that occurred in previous

test cycles using TMON. It was conducted using two web servers, two application servers, with four clones, each with 100 threads and 1 GB memory for the JVM and CSS. The test was ramped up to 1500 users and maintained for the duration of the test. At the 1500 user level, the CPU utilization on the application servers averaged 22% and memory utilization averaged 50%. The web servers averaged 7% CPU utilization and 32% memory utilization. No full garbage collections occurred during the test. Several super traces were run using TMON during the test, which caused the problem last time. None of the TMON functions caused any problems in the environment and the issue will be closed.

Test 2

- FAFSA 8.0 Performance Test Cycle 24 was executed on December 9, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 and RP3 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA
- Goals: The purpose of the test was to test the failover capabilities of the environment.

Summary of Results:

The second test was a continuation of the failover testing. The purpose of the test was to stop one of the apache servers with 3000 users and monitor the system. It was conducted using two web servers, two application servers, with four clones, each with 100 threads and 1 GB memory for the JVM and CSS. The test was ramped up to 3000 users and maintained for the duration of the test. Once the system was stabilized, Apache was stopped on RP4 and the number of users declined. The system reached the number of max clients (which was set to 768) and stayed, there were not enough daemons available to support the full user load. Apache was brought back up and the daemons returned to normal and the system stabilized. We then performed a clone failover where rp3c2 was stopped. The system showed several expected errors and stabilized very quickly. An additional clone (n8c1) was then stopped and the same behavior was seen. Both clones were then restarted. The failover testing proved that one or more clones may be turned off without having the web servers reach the maximum number of clients available.

Test 3

- FAFSA 8.0 Performance Test Cycle 24 was executed on December 9, 2003.
- Hardware & configuration:
 - Web server – RP2 and RP4 (8-way, 750 MHz, 8 GB memory. Max client set to 2048.)
 - App server – HPN8 (8-way, 750 MHz, 8 GB memory.)
 - Database – DB2 on CICS mainframe environment
 - Messaging – MQ handled traffic between app server and DB2
- Business Process: Fill Out a FAFSA



- Goals: The purpose of the test was to see the impact of changing the session database index to unique.

Summary of Results:

The third test was to see the impact of changing the session database index to unique. The session database was recreated in the performance test environment and the session database was added. It was conducted using two web servers, one application server, with one clone, with 100 threads and 1 GB memory for the JVM and CSS. The test was ramped up to 3000 users and maintained for 45 minutes. No problems were seen in any of the logs and the test was considered successful.

Conclusions-Cycle 24

- In the first test, none of the TMON functions caused any problems in the environment and the issue will be closed.
- The failover test to stop one of the apache servers with 3000 users and monitor the system was not successful since there were not enough daemons available to support the full user load once apache was stopped.
- The failover testing proved that one or more clones may be turned off without having the web servers reach the maximum number of clients available.
- There were no problems seen in any of the logs in the third test to see the impact of changing the session database index to unique and the test was considered successful.



5 Capacity Planning

The capacity planning and performance test efforts work hand-in-hand. Actual peak data from last year was used to come up with targets for the number of concurrent users to test. Based on the results of the tests, the capacity and utilization requirements were estimated for the following year. Many of the calculations and estimates are based on an assumption that there will be a 30% increase from FAFSA 7.0 in utilization during peak 2004.

5.1 Number of Users

The following tables specify the number of expected users for FAFSA 8.0. Included are tables for the average daily number of users as well as the estimated peak number of users, and several significant calculations based on the peak number of users estimated.

	FAFSA 7.0	FAFSA 8.0 Calculations
Peak Day		
Users	301,418 (Note: This number does not take into consideration that there are multiple IPs for each unique visitor.)	391,843
User session length (min)	18.32	23.82
Application Submissions	100,991	131,288
Peak Hour		
# concurrent users	20,000	26,000
Page Views	1,400,000	1,823,000
CICS Transactions / Second	40	52

PIN Capacity Planning:

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

Business Processes	Jan	Feb	Mar	Apr	May	Jun	July
Authentication	11745	21467	20016	15397	1,971	2,427	3,308
Registration	2855	4541	3765	2397	12,688	14,156	18,716

After acquiring the predicted volume (based on a 30% increase, which is to be confirmed by FSA) 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: $(4541 * 1.30) = 5,903$
- Authentication (FAFSA) transactions per hour: $(21467 * 1.30) = 27,907$
- Authentication (Other Applications) transactions per hour: 2,790 (assuming 10% of peak transactions).



5.2 Extrapolations

The spreadsheet in diagram 2.1.1 is the method used to extrapolate the number of application servers needed for peak 2004 processing.

Diagram 2.1.1

Server Extrapolations	
Users Tested	3,000
Clones Used	1
Performance Test Server CPU (Web and App)	8 x 750
Users per Clone	3000
Projected # Peak Concurrent Users	26,000/hour
Clones Needed for Peak	10 for FAFSA 2 for FAFSA Demo 4 for PIN
Projected clones per server	2 (Note: HPN15 and HPN16 will have 4)
# WAS Servers for peak	6
# IHS Servers for peak	5

6 Environment Recommendations

Based on the performance testing and tuning, the following configuration should be able to handle the FAFSA peak load with 26,000 concurrent users.

FAFSA

- Web Servers: CPU: 12,000 Mhz, Memory: 16 GB Total
- Application Servers: CPU: 18,000 Mhz, Memory: 24 GB Total

PIN

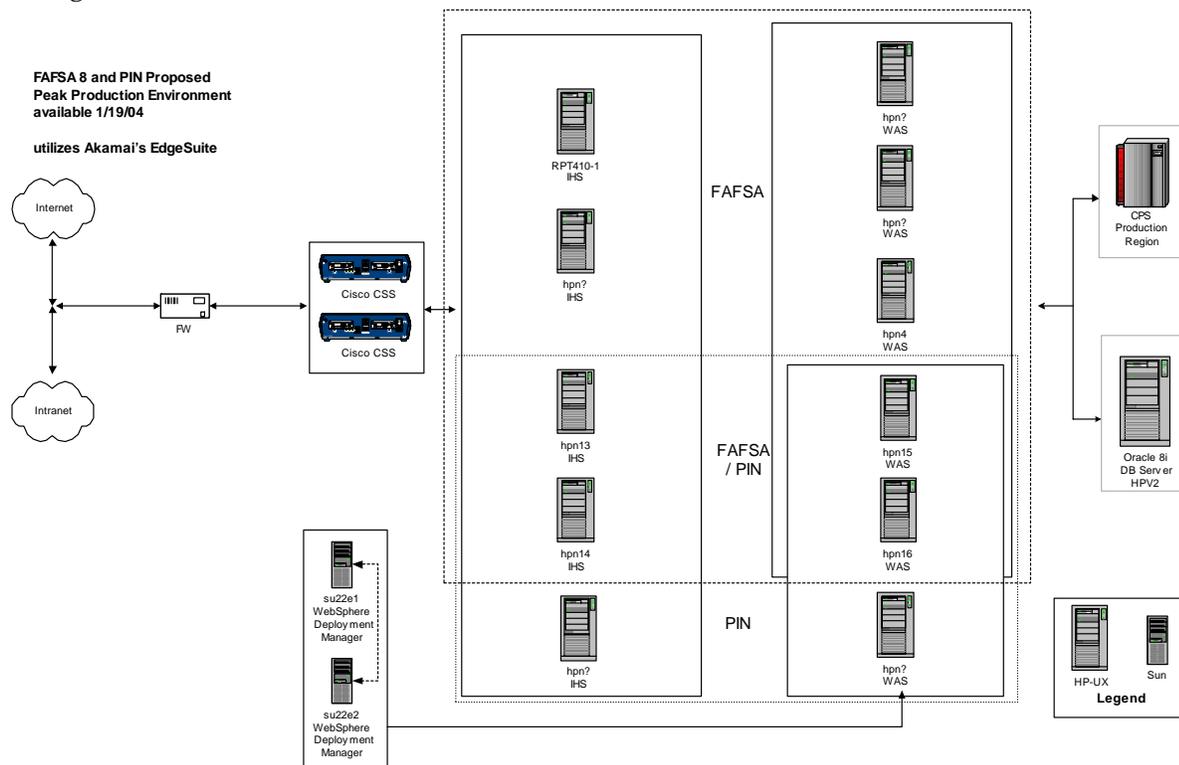
- Web Servers: CPU: 2,880 Mhz, Memory: 8 GB Total
- Application Servers: CPU: 2,880 Mhz, Memory: 8 GB Total

FAFSA/PIN

- Web Servers: CPU: 12,000 Mhz, Memory: 16 GB Total
- Application Servers: CPU: 12,000 Mhz, Memory: 16 GB Total

Diagram 2.1.2 illustrates the projected peak production logical technical architecture requirements.

Diagram 2.1.2





Appendix 1



7.2 Completed Action Items

No	Date Identified	Action Item	Responsible	Status	Date Resolved/Due
1	10/2/03	<p>Issue: There were some ports hung in the FAFSA performance env. By default 11i has a tcpip ndd parameter called tcp_fin_wait_2_timeout that is set to 0. If a tcp port is left in a FIN_WAIT_2 then the os will never time the bad port out.</p> <p>Resolution: tcp_fin_wait_2_timeout should be set to 20.</p> <p>There is an ndd parameter, post-patch PHNE_19375/11.0 and included in 11i, that is called</p> <p style="padding-left: 40px;">tcp_fin_wait_2_timeout</p> <p>This parameter sets the fin_wait_2 timer on 11.x to stop idle fin_wait_2 connections. It will not survive a reboot, so modification of the /etc/rc.config.d/nddconf is a necessary.</p> <p>Command To set the value to 20 min's: # ndd -set /dev/tcp tcp_fin_wait_2_timeout 1200000</p> <p>10/2/03: Added change into performance test environment and executed for all test cycles. Did not encounter any hanging ports after change.</p>	Bob Wehrle	Closed	10/2/03
2	10/02/03	<p>When starting FAFSA 8.0 performance test, CSS could not be reached in the performance test environment.</p> <p>10:00 AM – Dropped CSS in perf env to use Network Dispatcher</p> <p>10/03/03 9:00 AM – Worked on configuration changes for CSS in perf env to enable for 10/7 cycle 2. Bob Wehrle worked with CSC to make changes and test.</p> <p>10/9/03 – Restarted CSS in Performance Test environment – ran with 1000 concurrent users and did not experience any problems.</p>	Jay Walker	Closed	10/14/03



**Task Order 145
FAFSA 8.0 and ED PIN
Performance Test Results**

		<p>10/10/03 – Tested CSS with 1500 users successfully. Severity changed to Medium pending a test of 3000 users.</p> <p>10/14/03 – Ran test with 2700 concurrent users successfully. Did not see any CSS specific errors.</p>			
3	09/30/03	<p>Akamai not installed/configured in performance test environment. In order to complete capacity planning test cycles for FAFSA 8.0 perf test, Akamai needs to be configured in the performance test environment</p> <p>10/13/03 – Status call for organizing proof of concept test for Akamai.</p> <p>10/17/03 – Performed preliminary test from Akamai to perf.fotw.ed.gov and was successful. Also performed browser test from Load Generator box and was unsuccessful due to DNS resolution. Will test this again on Monday – Bill Pallis working on this issue.</p> <p>10/22/03 – Akamai proof of concept test was successful.</p>	David Yoon / Richard Carriere/ Matt Portolese	Closed	10/22/2003
4	10/2/03	<p>Capacity growth expectations for FAFSA 8.0 needed to conduct capacity planning exercise in performance test.</p> <p>10/21 – Growth Expectations for FAFSA received.</p>	FSA	Closed	10/21/2003
5	10/14/03	<p>Cycle 4: At the intervals ending 10:45, 12:00, and 12:15 it appears that transaction processing through CICS was delayed. In all three of these intervals, transactions queued in CICS (were delayed in ending). According to Tom it does not appear that the mainframe was overworked, only that transactions arrival rate exceeded service rate. Tom is working with DB2 support to take a look at DB2 statistics for those intervals.</p> <p>10/21-(Cycle 6) With 1500 users running FAA Corrections - CPU on the mainframe was 100% utilized during the performance test causing users to fail. This affected the production traffic for about 4 minutes. Tom will review the RMF and SMF measurement data in detail and provide details.</p> <p>10/21 – Tom Puddicombe changed the Workload Management to make the performance test requests a lower priority.</p> <p>10/24 – Additional testing found that DB2 indexing had not been added back to the database. This has been added. Investigating MYAD mainframe module as suspect for decreased performance. It was confirmed that the transactions that uses MYAD modules have problems. The CICS transaction was 8 /sec while the cpu was above 80% with this module. Pearson is working on fixing this problem.</p> <p>10/27—This issue was tested on 10/27 after Pearson made several fixes to the code and indexed the database. However, the issue still exists.</p> <p>10/29 – Several indexes were added in the DB2 table. The MYAD module was changed (updated the SQL in the MYAD module to use locks efficiently). Several tests were run between 10/27 and 10/29.</p>	Bill Devore, Dan Butler and Tom Puddicombe	Closed	10/29/03



**Task Order 145
FAFSA 8.0 and ED PIN
Performance Test Results**

		This issue is fixed now. We were able to see 65 CICS transactions with about 40% cpu utilization.			
6	10/2/03	<p>WAS 5.0 Service Pack 2 – this upgrade should be installed in both the Dev/Test and Performance Test environments concurrently. When is this expecting to take place?</p> <p>11/03 – This upgrade could not be done in the FAFSA Dev/Test env due to the following reasons: FAFSA system test started, PIN mailer, EAC conference etc. Since half of the performance test is already completed this changed has been placed on hold until the FASFA peak is over.</p>	FSA	Closed	10/29/03
7	10/28/03	<p>RP2 and RP4 throw framing errors.</p> <p>CSC networking team is seeing “physical errors” and “long acknowledgement “errors while running the test.</p> <p>10/29/03 – Suspected issue with network latency as well. The load generator boxes are running on the old Bay 350 network and the new performance test hardware was installed on the CAT 6000 network at the VDC. TCP/IP may be experiencing dropped packets due to a delay in the network transition. Plan is to connect load generators to the CAT 6000 network and monitor for improvements.</p> <p>10/30/03 – The load generator boxes were moved to the CAT 6000 network and the physical errors and long acknowledgement times disappeared. The rate of re-transmissions of packets dropped as well.</p>	Bill Pallis	Closed	11/03/03
8	10/8/03	<p>Connection refused during test 1 of cycle 2. After 45 minutes of testing at 1500 users, one of the load generator boxes received failed to connect errors for http://perf.fotw.ed.gov. The web server HPL14 would not allow additional users to connect once the number of web clients hit the server limit of 1024.</p> <p>10/08- (Identified as Not related) An exception occurred near the same time on N3 where the connection to the T4 WAN database failed. The exact exception was AFOTWDatabase.executeProcParms:no connection: communication link broken. This may or may not be related to the above issue, but FAFSA Corrections does not use this database.</p> <p>Page Timeout errors were also seen on Cycle 2 and Cycle 4.</p> <p>10/9 & 10/10/03: Did not observe this issue. Will keep this issue open for the next test cycles and reevaluate.</p> <p>10/14/03 – Potentially recreated this issue in Cycle 4- when running at 3000 users for 30 minutes. After investigating this issue further it became clear that something builds up between the load generator boxes and CSS and causes this issue. For cycle 5 on 10/16 we need network administrator and CSS administrator from CSC present during the performance test to work on this issue.</p> <p>10/16/03 – This problem was not seen in cycle 5 of FAFSA performance test. Will continue to monitor for this situation in future test cycles.</p> <p>10/23/03 – This problem may be related to a problem seen during cycle 7 on 10/23. When 2000 users hit the FAFSA index page – CSS shut down indicating Denial of Service attack and majority of the users failed. For now we are keeping the denial of attack as a separate issue than this one but it</p>	John Huddick (CSS), Todd Basset (Network), Bob Wehrle (Web Server), Roshani Bhatt (Identifying bottleneck/ resolution)	Closed	11/03/03



**Task Order 145
FAFSA 8.0 and ED PIN
Performance Test Results**

		<p>may be related. 10/29/03 – Potentially related to issue # 9. 10/30/03 – Testing using HTTP 1.0 eliminated the problem. Issue is related to the handling of persistent connections in CSS. 10/31/03 – Testing has revealed that CSS uses a new type of redundancy called Adaptive Session Redundancy (ASR). Cisco has said that ASR currently has an open software bug. ASR was also limiting the ports that were available for use in the application causing the connection refused errors. When the redundancy was changed to Box to Box redundancy (Active/Passive), the connection issue no longer appeared.</p>			
9	10/28/03	<p>When the primary CSS was shut down the backup CSS came up and assumed the role of the primary CSS. However none of the users were allowed to go thru CSS and the FAFSA performance test site become non-responsive. 10/31/03 – Identified as a bug in the redundancy type selected by default (Adaptive Session Redundancy – ASR). Once the redundancy type was changed to Box-to-Box, the failover tests were successful.</p>	Bill Pallis	Closed	11/03/03
10	10/28/03	<p>When one of the web servers went down CSS cluster hung and none of the users can access the FAFSA performance test site. 11/03/03 – The default redundancy (ASR) had a known bug that was related. Once the redundancy was changed to Box-To-Box, the issue did not reappear.</p>	Bill Pallis	Closed	11/03/03
11	10/10/03	<p>Sessions not being invalidated in the FAFSA Corrections business process 10/17/03 – Matt Kain reports that this issue is fixed and will be closed pending a performance test of this by 10/31. 11/03/03 – Verified that sessions are being invalidated as expected.</p>	Matt Kain	Closed	11/03/03
12	10/23/03	<p>CSS Denial of Service attack registering – A new script was created to test the CSS failover which only hit the home page for FAFSA. This was run with 1000 and 500 users and several Denial of Service attacks were registered on CSS. Next steps: Bill Pallis to contact Cisco to get more information on why these requests were registering as denial of service. The test will be re-run with a normal Fill Out a FAFSA script. 10/31/03 – This issue was no longer experienced in the performance test, but still needs to be addresses with Cisco as to how this feature can be disabled. 11/3/03 - Cisco reported that Denial of services cannot be turned off.</p>	Bill Pallis	Closed	10/28/03
14	10/16/03	<p>Fin Wait Parameter: The setting of the Fin Wait parameter is different in the performance test and production environments. Currently the parameter is set to 0 in production, but is set to 20 in the performance test environment. There is an ECM on hold to change this parameter in production, pending final determination of the value. Bill Gardner is to follow up with HP, Bob Wehrle is to</p>	CSC (Lead) Bill Gardner / Bob Wehrle	Closed	11/21/03



**Task Order 145
FAFSA 8.0 and ED PIN
Performance Test Results**

		<p>open a PMR ticket with IBM.</p> <p>11/10: HP suggested keeping the FIN wait to 20 and IBM believed this is an OS level change so they could concur with HP. An ECM was opened to move this change to production – scheduled on 11/23.</p>			
15	10/29/03	<p>TMON, the monitoring software, was causing abends in the CICSPTST region during performance testing. This has been potentially addresses with an ASG fix.</p> <p>11/05: Walt Barrett has ordered the maintenance upgrade for TMONCICS</p> <p>ACTION: Apply fix, Re-Test Per CSC this issue is same as CICS not responding during the performance test so this issue is being tracked with CICS unresponsive issue.</p>	<p>CSC (Lead) Walt Barrett</p>	Closed	11/18/03
16	10/23/03	<p>CKB4 / CKB5 Abends on the Mainframe – These abends have appeared in both production and in the performance test environment and have been occurring since 09/25/03. A ticket has been opened with IBM to investigate the root cause.</p> <p>10/29/03 – A GCARS has been submitted to apply a fix on 11/02 and 11/09/03.</p> <p>11/05/03 Nancy Mathisen applied UQ79347 to CPA1 environment on 11/2/03 and is applying the same ptf to CPP1, CPT1, CPD1 on 11/9/03. Ready to Perf. Test on 11/11</p> <p>11/12: The PTF was applied last weekend to CPP1, CPT1, and the CPD1 regions. No errors seen since this was applied.</p>	<p>CSC (Lead) Nancy Mathisen/ Carol Greer</p>	Closed	11/12/03
17	11/04/03	<p>The EAR file that was obtained for the code merge on Monday 11/3 was missing several JSP's which caused problems when executing several Load Runner scripts. This is the second time that ITA received a bad EAR file and spend significant amount of time debugging the load runner scripts.</p> <p>11/04/03 – The JSP's were added into the EAR file and the scripts executed successfully.</p> <p>ITA will contact Pearson before doing the code merge and Pearson will notify ITA if there are any issues with their code merge so that we can minimize these issues.</p>	<p>Pearson (Lead) Matt Kain</p>	Closed	11/12/03
18	11/11/03	<p>Cabling was changed on the performance test environment during the weekend of 11/09/03 along with some configuration changes. One of the settings was the negotiation for the servers, which was set to “auto”. This caused the communication channel to be used at half – duplex and caused network errors to occur. This setting was changed back to full-duplex for both rp3 and rp4 and the network errors did not continue.</p> <p>11/12/03: After changing everything to full duplex – this issue did not reappear in perf. test in cycle</p>	<p>CSC (Lead) Bill Pallis</p>	Closed	11/14/03



**Task Order 145
FAFSA 8.0 and ED PIN
Performance Test Results**

		14 and 15.			
19	10/30/03	<p>The new HP boxes in the performance test environment are enabled for Virtual IP. This causes a larger packet size to be transmitted on the network. This does not cause a communication problem but when the sniffer was attached to the network to monitor for problems, it could not analyze the larger packets.</p> <p>11/12: Bill Pallis investigating this issue.</p> <p>11/20 - Packet traces taken on the 4.20.18.64/192 network found Ethernet frame errors between the Web and Application Servers. The original trace was taken from a Distributed Sniffer unable to recognize the Ethernet Frame. An updated NAI Gigabit Sniffer was installed in place of the DSS. It was determined that the Web and Application servers were VLAN aware and communicating with the new Cisco Catalyst via IEEE 802.1q encapsulation. This has no effect on the HP server's ability to communicate. The only outstanding issue is an upgrade to the legacy Distributed Sniffer.</p>	CSC (Lead) Bill Pallis	Closed	11/25/03
20	11/04/03	<p>Using Akamai in the Cycle 11 performance test caused traffic to use the backup interface to the internet. Traffic was going both ways at a consistent rate of 25 MB/sec, and the backup network only has a consistent network allowance of 15 MB/sec with bursts up to 30 MB/sec. In order to continue using Akamai in the capacity planning tests, we will need to ensure traffic uses the regular network by shutting down the backup or re-configuring the routing tables. For now, Akamai will not be included in the tests.</p> <p>11/05 -- There is a DS3 with 30Mbps burst and a 90Mbps POS for internet connections. The 90Mbps circuit is through Level 3. 90mbps circuit will be configured so that the performance test team will utilized this connection. CSC is working with Akamai to provide a DNS that will hand over any Level 3 IP addresses for our next test on 11/13</p> <p>11/12 -- Akamai will now direct the traffic to the Level 3 connection by using its edge servers in Level 3, rather than SBC. Ready to use on Perf Test on 11/13</p> <p>11/13 -- CSC changed the network so that the performance test will use bigger pipe for Akamai. On Cycle 15 CSC reported Denial of Service (DOS) attack during the test. Initial investigation showed CSS as culprit for throwing DOS attacks.</p> <p>11/18 -- Additional tests were scheduled on 11/14, 11/15, and 11/17 to investigate this issue. After testing for several days it was found that the individual Akamai servers which are pointing to the test environment are unable to handle more than 2000 user load. There were couple of suggestions:</p> <ol style="list-style-type: none"> 1) Remove the load generator boxes from VDC and spread the load to different location (not 	CSC (Lead) Bill Pallis	Closed	11/18/03



**Task Order 145
FAFSA 8.0 and ED PIN
Performance Test Results**

		<p>feasible due to lack of time and resource)</p> <p>2) Performance test with Akamai with 1000 user load since we don't see any errors at that load (this test does not add any value – agreed by FSA, CSC, and Accenture).</p> <p>It was agreed by all the party that Akamai will be dropped from the performance test hence this issue is closed.</p>			
21	10/27/03	<p>The started task QPMON was observed intermittently using as much as 70% of a single processor for brief periods of time interspersed with relatively long idle periods. QPMON is a component of QPASA, a monitor for Websphere MQ. QPMON appears to "wake up" every so often, do something, and then "go back to sleep" for awhile. While "awake" it is very CPU intensive. It is necessary to understand QPMON's resource consumption - and identify ways to reduce it.</p> <p>11/05 -- Nancy Mathisen is currently working with the vendor to determine why the CPU consumption is so high</p> <p>11/07 -- Carol has escalated issue to vendor. Nancy Mathisen sent additional logging info to vendor on 11/06. Sent additional info on 11/07.</p> <p>11/10 -- This issue has been escalated to Mary Jo Blaisdell, who is the manager of Support. MQSoftware has been working with Nancy on this problem. Dave Lass had an update today from Rick Tercero, a Senior Sales Engineer from MQSoftware, and Dave will get another one tomorrow from Rick as well as Doug Hermanson, the Senior Director of Sales. The problem occurs whenever the QPASA service becomes unavailable. This happened once this week during the UNIX Sun box reboot. The problem surfaced and was resolved without any manual intervention when the UNIX box came up and the services restarted. It is strictly relegated to mainframe, and MQSoftware does not know why it is happening yet. Nancy sent MQSoftware logs on Sunday, which they have reviewed, and today they have asked her to increase the logging capability. The initial investigation says that there is a bug in the mainframe agents which they are trying to find and fix.</p> <p>11/12 – This has been raised as a Sev 1 issue within MQsoftware</p> <p>11/17 – Issue is being dealt by a CSC QPASA Team. Greg Dwyer is providing daily status. The MQSoftware vendor stated they will be escalating their questions to IBM to a priority 1. Nancy Mathisen made changes to the LE parms 'HEAP' settings and is attempting to send the logs to the MQSsoftware website.</p> <p>11/26: A CSC team has been created to work on the QPASA issue. Greg Dwyer has been sending out daily updates. CSC indicates that this issue is of a priority and CSC is working with the vendor</p>	CSC (Lead) Carol Greer	Closed	11/26/03



**Task Order 145
FAFSA 8.0 and ED PIN
Performance Test Results**

		for a speedy resolution. CSC requests that since the performance test team is not actively working on this issue and a special team has been created to resolve this issue this should be closed from the performance test issue list. If all the party feels the same then we can close this issue from the performance test issue list.			
22	11/06/03	<p>FAFSA needs to use DES3 which needs to be configured and performance tested.</p> <p>11/12 – Must define exactly what encryption is required to be DES3. According to different sources, complying with DES3 means 128 bit encryption or 168 bit encryption. 168 bit encryption is not supported by most browsers that are currently supported for FAFSA, it is only supported by Windows NT and Windows 2000.</p> <p>11/15 -- DES 3 does not work with Windows 95 or Windows 98. Thus, we may limit whole bunch of users if DES3 is configured in the FAFSA environment. FSA will discuss this with OIG. Meanwhile, we are planning to add DES3 in the performance test and see its impact.</p> <p>11/18 – This is on hold for now. FSA will communicate the impact of configuring FAFSA with DES3 with OIG.</p> <p>11/26 – FSA has set up a meeting with OIG around mid December. This will be discussed with OIG and will not be implemented before the FAFSA peak.</p>	Pearson (Lead) Matt Kain/Bob Wehrle	Closed	11/26/03
23	10/2/03	<p>Null Pointer Exception: During Fill out a FAFSA perf test, the same SSN was used in consecutive applications. This caused a null pointer exception to occur on HPN8.</p> <p>10/17/03 – Matt Kain reports that this is fixed – scheduled to be tested by 10/31.</p> <p>11/3/03 – This issue could not be tested before 10/31 due to CSS issue taking more priority. Pearson is not available this week to test this issue. This will be tested after the capacity planning tests are completed.</p> <p>11/18/03 -- This was tested on cycle 20 and the null pointer errors were seen.</p> <p>12/02/03 – This was retested in cycle 22 and the null pointer errors were no longer seen.</p>	Pearson (Lead) Matt Kain	Closed	12/02/03
24	12/01/03	<p>Several problems occurred while re-testing load runner scripts prior to the test.</p> <p>1) A05 Exception thrown when accessing Corrections Reason: This happens when an correction is applied to a transaction that doesn't exist. Since we</p>	Pearson (Lead) Bill Devore	Closed	12/02/03



**Task Order 145
FAFSA 8.0 and ED PIN
Performance Test Results**

		<p>were pointing to a different database, the data was not found. Module A05</p> <p>2) Null Pointer Exception in Fillout a FAFSA and FAFSA Renewals Reason: One of the edit modules was failing on the first database lookup for date validation. Module A41</p> <p>3) Received message: "Error occurred while accessing database" Reason: The edit module database insert module was failing. Module A48</p> <p>As a result of these errors, the following scripts were unable to complete processing: Fill out a FAFSA, FAFSA Corrections, FAFSA Renewals, FAA Corrections, FAA Renewals.</p> <p>12/02/03 – On 11/24, the CPS Test System and Web Demo site were put into production. The scripts used to migrate and rebind those programs, so they could work on database 503 were incorrectly run against the performance test environment. In essence, the programs in the performance test were working properly, however they were bound (connected) to a different database (we use 502 in performance test, 503 is the test system). Only some programs were impacted, since not all of the scripts were incorrect (the ones used in the test system, that have shared components with DB2 access).</p> <p>Resolution: Same for all 3... A "mini" code merge was performed, to put in place the correct load module back into performance test environment and rebound to the correct database. Modules updated were (A05, A41, and A48). In addition, B06 was done. This is not something that can happen in production, since the production CICS transactions are all defaulted to the correct database. It is unique to the configuration of the performance test environment.</p>			
25	10/21/03	<p>10/21 – Tom Puddicombe changed the Workload Management to make the performance test requests a lower priority.</p> <p>10/22 -- Still to be addressed – there are other aspects of Workload Management on the mainframe that need to be considered/addressed to be positive that performance test will not impact production in the future (eg. Channel Initiators).</p> <p>11/24 -- Tom, Scott, Bill, and Carol met to discuss the work load management for the mainframe. There will be a working group (meeting at 2 pm Monday for 2 -3 weeks) to identify and implement the workload management policy.</p> <p>12/01-- Discussion of Workload Management CSC (Tom), Pearson (Bill), and Scott Gray. All parties agreed to current workload management configuration.</p> <p>12/2 -- All parties agreed to current workload management configuration.</p>	CSC (Lead) Tom Puddicombe, Bill Devore, Scott Gray	Closed	12/01/03



**Task Order 145
FAFSA 8.0 and ED PIN
Performance Test Results**

26	11/10/03	<p>Tom noticed that the transactions CPU demand increased from the performance test that was conducted on 10/28 and 11/4. Pearson indicates that the application has not changed from 10/28 to 11/4.</p> <p>11/17 -- Tom Puddicombe is in the process of analyzing SMF records to identify the subset of which function is the big CPU user.</p> <p>11/26 – Tom did initial research and send out information to Diane and Bill. Pending input from Bill and Diane.</p> <p>12/2: Bill reviewed Tom’s analysis and informed the group that there were no issues. This is an expected behavior.</p>	CSC (Lead) Tom Puddicombe, Diane Uhl Bill Devore	Closed	12/03/03
27	10/23/03	<p>Cycle 7 – CICS region became non-responsive and failed. This occurred during a test of the Student Access business process with 1500 users executing.</p> <p>TMON, the monitoring software, was causing abends in the CICSPTST region during performance testing. This has been potentially addresses with an ASG fix. (this was previously opened as a separate issue – per CSC’s this is same as the above issue – thus two issues were combined into one 11/18)</p> <p>11/05 -- Walt Barrett has ordered the maintenance upgrade for TMONCICS</p> <p>11/10 -- Walt Barrett has ordered the maintenance upgrade for TMONCICS and has not received this yet.</p> <p>11/12 -- ASG has another fix and are sending. Maintenance upgrade should be shipped today.</p> <p>11/17 -- Walt Barrett is currently working on laying down the TMONCICS maintenance upgrade on the CPS systems.</p> <p>11/18 -- The ASG Vendor has notified us that a PTF is being written to fix the S0C4, S0C1 abends that occurred in TMONCICS during performance testing. They have found a problem in the TMONCICS hook to the CICS Dispatcher routines. CSC does not have an ETA at this point, but will continue to follow up with the vendor for status.</p> <p>11/21 -- CSC received the PTF and is reviewing pre/co requisites and will have a target date set shortly dependant on the outcome of that review.</p>	CSC (Lead) Tom Puddicombe Bill Devore	Closed	12/09/03



**Task Order 145
FAFSA 8.0 and ED PIN
Performance Test Results**

		<p>11/26 -- CPSD scheduled for 12/3 and CPSP scheduled for 12/7.</p> <p>12/3 – Once the PTF is applied the performance test team will run FAA corrections on 12/9 to test this fix.</p> <p>12/9 -- FAA Correction was run to test the fix. The test was run for 45 minutes and no errors were seen.</p>			
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