Program 42

MALCOLM CAMPBELL

Workbrain Scalability Assessment

Test Completion Report

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Revision History

Version number	Revision date	Summary of changes	Primary Author
0.1	28/04/08	Initial version	Amir Mahmoudi
0.2	30/04/08	Review and update	John Sinclair
0.3	06/05/08	Updates based on Internal review	John Sinclair
1.0	15/05/08	Updated based on comments from the client and minor update to section 4.3.2	Amir Mahmoudi
1.1	23/05/08	Updates the recommendations section	Amir Mahmoudi
2.0	25/07/08	Final version	PDO

Reviewer List

Name	Title

Distribution

Name	Title

Related Documents

Test Type	Release Date	Title of Document/Location	Version
Project Execution Plan	26/03/08	\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Project Execution Plan\Workbrain Scalability Assessment PEP v0.1.doc	0.1
Test Plan	23/04/08	\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Deliverables\Test Plan\Workbrain Scalability Assessment Test Plan ver 1.1 final.doc	1.1
1	07/02/08	\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime	0.2

Test Type	Release Date	Title of Document/Location	Version
		Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 1\Results\P42 Scalability Testing Test1 Report v0.2.doc	
2a	06/03/08	\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 2a\Results\Workbrain POC rostering Test 2 summary of findings.doc	
		\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 2a\Results\Workbrain POC rostering Test 2 summary of problems encountered.doc	
		\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 2a\Results\Workbrain Scalability - Test 2 first rostering test - Analysis v0.1.doc	
		\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 2a\Results\Workbrain Scalability - Test 2a - Analysis v0.2.doc	
2b	28/03/08	\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 2b\Results\Workbrain POC rostering Test 2b Executive Summary.doc	
2c	07/04/08	\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 2c\Results\Microsoft Word - Test2c_500VU_Run1_3Server_03042008_Report.pdf	
		\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 2c\Results\Microsoft Word - Test2c_1000VU_Run1_3Server_03042008_Report.pdf	
		\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 2c\Results\Microsoft Word - Test2c_1500VU_Run2_3Server_NS_RR_04042008_Report.pdf	
3-online	18/04/08 to 24/04/08	\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 3\Results\Test3_500VU_Run1_1Server_17042008_Report.pdf	
		\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 3\Results\Test3_500VU_Run1_2Server_18042008_Report.doc	
		\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 3\Results\Test3_1000VU_Run1_1Server_17042008_Report.pdf	
		\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 3\Results\Test3_1000VU_Run1_2Server_18042008_Report.doc	
		\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 3\Results\Test3_1200VU_Run1_1Server_18042008_Report.doc	
		\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 3\Results\Test3_1500VU_Run1_1Server_18042008_Report.doc	
		\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 3\Results\Test3_1500VU_Run1_3Server_22042008_Report.pdf	
		\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 3\Results\Test3_2000VU_Run1_3Server_22042008_Report.pdf	
		\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 3\Results\Test3_2500VU_Run1_3Server_22042008_Report.pdf	
		\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 3\Results\Test3_3000VU_Run1_3Server_22042008_Report.pdf	
3-batch		\\NW-CLUSTER-01_CTDATA_SERVER\CTDATA\DATA\CT\17 - SSS - Prime Contractor - IBM\23. Workbrain Scalability Assessment\Plan\Test 3\Results\P42	0.2

Test Type	Release Date	Title of Document/Location	Version
		Scalability Testing Test 3 Batch Report v0.2.doc	

Definitions

Term	Definition
CPU	Central Processing Unit.
End-state	This term refers to the end of the SSI, SSS design, build and implementation program, when all Queensland Government agencies and Shared Service Providers have gone live with the new SSS business solutions.
HTTP	Hypertext Transfer Protocol.
J2EE	Java 2 Platform, Enterprise Edition.
LDAP	Lightweight Directory Access Protocol.
POC	Proof-of-Concept
SDA	Solution Design Authority
SSI	Shared Service Initiative.
SSL	Secure Socket Layer.
SSS	Shared Service Solutions.
TPH	Transactions per hour.
TPS	Transactions per second.
Vuser	Virtual User, HP/Mercury LoadRunner user that emulates the business transaction of a normal user.
WoG	Whole-Of-Government.

Table of Contents

1. Introduction

1.1 Purpose

The purpose of this document is to:
- Provide a summary of the Workbrain Scalability Assessment testing effort;
- Enable management to make an informed decision regarding whether Workbrain is the right solution for award interpretation, or if it is not, to identify the associated risks;
- Ensure exit criteria are met, or if they are not, that risk is accepted.

This document does not cover the detailed testing results. Rather it provides a high level summary of the results. For further detail, please refer to the individual testing results.

1.2 Audience

The target audience includes all those who have had a role to play both during test preparation and test execution as well as those who will be involved in making the go/no go decision. This will include:
- CorpTech SDA and SSS Technology Solutions
- IBM
- Program / Project Managers

2. Description

2.1 Overview

The original SSS solution design for non rostering Agencies relied solely on the SAP application for award interpretation processing. Based on actual payroll processing results at the Department of Housing, and extrapolating these to include the remainder of non rostering agencies, it became evident that the SAP application would be unable to process the award interpretation function within an acceptable timeframe to meet SSS business requirements.

In IBM's Invitation to Offer, it was proposed to replace the SAP centric approach to award interpretation with the Workbrain application to alleviate processing time constraints and to realise the additional following benefits:

- Economies of scale through developing only one set of rules that will be utilised across all Agencies. The Workbrain architecture allows pay rules to be designed so they are fully configurable across multiple awards and across multiple Agencies. The award configurations have a large number of similarities allowing a small set of rule components to be built that can then simply be reconfigured to fit any number of awards. Currently awards and their associated pay rules will be developed in Workbrain as part of the Phase One roll out to Health. Therefore, huge efficiencies can be gained through re-using these existing rules and configurations for other Agencies, eliminating the costly and time consuming development phase in SAP;
- Implementing all awards in Workbrain provides a single system of record for their configuration, therefore providing significant efficiencies for maintenance, EBA updates, training, etc;
- The Workbrain rule and leave accrual engine is extremely efficient in providing considerable time savings, particularly when all awards will already have been interpreted when SAP payroll runs are made, vastly improving the time window required for this;
- The system architecture of the Workbrain rule engine is designed to allow simple and efficient integration with custom components. This allows for a very short development cycle where all customisations are written in Java and fully extendable and re-usable;
- Workbrain provides a large number of standard pay rules within the core system, considerably reducing the size of custom development required;
- Changes to award agreements can be made quickly and easily via the pay rule editor in Workbrain, eliminating the need for further custom development and associated costs;
- Configuration of pay rules in Workbrain is simple relative to SAP, with all configurations fully exportable via XML.

In principle, SSS accepted IBM's proposal to utilise the Workbrain application for both rostering and non rostering agency award interpretation. Before proceeding with this approach, SSS has requested that IBM perform a series of tests that must evidence Workbrain's ability to scale, providing comfort that business requirements can be satisfied. This scalability test requirement is documented as a deliverable in SOW 5 – Priority Core HR & Finance Development. On test completion, a Workbrain Scalability Assessment Test Completion Report (contracted deliverable, this document) will be presented to SSS, outlining the tests performed, results obtained and interpreted findings. A go/no-go decision on the proposed solution will be made by SSS after review and consideration of this document.

3. Test Scope

The scope of this testing exercise is to assess the scalability capability of the Workbrain application. As such any application functional testing, performance testing, stress and volume testing, and any tests to confirm production sizing is out of scope of this activity.

There are three types of testing involved in this assessment:
- Non-rostering agency processing (Test 1) will execute award interpretation in batch utilising an imported employee file as input. This test will be executed on interim sized batch and production sized database servers;
- Rostering agency processing (Test 2) will test concurrent user scalability by submitting timesheets through the online Workbrain application front end and subsequently perform the Award interpretation. This test will be conducted on a production sized database server and on interim hardware (approximately ~ 50% production) for the application servers;
- Combined rostering and non-rostering (Test 3) scenarios on production sized hardware using a range of transactions per hour and a range of concurrent users. Results will be assessed against anticipated volumes. The rostering and non-rostering tests will not overlap in time, i.e. The rostering and non-rostering tests will be executed at different times.

Important Note: Initially Test 3 included a file transfer portion via SAP XI. A decision has been made to exclude the same from the scope of Test 3. A CR has been raised by CorpTech in order to remove this from the scope of the Test 3. Below is a representation of the testing types:
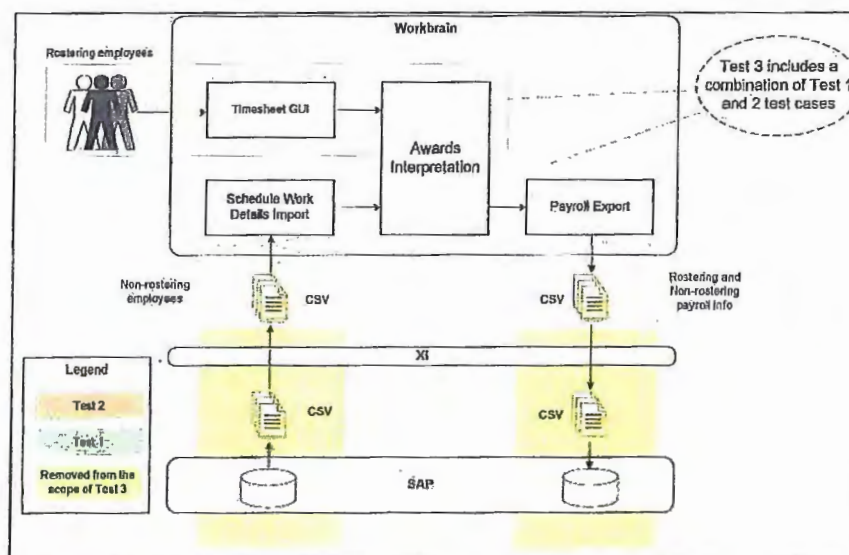
4. Test Results

4.1 Test 1

The results of Test 1 demonstrate the ability of the Workbrain batch processing solution to scale horizontally and vertically. In addition, they indicate very fast processing speeds for two of the three

tests - full recalculation and creating the export file. Both show increased performance proportionate to changes in horizontal and vertical configuration.

The results of the schedule work detail import test, were inconsistent and required further database tuning and test configuration before developing a final assessment on either processing speeds or the solution's ability to scale to meet data import requirements. The test results to date demonstrate the ability to scale vertically. They also indicate fast processing times which, when extrapolated, would very easily fall within the window for pay processing. However, an issue was surfaced with horizontal scaling (i.e., addition of job schedulers). The database timed out in an irregular manner when running 40 or more import process threads simultaneously, even though processing completed within required windows.

Test	Assessment	Optimal Test Result	Optimal Configuration
Schedule Work Detail Import File	Y	112 minutes	• Batch Servers: 1 • Job schedulers: 4 • Tasks per scheduler: 10 • Total Tasks : 40 • Period: 7 Days (05May - 12May) • Records 1,060,000
Full Recalculation Process	G	48 minutes	• Batch servers: 2 • Job schedulers: 2 • Tasks per scheduler: 2 • Threads per task: 4 • Total threads: 16
Export File	G	12 minutes	• Batch servers: 2 • Job schedulers: 8 • Tasks per scheduler: 1 • Threads per task: 1 • Total threads: 8 • Pay groups: 8

4.2   Test 2

4.2.1   Test 2a

Tests were performed to determine the maximum number of users that could be successfully run on 1 server, 2 servers and 3 servers. Below matrix shows the results with 1, 2 and 3 servers:

| WorkBrain Servers	VUsers		
	Success	Borderline	Fail
1	100	-	
2	200	300	
3	300	450	600

Test 2a
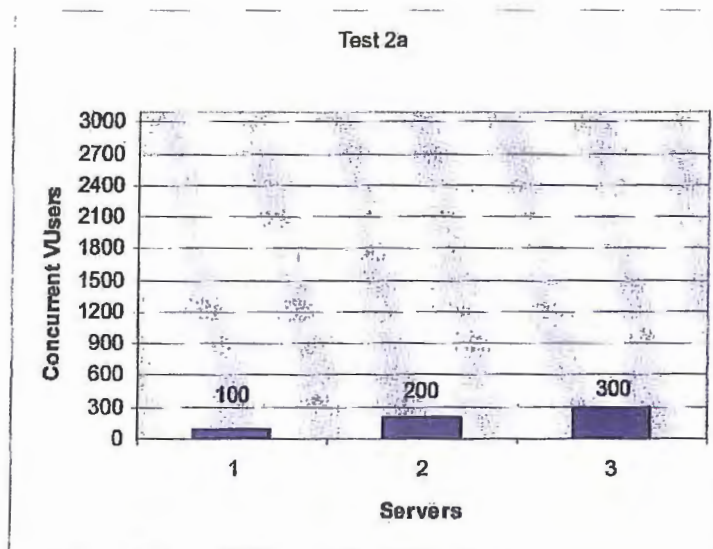
It was determined that Workbrain was installed using default settings for WebSphere and that a WebSphere specialist should be engaged to tune WebSphere. It was also determined that the LoadRunner VUsers were executing at the rate of 32 timesheets submitted per VUser per hour. It was agreed that a more realistic scenario was that each of the concurrent users was executing at the rate of 12 timesheets per VUser per hour, and this definition of concurrent users was used for subsequent tests, and VUsers were calibrated to this rate.

4.2.2 Test 2b

Tests were performed to determine the maximum number of concurrent users that could be successfully run on 1 server, 2 servers and 3 servers. Below matrix shows the results with 1, 2 and 3 servers:

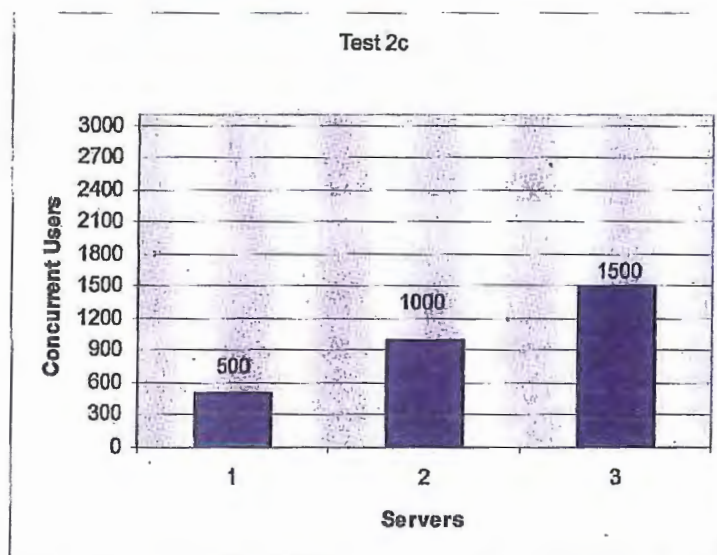| WorkBrain Servers	Concurrent Users		
	Success	Borderline	Fail
1	380	-	400
2	500	630	675
3	760	775	800
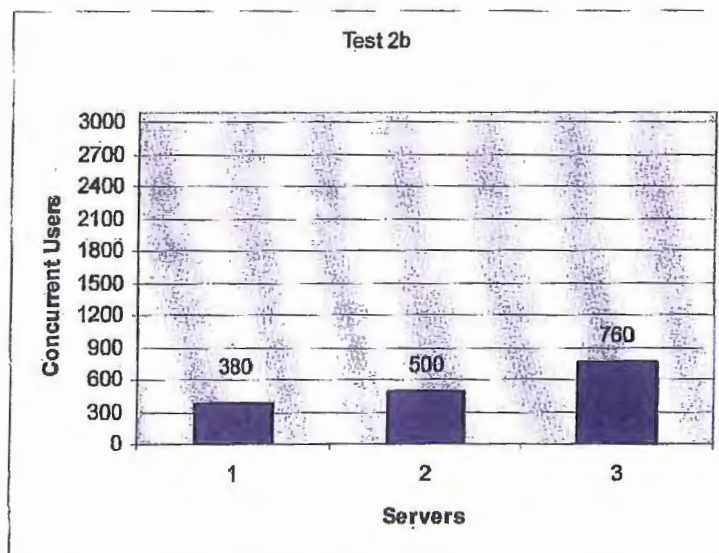
Test 2b

It was determined that the cause of the problem was the load balancing method used by the Web Server Plug-in. During this test, the "Weighted Round Robin Equal Weight" method was used. The method was changed to Random and subsequently Test 2c was executed.

4.2.3 Test 2c

After completion and certification of test 2b, further tuning was done to the interim landscape. Capacity was doubled by employing an alternative load balancing algorithm on the web server plug-in. Where "Weighted Round Robin Equal Weight" had been employed previously, the use of "Random" doubled the performance.

Tests were performed to determine the maximum number of users that could be successfully run on 1 server, 2 servers and 3 servers. Below matrix shows the results with 1, 2 and 3 servers:

WorkBrain Servers	Concurrent Users		
	Success	Borderline	Fail
1	500	-	1000
2	1000	-	1500
3	1500	1650	2000

Test 2c

With this configuration, the interim environment showed scaling as additional servers were added, more concurrent users could be handled, and the configuration could successfully handle the 1500 concurrent users that it was sized for.

4.3 Test 3

4.3.1 Test 3 online

The online portion of Test 3 was executed against the Workbrain environment on the Production infrastructure. Note that SSL is fully configured from Client all the way up to the WebSphere Application Servers, due to security requirements in the Production infrastructure.

Tests were performed to determine the maximum number of users that could be successfully run on 1 server, 2 servers and 3 servers. Below matrix shows the results with 1, 2 and 3 servers:

WorkBrain Servers	Concurrent Users		
	Success	Borderline	Fail
1	1200	–	1500
2	2000	–	2500
3	3000	–	-

Test 3
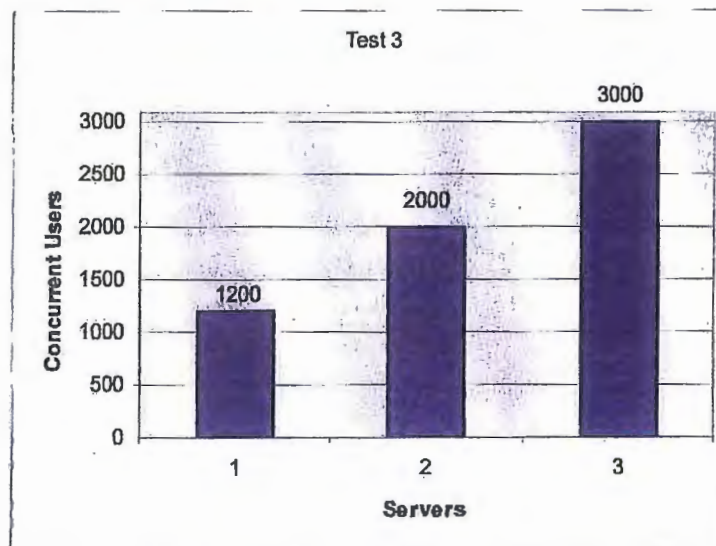
This test was executed using 3,000 concurrent virtual users on three Production Workbrain servers. 3,000 concurrent users represent a total user base of 90,000 and is considered to be the end state figure for rostered employees. This test was successful.

4.3.2 Test 3 batch

The results of Test 3 demonstrate the ability of the Workbrain batch processing solution to meet the exit criteria on production-sized hardware.

Test	Assessment	Optimal Test Result	Optimal Configuration
Schedule Work Detail Import File	☺	119 minutes	Two sequential jobs of • Batch Servers: 1 • Schedulers per Server: 4 • Tasks per Scheduler: 2 • Total Tasks: 8 • Batch Process Size: 200
Full Recalculation Process	☺	56 minutes	• Batch Servers: 2 • Schedulers per Server: 4 • Tasks per Scheduler: 2 • Threads per Task: 8 • Total Threads: 128 • Batch Process Size: 20
Export File	☺	28 minutes	• Batch servers: 2 • Schedulers per Server: 2 • Tasks per Scheduler: 1 • Threads per Task: 1 • Total Tasks: 4 • Payroll Groups per Task: 4

4.4   Any variance to original plan

The original plan for Test 3 included a file transfer portion to SAP via XI. CorpTech raised a Change Request in order to remove this from the scope of Test 3, hence Test 3 execution included the Online Award processing and Batch Award processing. The Batch Award processing included an import to Workbrain, processing by Workbrain and export from Workbrain, without transferring files to and from Workbrain from SAP (via XI).

4.5   Observations

During Test 2c, an additional approach was also undertaken. The web servers were eliminated from the solution and Citrix Netscaler performed all load balancing. All traffic was routed directly from Citrix Netscaler to the Workbrain application servers. The three load balancing algorithms were:
- Simple round robin;
- Fastest response time;
- Least connections.

The first algorithm provided performance comparable to (if not marginally better than) the performance when using the web servers. The remaining algorithms did not exhibit good performance.

During Test 3, it was found that the Oracle SQL execution plan for Payroll Export was not optimal, and the registry parameter was changed from FIRST_ROWS to ALL_ROWS.

During Test 3, it was found that the Oracle SQL execution plan was not optimal, and that Oracle was choosing the wrong index for the query. The workaround used to was to drop the IDX_EMPSKD_WORKDT index. A Workbrain Support Hub Incident was raised to add a configurable registry parameter for this tuning (Incident number 1978603).

5.   Conclusions

5.1   Exit criteria

All exit criteria, as defined in the Test Plan, have been reached.

Online

3000 concurrent users on 3 Servers –	reached
Application scales linearly -	reached

Batch

Work Schedule Import less than 4 hours –	reached
Full Award Recalculation less than 1 hour –	reached
Payroll Export less than 30 minutes –	reached

5.2   Recommendations

Recommendation 1:
> Based on the results of the scalability assessment tests, it is recommended that a "Go" decision be made to adopt Workbrain as the whole-of-government solution for awards interpretation. The tests did not identify any unacceptable risks. The Workbrain scalability assessment has been successfully completed.

Recommendation 2:
> It is recommended that further architectural analysis and testing be undertaken to determine if the Web Server functionality can be handled by the NetScaler device.

Recommendation 3:
> It is recommended that detailed Non-Functional Requirements be gathered and architectural work products developed for Program 42.

This is the last page of this document.

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Deliverable Acceptance Sheet

A separate Acceptance Sheet is to be completed for each deliverable. Upon completion, please submit to Vendor Management

Deliverable Description

Deliverable ID	CD_B05_0005
Deliverable Name	Workbrain Scalability Assessment Test Report
SoW Number	SOW 5
Deliverable Lead	Tom Lambert
Purpose	Submission of Workbrain Scalability Assessment for SOW 5

Date of Deliverable	26/05/08	Date due to IBM	30/06/08

Deliverable Composition	Word document
Dependent Deliverables	N/A
Prerequisite Deliverables	N/A
Linked to Payment Milestone ☒ Yes ☐ No	Milestone Date: 30th June 2008

Acceptance Details

Created:	Date:
Acceptance Lead: Mike Robinson	Date:
ACCEPTED (refer to 'Comments' Section) ☒	NOT ACCEPTED (refer to 'Comments' Section) ☐
Acceptance Lead Signature:	Date: 30/05/2008

Acceptance Board

Acceptance Panel (List Board Members)	Area of Acceptance (e.g. Technical, Quality, Audit, Resourcing etc)	Date
Mike Robinson	HR Lead	30/05/2008

Comments

Comments / Issues / Defects (add notes or attach document. If not accepted, please provide list of defects and issues).