

**VOLUME AND PERFORMANCE TEST REPORT - PHASE 2**  
**COMMERCIAL IN CONFIDENCE**

**Document Title:** VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

**Document Reference:** TST/SOT/REP/0866

**Release:** HNGX Release 1

**Abstract:** This is the Volume and Performance Test Report for Phase 2 of testing conducted on the VOL rig for HNG-X Release 1.

**Document Status:** APPROVED

**Author & Dept:** Michael Welch

**External Distribution:** None

**Security Risk Assessment Confirmed** YES security risk has been considered, see section 0.9 for details

**Approval Authorities:**

Name	Role	Signature	Date
Geoff Butts	Programme Manager	See Dimensions for record	
Debbie Richardson	Testing Manager	See Dimensions for record	
Lee Farman (POL, JTT)	POL Test Manager	See Dimensions for record	
Dave Chapman	Capacity Management	See Dimensions for record	





VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



## 0 Document Control

### 0.1 Table of Contents

<b>0</b>	<b><u>DOCUMENT CONTROL</u></b>	<b>2</b>
<b>0.1</b>	<b><u>Table of Contents</u></b>	<b>2</b>
<b>0.2</b>	<b><u>Document History</u></b>	<b>4</b>
<b>0.3</b>	<b><u>Review Details</u></b>	<b>4</b>
<b>0.4</b>	<b><u>Associated Documents (Internal &amp; External)</u></b>	<b>5</b>
<b>0.5</b>	<b><u>Abbreviations and Terms</u></b>	<b>5</b>
<b>0.6</b>	<b><u>Glossary</u></b>	<b>6</b>
<b>0.7</b>	<b><u>Changes Expected</u></b>	<b>6</b>
<b>0.8</b>	<b><u>Accuracy</u></b>	<b>6</b>
<b>0.9</b>	<b><u>Security Risk Assessment</u></b>	<b>7</b>
<b>1</b>	<b><u>INTRODUCTION</u></b>	<b>8</b>
<b>2</b>	<b><u>SCOPE</u></b>	<b>8</b>
<b>3</b>	<b><u>MANAGEMENT SUMMARY</u></b>	<b>9</b>
<b>3.1</b>	<b><u>Test Approach</u></b>	<b>10</b>
3.1.1	Cycle 1	10
3.1.2	Cycle 2	11
3.1.3	Cycle3	11
3.1.4	Peak Clearance Cycle	11
<b>3.2</b>	<b><u>Test Case Coverage</u></b>	<b>11</b>
<b>3.3</b>	<b><u>Defects</u></b>	<b>15</b>
3.3.1	Defects Raised	15
3.3.2	Open Defects	15
<b>3.4</b>	<b><u>Conclusion</u></b>	<b>17</b>
<b>4</b>	<b><u>PRE-REQUISITES</u></b>	<b>18</b>
<b>4.1</b>	<b><u>Environment</u></b>	<b>18</b>
<b>4.2</b>	<b><u>Application Under Test</u></b>	<b>20</b>
<b>5</b>	<b><u>TEST CASE DETAILS</u></b>	<b>21</b>
<b>5.1</b>	<b><u>Test Group XCAL – HNG-X Calibration Test</u></b>	<b>21</b>
5.1.1	HNG-X Calibration – Simple EPOSS	21
5.1.2	HNG-X Calibration – Simple EPOSS for MVP	23
5.1.3	HNG-X Calibration – Basket Mix	24
<b>5.2</b>	<b><u>Test Group C01 – HNG-X Counter Performance</u></b>	<b>27</b>
<b>5.3</b>	<b><u>Test Group H11 – APOP</u></b>	<b>27</b>
5.3.1	APOP Contracted Peak Hour / Peak 5 Minutes	27
<b>5.4</b>	<b><u>Test Group H12 – DVLA</u></b>	<b>28</b>
5.4.1	DVLA Contracted / Design Limit Peak Hour / Peak 5 Minutes	28
5.4.2	DVLA Stress Test	29



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



<b>5.5</b>	<b><u>Test Group H13 – PAF</u></b>	<b>30</b>
5.5.1	PAF Stress Test	31
<b>5.6</b>	<b><u>Test Group R01 – Branch Router</u></b>	<b>31</b>
<b>5.7</b>	<b><u>Test Group X01 – HNG-X Volume</u></b>	<b>31</b>
5.7.1	HNG-X Volume (Monday)	31
<b>5.8</b>	<b><u>Test Group X05 – Debit Card</u></b>	<b>33</b>
5.8.1	Debit Card Contracted / Design Limit Peak Hour / Peak 5 Minutes	33
5.8.2	Debit Card & ETU Stress Test	34
<b>5.9</b>	<b><u>Test Group X06 – HNG-X CAPO</u></b>	<b>36</b>
5.9.1	HNG-X CAPO Contracted / Design Limit Peak Hour / Peak 5 Minutes	36
5.9.2	HNG-X CAPO Stress Test	37
<b>5.10</b>	<b><u>Test Group X07 – LINK</u></b>	<b>37</b>
5.10.1	HNG-X LINK Stress Test	37
<b>5.11</b>	<b><u>Test Group X08 – HNG-X A&amp;L</u></b>	<b>37</b>
5.11.1	HNG-X A&L Stress Test	37
<b>5.12</b>	<b><u>Test Group X09 – HNG-X ETU</u></b>	<b>38</b>
5.12.1	HNG-X ETU Contracted / Design Limit Peak Hour / Peak 5 Minutes / Stress Test	38
<b>5.13</b>	<b><u>Test Group X10 – HNG-X T&amp;T</u></b>	<b>38</b>
5.13.1	HNG-X T&T Contracted / Design Limit Peak Hour / Peak 5 Minutes	38
5.13.2	HNG-X T&T Stress Test	38
<b>5.14</b>	<b><u>Test Group X11 – BAL &amp; BRDB</u></b>	<b>40</b>
5.14.1	BAL & BRDB – Start of Day Profile	40
5.14.2	BAL & BRDB – Mid-Day Profile	51
5.14.3	BAL & BRDB – End of Day Profile	62
<b>5.15</b>	<b><u>Test Group X12 – BAL &amp; BRDB Stress Test</u></b>	<b>77</b>
5.15.1	BAL & BRDB Stress Test	77
<b>5.16</b>	<b><u>Test Group X13 – Logon / Logoff</u></b>	<b>80</b>
5.16.1	Logon / Logoff Contracted / Design Limit Peak 5 Minutes	80
5.16.2	Logon / Logoff Stress Test	82
5.16.3	Maximum Concurrent Sessions	83
<b>5.17</b>	<b><u>Test Group X15 – Reports</u></b>	<b>85</b>
5.17.1	Reports Contracted / Design Limit Peak 5 Minutes	85
5.17.2	Reports Stress Test	85
<b>5.18</b>	<b><u>Test Group XCB – HNG-X Combined Banking</u></b>	<b>91</b>
5.18.1	HNG-X Combined Banking Contracted / Design Limit Peak Hour / Peak 5 Minutes	91
5.18.2	HNG-X Combined Banking Stress Test	91
<b>6</b>	<b><u>ADDITIONAL TESTING</u></b>	<b>95</b>
<b>7</b>	<b><u>LESSONS LEARNED</u></b>	<b>95</b>
<b>8</b>	<b><u>RECOMMENDATIONS</u></b>	<b>96</b>
<b>9</b>	<b><u>CONCLUSIONS</u></b>	<b>98</b>



VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



## 0.2 Document History

Version No.	Date	Summary of Changes and Reason for Issue	Associated Change - CP/PEAK/PPRR Reference
0.1	24-AUG-2010	First draft for review	
1.0	17-SEP-2010	Final version for Approval following review. Changes made: 3.1.1 – minor change to 3 <sup>rd</sup> paragraph 3.2 – updated table for Test Group X11 details 3.4 – updated to reflect current Peak status 4.1 – IP addresses and platform names removed from table 5.14.2.1.1 – corrected graphs legend 5.14.3 – updated result details following re-test after fix for PC0201529 applied 5.18.2 – clarify wording of CAPO results 8. – updated wording for 2 <sup>nd</sup> bullet concerning ORM settings	

## 0.3 Review Details

<b>Review Comments by :</b>	
<b>Review Comments to :</b>	

Mandatory Review	
Role	Name
Programme Manager	Geoff Butts *
Testing Manager	Debbie Richardson
POL Test Manager	Lee Farman (POL, JTT) *
Capacity Management	Dave Chapman

Optional Review	
Role	Name
Solution Design / Development	Andy Beardmore
Solution Design / Development	Andrew Aylward
Solution Design / Development	Andy Thomas
Solution Design / Development	Martin Tonge
Solution Design / Development	Peter Jobson
Solution Design / Development	Graham Allen
Capacity Management	Mitul Unalkat
VI & TE Manager	Mark Ascott
VOL Test Team	Raj Kumar
VOL Test Team	Richard Locke



**VOLUME AND PERFORMANCE TEST REPORT - PHASE 2**  
**COMMERCIAL IN CONFIDENCE**

( \* ) = Reviewers that returned comments

Issued for Information – Please restrict this distribution list to a minimum	
Position/Role	Name
LST Manager	Sheila Bamber
SV&I Manager	Chris Maving

## 0.4 Associated Documents (Internal & External)

*References to associated documents should normally be made to the latest approved version in Dimensions; only refer to a specific version if necessary.*

Reference	Version	Date	Title	Source
[1] PGM/DCM/TEM/0001 (DO NOT REMOVE)			RMG BU Generic Document Template ( <i>This document</i> )	Dimensions
[2] TST/SOT/HTP/0003			HNG-X Volume and Performance High Level Test Plan	Dimensions
[3] PA/PER/033			Horizon Capacity Management and Business Volumes	PVCS
[4] ARC/PER/ARC/0001			System Qualities Architecture	Dimensions
[5] TST/SOT/REP/0008			Volume and Performance Test Report – Phase 1	Dimensions
[6] TST/SOT/HTP/0008			HNGX Counter Performance High Level Test Plan	Dimensions

## 0.5 Abbreviations and Terms

Abbreviation	Definition
A&L	Alliance & Leicester
AG4	Acceptance Gateway 4
APOP	Automated Payments-Out Processing
BAL	Branch Access Layer
BDB / BRDB	Branch Database
BRS	Branch Support Database
CAPO	Card Account at Post Office
DC	Data Centre
DCS	Debit Card Service
DRS	Data Reconciliation Service

**VOLUME AND PERFORMANCE TEST REPORT - PHASE 2**  
**COMMERCIAL IN CONFIDENCE**

Abbreviation	Definition
DVLA	Driver Vehicle Licensing Authority
EPOSS	Electronic Point Of Sale Service
ETU	Electronic Top-Up
HLTP	High Level Test Plan
HVP	High Volume Pilot
MVP	Medium Volume Pilot
NPS	Network banking Persistent Store
ORM	Oracle Resource Manager
OSR	Online Service Routing
PAF	Postal Address File
PCI	The Payment Card Industry Data Security Standard
SVP	Small Volume Pilot
T&T	Track & Trace
TPS	Transaction Processing System
tps	transactions per second
TWS	Tivoli Workload Scheduler
V&I	Volume & Integrity
VOL	Volume Test Rig Environment

## 0.6 Glossary

Term	Definition
Performance Testing or Load Testing	A series of tests to measure the performance characteristics and behaviour of specific components of the solution under load to demonstrate their ability to achieve defined performance requirements. For example, to test that a particular web service is capable of supporting the relevant contractual peak rate of transactions per second (the defined load).
Volume Testing	A series of tests to demonstrate that the whole solution is able to support a typical daily workload. For example, to test that a peak weekday transaction profile can be successfully harvested and that all scheduled batch processing can be completed within expected timescales.

## 0.7 Changes Expected

Changes
None

## 0.8 Accuracy



---

Fujitsu Services endeavours to ensure that the information contained in this document is correct but, whilst every effort is made to ensure the accuracy of such information, it accepts no liability for any loss (however caused) sustained as a result of any error or omission in the same.

## 0.9 Security Risk Assessment

Security risks have been assessed and it is considered that there are no security risks relating specifically to this document.



VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



## 1 Introduction

The Volume and Performance High Level Test Plan [2] outlined a 2-phase approach using different test environments:

- Phase 1 on the VI (Live rig) in IRE11 prior to pilot.
- Phase 2 on the VOL rig in IRE19 post pilot

This is the Test Report for Volume and Performance testing only, as executed during Phase 2.

Phase 2 Test Cycles were periods of testing interspersed with rig build activity to introduce new Data Centre and Counter releases.

This report provides a factual statement on the test status metrics at completion of Phase 2. The status of particular Test Cases and any associated defects can be ascertained from the Quality Centre system.

## 2 Scope

This report is solely concerned with the Phase 2 Volume and Performance test activities and is not reporting on the rig build activities that occurred before and during the period,.

The main objectives of Phase 2 Volume and Performance testing focussed on those test areas that must be completed prior to full rollout. In essence, this concentrated on demonstrating performance characteristics for a fully migrated branch estate at HNG-X with no Horizon elements. In addition, prior to commencing the formal performance tests, HNG-X 'calibration' testing was performed so as to provide comparison with the benchmark performance characteristics gathered in Phase 1 on the V&I rig. This was to demonstrate that the VOL rig had live-like characteristics to support the validity of all testing conducted during Phase 2.

The test outputs of Phase 2 testing supported:

- SVP (Small Volume Pilot)
- MVP (Medium Volume Pilot)
- HVP (High Volume Pilot)
- AG4 (Acceptance Gateway 4)



VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



### 3 Management Summary

For completeness, the following table shows all tests originally identified in the HLTP.

Green = tests conducted during Phase 1 as detailed in the Phase 1 Test Report [5].

Yellow = tests conducted during Phase 2 on the VOL rig, which are the subject of this report

Pink = Not tested (as agreed on completion of Phase 1). These were either subsumed in other tests or considered to be low risk.

Test Grp	Description	Phase 1 on V&I	Phase 2 on VOL	Not run
C01	Counter performance tests		Y	
H01	Horizon volume - Monday	Y		
H04	Horizon volume 2 day harvest			Y
H05	Horizon Debi Card to contractual limits - non-PCI			Y
H06	Horizon CAPO to contractual limits - non-PCI			Y
H07	Horizon Link to contractual limits - non-PCI			Y
H08	Horizon A&L to contractual limits - non-PCI			Y
H09	Horizon ETU to contractual limits			Y
H10	Horizon T&T to contractual limits	Y		
H11	APOP to contractual & design limits		Y	
H12	DVLA to contractual & design limits		Y	
H12b	DVLA stress test		Y	
H13	PAF to contractual & design limits	Y		
H13b	PAF stress test		Y	
HCb	Horizon combined banking to contractual limits - non-PCI	Y		
HPC	Horizon PCI combined banking & Debit Card to contractual limits	Y		
M01	Hydra mixed volume Monday			Y
M02	Hydra mixed volume Saturday			Y
M03	Hydra mixed volume Sunday			Y
M04	Hydra mixed volume 2 day harvest			Y
M05	Hydra mixed Debit Card to contractual and design limits			Y
M09	Hydra mixed ETU to contractual & design limits			Y
M10	Hydra mixed T&T to contractual & design limits			Y
MCB	Hydra mixed combined banking to contractual & design limits (PCI)			Y
R01	Branch router tests		Y	
X01	HNG-X volume Monday		Y	
X05	HNG-X Debit Card to contractual & design limits		Y	
X05b	HNG-X Debit Card stress test		Y	
X06	HNG-X CAPO to contractual & design limits		Y	
X06b	HNG-X CAPO stress test		Y	
X07	HNG-X Link to contractual & design limits			Y
X07b	HNG-X Link stress test		Y	
X08	HNG-X A&L to contractual & design limits			Y
X08b	HNG-X A&L stress test		Y	
X09	HNG-X ETU to contractual & design limits		Y	
X09b	HNG-X ETU stress test		Y	





## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



Test Grp	Description	Phase 1 on V&I	Phase 2 on VOL	Not run
X10	HNG-X T&T to contractual & design limits		Y	
X10b	HNG-X T&T stress test		Y	
X11	BAL and BRDB to contractual & design limits		Y	
X12	BAL and BRDB stress test		Y	
X13	Logon / logoff to contractual & design limits		Y	
X13b	Logon / logoff stress test		Y	
X13c	Maximum concurrent session		Y	
X15	HNG-X Reports to contractual & design limits		Y	
X15b	HNG-X Reports stress test		Y	
XCB	HNG-X combined banking to contractual & design limits		Y	
XCBb	HNG-X combined banking stress test		Y	
XCAL	HNG-X calibration test	Y	Y	

## 3.1 Test Approach

There were 3 planned Cycles of test iteration for Phase 2, run out of IRE19 and BRA01 within a dedicated VOL test environment. SSC Workstations in Bracknell were used to connect to the Data Centre and BRA01 platforms.

### 3.1.1 Cycle 1

Cycle 1 started on the 5th February 2010 and formally finished on 26th February 2010.

The original aim of Test Cycle 1 was to provide supporting evidence that from a performance perspective, the HNGX Release 1 solution was capable of supporting Medium Volume Pilot (MVP) and High Volume Pilot (HVP). Delays in starting Cycle 1 meant that the test outputs derived would only have real value in informing Programme Management decision making concern HVP.

Test coverage during Cycle 1 was limited and a number of key issues were identified during the cycle. Specific details of coverage and issues identified are documented in the separate Cycle 1 Test Report (NB: This was an informal document that only reached draft status and is not registered in Dimensions. A copy is available on request, though any important information of relevance is included in this report.).

Following review by the Test Management team, it was decided to curtail Cycle 1 in order to upgrade the rig to Release 01.08.03.10A. The main reasons for curtailing the cycle was due the high number of patches and fixes that had been applied to the Live estate and the difficulties of identifying performance related hot fixes that had been applied to LST. The value being obtained from the test runs was diminishing. In order to re-establish a clean and known position, the C1/C2 rig top up was brought forward.

As a result of the solution issues identified by the key defects/peaks identified during cycle 1, the conclusions drawn were:

- MVP would be able to proceed, albeit at reduced Branch numbers. This was because the transaction level of the MVP branches would not exceed a transaction rate of 500 tps.
- HVP would be able to start as the solution would support up to 1500 Branches. However it could not complete until fix resolutions to the key defects/peaks identified above had been proven on VOL and LST and were available for release into the Live estate.

**VOLUME AND PERFORMANCE TEST REPORT - PHASE 2**  
**COMMERCIAL IN CONFIDENCE**

### 3.1.2 Cycle 2

Cycle 2 started on the 1<sup>st</sup> March 2010 and formally finished on 25<sup>th</sup> March 2010.

Following a live incident resulting in Red Alert status being raised, the attention of VOL testing was switched to supporting the investigation and resolution of issues emanating from the Red Alert. In effect, therefore, the planned VOL Cycle 2 testing was abandoned. No separate Cycle 2 Test Report was produced.

### 3.1.3 Cycle3

Following conclusion of Red Alert testing, VOL Cycle 3 commenced on 18<sup>th</sup> June and formally finished on 28<sup>th</sup> July.

In light of the abandonment of Cycle 2, the stress tests targeted for Cycle 3 were modified to demonstrate conformance of contractual and design limit volumes as part of those tests, and a number of tests previously completed successfully during Cycle 1 were also repeated in consideration of the significant number of solution updates introduced since completion of Cycle 1.

A test review identified and prioritised the specific planned tests required to be completed to support AG4. These were completed on 27<sup>th</sup> June 2010 to enable AG4 decision to start full live roll-out on 30<sup>th</sup> June 2010.

Additional tests over and above those specified in the HLTP were also included in Cycle 3 following the test review. These included

- 9 day soak test (running at Peak load for an extended number of days)
- test against Egenera recommended changes
- test against a single C-blade
- test with constrained DB Caching
- test with node failure and reintroduction of failed node during on-line day
- tests for various ORM configuration settings

Monitoring and measurement of Streams behaviour was also captured throughout Cycle 3 and Peak clearance.

### 3.1.4 Peak Clearance Cycle

This Cycle focussed on specific testing of further Peak fix deliveries, and other additional tests requested by Development and Capacity Management to help confirm understanding of system behaviour and identify optimal performance settings. This Cycle also included regression testing of BRDB performance following the introduction of new blade (v249) hardware.

## 3.2 Test Case Coverage

The following table provides an overview of the final test status at the end of Phase 2 for each Test Case within those test groups highlighted in yellow in the table in section 3 above..

Test Group	Test Description	Status	Date last run	TestID	DC Build CTR Build
C01	C01.M01_HNG-X CAPO Balance Enquiry & Withdrawal	✓ PASS	28/04/10		01.20.00 CTR25.11



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



Test Group	Test Description	Status	Date last run	TestID	DC Build CTR Build
	C01.M02_HNG-X A&L Business Deposit	✓ PASS	28/04/10		01.20.00 CTR25.11
	C01.M03_HNG-X LINK Cash Withdrawal	✓ PASS	28/04/10		01.20.00 CTR25.11
	C01.M04_HNG-X Purchase E-Top Up	✓ PASS	28/04/10		01.20.00 CTR25.11
	C01.M05_HNG-X Purchase Phone Card	✓ PASS	20/06/10		01.20.00 CTR25.11
	C01.M06_HNG-X Tax a vehicle for 12 months no VAT	✓ PASS	28/04/10		01.20.00 CTR25.11
	C01.M07_HNG-X SORN with vehicle address changes	✓ PASS	28/04/10		01.20.00 CTR25.11
	C01.M08_HNG-X Purchase postal order	✓ PASS	20/06/10		01.22.00 01.22.00
	C01.M09_HNG-X Encash postal order	✓ PASS	21/06/10		01.22.00 01.22.00
	C01.M10_HNG-X Payment by Debit-Credit card	✓ PASS	21/06/10		01.22.00 01.22.00
	C01.M11_HNG-X Address Lookup	✓ PASS	28/04/10		01.20.00 CTR25.11
	C01.M12_HNG-X Purchase Saving Stamp	✓ PASS	06/04/10		01.08.03 CTR25.10
	C01.M13_HNG-X Purchase 1st Class Stamps	✓ PASS	21/06/10		01.22.00 01.22.00
	C01.M14_HNG-X Purchase Pure Air Sure Europe Stationary	✓ PASS	06/04/10		01.08.03 CTR25.10
	C01.M15_HNG-X Purchase Scratchcard	✓ PASS	06/04/10		01.08.03 CTR25.10
	C01.M16_HNG-X Purchase Electricity Tokens	✓ PASS	28/06/10		01.22.00 01.22.00
	C01.M17_HNG-X Purchase Premium Bonds	✓ PASS	19/02/10		01.07.04 CTR24.05
	C01.M18_HNG-X Purchase 1 Day Fishing License	✓ PASS	19/02/10		01.07.04 CTR24.05
	C01.M19_HNG-X Post Special Delivery Small Letter	✓ PASS	28/04/10		01.20.00 CTR25.11
	C01.M20_HNG-X Post Large Letter	✓ PASS	28/04/10		01.20.00 CTR25.11
	C01.M21_HNG-X Post Letter USA Weighting	✓ PASS	19/02/10		01.07.04 CTR24.05
	C01.M22_HNG-X Packet	✓ PASS	28/04/10		01.20.00 CTR25.11
	C01.M23_HNG-X Bulk Post	✓ PASS	28/06/10		01.22.00 01.22.00
	C01.M24_HNG-X Pay Bill	✓ PASS	21/06/10		01.22.00 01.22.00
	C01.M25_HNG-X Freedom Passes	✓ PASS	17/06/10		01.22.00 01.22.00
	C01.M26_HNG-X Moneygram	✓ PASS	06/04/10		01.08.03 CTR25.10
	C01.M27_HNG-X Travel Insurance	✓ PASS	23/06/10		01.22.00 01.22.00





## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



Test Group	Test Description	Status	Date last run	TestID	DC Build CTR Build
	C01.M28_HNG-X Purchase Foreign Currency	✓ PASS	06/04/10		01.08.03 CTR25.10
	C01.M29_HNG-X Purchase Foreign Currency in Travellers Cheques	✓ PASS	21/06/10		01.22.00 01.22.00
	C01.M30_HNG-X Purchase Pre-Order Foreign Currency	✓ PASS	17/06/10		01.22.00 01.22.00
	C01.M31_HNG-X Foreign Currency Buy Back	✓ PASS	19/02/10		01.07.04 CTR24.05
	C01.M32_HNG-X Remittance Acceptance	✓ PASS	15/06/10		01.22.00 01.22.00
	C01.M33_HNG-X Remittance Rejection	✓ PASS	28/06/10		01.22.00 01.22.00
	C01.M34_HNG-X Transaction Correction for a Remittance Shortage	Redundant	N/A	-	-
	C01.M35_HNG-X Spoiled Postal Orders	✓ PASS	22/06/10		01.22.00 01.22.00
	C01.M36_HNG-X Stock Unit Reports	✓ PASS	22/06/10		01.22.00 01.22.00
	C01.M37_HNG-X Office Reports	✓ PASS	15/06/10		01.22.00 01.22.00
	C01.M38_HNG-X Logon	✓ PASS	28/04/10		01.20.00 CTR25.11
	C01.M39_HNG-X Logoff	✓ PASS	28/04/10		01.20.00 CTR25.11
	C01.M40_HNG-X Help	✓ PASS	22/06/10		01.22.00 01.22.00
H11	APOP Contracted Peak Hour	✓ PASS	14/03/10	082	01.08.03 CTR25.07
	APOP Contracted Peak 5 Minutes				
H12	DVLA Contracted Peak Hour	✓ PASS	13/03/10	079	01.08.03 CTR25.07
	DVLA Contracted Peak 5 Minutes				
	DVLA Design Limit Peak Hour				
	DVLA Design Limit Peak 5 Minutes				
H12b	DVLA stress test	✓ PASS	02/07/10	205	01.22.00 01.22.00
H13b	PAF stress test (covered by X10b)	✓ PASS	29/06/10	201	01.22.00 01.22.00
R01	R01.M01 Branch Router Performance 1 Counter	✓ PASS	16/03/10		01.08.03 CTR25.07
	R01.M02 Branch Router Performance 5 Counter	✓ PASS	18/03/10		01.08.03 CTR25.07
	R01.M03 Branch Router Performance 10 Counter	✓ PASS	18/03/10		01.08.03 CTR25.07
	R01.M04 Branch Router Performance 20 Counter	✓ PASS	23/03/10		01.08.03 CTR25.07
X01	HNG-X Volume Monday Schedule	✓ PASS	19/03/10	097	01.08.03 CTR25.07
X05	HNG-X Debit Card Contracted Peak Hour	✓ PASS	25/02/10	055	01.07.04 CTR24.05
	HNG-X Debit Card Contracted Peak 5 Minutes				
	HNG-X Debit Card Design Limit Peak Hour				
	HNG-X Debit Card Design Limit Peak 5 Minutes				



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



Test Group	Test Description	Status	Date last run	TestID	DC Build CTR Build
X05b	HNG-X Debit Card stress test (combined with X09b)	✓ PASS	01/07/10	204	01.22.00 01.22.00
X06	HNG-X CAPO Contracted Peak Hour	✓ PASS	22/02/10	051	01.07.04 CTR24.05
	HNG-X CAPO Contracted Peak 5 Minutes				
	HNG-X CAPO Design Limit Peak Hour				
	HNG-X CAPO Design Limit Peak 5 Minutes				
X06b	HNG-X CAPO stress test (covered by XCBb)	✓ PASS	30/06/10	202	01.22.00 01.22.00
X07b	HNG-X Link stress test (covered by XCBb)				
X08b	HNG-X A&L stress test (covered by XCBb)				
X09	HNG-X ETU Contracted Peak Hour (covered by X09b)	✓ PASS	01/07/10	204	01.22.00 01.22.00
	HNG-X ETU Contracted Peak 5 Minutes (covered by X09b)				
	HNG-X ETU Design Limit Peak Hour (covered by X09b)				
	HNG-X ETU Design Limit Peak 5 Minutes (covered by X09b)				
X09b	HNG-X ETU stress test (combined with X05b)	✓ PASS	29/06/10	201	01.22.00 01.22.00
X10	HNG-X T&T Contracted Peak Hour (covered by X10b)				
	HNG-X T&T Contracted Peak 5 Minutes (covered by X10b)				
	HNG-X T&T Design Limit Peak Hour (covered by X10b)				
	HNG-X T&T Design Limit Peak 5 Minutes (covered by X10b)				
X10b	HNG-X T&T stress test	✓ PASS	13/08/10	247	01.22.00 01.22.00
X11	BAL and BRDB Contracted Peak Hour - Start of Day mix				
	BAL and BRDB Contracted Peak 5 Minutes - Start of Day mix				
	BAL and BRDB Design Limit Peak Hour - Start of Day mix				
	BAL and BRDB Design Limit Peak 5 Minutes - Start of Day mix				
	BAL and BRDB Contracted Peak Hour - Mid-Day mix				01.22.00 01.22.00
	BAL and BRDB Contracted Peak 5 Minutes - Mid-Day mix				
	BAL and BRDB Design Limit Peak Hour - Mid-Day mix				
	BAL and BRDB Design Limit Peak 5 Minutes - Mid-Day mix				
X11	BAL and BRDB Contracted Peak Hour - End of Day mix		24/08/10	254	01.22.00 01.22.00
	BAL and BRDB Contracted Peak 5 Minutes - End of Day mix				
	BAL and BRDB Design Limit Peak Hour - End of Day mix				
	BAL and BRDB Design Limit Peak 5 Minutes - End of Day mix				
X12	BAL and BRDB stress test	✓ PASS	17/08/10	251	01.22.00 01.22.00
X13	Logon / logoff Contracted Peak 5 Minutes	✓ PASS	10/03/10	072	01.08.03 CTR25.07
	Logon / logoff Design Limit Peak 5 Minutes				
X13b	Logon / logoff stress test	✓ PASS	01/07/10	203	01.22.00 01.22.00
X13c	Maximum concurrent session	✓ PASS	24/03/10	145	01.08.03 CTR25.07
X15	HNG-X Reports Contracted Peak 5 Minutes (covered by X15b)	✓ PASS	27/06/10	198 - 199	01.22.00 01.22.00
	HNG-X Reports Design Limit Peak 5 Minutes (covered by X15b)				
X15b	HNG-X Reports stress test	✓ PASS	30/06/10	202	01.22.00 01.22.00
XCB	HNG-X Combined Banking Contracted Peak Hour (see XCBb)				
	HNG-X Combined Banking Contracted Peak 5 Minutes (see XCBb)				
	HNG-X Combined Banking Design Limit Peak Hour (see XCBb)				
	HNG-X Combined Banking Design Limit Peak 5 Minutes (see XCBb)				



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



Test Group	Test Description	Status	Date last run	TestID	DC Build CTR Build
XCBb	HNG-X Combined Banking stress test				
XCAL	HNG-X Calibration tests	✓ PASS	07/02/10	002 - 015	01.07.04 CTR24.03

<b>Note:</b>	BAL / OSR release was updated independently to the rest of the Data Centre Build stated above as follows:			
	19/05/10	BAL/OSR version	01.22.01.01	
	16/06/10	BAL/OSR version	01.23.01.01	
	23/08/10	BAL/OSR version	01.23.02.01	

Full results for each of the above tests are detailed in Section 5 of this report.

Additional testing over and above those specified in the HLTP was also conducted in support of specific activities or enhancements. See section 6 for details.

### 3.3 Defects

#### 3.3.1 Defects Raised

A total of 135 Volume and Performance related defects were raised up to the conclusion of Phase 2 testing. The following table shows the priority and status breakdown for these defects as at the date of this report.

Current Priority PEAK (QC)	Open	Awaiting Test	Informally Tested	Closed	Totals
A (4 – Very High)			1	47	48
B (3 – High)	1		4	65	70
C (2 – Medium)	3		4	9	16
D (1 – Low)				1	1
Totals	4		9	122	135

Open	Calls are with a development or support team and fix not yet available
Awaiting Test	Calls have been returned to V&I awaiting retest or some other action
Informally Tested	Calls have been successfully tested with an informal fix applied to VOL, but formal delivery not yet available to allow call closure.
Closed	Calls are closed, no further actions required

#### 3.3.2 Open Defects

The following table shows the priority and call summary for defects that currently remain Open, including those for which an informal fix has been successfully tested (highlighted in green).



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



Defect	Peak	Pty	Summary	Date Opened	Assigned Team	Last Updated
13463	PC0196544	C	VOL - Ramped up Logons - Clone of PC0196039	20100326	Crypto-Dev	20100809
13464	PC0196549	C	VOL: Counter Performance Stats log doesn't log logins and logoffs	20100326	xCtr_SUC_GDC	20100804
13481	PC0196695	B	VOL C2 - Enable formal delivery of Oracle Listener Timeout Value changed in Live and VOL on 28/03/10	20100329	RelMngmntForum	20100709
13487	PC0196818	B	VOL - PFEMIS Payment file creation reports errors suggesting negative amounts.	20100330	TSC-Dev	20100903
13558	PC0197725	B	VOL - BRDB nodes being evicted and rebooting overnight during schedule runs.	20100414	Infra Networks	20100708
13629	PC0198381	C	VOL - Inconsistent counter processing (according to counter stats) across many transaction types	20100430	xCTR_NT_GDC	20100804
13879	PC0200282	C	VOL - When a parse error occurs with a message in the OSR the log file fails log the invalid message	20100616	QC Interface	20100915
13881	PC0200284	C	VOL - Primary Key violations invoked	20100616	xOSR_GDC	20100809
13913	PC0200531	B	Live - Stats gathering improvements	20100622	RelMngmntForum	20100908
14016	PC0201529	A	VOL - High CPU usage results when running Group Reports	20100714	QC Interface	20100915
14101	PC0202763	C	VOL - OSR issues response before DB commit is complete	20100810	xOSR_GDC	20100909
14111	PC0202857	C	VOL - APSC2085 abends with column overflow message	20100812	RelMngmntForum	20100812
14112	PC0202881	B	Live - OSR Minimum and Maximum Connection Settings once BDB established on v249 pBlades	20100812	xOSR_GDC	20100901

The above open defects have the following target release as at the date of this report.

Release					
No Target	02.10.03	02.11.00	02.12.00	02.13.00	03.00.00
PC0196544			PC0200282	PC0202857	PC0200284
PC0196549			PC0201529		
PC0196695					
PC0196818					
PC0197725					
PC0198381					
PC0200531					
PC0202763					
PC0202881					
9	0	0	2	1	1
13					

successfully tested on VOL with informal fix

fix implemented in Live via MSC after successful VOL test

fix unavailable for VOL testing





## 3.4 Conclusion

A significant number of performance and capacity related issues have been identified and resolved throughout VOL testing. Additional testing over and above that specified in the HLTP has also been conducted to support further 'tuning' of performance characteristics. As at completion of Cycle 3, testing has demonstrated ability of the solution to support full contractual and design limit workloads for each of the service types under test. Stress testing has also identified the headroom capacity to support future growth in business volumes.

Some Peaks remain open which would deliver further performance improvements. Whilst desirable, they are not deemed critical to be able to support current live volumes.





VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



## 4 Pre-Requisites

### 4.1 Environment

The platform instances comprising the VOL rig and their location are shown in the following table.

Platform Type	No. Instances			Comments
	IRE11	IRE19	BRA01	
ACD	0	1	0	
ARC	0	2	0	
AUW	0	0	1	
AWS	0	2	0	
BAL	0	9	0	
BDB	0	4	0	Node 1 upgraded to v249 on 30/07/10 Nods 2, 3, 4 upgraded to v249 on 12/08/10
BDS	0	1	0	4 pBlades required to build all nodes of the cluster, 3 instances are then turned off and only 1 pBlade required for default operation of BDS.
BMX	0	2	0	Instance 2 Offline, no pBlade resource allocated.
BPL	0	2	0	Instance 2 Offline, no pBlade resource allocated.
BRS	0	1	0	
BSL	1	0	0	
BSM	0	1	0	
BSS	1	0	0	
BSW	1	0	0	
BWS	0	2	0	Instance 2 Offline, no pBlade resource allocated.
CDG	0	1	0	
CDS	0	0	1	
DAT	0	1	0	
DCM	0	1	0	
DEA	0	2	0	Instance 2 Offline, no pBlade resource allocated.
DNP	0	1	0	
DNS	0	1	0	
DOX	0	5	0	
DWS	0	2	0	Instance 2 Offline, no pBlade resource allocated.
DXC	0	1	0	
EAS	0	1	0	
EDS	0	1	0	
EES	0	1	0	
EFS	0	2	0	
EMD	0	1	0	
EMM	0	1	0	
EMS	0	1	0	
EPM	0	1	0	
ERP	0	1	0	
EST	0	1	0	
EUI	0	1	0	



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



FLG	0	1	0	
FRG	0	0	1	
HWS	0	2	0	Instance 2 Offline, no pBlade resource allocated.
KMN	0	1	0	
KSN	0	0	1	
LLX	0	0	2	
LRC	0	0	1	
LRG	0	5	0	
MSH	0	1	0	
MWS	0	2	0	Instance 2 Offline, no pBlade resource allocated.
NAA	0	1	0	
NAC	0	2	0	
NAL	0	1	0	
NDM	0	1	0	
NPS	0	2	0	
NRS	0	1	0	
OES	0	1	0	
OVS	0	2	0	Instance 2 Offline, no pBlade resource allocated.
PLG	0	1	0	
PRG	0	0	1	
PWS	0	2	0	Instance 2 Offline, no pBlade resource allocated.
RDM	0	0	1	
SPN	0	1	0	
SRG	0	0	1	
SSC	0	1	0	
SSN	0	1	0	
SSW	0	0	5	
SYS	0	1	0	
TRF	0	1	0	
TWS	0	1	0	
VDX	0	1	0	
VPX	0	8	0	
VSD	0	1	3	vsd001 hosts lrvpcds001 vsd002 hosts lrvpauw001 vsd003 hosts vdx, vpx and domain controllers vsd004 hosts lrvpfrg001, lrvpprg001, lrvpsrg001
VSH	0	1	0	hosts tinvm101
XCS	0	0	5	xcs001 - DVLASIM xcs002 - MASim xcs003 - TNTSim xcs004 - ETUSim + tools xcs005 - LINK Multiplexors



## 4.2 Application Under Test

Component	Description
TWS Schedule	Tivoli Workload Scheduler for the complete Batch Schedule pertaining to all platforms contained on VOL
HNGX Counters / Branch Router	Application used to complete business transactions with Data Centre systems
ACEBlade, BAL/OSRs	Solution Load Balancer and Branch Access layer systems
BDB, BRS, Streams	Branch Database server and Branch Support Database server and replication application
NPS, APOP	Network Persistent Storage and APOP Database
CAPO, A&L, Link	Main Banking Transaction Applications
DCS, ETU, PAF, DVLA, T&T	Key Web Service Applications

The relevant build release for the test environment was upgraded in accordance with the following timescales.

VOL rig Build Status			
Date	Main Data Centre	Counter Build	OSR build (where different)
02-Feb-2010	01.07.04	CTR24.03	
16-Feb-2010		CTR24.05	
02-Mar-2010	01.08.03	CTR25.07	
27-Mar-2010		CTR25.10	
20-Apr-2010	01.20.00	CTR25.11	
19-May-2010	01.22.00	01.22.00	01.22.01.01
18-Jun-2010			01.23.01.00
23-Aug-2010			01.23.02.00

Critical Peak fixes were also intercepted and applied to the relevant platforms throughout the duration of testing, whether through formal baseline delivery or by informal change where appropriate.

**VOLUME AND PERFORMANCE TEST REPORT - PHASE 2**  
**COMMERCIAL IN CONFIDENCE**

## 5 Test Case Details

This section provides a more detailed view of each Test Case executed for each of the Test Groups during Phase 2. For many of the tests, several iterations were run during the different test cycles following application of fixes for defects raised, or other upgrades to system components (software and hardware). The results shown in this section are for the latest iteration of each test case concerned.

However, for the main BRDB load tests, results are shown for execution of these tests against both old and new blade hardware for comparison.

The results detailed are the 'front-end' view in terms of transaction rates, response times and error rates. Performance metrics of the key system components were also gathered from analysis of Athene data for each test. The detailed information and graphical view of Athene data is not shown in this report due to the sheer volume of information. Instead, a simple summary statement of any key observations is made where appropriate. Full Athene analysis is available for any given test on request.

### 5.1 Test Group XCAL – HNG-X Calibration Test

The objective of the 'calibration' test was to run a reduced basket mix of HNG-X transactions, but at reasonable volumes, in order to capture performance metrics of the V&I rig using Metron Athene Data gathered for the period of the test run. The same tests would then be performed on the VOL rig to help understand any environment differences and how this could affect interpretation of performance results.

The following sections detail the results of the calibration tests as performed on the VOL rig.

An initial test was performed for EPOSS transactions only, before later attempting a more representative basket mix.

#### 5.1.1 HNG-X Calibration – Simple EPOSS

This test comprised of simple EPOSS transactions (selling a stamp) only and the conditions under which the test was run are the same as during Phase 1 on V&I as follows:

There were 16 OSR instances in total, with 2 OSRs running on each of servers BAL001 – BAL008.

There were 4 BRDB nodes available.

The bandwidth was throttled to 256Kbps from the load generator to the ACE Blade.

All messages were compressed.

The 400 branches used in the test were spread across the fad hashes to generate an even load across the 4 BRDB Nodes.

The incremental rate of transaction volumes during the run was as follows:

150 tps (across 150 branches) for 15 minutes, then increased to

200 tps (across 200 branches) for further 15 minutes, then increased to

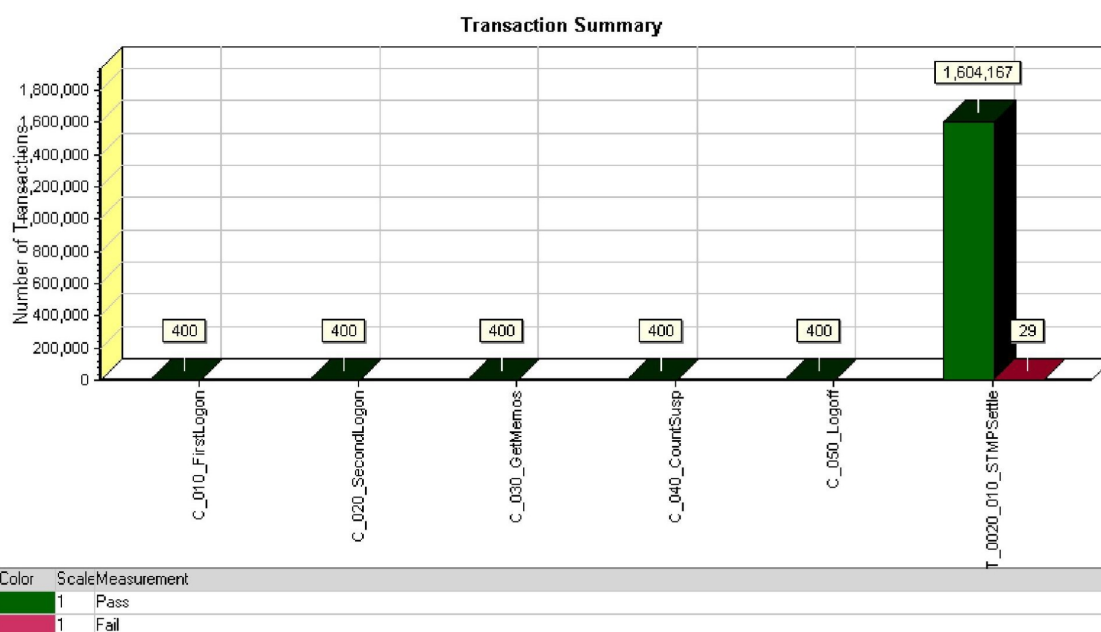
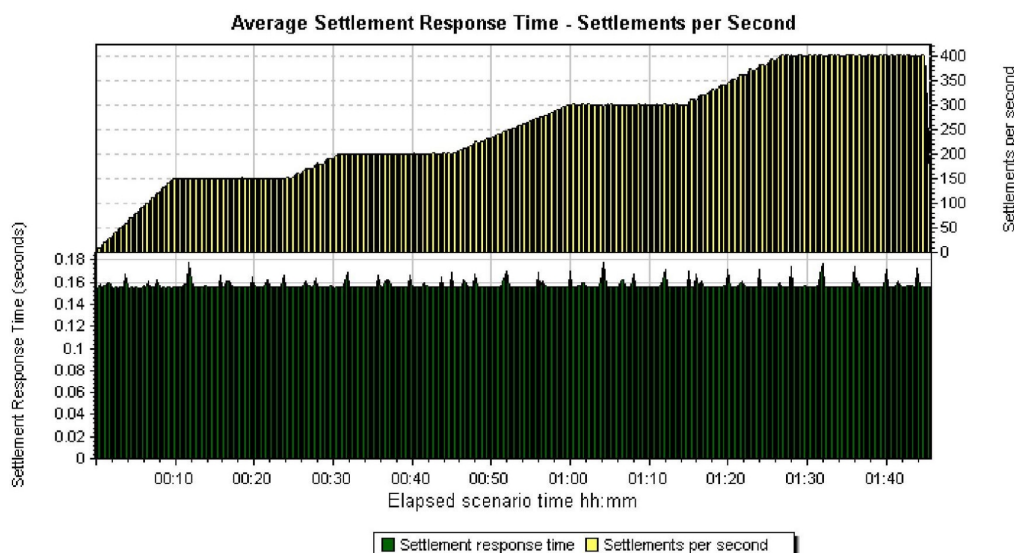
300 tps (across 300 branches) for further 15 minutes, then increased to

400 tps (across 400 branches) until the end of the test.

Throughout this test run, transaction response times were good and similar to those witnessed during Phase 1, with just 29 transaction failures out of a total of 1.6 million



VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



Utilisation data gathered by Athene was as expected in comparison to the same test run during Phase 1.

Test Status: Passed

Date of Final Run: 2<sup>nd</sup> February 2010 16:18 to 18:04

Build Release: 01.07.04 / CTR24.03

TestID: 002





VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



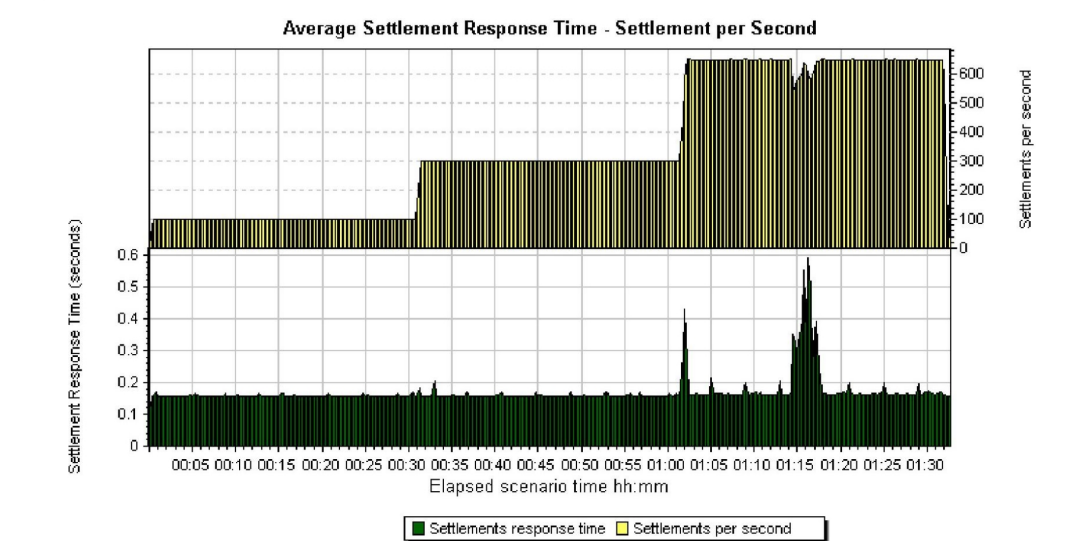
### 5.1.2 HNG-X Calibration – Simple EPOSS for MVP

An additional Simple EPOSS test was also run at the request of the Performance Architect. This was not previously run during Phase 1 on V&I, but was considered useful for gaining an indication of likely performance during live medium pilot.

The environment conditions under which the test was conducted was the same as in section 4.1.1 with incremental rate of transaction volumes as follows:

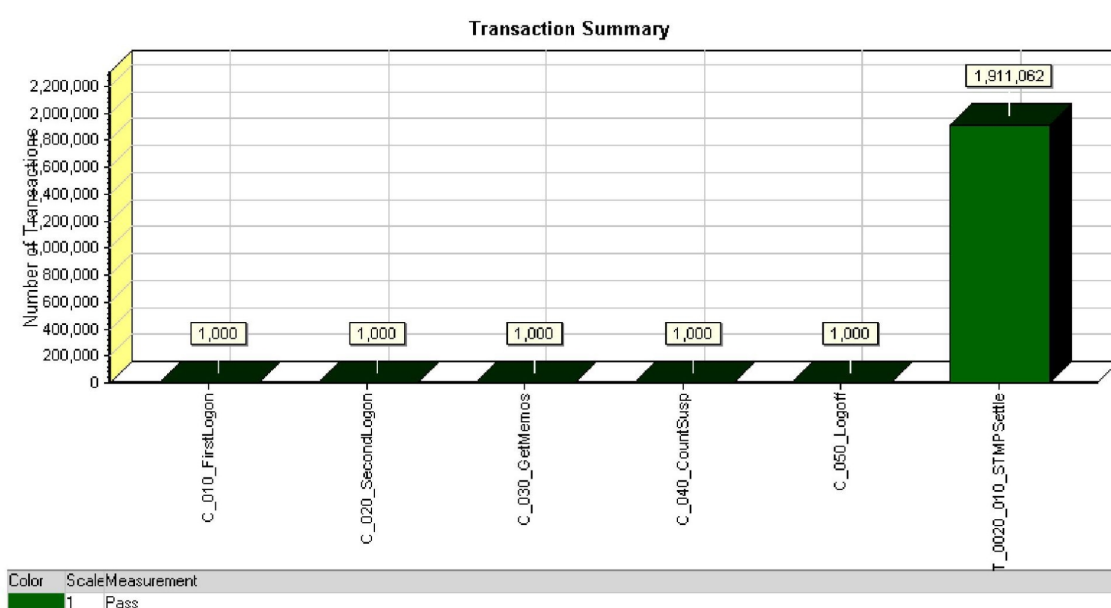
- 100 tps (across 275 branches) for 30 minutes, then increased to
- 300 tps (across 550 branches) for further 30 minutes, then increased to
- 650 tps (across 1000 branches) until the end of the test.

Again, throughout this test run, transaction response times were good apart from a brief 'spike' 1 hour 15 minutes into the run during which 165 transaction timeouts occurred out of a total of 1.9 million. This demonstrates acceptable performance at a rate of 300tps expected during pilot, but a potential issue at higher rates which will be further understood during the formal performance testing at peak rates.





VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



Test Status: Passed

Date of Final Run: 2<sup>nd</sup> February 2010 18:30 to 20:03

Build Release: 01.07.04 / CTR24.03

TestID: 003

### 5.1.3 HNG-X Calibration – Basket Mix

The following calibration tests were run under similar conditions as during Phase 1 as follows:

There were 16 OSR instances in total, with 2 OSRs running on each of servers BAL001 – BAL008.

There were 4 BRDB nodes available.

The bandwidth was set to maximum between the load generator and the ACE Blade.

All messages were compressed.

All branches used in the test were spread across the fad hashes to generate an even load across the 4 BRDB Nodes.

All banking transactions were submitted for agent hash value 1, meaning that only the capo\_b, al\_b and link\_b services were handling transaction load.

An outline of each iteration is shown in the following sections. In each table, the value shown for Txn/sec is the total number of transaction records per second for each service type, including settlement transaction (i.e. the number of transactions addressed to the BAL layer). The values shown for Auth/sec is the number of actual requests that would be forwarded to each relevant Authorisation service. The end



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



column shows the median number of transactions per second successfully authorised for banking, debit card and ETU services.

During each of the following tests, there was a gradual decline in successful authorisations for debit card, with dropped connections between the OSR services and the DCS agent being observed (Peak Ref PC0194218). Similar failures were also observed with connections to other banking services. Further analysis of the DCS agent showed an issue with saturated CPU, with a single thread (NX\_NQ\_DCS/47) running at 100% CPU. This is the same behaviour as was observed during similar tests for Phase 1. In effect, therefore, this verified that the VOL rig was comparable to the V&I rig as a starting position and a suitable environment against which to diagnose the issues observed and to enable Phase 2 testing.

#### 5.1.3.1 Mix of EPOSS/Banking/Debit/E-TopUps/DVLA/Login/Logoffs @ 100tps

Function	Users	Txn/sec	Auth/sec	Pass/sec
0700_CAPO_CAL	37	37	13	12.33
0800_AL_CAL	3	3	1	1
0900_LINK_CAL	7	8	3	2.4
1000_EPOSS_CAL	23	24	24	
1100_DEBIT_CAL	7	6	3	0.6
1200_LoginLogoff_CAL	8	4	1	
1300_DVLA_CAL	7	11	6	
1400_ETU_CAL	8	8	3	2.667
	100	101	54	

Test Status: Completed

Date of Final Run: 5<sup>th</sup> February 2010 07:55 to 09:04

Build Release: 01.07.04 / CTR24.03

TestID: 004

#### 5.1.3.2 Mix of EPOSS/Banking/Debit/E-TopUps/DVLA/Login/Logoffs @ 200tps

Function	Users	Txn/sec	Auth/sec	Pass/sec
0700_CAPO_CAL	75	75	25	25.016
0800_AL_CAL	7	7	2.33	2.336
0900_LINK_CAL	13	14	4.68	3.953
1000_EPOSS_CAL	47	49	49	
1100_DEBIT_CAL	13	13	4.17	2.258
1200_LoginLogoff_CAL	17	9	1.74	
1300_DVLA_CAL	13	20	10.14	
1400_ETU_CAL	15	15	5	5.008
	200	202	103	

Test Status: Completed



**VOLUME AND PERFORMANCE TEST REPORT - PHASE 2**  
**COMMERCIAL IN CONFIDENCE**Date of Final Run: 5<sup>th</sup> February 2010 11:19 to 12:26

Build Release: 01.07.04 / CTR24.03

TestID: 008

**5.1.3.3 Mix of EPOSS/Banking/Debit/E-TopUps/DVLA/Login/Logoffs @ 300tps**

Function	Users	Txn/sec	Auth/sec	Pass/sec
0700_CAPO_CAL	112	112	37.33	34
0800_AL_CAL	11	11	3.66	2.933
0900_LINK_CAL	19	21	6.84	5.4
1000_EPOSS_CAL	71	75	75	
1100_DEBIT_CAL	19	19	6.16	0.667
1200_LoginLogoff_CAL	26	13	4.45	
1300_DVLA_CAL	19	30	9.88	
1400_ETU_CAL	23	23	7.66	6.933
	300	303	151	

Test Status: Completed

Date of Final Run: 7<sup>th</sup> February 2010 14:02 to 15:09

Build Release: 01.07.04 / CTR24.03

TestID: 014

**5.1.3.4 Mix of EPOSS/Banking/Debit/E-TopUps/DVLA/Login/Logoffs @ 400tps**

Function	Users	Txn/sec	Auth/sec	Pass/sec
0700_CAPO_CAL	150	150	50	31.4
0800_AL_CAL	15	15	5	3.133
0900_LINK_CAL	25	27	9	4.867
1000_EPOSS_CAL	95	100	100	
1100_DEBIT_CAL	25	22	8	0.013
1200_LoginLogoff_CAL	35	30	6	
1300_DVLA_CAL	25	26	13	
1400_ETU_CAL	30	30	10	10
	400	400	201	

Test Status: Completed

Date of Final Run: 7<sup>th</sup> February 2010 15:36 to 16:39

Build Release: 01.07.04 / CTR24.03

TestID: 015



## 5.2 Test Group C01 – HNG-X Counter Performance

Specific Counter (C01) and Branch Router (R01) performance tests are the subject of a separate HLTP [6]. Accordingly, whilst the test result status is shown in section 3.2 of this document for completeness, detailed test results are to be documented in a separate test report aligned to the Counter Performance HLTP.

## 5.3 Test Group H11 – APOP

### 5.3.1 APOP Contracted Peak Hour / Peak 5 Minutes

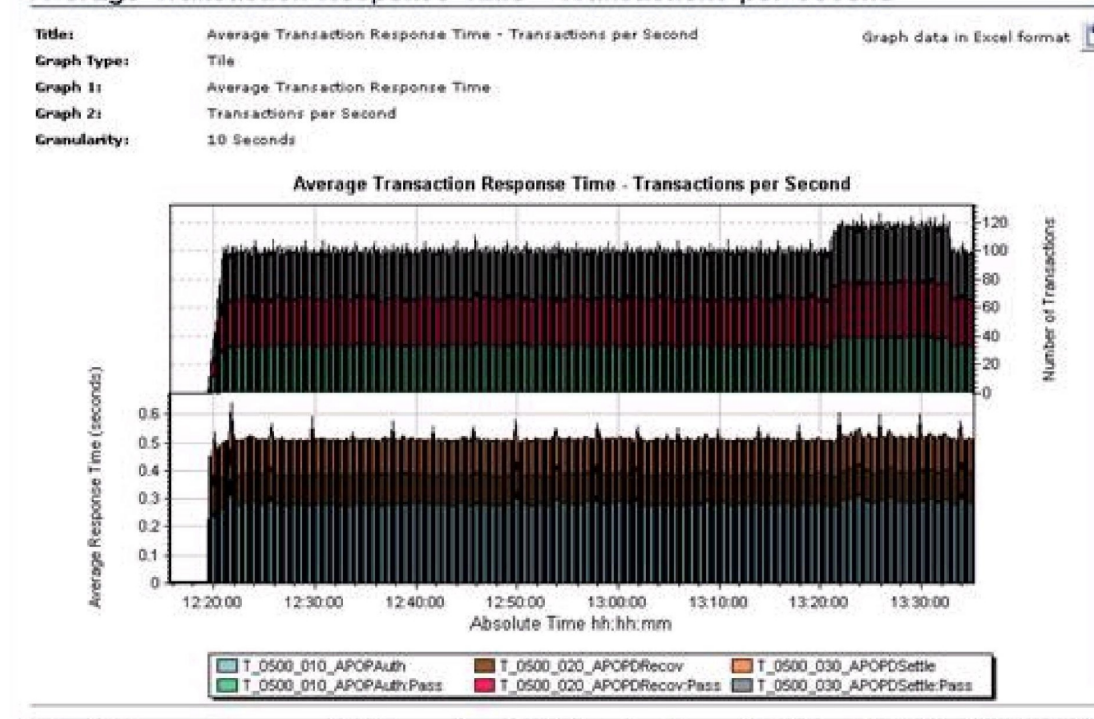
Target Transaction Rates:

Contractual Peak Hour 33tps

Contractual Peak 5 Minutes 39tps

APOP transactions were ramped up to a rate of 33tps for 1 hour and then further increased to 39tps for an additional 5 minutes. Average response times were good with no transaction failures.

#### Average Transaction Response Time - Transactions per Second



Test Status: Passed

Date of Final Run: 14<sup>th</sup> March 2010 12:15 to 13:35

Build Release: 01.08.03 / CTR25.07

Specific Configuration Details:



4 x BRDB nodes

Swappiness=0 on BRDB

16OSRS (BAL002 – BAL009) min connection value set to 5 and max connection value set to 20

SGA @ 16G

PGA @ 4G

TestID: 082

## 5.4 Test Group H12 – DVLA

### 5.4.1 DVLA Contracted / Design Limit Peak Hour / Peak 5 Minutes

Target Transaction Rates:

Contractual Peak Hour 29tps

Contractual Peak 5 Minutes 30tps

Design Limit Peak Hour 34tps

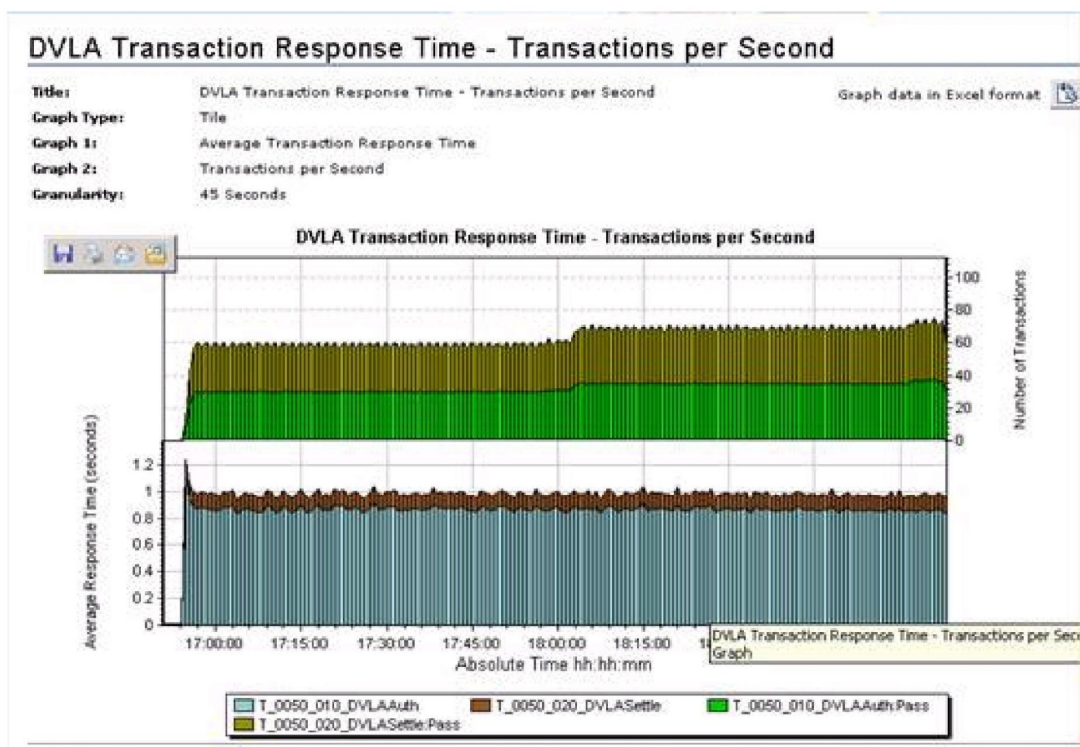
Design Limit Peak 5 Minutes 36tps

DVLA transactions were ramped up to a rate of 29tps for 1 hour, then further increased to 30tps for an additional 5 minutes, then further increased to 34tps for another hour and finally further increased to 36tps for an additional 5 minutes. This test was performed alongside an additional load of APOP transactions at a rate of 28tps for 2 hours and then increased to 34tps.

Average response times were good with no transaction failures



VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



Test Status: Passed

Date of Final Run: 13<sup>th</sup> March 2010 16:50 to 19:08

Build Release: 01.08.03 / CTR25.07

Specific Configuration Details:

4 x BRDB nodes

Swappiness=0 on BRDB

16OSRS (BAL002 – BAL009) min connection value set to 5 and max connection value set to 20

SGA @ 16G

PGA @ 4G

TestID: 079

## 5.4.2 DVLA Stress Test

The objective of this test was to take the DVLA service beyond Design Limits up to a rate at which either

- the service is no longer able to support the transaction load and thus identifying the maximum headroom capacity limit, or
- a notional transaction rate (as agreed with Capacity Management) such that, if achieved, it would demonstrate sufficient headroom capacity for future growth without needing to find the absolute breaking point





## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

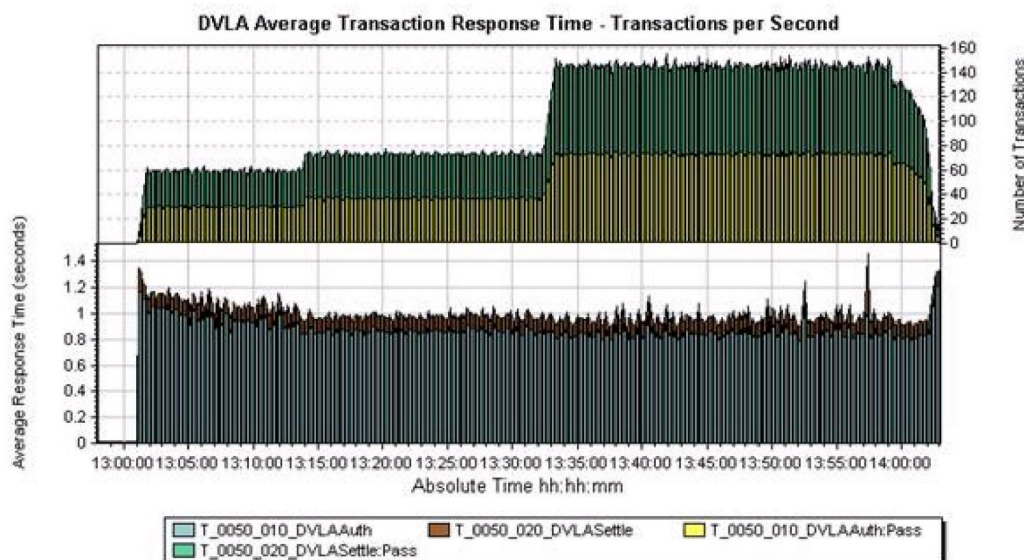
COMMERCIAL IN CONFIDENCE



The target transaction rate for this test was 72tps and this was achieved with capacity to spare..

Service	Historical Peak		Contractual Limit		Design Limit			Sustained	H/R %
	Hour	5 mins	Hour	5 mins	Hour	5 mins	Per sec peak		
DVLA	not spec'd	34	29	30	34	36	36	72	100.00%

HR% above is the sustained tps rate % increase over and above the Design Limit Peak 5 min rate.  
Transaction response times were good and there were no failures



The following table gives a summary of the response times (min/max/avg/90th percentile) and pass / fail rates for each transaction type.

Transaction Name	Minimum	Average	Maximum	Std. Deviation	90 Percent	Pass	Fail
C_010_FirstLogon	0.125	0.134	0.459	0.026	0.149	1,000	0
C_020_SecondLogon	0.13	0.161	0.652	0.031	0.189	1,000	0
C_030_GetMemos	0.07	0.073	0.122	0.003	0.08	1,000	0
C_040_CountSusp	0.072	0.075	0.525	0.02	0.079	1,000	0
C_050_Logoff	0.086	0.088	0.52	0.015	0.09	1,000	0
T_0050_010_DVLAAuth	0.378	0.865	4.621	0.257	1.248	187,309	0
T_0050_020_DVLASettle	0.108	0.115	2.863	0.057	0.13	187,309	0

Test Status: Passed

Date of Final Run: 2<sup>nd</sup> July 2010 12:58 to 14:03

Build Release: 01.22.00 / OSRs at 01.23.01.00

TestID: 205

## 5.5 Test Group H13 – PAF



### 5.5.1 PAF Stress Test

This test was covered by Test Group X10 (Track and Trace Stress test) as each transaction request for that test required a PAF lookup to be performed. The test was performed against a single PAF Web Server (as opposed to 2 servers which would share the load in live).

The objective of this test was to take the PAF service beyond Design Limits up to a rate at which either

- the service is no longer able to support the transaction load and thus identifying the maximum headroom capacity limit, or
- a notional transaction rate (as agreed with Capacity Management) such that, if achieved, it would demonstrate sufficient headroom capacity for future growth without needing to find the absolute breaking point

The target transaction rate for this test was 100tps and this was achieved with capacity to spare. The PAF Web Server CPU peaked at 15% utilisation during the test.

Service	Historical Peak		Contractual Limit		Design Limit			Sustained	H/R %
	Hour	5 min	Hour	5 min	Hour	5 min	Per sec peak		
PAF	18	18	45	46	54	55	not specified	100	81.82%

HR% above is the sustained tps rate % increase over and above the Design Limit Peak 5 min rate. Transaction response times were good and there were no failures

See the test results for X10 T&T Stress Test for a detailed breakdown of transaction response times.

Test Status: Passed

Date of Final Run: 29<sup>th</sup> June 2010 15:22 to 17:22

Build Release: 01.22.00 / OSRs at 01.23.01.00

TestID: 201

## 5.6 Test Group R01 – Branch Router

Specific Counter (C01) and Branch Router (R01) performance tests are the subject of a separate HLTP [6]. Accordingly, whilst the test result status is shown in section 3.2 of this document for completeness, detailed test results are to be documented in a separate test report aligned to the Counter Performance HLTP.

## 5.7 Test Group X01 – HNG-X Volume

### 5.7.1 HNG-X Volume (Monday)

#### Volumes:

The volumes for transactions processed during this test in comparison to contractual and design limits is as follows:

	Contractual	Design Limit	Txn Count in test run	% of contractual	% of Design
EPOSS	8602518	10323021	13938369	162.03%	135.02%
APS	3031573	3637887	1717674	56.66%	47.22%



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



	Contractual	Design Limit	Txn Count in test run	% of contractual	% of Design
NBS	2553600	3064320	2319810	90.84%	75.70%
			A&L 135983		
			Link 367816		
			CAPO 1816011		
DCS	288425	346110	272111	94.34%	78.62%
ETU	121200	145440	95997	79.21%	66.00%
DVLA	737774	885329	533698	72.34%	60.28%
PAF	1100788	1320945	255832	23.24%	19.37%
Settlement	9565842	11479010	7565296	79.09%	65.91%
T&T	213000	255600	255832	120.11%	100.09%
Bureau	76775	92130	95999	125.04%	104.20%

Some of the business transactions are routed to additional online services. This applies to NBS, DCS, ETU, DVLA, PAF and APOP; it does not apply to EPOSS, APS and Settlement which just update the Branch Database.

These online business services are subject to additional overall contracted volumes and design limits for the combined total over any contractual period (this is less than the sum of all the services). These are shown below

	Contractual	Design Limit	Txn Count in test run	% of contractual	% of Design
Online Services	3556145	4267374	3477448	97.79%	81.49%

The total Online Business Services generated during the test was 97.79% of the Contractual Peak Day volume.

TOTAL of ALL transactions for TRADING\_DATE 19th March: 18,439,960

**Batch Processing:**

There were a number of issues encountered during the test run which caused the overall batch suite to overrun. However, investigations confirmed that these issues were rig specific. Allowing for the constraints of the test environment causing certain schedules to take a long time to complete (due to compressing large files to a 'dummy' NAS share set-up on VOL), it was determined that the overnight batch would complete in good time in the live environment before start of the next trading day. All of the actual data processing schedules completed in good time.,

A summary of processing times for some of the critical overnight batch processes is as follows:

**Aggregation Schedules:**

- BRDB\_NCU\_TXN\_AGG  
Started at 01:15 and completed in 10 minutes
- BRDB\_CU\_TXN\_AGG  
Started at 01:23 and completed in 11 minutes

**Data Feed Schedules:**

- BRDB\_EPOS\_TO\_TPS  
Started at 19:10 and completed in 13 minutes





## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



- BRDB\_DCS\_TO\_TPS  
Started at 19:20 and completed in 9 minutes
- BRDB\_DCS\_TO\_DRS  
Started at 20:30 and completed in 10 minutes
- BRDB\_NWB\_TO\_TPS  
Started at 19:28 and completed in 12 minutes
- BRDB\_NWB\_TO\_DRS  
Started at 19:46 and completed in 61 minutes. Of this total time, the BRDBX003 jobs performing the actual data feed completed in 25 minutes (rest of schedule is made up of check jobs and waits)
- DRS\_NWB\_C12\_PARS (DRSC301 jobs) and TES\_CO\_HARV (TESC310 jobs)  
From the data fed to DRS by BRDB\_NWB\_TO\_DRS schedule, the parsers began processing the data at 19:46 and completed by 21:23.  
From the data processed by the DRSC301 parsers, the TES\_CO\_HARV jobs began processing the data at 19:48 and completed by 23:24

Test Status: Passed

Date of Final Run: 19<sup>th</sup> March 2010

Build Release: 01.08.03 / CTR25.07

TestID: 097

## 5.8 Test Group X05 – Debit Card

### 5.8.1 Debit Card Contracted / Design Limit Peak Hour / Peak 5 Minutes

Target Transaction Rates:

Contractual Peak Hour	29tps
Contractual Peak 5 Minutes	29tps
Design Limit Peak Hour	57tps
Design Limit Peak 5 Minutes	57tps

Target rates for DCS as specified in ARC/PER/ARC/0001 have since been increased. The target rates above are as specified by Capacity Management Team.

DCS transactions were ramped up to a rate of 29tps for 1 hour, then further increased to 57tps for an additional 5 minutes.

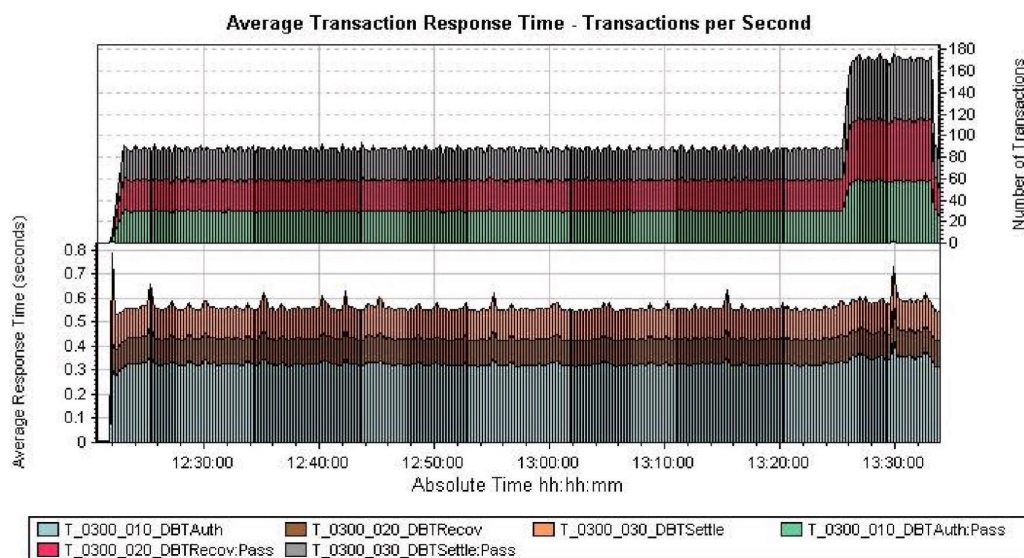
Average response times were good with no transaction failures





## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

### COMMERCIAL IN CONFIDENCE



Test Status: Passed

Date of Final Run: 25<sup>th</sup> February 2010 12:20 to 13:34

Build Release: 01.07.04 / CTR24.05

TestID: 055

### 5.8.2 Debit Card & ETU Stress Test

The Debit Card Stress Test and ETU Stress Test were combined as a single run.

The objective of this test was to take the Debit Card and ETU service beyond Design Limits up to a rate at which either

- the service is no longer able to support the transaction load and thus identifying the maximum headroom capacity limit, or
- a notional transaction rate (as agreed with Capacity Management) such that, if achieved, it would demonstrate sufficient headroom capacity for future growth without needing to find the absolute breaking point

The target transaction rates for this test was 100tps for Debit Card and 20tps for ETU and this was achieved with capacity to spare. The transaction rates were run at the contractual and design limit rates on the way to achieving the end target rate.

Service	Historical Peak		Contractual Limit		Design Limit			Sustained	H/R %
	Hour	5 min	Hour	5 min	Hour	5 min	Per sec peak		
Debit Card	not spec'd	22	29	29	57	57	57	100	75.44%
E-Topup	not spec'd	5	5	5	6	6	8	20	233.33%
Total	not spec'd	27	34	34	63	63	65	120	90.48%

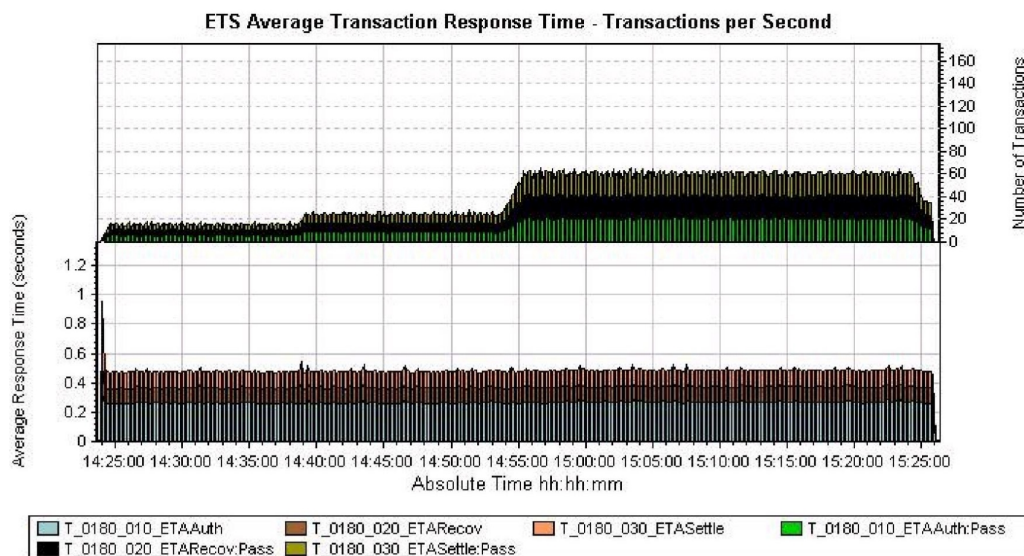
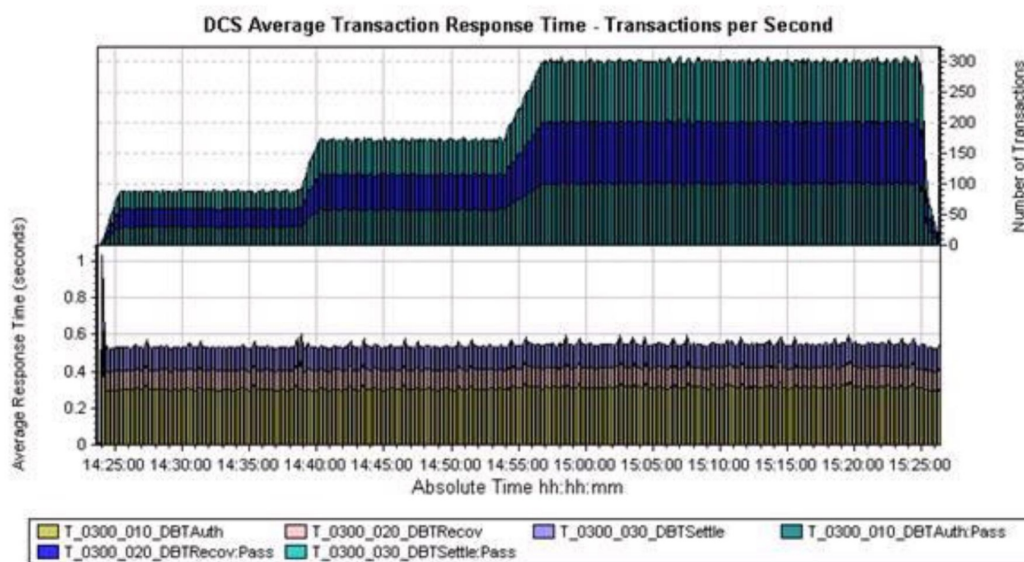
HR% above is the sustained tps rate % increase over and above the Design Limit Peak 5 min rate.

Transaction response times were good and there were no failures



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



The following table gives a summary of the response times (min/max/avg/90th percentile) and pass / fail rates for each transaction type.

Transaction Name	Minimum	Average	Maximum	Std. Deviation	90 Percent	Pass	Fail
C_010_FirstLogon	0.125	0.137	0.251	0.012	0.15	1000	0
C_020_SecondLogon	0.137	0.175	0.331	0.023	0.21	1000	0
C_030_GetMemos	0.07	0.075	0.2	0.006	0.089	1000	0
C_040_CountSusp	0.072	0.075	0.127	0.004	0.09	1000	0
C_050_Logoff	0.083	0.088	0.336	0.01	0.099	1000	0
T_0180_010_ETAAuth	0.132	0.266	1.114	0.048	0.32	48806	0
T_0180_020_ETAREcov	0.099	0.104	1.007	0.014	0.12	48806	0



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



Transaction Name	Minimum	Average	Maximum	Std. Deviation	90 Percent	Pass	Fail
T_0180_030_ETASettle	0.11	0.114	1.531	0.017	0.13	48806	0
T_0300_010_DBTAuth	0.166	0.31	1.468	0.06	0.391	260102	0
T_0300_020_DBTRecov	0.104	0.108	1.556	0.014	0.12	260102	0
T_0300_030_DBTSettle	0.124	0.128	1.311	0.015	0.14	260102	0

Test Status: Passed

Date of Final Run: 1<sup>st</sup> July 2010 14:23 to 15:26

Build Release: 01.22.00 / OSRs at 01.23.01.00

TestID: 204

## 5.9 Test Group X06 – HNG-X CAPO

### 5.9.1 HNG-X CAPO Contracted / Design Limit Peak Hour / Peak 5 Minutes

Target Transaction Rates:

Contractual Peak Hour	134tps
Contractual Peak 5 Minutes	160ps
Design Limit Peak Hour	161tps
Design Limit Peak 5 Minutes	250tps

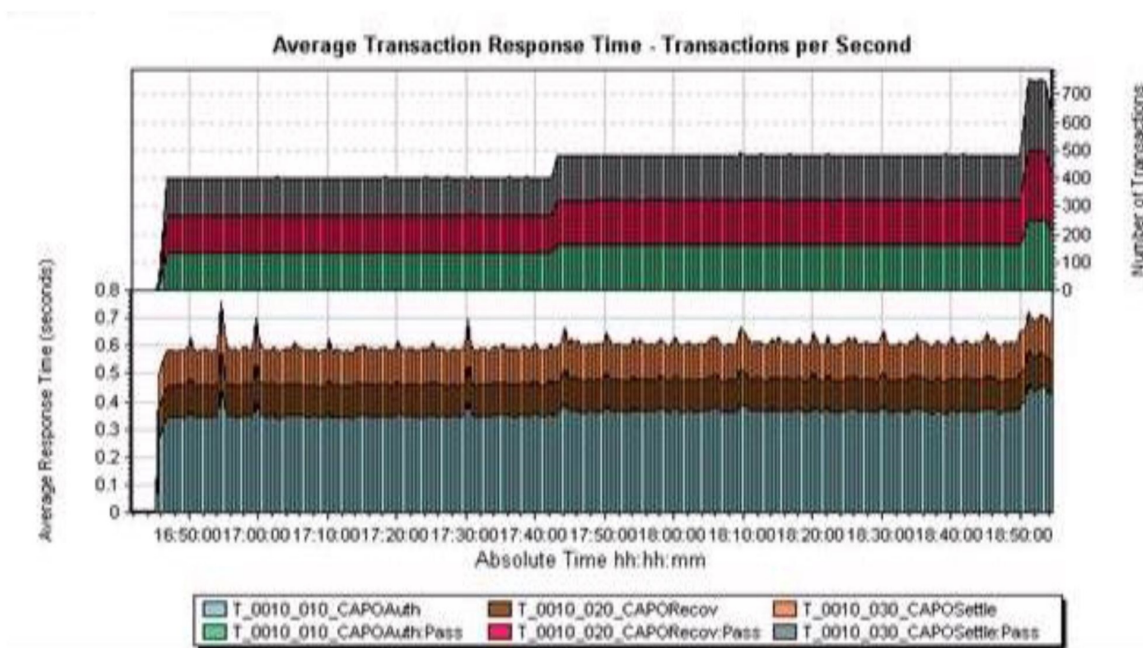
CAPO transactions were ramped up to a rate of 134tps for 1 hour, then further increased to 160tps for an additional 5 minutes, then further increased to 161tps for another hour and finally further increased to 250tps for an additional 3 minutes (the test was terminated slightly early).

Average response times were good with no transaction failures





VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



Test Status: Passed

Date of Final Run: 22<sup>nd</sup> February 2010 16:41 to 18:55

Build Release: 01.07.04 / CTR24.05

TestID: 051

## 5.9.2 HNG-X CAPO Stress Test

This test is covered by the Combined Banking Stress Test. See section 5.18.2 for detailed test results.

## 5.10 Test Group X07 – LINK

### 5.10.1 HNG-X LINK Stress Test

This test is covered by the Combined Banking Stress Test. See section 5.18.2 for detailed test results.

## 5.11 Test Group X08 – HNG-X A&L

### 5.11.1 HNG-X A&L Stress Test

This test is covered by the Combined Banking Stress Test. See section 5.18.2 for detailed test results.





## 5.12 Test Group X09 – HNG-X ETU

### 5.12.1 HNG-X ETU Contracted / Design Limit Peak Hour / Peak 5 Minutes / Stress Test

These tests are covered by the combined Debit Card and ETU stress test. See section 5.8.2 for detailed test results.

## 5.13 Test Group X10 – HNG-X T&T

### 5.13.1 HNG-X T&T Contracted / Design Limit Peak Hour / Peak 5 Minutes

These tests are covered by the T&T stress test. See section 5.13.2 below for detailed test results.

#### 5.13.2 HNG-X T&T Stress Test

The objective of this test was to take the T&T service beyond Design Limits up to a rate at which either

- the service is no longer able to support the transaction load and thus identifying the maximum headroom capacity limit, or
- a notional transaction rate (as agreed with Capacity Management) such that, if achieved, it would demonstrate sufficient headroom capacity for future growth without needing to find the absolute breaking point

Target rates for T&T are not specified in ARC/PER/ARC/0001 and the rates detailed in PA/PER/033 have since been increased. The target rates below are as specified by Capacity Management Team.

Service	Historical Peak		Contractual Limit		Design Limit			Sustained	H/R %
	Hour	5 min	Hour	5 min	Hour	5 min	Per sec peak		
T&T *	not spec'd	not spec'd	43	43	52	52	52	100	92.31%

HR% above is the sustained tps rate % increase over and above the Design Limit Peak 5 min rate

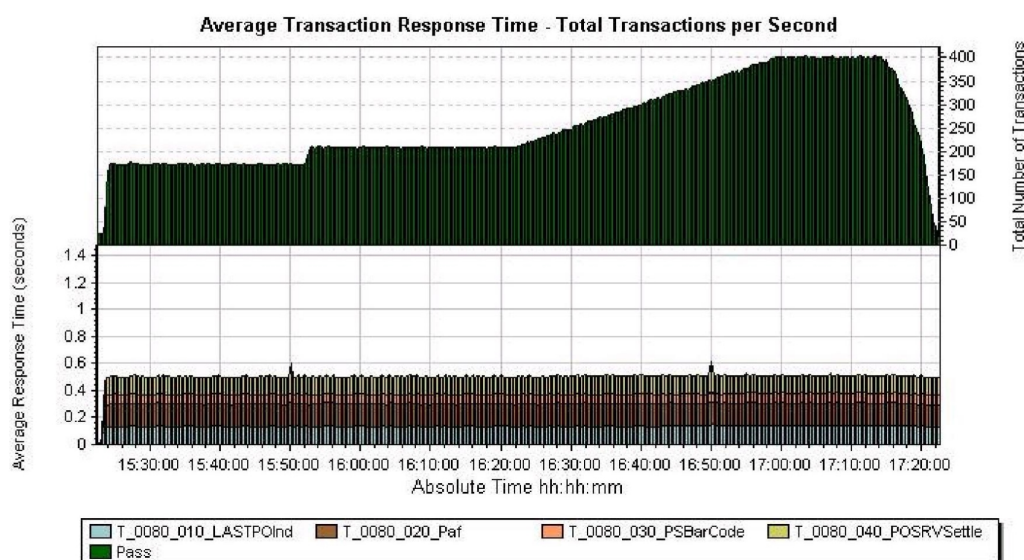
The transaction rates went through the contractual (43tps) and design limits (52tps) up to a maximum of 100 Track and Trace transactions per second. As part of the script, PAF lookups and settlements were carried out as well; so taking into account all parts of the different transactions (XML) taking place, an overall hit rate of 400tps was achieved which equates to 100 T&T transactions per second..

The target rates were achieved with excellent response times and no failures. The graph below shows the overall transactions rates achieved and the response times.



# VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

## COMMERCIAL IN CONFIDENCE



The table below is a summary of the test; showing the response time (min/avg/max/90th percentile) for each transaction type and also the number of transactions which 'passed & 'failed'.

Transaction Name	Minimum	Average	Maximum	Std. Deviation	90 Percent	Pass	Fail
C_010_FirstLogon	0.126	0.138	0.443	0.025	0.149	1000	0
C_020_SecondLogon	0.137	0.174	0.688	0.037	0.21	1000	0
C_030_GetMemos	0.07	0.073	0.152	0.004	0.08	1000	0
C_040_CountSusp	0.072	0.075	0.526	0.02	0.078	1000	0
C_050_Logoff	0.084	0.087	0.311	0.01	0.09	1000	0
T_0080_010_LASTPOInd	0.072	0.136	3.005	0.021	0.14	457419	0
T_0080_020_Paf	0.152	0.164	1.93	0.018	0.18	457419	0
T_0080_030_PSBARCode	0.07	0.074	1.931	0.012	0.08	457419	0
T_0080_040_POSRVSettle	0.128	0.132	2.987	0.032	0.14	457419	0

The BDB to NPS feed kept up to date with the transaction load. The last batch of transactions was passed to NPS at approximately 17:25. The non-online part of processing, by the TTEDGInt agents running on the FLG platform, continued clearance of the backlog to complete update status by 19:17

The table below gives a view of transaction status in the NPS database at various points. It includes a few snapshots over the last 20 minutes of the test to demonstrate the total transaction rate from the BDB feed keeping up, and then continued snapshots until all processing by the FLG agents is completed.

ID	ACTIONED	16:59	17:04	17:09	17:20	feed of txns from BDB to NPS finished approx 17:25 - total txns no longer	17:30	17:55	18:25	18:55	19:10	19:17
5	N	29052	34114	35606	45284		40957	28314	13033	0	0	0
5	Y	52952	56138	58772	64616		70581	83224	98505	111538	111538	111538
6	N	37690	44269	46520	59308		55413	42768	27488	11805	3793	0
6	Y	50908	54089	56729	62586		68590	81235	96515	112198	120210	124003
7	N	33524	39722	41797	53889		50028	37365	22014	6336	0	0



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



7	Y	55580	58767	61405	67260	increasing	73241	85904	101255	116933	123269	123269
8	N	30906	36659	38518	49717		45661	33025	17796	2112	0	0
8	Y	54513	57694	60332	66170		72124	84760	99989	115673	117785	117785
TOTAL TXNS		345125	381452	399679	468830		476595	476595	476595	476595	476595	476595

ID	MAX(INSERT_TSMP)	MAX(UPDATE_TSMP)
5	29/06/2010 17:25	29/06/2010 18:50
6	29/06/2010 17:25	29/06/2010 19:17
7	29/06/2010 17:25	29/06/2010 19:07
8	29/06/2010 17:25	29/06/2010 18:59

Test Status: Passed

Date of Final Run: 29<sup>th</sup> June 2010 15:22 to 17:22

Build Release: 01.22.00 / OSRs at 01.23.01.00

TestID: 201

## 5.14 Test Group X11 – BAL & BRDB

Earlier iterations of BAL/BRDB testing at design limit transaction load identified a number of concerns with regard to system utilisation and memory usage. Whilst the target transaction rates were achievable, response times were sometimes erratic and performance characteristics of the BRDB were at undesirable levels, which in turn had a knock-on effect at the BAL layer. A number of patches and performance improvements were implemented, but upgrade of the pblades hosting the BRDB nodes to v249 blades demonstrated a considerable improvement such that performance concerns have been eliminated.

The transaction rates and response times shown in the following sections are those for the iteration performed against all 4 BRDB nodes operating on the new v249 blades. However, to demonstrate the significant improvement in system performance, graphs have been included to illustrate system metrics gathered by Athene for comparative tests run against the old blades and against just node 1 on a new v249 blade.

### 5.14.1 BAL & BRDB – Start of Day Profile

This test had a high transaction rate with 'counter' logins/logoffs occurring throughout the run. The transaction types included EPOSS, Banking, Debit Card, E-TopUps, DVLA, PAF, Postal Orders, Bureau and Postal Services. The scenario had a target rate of 1074 transactions per second on average which equates to 498 settlements per second.

Basket/Script	Hits/sec	Settle/sec
0010_BKT01_CPO_WDL(2)	240	80
0011_BKT01_AL_WDL(2)	15	5
0012_BKT01_LNK_WDL(2)	45	15
0020_BKT02_STP_SLE(3)	150	150
0050_BKT05_DVL_TDC(3)	30	15
0060_BKT06_STP_SLE(3)	50	50
0070_BKT07_PTL_SRV(5)	90	30
0080_BKT08_PTL_SRV(8)	20	5





## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE

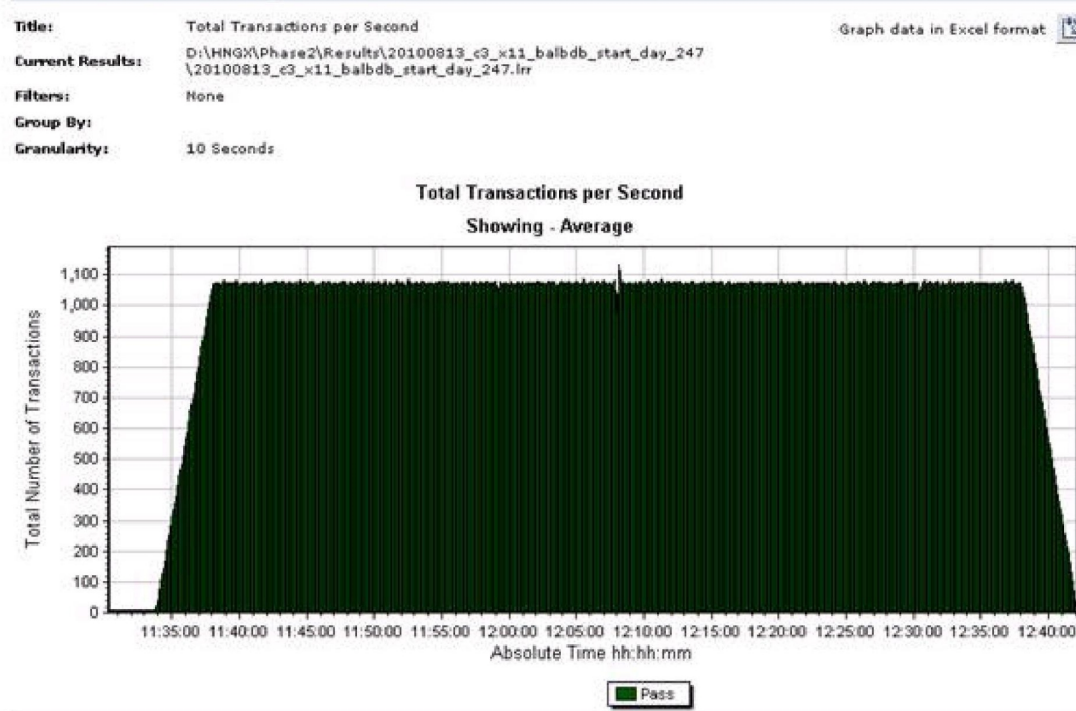


Basket/Script	Hits/sec	Settle/sec
0140_BKT14_EPO_CCQ(3)	80	80
0170_BKT17_BIL_CSH(3)	25	25
0180_BKT18_ETA_CSH(2)	9	3
0190_BKT19_BDC_CSH(3)	25	25
0300_BKT30_EPO_DBT(3)	30	10
0400_BKT40_LIN_LOF	250	50
0500_BKT50_POS_ORD(4)	15	5

1074 498

The test iteration run against all 4 BRDB nodes on new v249 blades produced excellent results, both in terms of throughput and response times. The graph below shows the total transaction rates for the test. Throughput was steady with 3 minor dips.

## Total Transactions per Second



The response times were steady with a few spikes coinciding with dip in throughput as shown in the merged graph below.



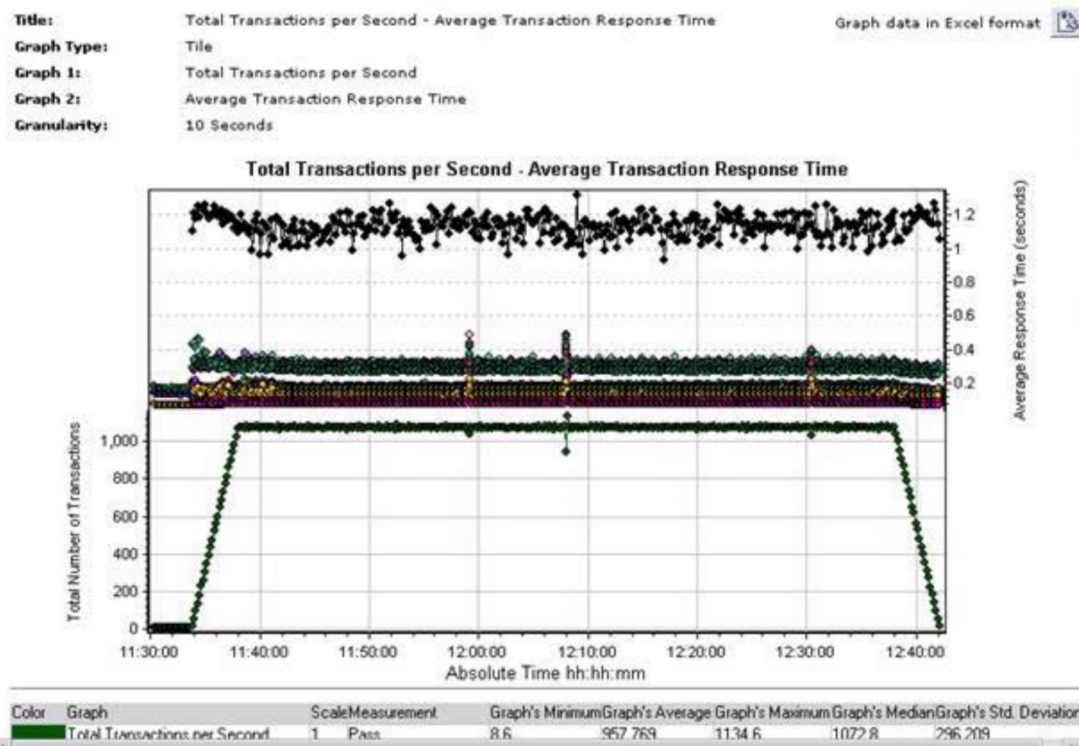


## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



## Total Transactions per Second - Average Transaction Response Time



The table below is a summary of the test; showing the response time (min/avg/max/90th percentile) for each transaction and also the number of transactions which 'passed' & 'failed'. The response times were good and the number of failures were low; 40 logoffs failures which was due to a data issue with the user details for those particular branches, and not a genuine issue. There were no other failures.

Transaction Name	Minimum	Average	Maximum	Std. Deviation	90 Percent	Pass	Fail
C_010_FirstLogon	0.124	0.149	3.298	0.058	0.17	193426	0
C_020_SecondLogon	0.117	0.191	3.5	0.066	0.24	193426	0
C_030_GetMemos	0.07	0.08	3.114	0.016	0.09	193426	0
C_040_CountSusp	0.07	0.08	3.023	0.014	0.09	193426	0
C_050_Logoff	0.084	0.098	3.112	0.041	0.11	193386	40
T_0010_010_CAPOAuth	0.167	0.323	3.548	0.075	0.421	308111	0
T_0010_020_CAPORecov	0.106	0.119	3.213	0.053	0.13	308111	0
T_0010_030_CAPOSettle	0.123	0.134	3.186	0.033	0.14	308111	0
T_0011_010_ALAuth	0.184	0.304	3.246	0.075	0.361	19254	0
T_0011_020_ALRecov	0.104	0.118	3.06	0.066	0.13	19254	0
T_0011_030_ALSettle	0.122	0.135	3.161	0.032	0.15	19254	0
T_0012_010_LINKAuth	0.174	0.323	3.433	0.078	0.421	57748	0
T_0012_020_LINKRecov	0.105	0.118	3.093	0.058	0.13	57748	0
T_0012_030_LINKSettle	0.122	0.134	3.201	0.031	0.14	57748	0
T_0020_010_STMPSettle	0.093	0.165	3.412	0.053	0.18	574830	0



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



Transaction Name	Minimum	Average	Maximum	Std. Deviation	90 Percent	Pass	Fail
T_0050_010_DVLAAuth	0.411	1.127	4.197	0.243	1.42	57752	0
T_0050_020_DVLASettle	0.108	0.122	2.728	0.054	0.13	57752	0
T_0060_010_STMPSettle	0.095	0.167	3.255	0.049	0.18	192405	0
T_0070_010_LASTPOInd	0.072	0.142	3.378	0.031	0.15	115703	0
T_0070_020_LABELEVTSrv	0.088	0.101	3.074	0.052	0.11	115703	0
T_0070_030_POSRVSettle	0.104	0.116	3.104	0.035	0.13	115703	0
T_0080_010_LASTPOInd	0.072	0.143	2.037	0.028	0.15	19265	0
T_0080_020_Paf	0.153	0.177	2.074	0.026	0.2	19265	0
T_0080_030_PSBARCode	0.071	0.082	1.573	0.021	0.09	19265	0
T_0080_040_POSRVSettle	0.128	0.143	2.527	0.054	0.15	19265	0
T_0140_010_EPOSSettle	0.095	0.167	3.373	0.054	0.18	307788	0
T_0170_010_BCSHSettle	0.104	0.176	3.276	0.058	0.19	96223	0
T_0180_010_ETAAAuth	0.185	0.289	1.984	0.061	0.36	11518	0
T_0180_020_ETAREcov	0.099	0.116	2.651	0.067	0.14	11518	0
T_0180_030_ETASettle	0.11	0.129	3.151	0.046	0.16	11518	0
T_0190_010_BDCSettle	0.101	0.173	3.327	0.052	0.18	96164	0
T_0300_010_DBTAuth	0.182	0.313	3.256	0.066	0.371	38575	0
T_0300_020_DBTRecov	0.104	0.116	3.118	0.058	0.12	38575	0
T_0300_030_DBTSettle	0.124	0.136	2.519	0.034	0.15	38575	0
T_0500_010_APOPAAuth	0.204	0.276	2.237	0.044	0.33	19253	0
T_0500_020_APOPDRecov	0.105	0.119	3.104	0.058	0.13	19253	0
T_0500_030_APOPDSettle	0.123	0.138	2.864	0.041	0.16	19253	0

Test Status: Passed

Date of Final Run: 13<sup>th</sup> August 2010 at 11:30 to 12:42

Build Release: 01.22.00 / OSRs at 01.23.01.00 (all 4 BRDB nodes on new v249 blades)

TestID 247

### 5.14.1.1 BRDB Performance Characteristics

The following graphs taken from Athene data captured, show a comparison of selected system performance characteristics for the following comparative test runs:

TestID 200 – with all 4 BRDB nodes on the original pblades (NB: ORM was OFF for this run so it is not an entirely fair comparison, but does still serve to highlight the main differences)

TestID 230 – with only BRDB Node 1 on new v249 pblade, others on the original pblades

TestID 247 – the test reported above with all 4 BRDB nodes on new v249 pblades

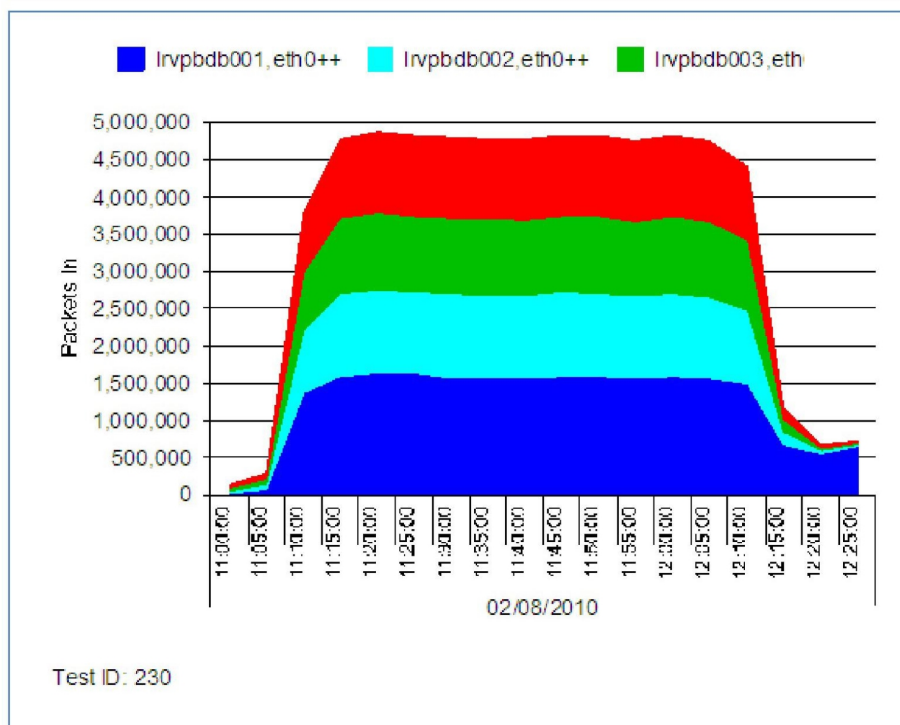
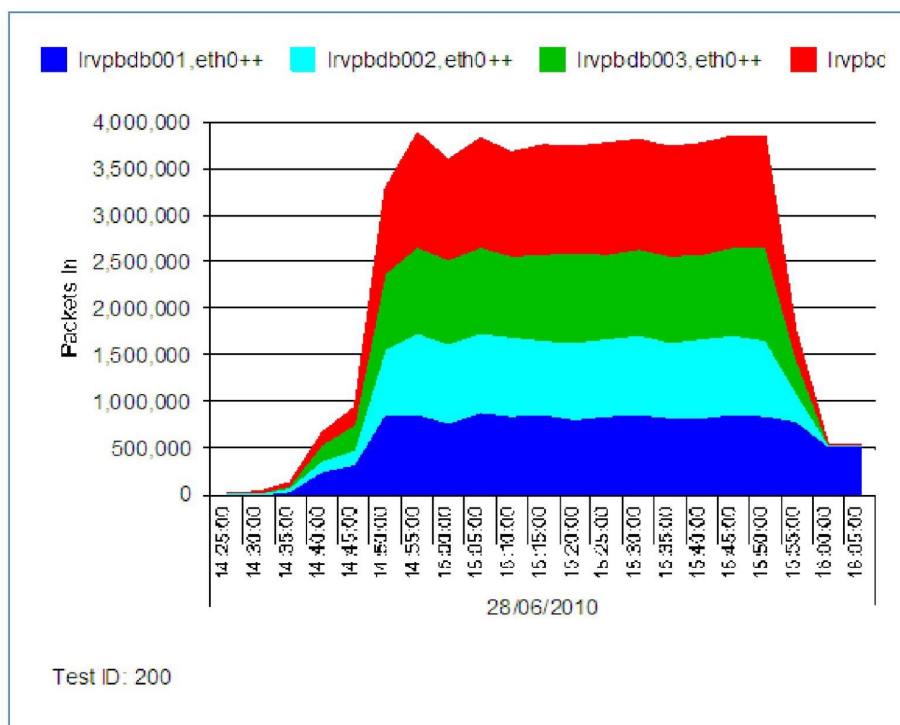
In regards to test 247, there were no capacity constraints anywhere in the system and the results were as expected. In comparing this test with TestID 200 and 230, the significant difference was the BDB memory profile and CPU Utilisation. There is a lot more free memory available post-upgrade, thus alleviating swapping on the nodes, and CPU utilisation is lower..

#### 5.14.1.1.1 BRDB Packets In



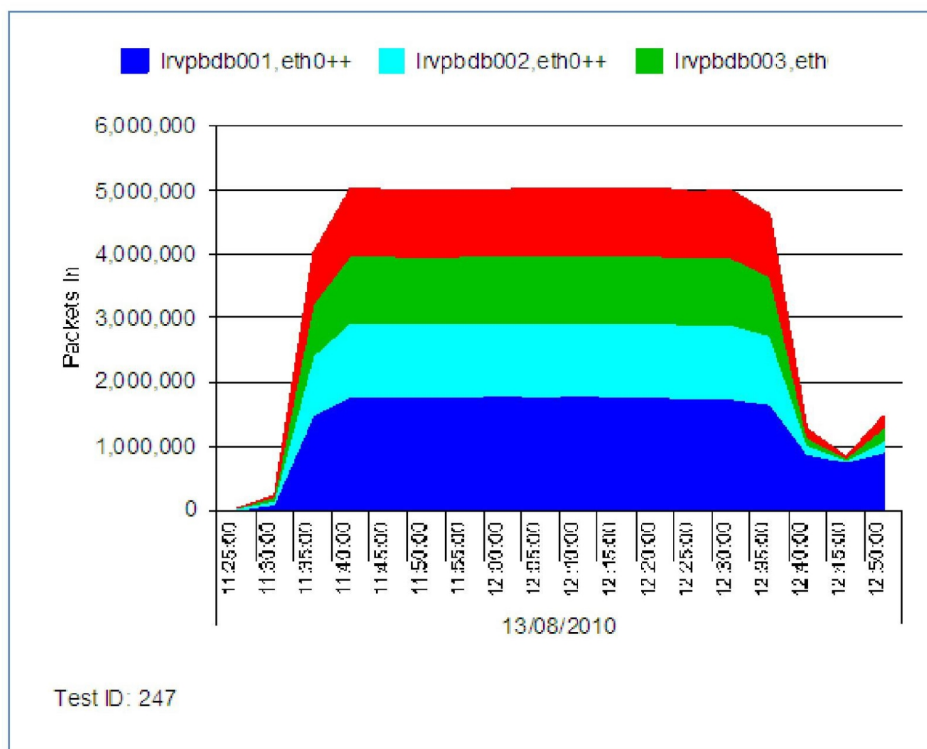
VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE





VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



#### 5.14.1.1.2BRDB CPU Utilisation

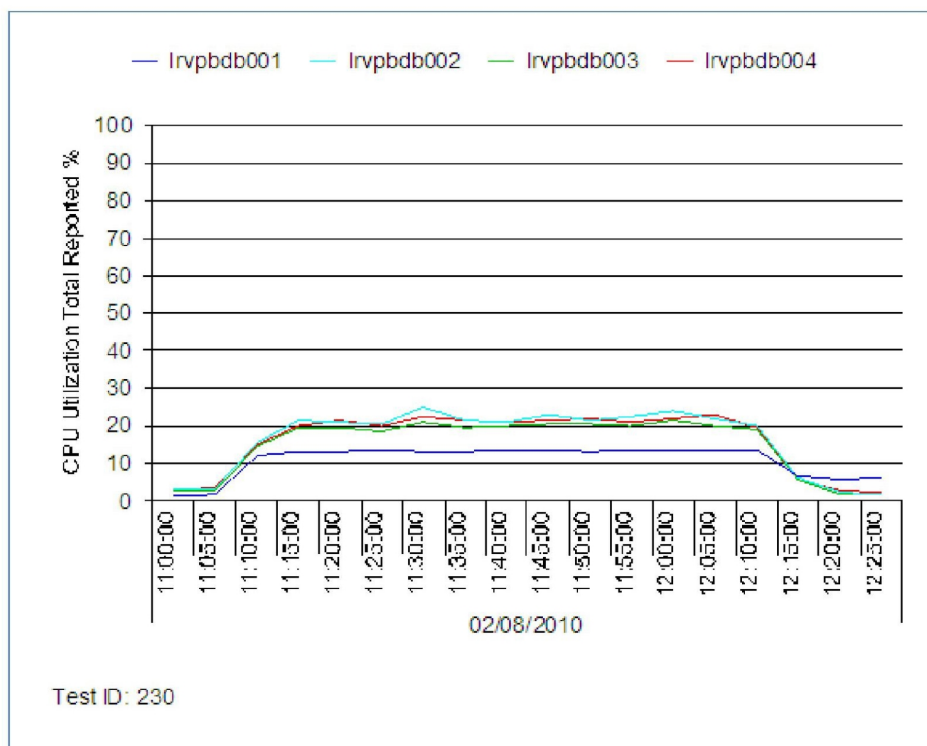
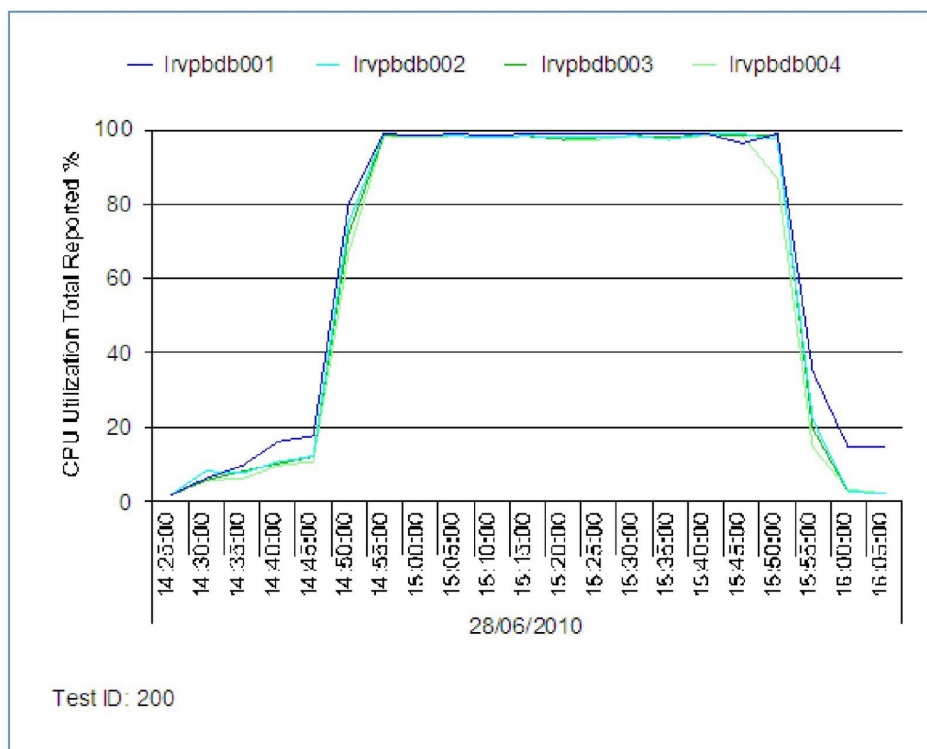
There was a bit of a spike in Test 247 for node 3 at the start of the test. Other than that, utilisation was down as expected.





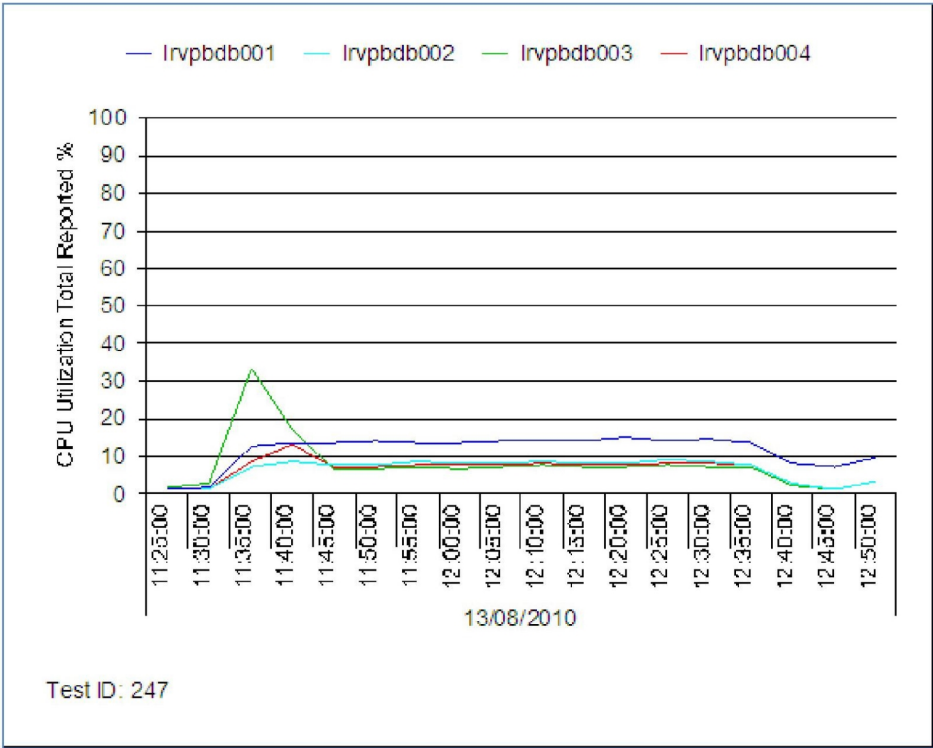
VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE





VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



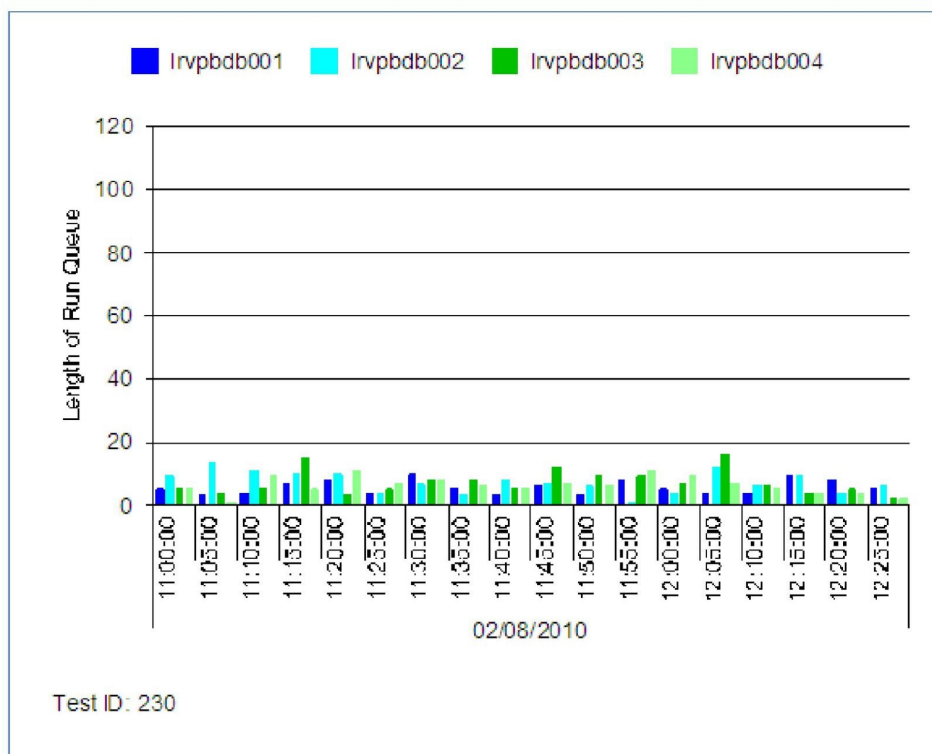
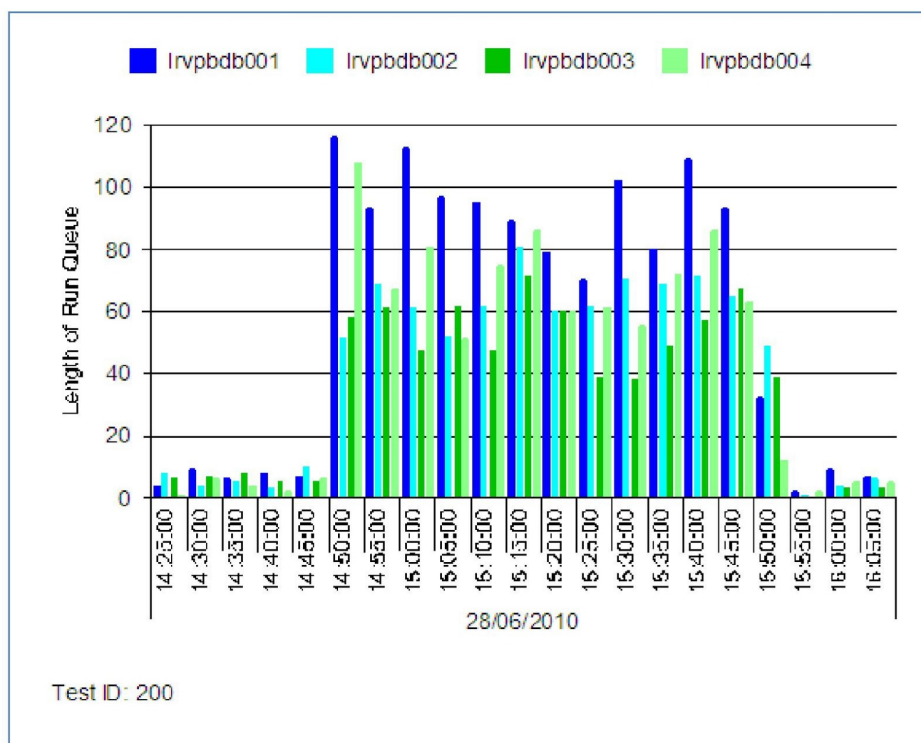
5.14.1.1.3BRDB Run Queue

The CPU queue length was right down on tests 230 and 247, slightly more so on test 247.



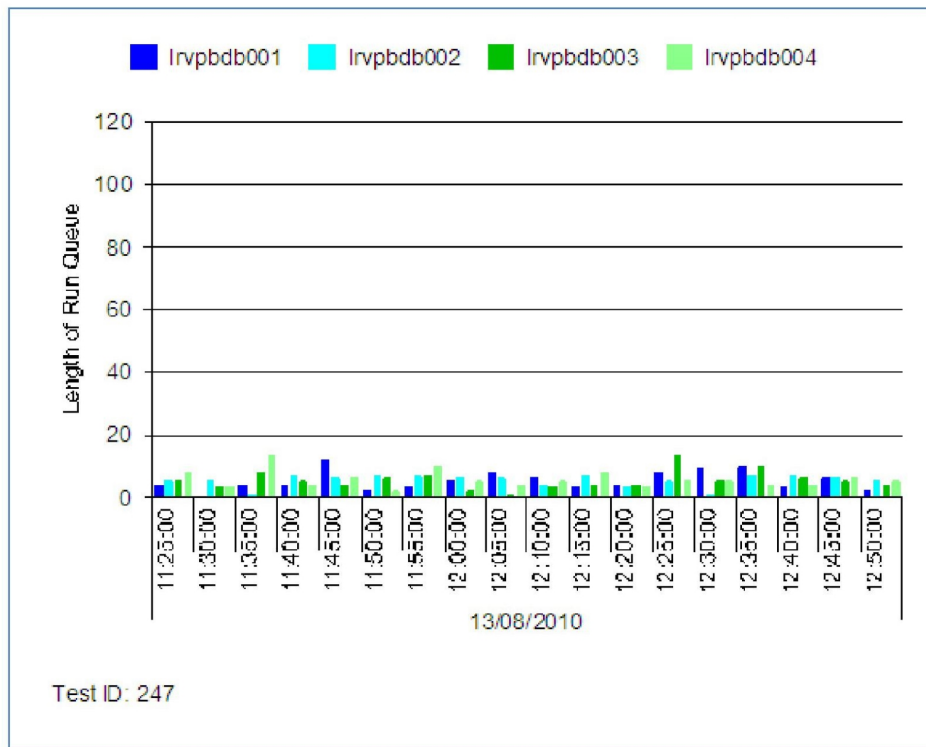
VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE





VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



#### 5.14.1.1.4BRDB Used Memory

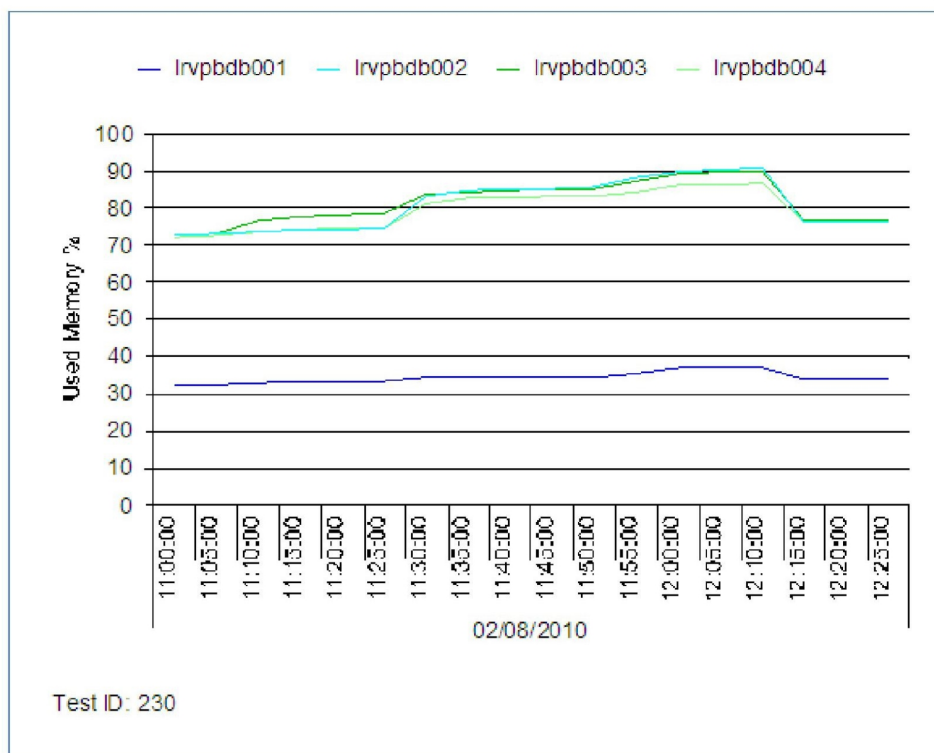
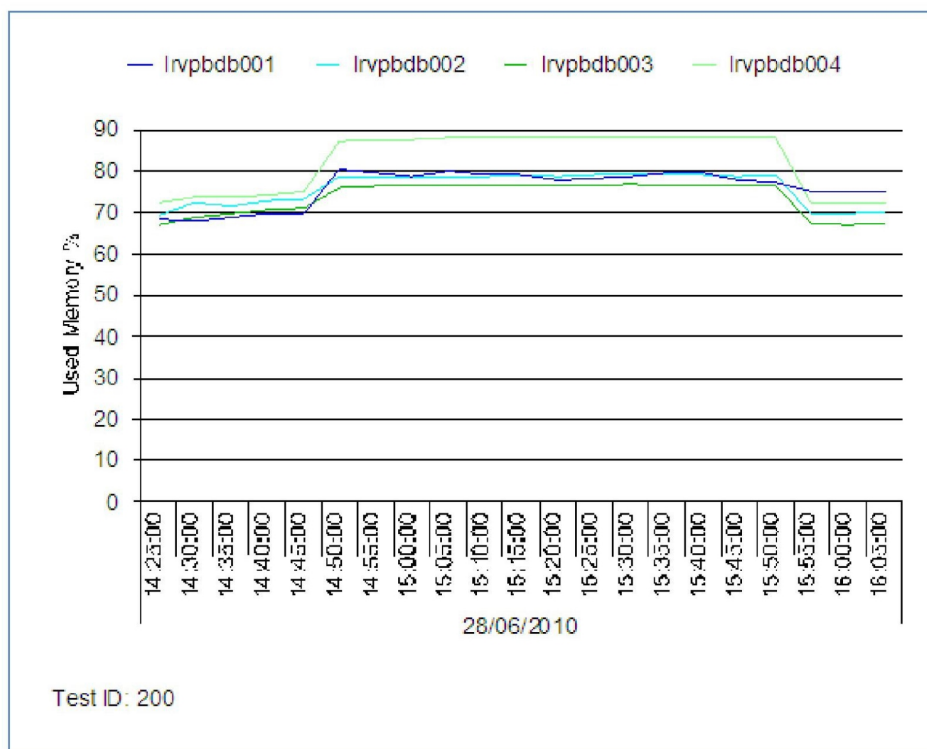
Memory utilisation on the new pblades was significantly lower than that of the old pblades (as expected).





VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

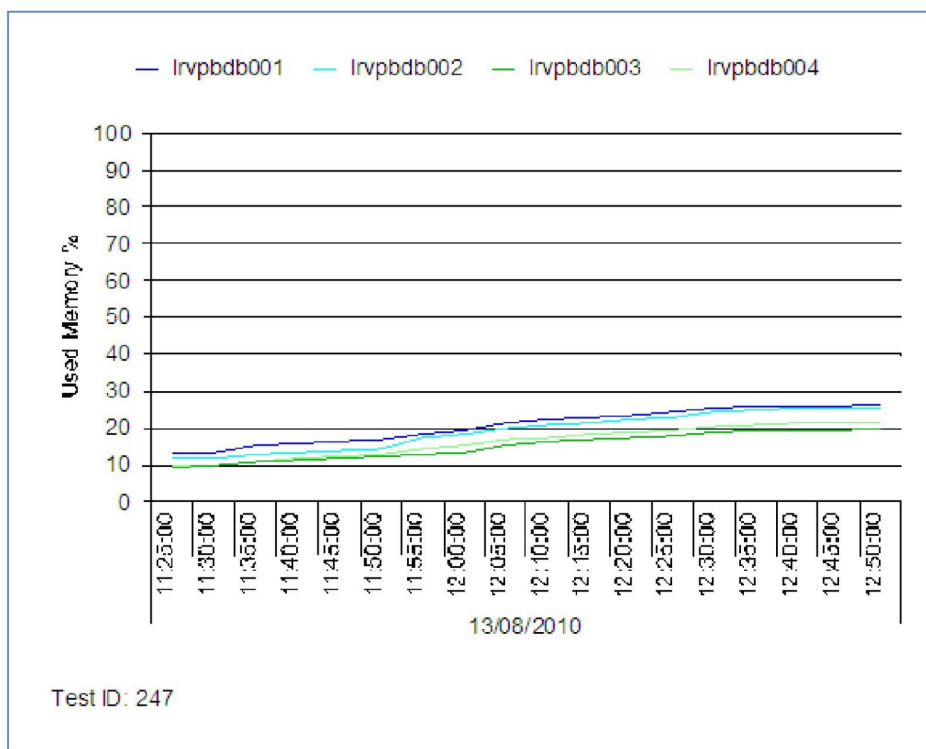
COMMERCIAL IN CONFIDENCE





## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



### 5.14.2 BAL & BRDB – Mid-Day Profile

This test subjected the BAL/BRDB layers to a very high load for over an hour. The transaction types included EPOSS, Banking, Debit Card, E-TopUps, DVLA, PAF, Postal Orders, Bureau, Bill Payments and Postal Services. The scenario had a target rate of 1393 transactions per second (average) which equates to 829 settlements per second

Basket/Script	Hits/sec	Settle/sec
0010_BKT01_CPO_WDL(2)	390	130
0011_BKT01_AL_WDL(2)	36	12
0012_BKT01_LNK_WDL(2)	120	40
0020_BKT02_STP_SLE(3)	300	300
0030_BKT03_BIL_PYT(2)	30	30
0050_BKT05_DVL_TDC(3)	48	24
0060_BKT06_STP_SLE(3)	30	30
0070_BKT07_PTL_SRV(5)	90	30
0080_BKT08_PTL_SRV(4)	40	10
0140_BKT14_EPO_CCQ(3)	120	120
0150_BKT15_PTL_SRV(2)	40	20
0160_BKT16_BIL_DBT(2)	30	10
0170_BKT17_BIL_CSH(3)	25	25
0180_BKT18_ETA_CSH(2)	24	8



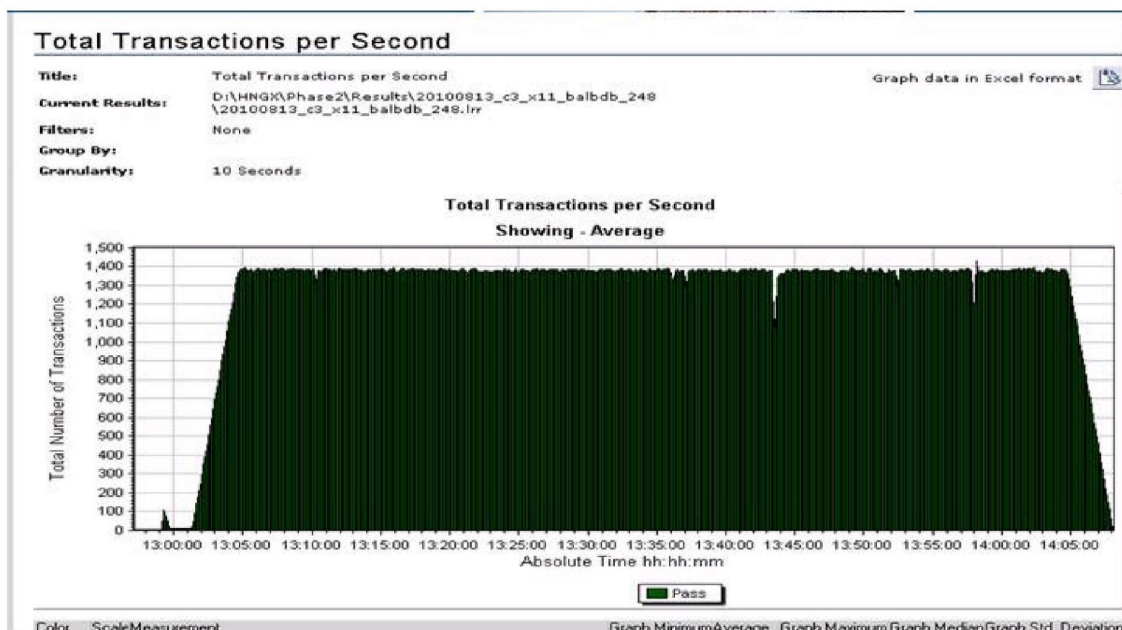
## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



Basket/Script	Hits/sec	Settle/sec
0190_BKT19_BDC_CSH(3)	25	25
0500_BKT50_POS_ORD(4)	45	15
	1393	829

The test iteration run against all 4 BRDB nodes on new v249 blades produced excellent results, both in terms of throughput and response times. The graph below shows the total transaction rates for the test. The throughput achieved was consistently good (~1390+tps) with a few dips.

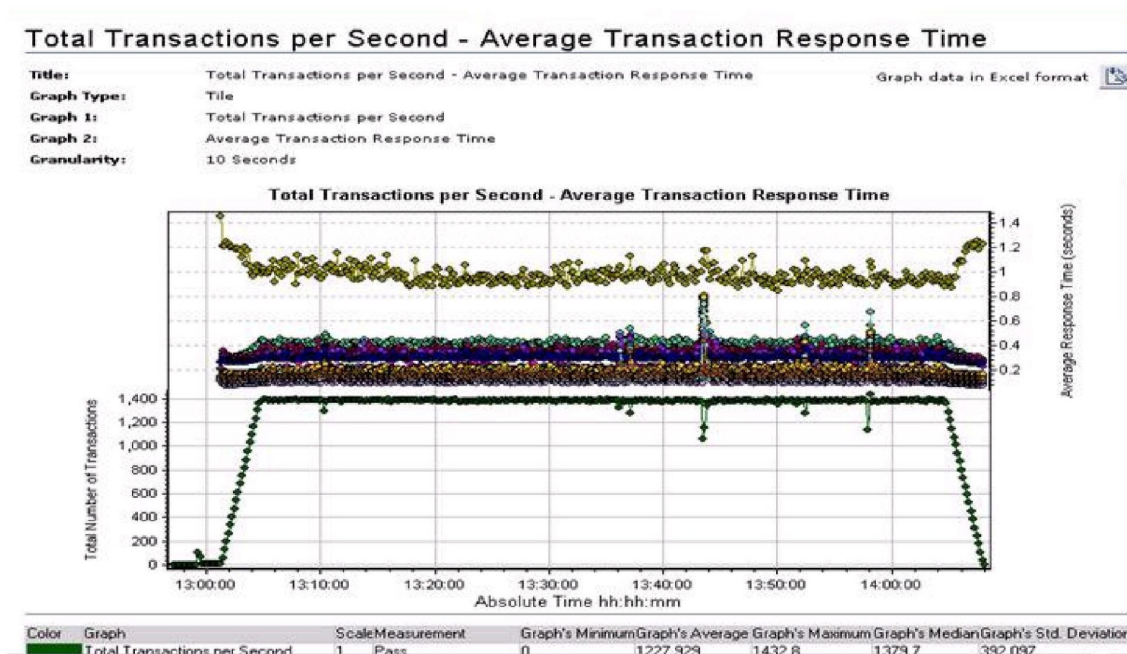


The response times achieved had a steady profile with a few spikes coinciding with the dips in throughput as shown in the merged graph below.



# VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

## COMMERCIAL IN CONFIDENCE



The table below is a summary of the test; showing the response time (min/avg/max/90th percentile) for each transaction and also the number of transactions which 'passed & failed'. The response times were good and the number of failures were low; 25 logoffs failures which was due to a data issue with the user details for those particular branches, and not a genuine issue. There were no other failures.

Transaction Name	Minimum	Average	Maximum	Std. Deviation	90 Percent	Pass	Fail
C_010_FirstLogon	0.125	0.13	0.233	0.011	0.14	1000	0
C_020_SecondLogon	0.127	0.199	0.395	0.035	0.24	1000	0
C_030_GetMemos	0.07	0.074	0.152	0.006	0.08	1000	0
C_040_CountSusp	0.063	0.081	0.652	0.021	0.09	1000	0
C_050_Logoff	0.078	0.096	0.592	0.029	0.11	975	25
T_0010_010_CAPOAuth	0.162	0.369	5.966	0.182	0.471	491046	0
T_0010_020_CAPORecov	0.094	0.138	5.561	0.162	0.15	491046	0
T_0010_030_CAPOSettle	0.075	0.154	8.865	0.171	0.17	491046	0
T_0011_010_ALAuth	0.166	0.334	9.185	0.188	0.401	45437	0
T_0011_020_ALRecov	0.104	0.138	3.48	0.171	0.16	45437	0
T_0011_030_ALSettle	0.121	0.154	3.447	0.151	0.18	45437	0
T_0012_010_LINKAuth	0.164	0.422	9.235	0.191	0.551	150909	0
T_0012_020_LINKRecov	0.105	0.135	5.529	0.165	0.15	150909	0
T_0012_030_LINKSettle	0.103	0.151	9.115	0.157	0.17	150909	0
T_0020_010_STMPSettle	0.082	0.192	9.042	0.176	0.21	1117247	0
T_0030_010_BILLSettle	0.1	0.205	5.754	0.189	0.23	112907	0
T_0050_010_DVLAAuth	0.405	0.97	4.809	0.321	1.4	90811	0
T_0050_020_DVLASettle	0.102	0.141	5.565	0.187	0.15	90811	0





## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



Transaction Name	Minimum	Average	Maximum	Std. Deviation	90 Percent	Pass	Fail
T_0060_010_STMPSettle	0.095	0.199	9.015	0.187	0.23	112953	0
T_0070_010_LASTPOInd	0.072	0.163	3.783	0.149	0.18	112704	0
T_0070_020_LABELEVTSrv	0.069	0.122	5.536	0.176	0.14	112704	0
T_0070_030_POSRVSettle	0.086	0.135	8.929	0.156	0.15	112704	0
T_0080_010_LASTPOInd	0.072	0.171	3.821	0.172	0.2	37592	0
T_0080_020_Paf	0.153	0.206	3.322	0.168	0.24	37592	0
T_0080_030_PSBARCode	0.071	0.104	3.262	0.152	0.13	37592	0
T_0080_040_POSRVSettle	0.126	0.168	8.89	0.192	0.19	37592	0
T_0140_010_EPOSSettle	0.073	0.194	9.074	0.178	0.22	452452	0
T_0150_010_LASTPOInd	0.072	0.172	3.923	0.172	0.2	74760	0
T_0150_020_POSettle	0.091	0.144	4.261	0.169	0.17	74760	0
T_0160_010_DBTAuth	0.187	0.351	3.868	0.194	0.421	37706	0
T_0160_020_DBTRecov	0.104	0.139	3.271	0.168	0.16	37706	0
T_0160_030_DBTSettle	0.129	0.162	3.465	0.147	0.19	37706	0
T_0170_010_BCSHSettle	0.103	0.21	5.805	0.189	0.24	93646	0
T_0180_010_ETAAuth	0.138	0.316	4.175	0.179	0.381	30264	0
T_0180_020_ETARecov	0.097	0.139	3.439	0.177	0.16	30264	0
T_0180_030_ETASettle	0.097	0.147	8.902	0.155	0.18	30264	0
T_0190_010_BDCSettle	0.101	0.208	6.069	0.194	0.24	93631	0
T_0500_010_APOPAAuth	0.183	0.3	3.865	0.159	0.341	56579	0
T_0500_020_APOPDRecov	0.104	0.14	3.425	0.177	0.16	56579	0
T_0500_030_APOPDSettle	0.111	0.156	3.614	0.158	0.18	56579	0

Test Status: Passed

Date of Final Run: 13<sup>th</sup> August 2010 at 12:57 to 14:08

Build Release: 01.22.00 / OSRs at 01.23.01.00 (all 4 BRDB nodes on new v249 blades)

TestID: 248

### 5.14.2.1 BRDB Performance Characteristics

The following graphs taken from Athene data captured, show a comparison of selected system performance characteristics for the following comparative test runs:

TestID 183 – with all 4 BRDB nodes on the original pblades

TestID 231 – with only BRDB Node 1 on new v249 pblade, others on the original pblades

TestID 248 – the test reported above with all 4 BRDB nodes on new v249 pblades

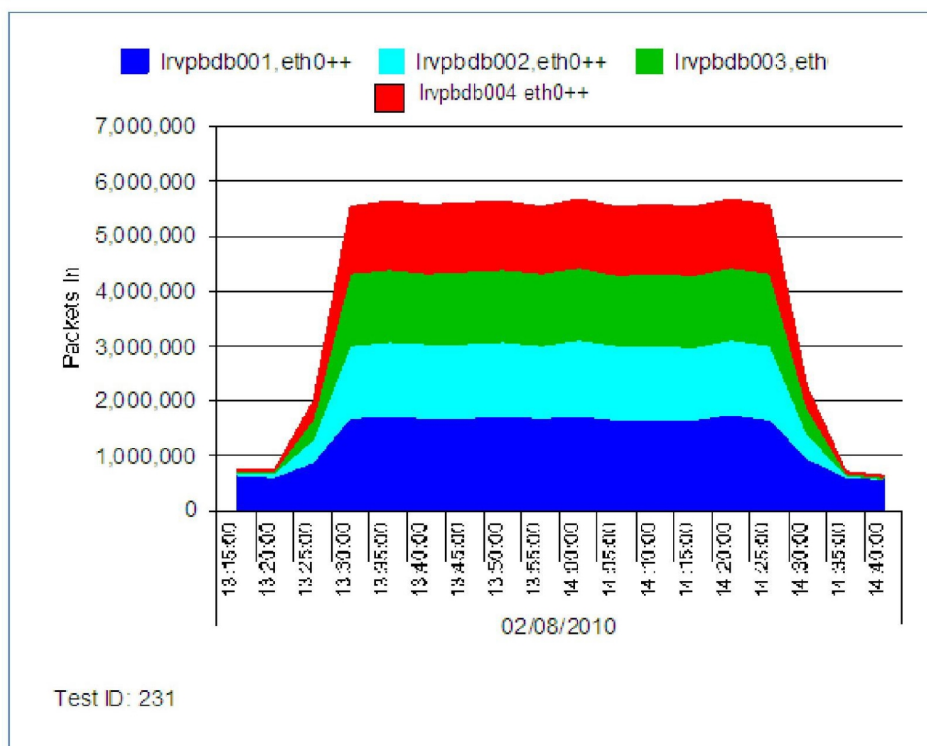
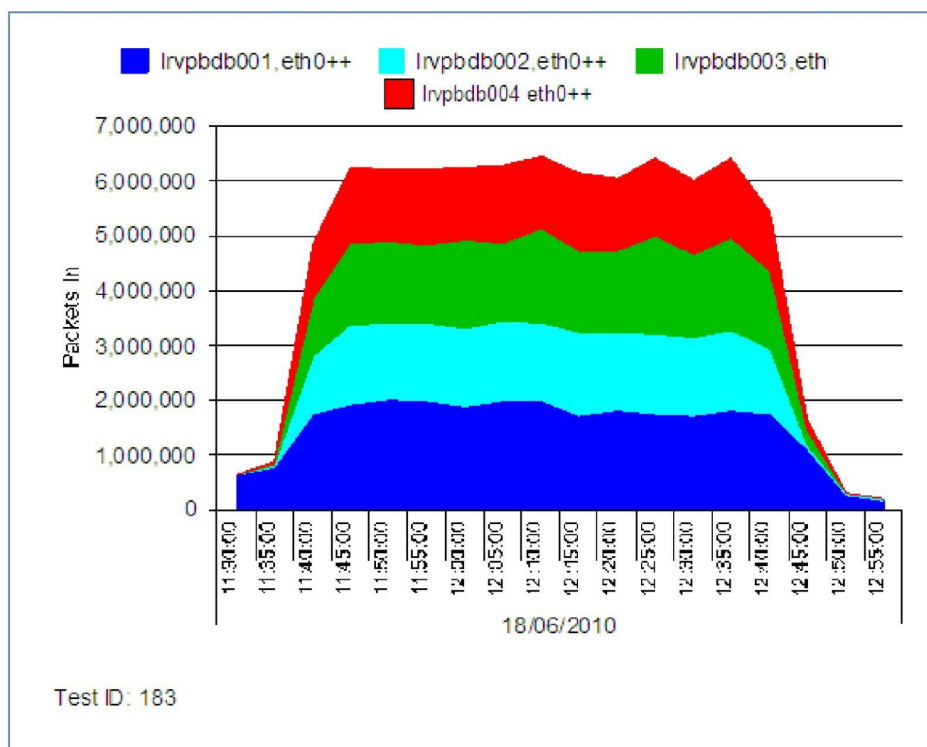
In regards to test 248, there were no capacity constraints anywhere in the system and the results were as expected. In comparing this test with TestID 183 and 231, the significant difference was the BDB memory profile and CPU Utilisation. There is a lot more free memory available post-upgrade, thus alleviating swapping on the nodes, and CPU utilisation is lower.

#### 5.14.2.1.1 BRDB Packets In



VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

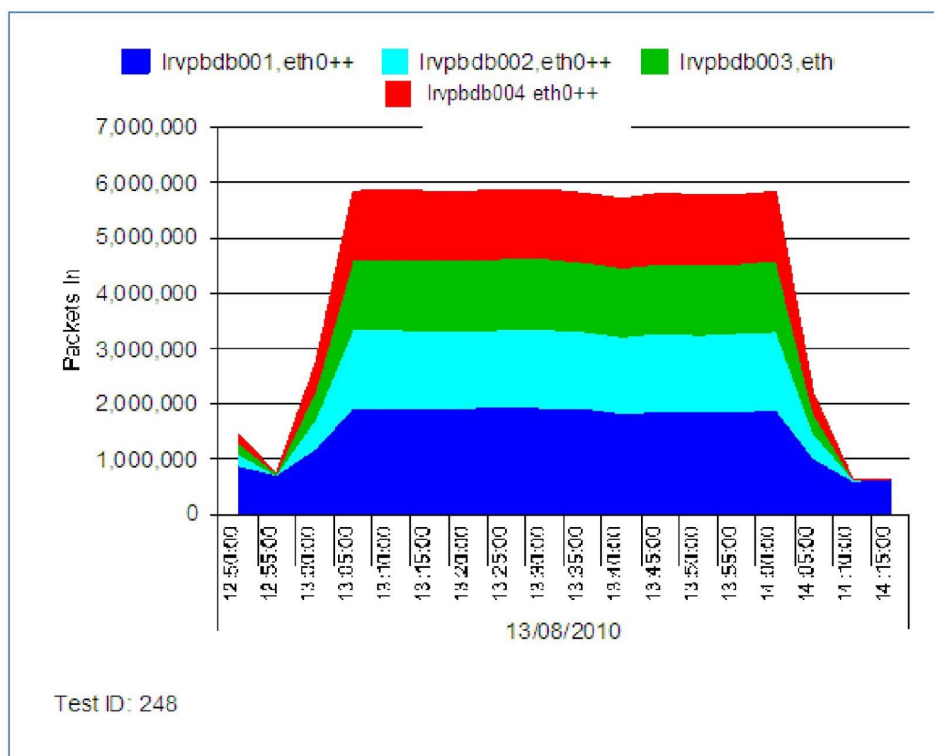
COMMERCIAL IN CONFIDENCE





VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE

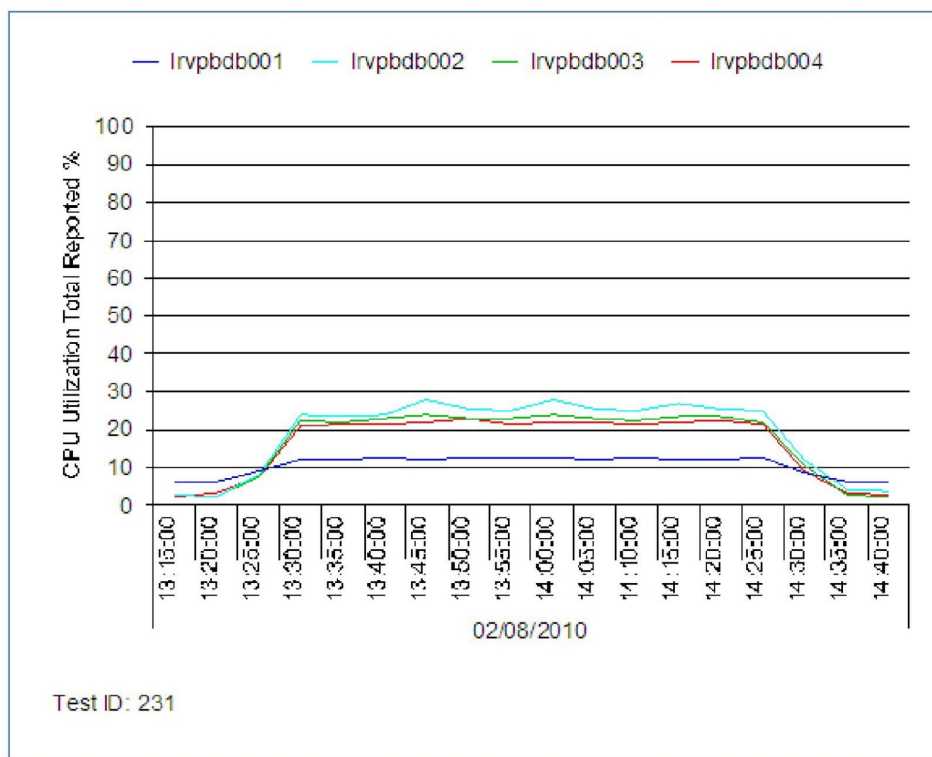
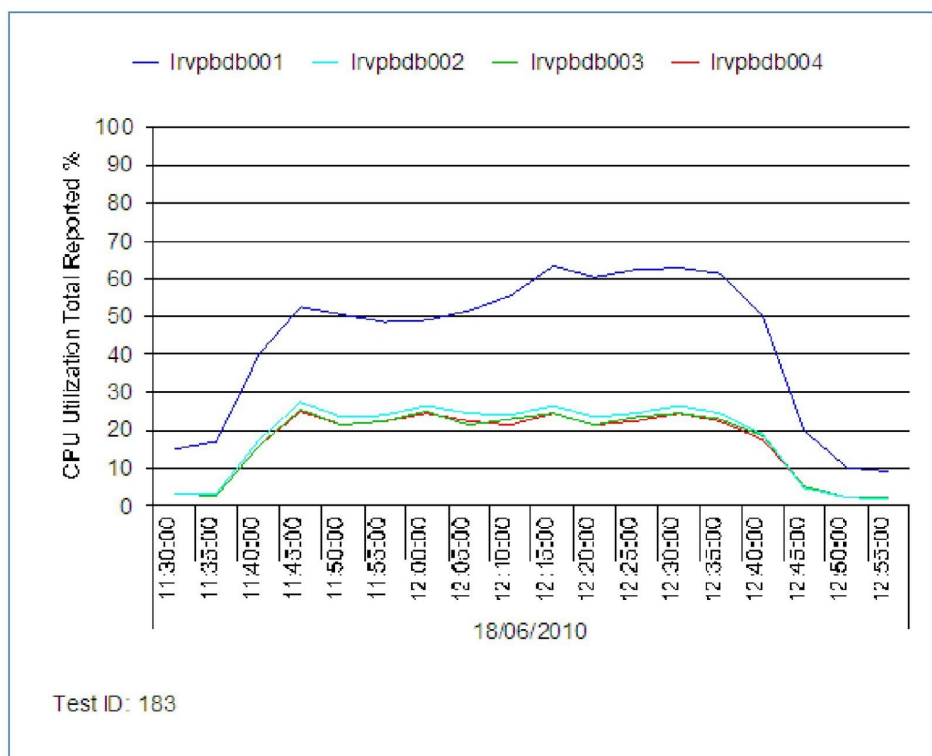


### 5.14.2.1.2BRDB CPU Utilisation



VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE

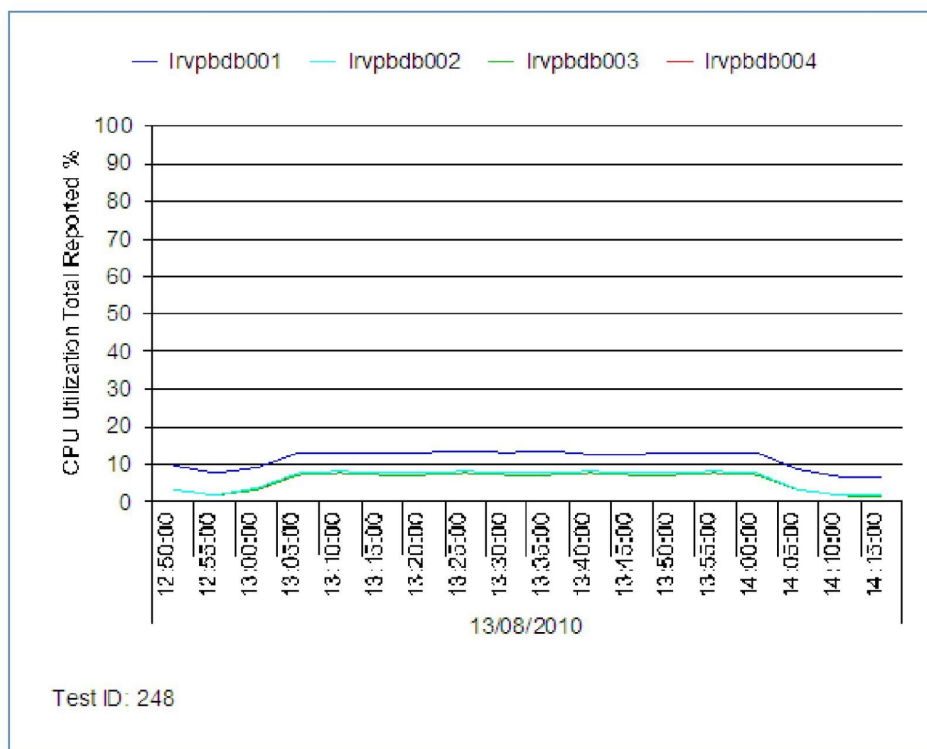






VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE

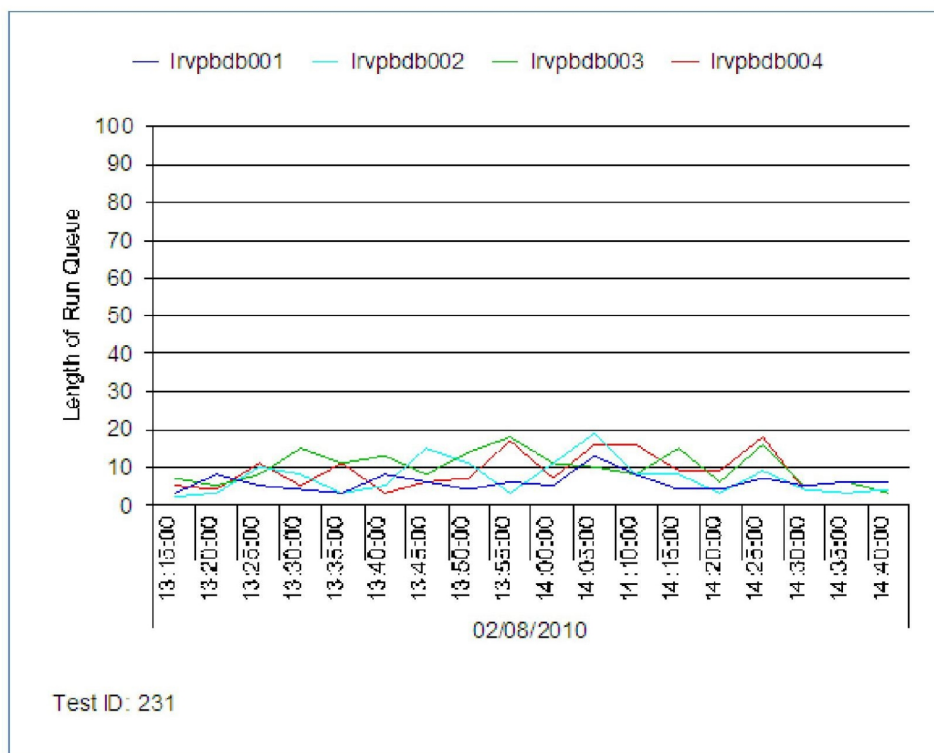
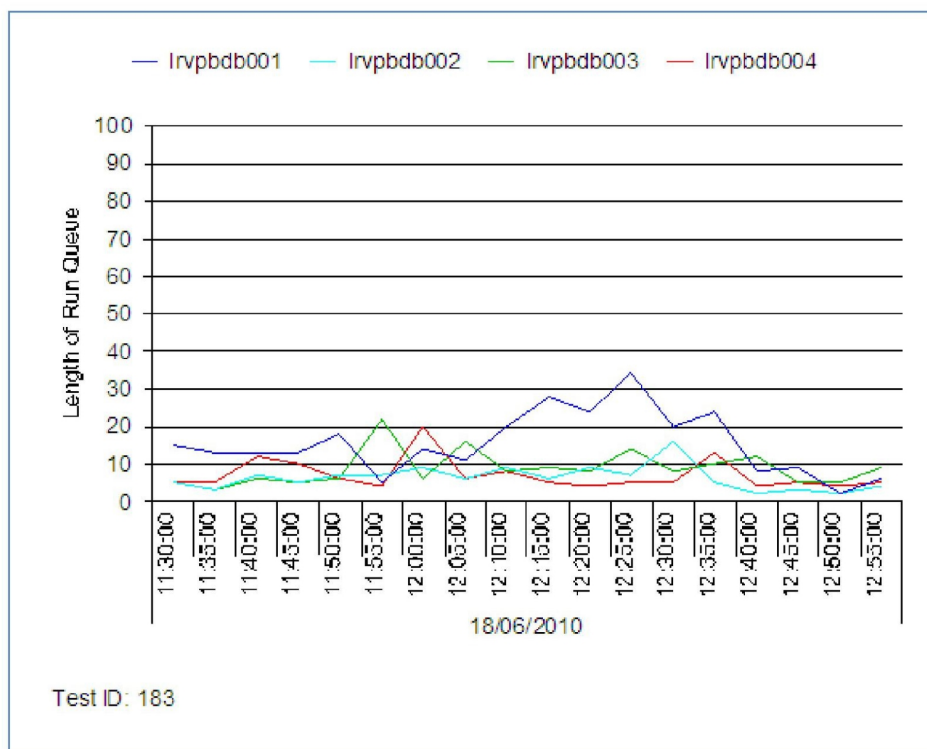


5.14.2.1.3BRDB Run Queue



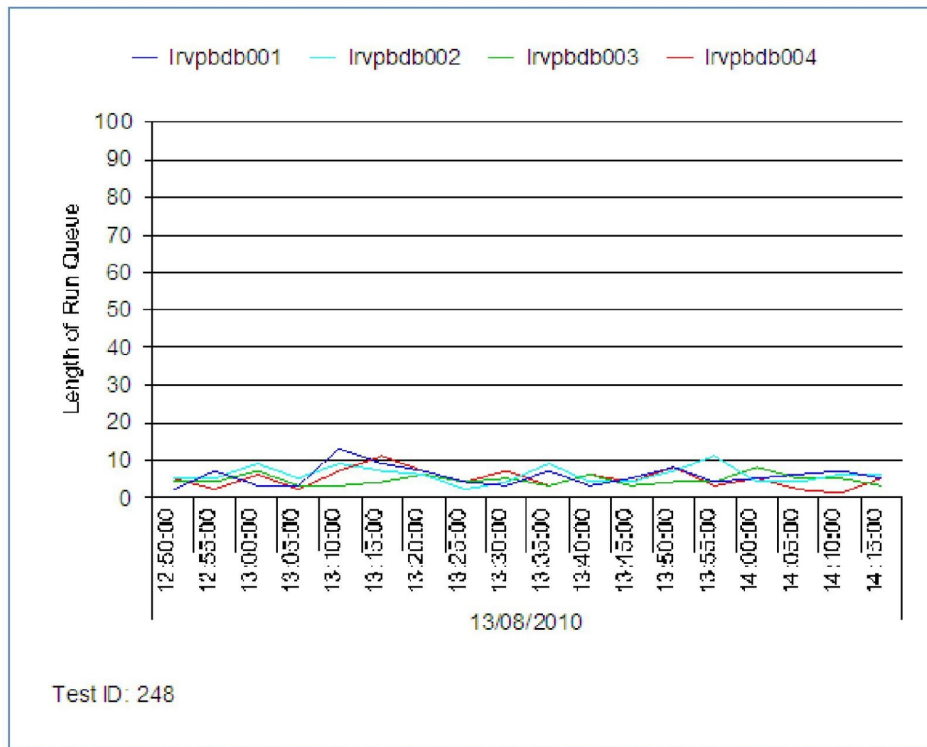
VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE





VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE

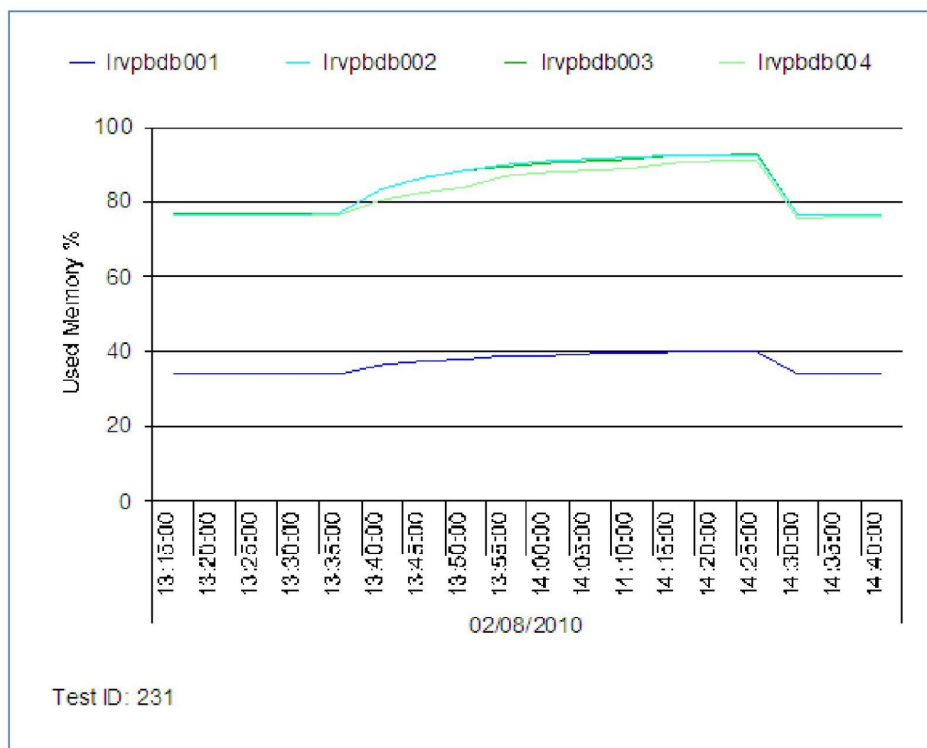
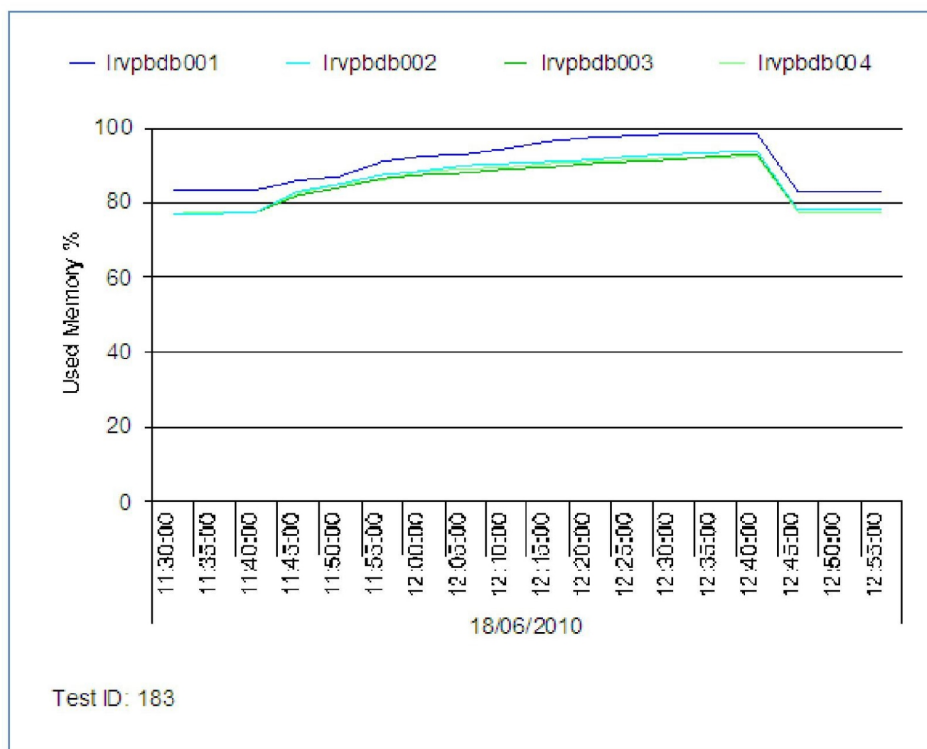


#### 5.14.2.1.4BRDB Used Memory



VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE

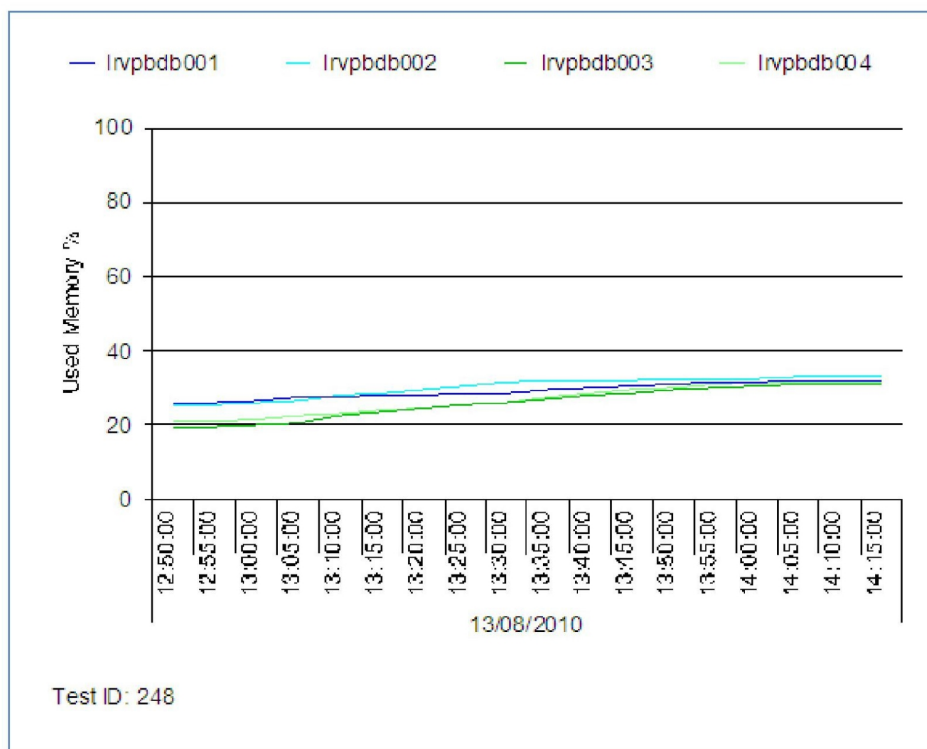






## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



### 5.14.3 BAL & BRDB – End of Day Profile

Since version 0.1 of this report was issued, this test has been re-run following delivery of an informal fix for PC0201529 (High CPU usage results when running Group Reports). To illustrate the significant performance improvement delivered by this fix, the results shown below provide a comparison of TestID 254 (after the fix was applied) and TestID 249 (before the fix was applied).

This test was run after the data loading tasks were fully completed. The test includes the Group Reports with other single reports and with a background transaction load.

The reports component had a selection of 'single' reports and 'group' reports (see table below). It should be noted that the 'Reports' in **red** below are not strictly reports but other end-of day activity.

Reports	Description
1800_CDCHL_RPT	Counter Daily Cheque Listing
2100_BALSS_RPT	Balance Snapshot Report
2400_OFFSS_RPT	Office Snapshot
2700_CWMTX_RPT	Weekly Group Report (3001)
2800_CSH_DEC	Cash Declaration
2900_STK_DEC	Stock Declaration
3000_STP_DEC	Stamp Declaration
3100_CDCUT_RPT	Daily Group Report (3000)



VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



The following multiplication factors apply to the group reports:

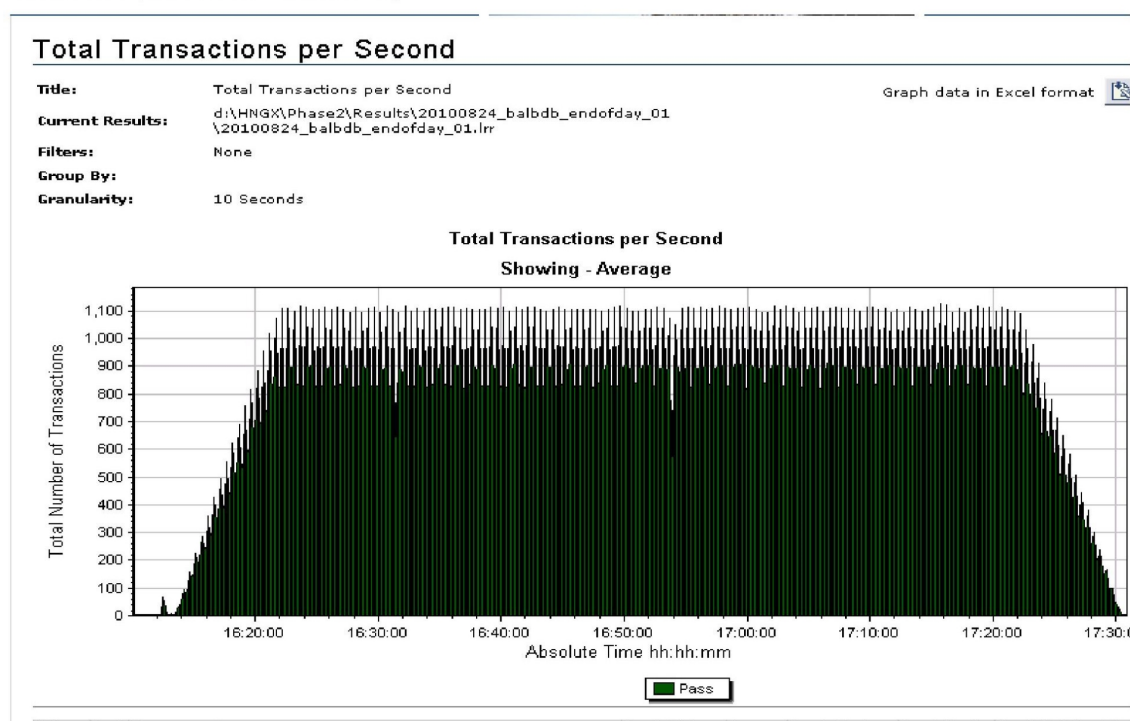
1 x 2700\_CWMTX\_RPT is equivalent to 8 single reports, and

1 x 3100\_CDCUT\_RPT is equivalent to 10 single reports

The test produced excellent results with good response times and throughput. Comparing with TestId 249 there was a significant improvement in every respect for both the reports and declarations as well as the background transaction load.

The graphs below show the Total Transaction Rates for the test. Spikes of up to 1100/sec was achieved for TestId 254 compared with 750/sec in TestId 249.

TestID 254 (after fix for PC0201529)






## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

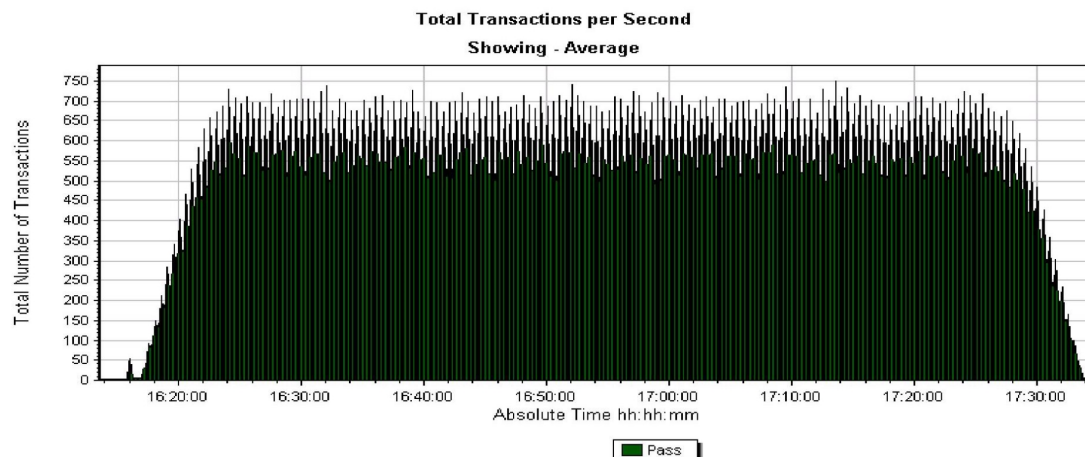
COMMERCIAL IN CONFIDENCE



TestID 249 (before fix for PC0201529)

## Total Transactions per Second


**Title:** Total Transactions per Second Graph data in Excel format   
**Current Results:** d:\HNGX\Phase2\Results\20100814\_balbdb\_endofday\_01  
20100814\_balbdb\_endofday\_01.lrr  
**Filters:** None  
**Group By:**  
**Granularity:** 10 Seconds

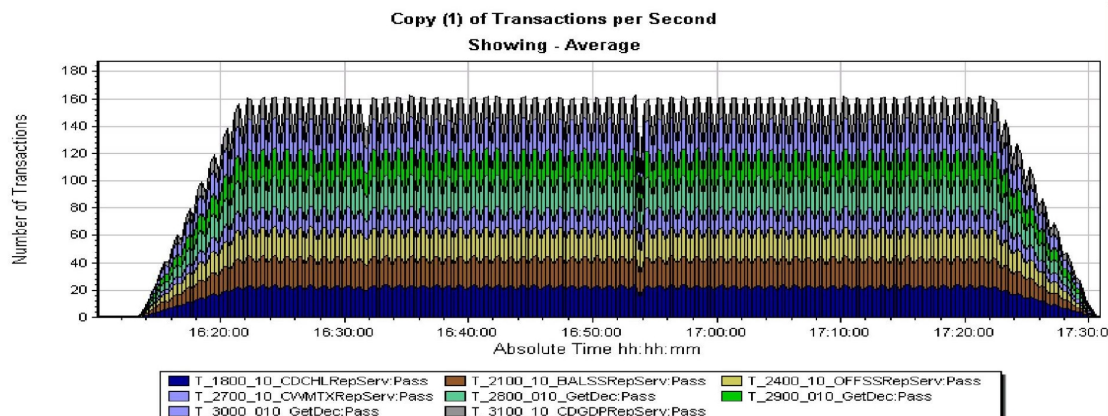


The graphs below show the transaction rates for the Reports and Declarations (cash/stamp/stock) and demonstrate up to 160/sec at points in the test. Taking into account the multiplication factors of the Group Reports then the overall rate is equivalent to up to 345tps for reports, and around 65tps for the declarations. This compares with an equivalent rate of 148-158tps for reports and 35-37tps for declarations in TestID 249

TestID 254 (after fix for PC0201529)

## Copy (1) of Transactions per Second

**Title:** Copy (1) of Transactions per Second Graph data in Excel format   
**Current Results:** d:\HNGX\Phase2\Results\20100824\_balbdb\_endofday\_01  
20100824\_balbdb\_endofday\_01.lrr  
**Filters:** (Include Think Time)  
**Group By:** Transaction End Status  
**Granularity:** 20 Seconds





## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



TestID 249 (before fix for PC0201529)

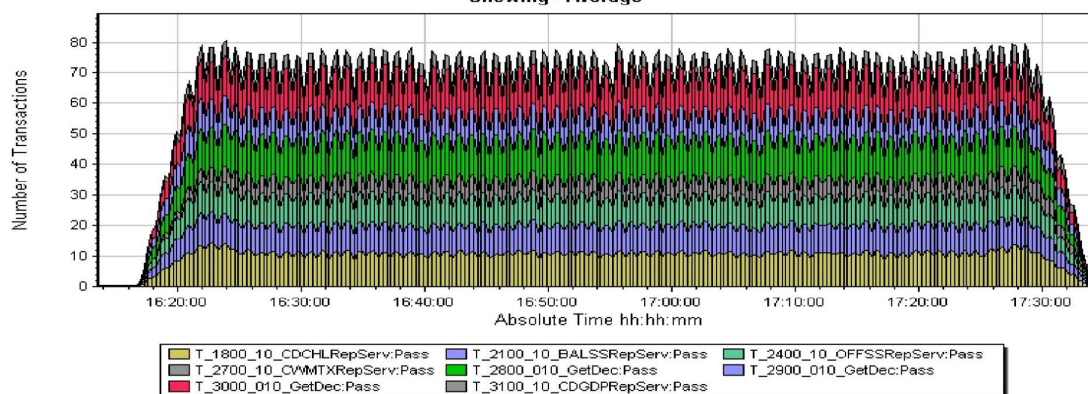
## Copy (1) of Transactions per Second

**Title:** Copy (1) of Transactions per Second  
**Current Results:** d:\HNGX\Phase2\Results\20100814\_balbdb\_endofday\_01  
20100814\_balbdb\_endofday\_01.lrr  
**Filters:** (Include Think Time)  
**Group By:** Transaction End Status  
**Granularity:** 20 Seconds

Graph data in Excel format

## Reports &amp; Declarations of Transactions per Second

Showing - Average



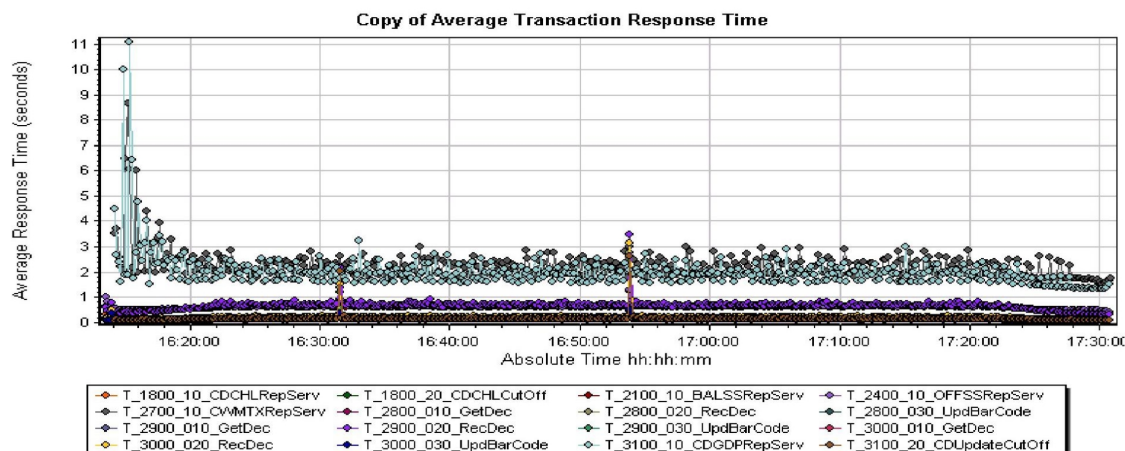
The following graph shows the average response times for the Reports and Declarations. They are fairly stable for both tests, but a lot better for TestID 254

TestID 254 (after fix for PC0201529)

## Copy of Average Transaction Response Time

**Title:** Copy of Average Transaction Response Time  
**Current Results:** d:\HNGX\Phase2\Results\20100824\_balbdb\_endofday\_01  
20100824\_balbdb\_endofday\_01.lrr  
**Filters:** Transaction End Status = (Pass), (Include Think Time)  
**Group By:**  
**Granularity:** 10 Seconds

Graph data in Excel format







## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE

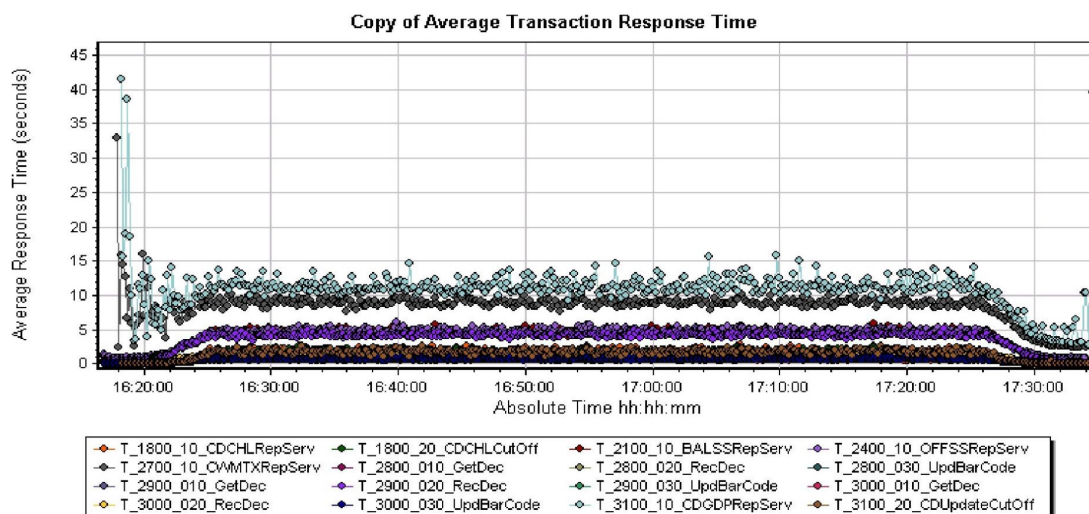


TestID 249 (before fix for PC0201529)

## Copy of Average Transaction Response Time

**Title:** Copy of Average Transaction Response Time  
**Current Results:** d:\HNGX\Phase2\Results\20100814\_balbdb\_endofday\_01  
20100814\_balbdb\_endofday\_01.lrr  
**Filters:** Transaction End Status = (Pass), (Include Think Time)  
**Group By:**  
**Granularity:** 10 Seconds

Graph data in Excel format



The table below provides a summary of the test; showing the response time (min//max/90th percentile) for each 'step' of the reports and baskets run and, also, the number of steps which 'passed'. The response times on the 90th percentile were excellent in TestID 254 and significantly better than TestID 249. The improved response times resulted in a much higher throughput of successful transactions in TestID 254

Transaction Name	Minimum		Maximum		90 Percentile		Pass	
	254	249	254	249	254	249	254	249
C_010_FirstLogon	0.124	0.125	6.999	21.169	0.24	0.895	63527	32253
C_020_SecondLogon	0.128	0.135	7.635	22.037	0.371	1.443	63527	32253
C_030_GetMemos	0.063	0.07	3.157	21.6	0.14	0.724	63527	32253
C_040_CountSusp	0.063	0.071	5.701	20.978	0.14	0.705	63527	32086
C_050_Logoff	0.078	0.083	7.172	23.215	0.18	0.877	63527	32085
T_0010_010_CAPOAuth	0.161	0.162	6.324	22.849	0.461	1.167	407910	301680
T_0010_020_CAPORecov	0.106	0.106	7.355	22.013	0.16	0.724	407910	301680
T_0010_030_CAPOSettle	0.097	0.123	7.299	44.337	0.18	0.844	407910	301679
T_0011_010_ALAuth	0.172	0.219	3.618	12.422	0.431	1.228	40271	17179
T_0011_020_ALRecov	0.104	0.105	6.907	20.732	0.17	0.744	40271	17178
T_0011_030_ALSettle	0.122	0.122	6.897	10.921	0.21	0.886	40271	17179
T_0012_010_LINKAuth	0.187	0.177	3.585	22.921	0.461	1.217	40777	29934
T_0012_020_LINKRecov	0.105	0.105	6.501	21.315	0.17	0.761	40777	29934
T_0012_030_LINKSettle	0.118	0.123	7.096	21.651	0.2	0.856	40777	29934



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



Transaction Name	Minimum		Maximum		90 Percentile		Pass	
	254	249	254	249	254	249	254	249
T_0020_010_STMPSettle	0.093	0.093	7.04	21.878	0.23	0.816	488611	422712
T_0050_010_DVLAAuth	0.484	0.59	4.671	22.96	1.389	2.145	40119	22899
T_0050_020_DVLASettle	0.108	0.109	7.108	21.329	0.18	0.836	40119	22899
T_0180_010_ETAAuth	0.163	0.195	3.786	20.849	0.401	1.206	20404	15246
T_0180_020_ETAREcov	0.099	0.099	6.939	21.469	0.18	0.745	20404	15246
T_0180_030_ETASettle	0.088	0.11	7.159	23.339	0.21	0.888	20404	15246
T_0300_010_DBTAuth	0.198	0.224	3.675	13.825	0.441	1.217	20480	18244
T_0300_020_DBTRecov	0.103	0.104	6.91	21.521	0.17	0.776	20480	18243
T_0300_030_DBTSettle	0.124	0.124	7.01	21.021	0.2	0.882	20480	18244
T_0500_010_APOPAuth	0.199	0.239	3.619	21.227	0.381	1.247	8211	8052
T_0500_020_APOPDRecov	0.106	0.106	6.931	10.069	0.18	0.745	8211	8052
T_0500_030_APOPDSettle	0.12	0.124	7.027	20.866	0.22	0.907	8211	8052
T_1800_10_CDCHLRepServ	0.084	0.095	5.61	24.587	0.22	1.982	91400	47520
T_1800_20_CDCHLCutOff	0.089	0.089	7.066	23.039	0.16	1.839	91400	47520
T_2100_10_BALSSRepServ	0.348	0.544	6.505	24.587	0.793	4.898	83540	40290
T_2400_10_OFFSSRepServ	0.4	0.669	6.653	25.929	0.823	4.959	83120	39900
T_2700_10_CWMTXRepServ	0.924	1.777	129.935	108.108	2.419	9.188	58693	24922
T_2800_010_GetDec	0.067	0.075	5.417	20.706	0.14	0.724	89380	55640
T_2800_020_RecDec	0.089	0.091	7.366	21.98	0.21	1.047	89380	55640
T_2800_030_UpdBarCode	0.072	0.084	7.012	23.292	0.15	0.755	89380	55640
T_2900_010_GetDec	0.041	0.075	7.382	21.436	0.15	0.753	77350	36830
T_2900_020_RecDec	0.267	0.269	8.399	30.091	1.035	4.332	77350	36830
T_2900_030_UpdBarCode	0.084	0.084	7.193	21.383	0.16	0.782	77350	36830
T_3000_010_GetDec	0.032	0.075	5.544	44.445	0.15	0.724	87900	52740
T_3000_020_RecDec	0.098	0.098	7.097	22.364	0.31	1.391	87900	52740
T_3000_030_UpdBarCode	0.046	0.084	7.272	21.035	0.15	0.775	87900	52740
T_3100_10_CDGDPRRepServ	0.97	2.593	115.567	113.571	1.989	11.968	59880	19117
T_3100_20_CDUpdateCutOff	0.078	0.073	7.009	17.481	0.18	1.93	59880	19141

The Improvement at the BAL layer has resulted in increased throughput and lower CPU Utilisation which is excellent – a two-fold improvement. The knock-on effect of removing the bottleneck at the BAL layer is that there is now additional load at the BDB layer. CPU Utilisation has gone up as a result of increased packets/in and where we were previously seeing ~10% utilisation in TestID 249, we are now seeing just under 50% in TestID 254. This is illustrated in the following section 5.14.3.1.

Test Status: Passed

Date of Final Run: 24<sup>th</sup> August 2010 at 16:10 to 17:31

Build Release: 01.22.00 / OSRs at 01.23.02.00 (all 4 BRDB nodes on new v249 blades)

TestID: 254

### 5.14.3.1 BRDB Performance Characteristics



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



The following graphs taken from Athene data captured, show a comparison of selected system performance characteristics for the following comparative test runs:

TestID 212 – with all 4 BRDB nodes on the original pblades

TestID 232 – with only BRDB Node 1 on new v249 pblade, others on the original pblades

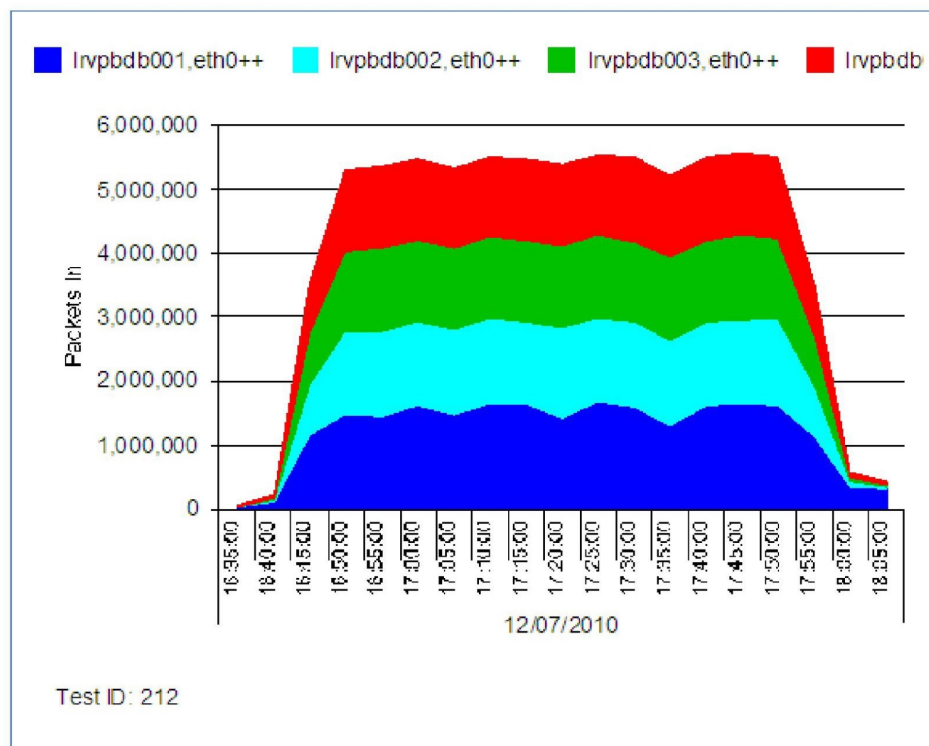
TestID 249 – the test reported above with all 4 BRDB nodes on new v249 pblades

In regards to test 249, there were no capacity constraints in relation to the BRDB and the results were as expected. In comparing this test with TestID 212 and 232, the significant difference was the BDB memory profile and CPU Utilisation. There is a lot more free memory available post-upgrade, thus alleviating swapping on the nodes, and CPU utilisation is lower. During this test run, there was an outstanding issue with high CPU Utilisation on the BAL servers for processing Group Reports (PC0201529)

TestID 254 – a repeat of TestID 249 after applying an informal fix for PC0201529 to address the High CPU utilisation at the BAL servers.

In regards to test 254, there were no capacity constraints in relation to the BRDB and the results were as expected. In comparing this test with TestID 249, the significant difference was the increase in Packets/In, thus indicating that the bottleneck had previously been at the BAL layer. CPU utilisation also increased in line with Packets/In

#### 5.14.3.1.1 BRDB Packets In

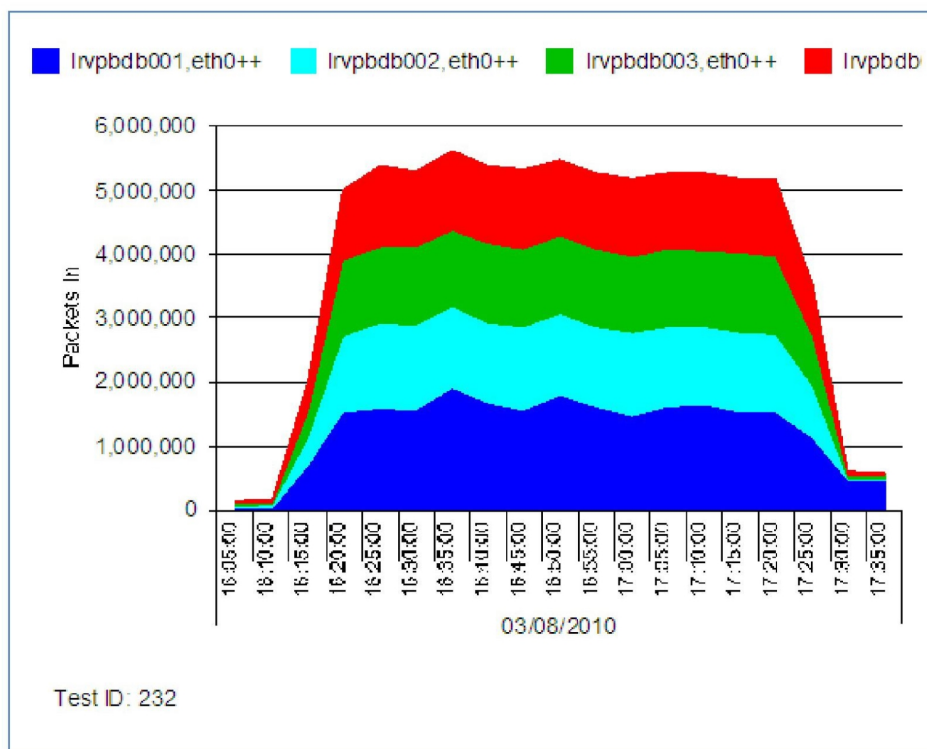




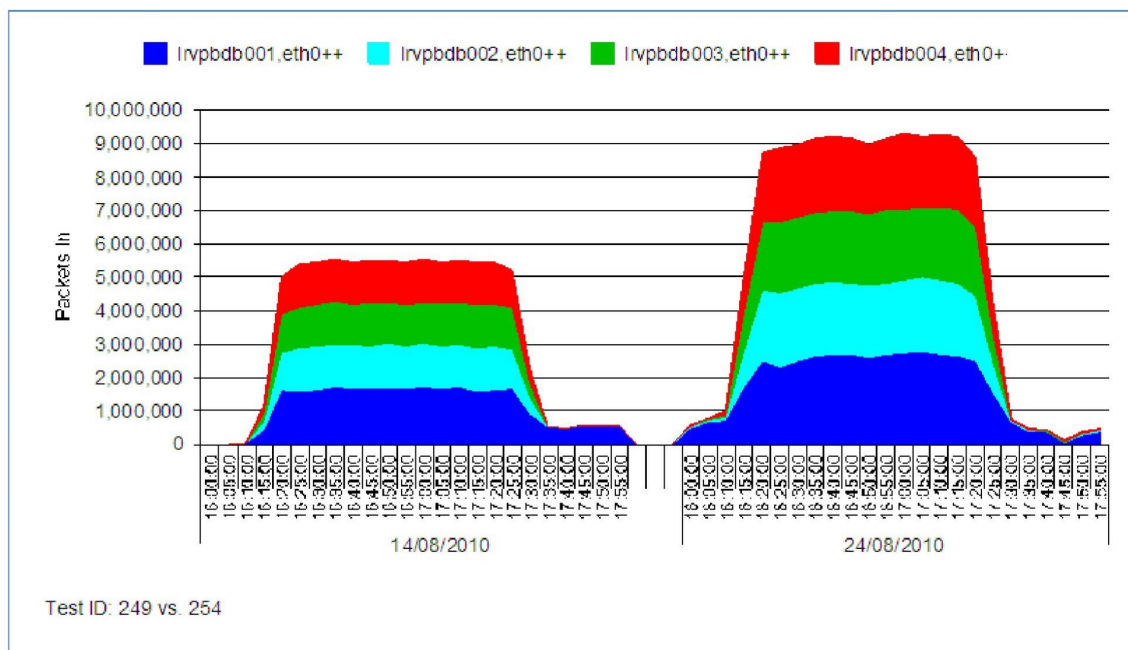


VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



The Packets/In at the BDB layer have increased massively in TestID 254 (indicating that the bottleneck has been the BAL layer).



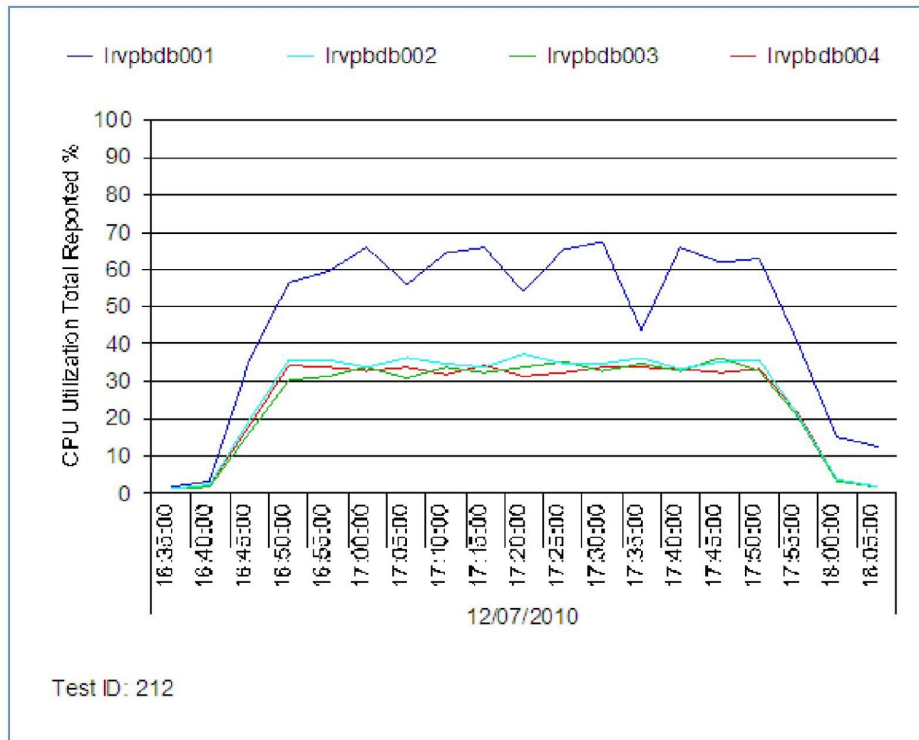




VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



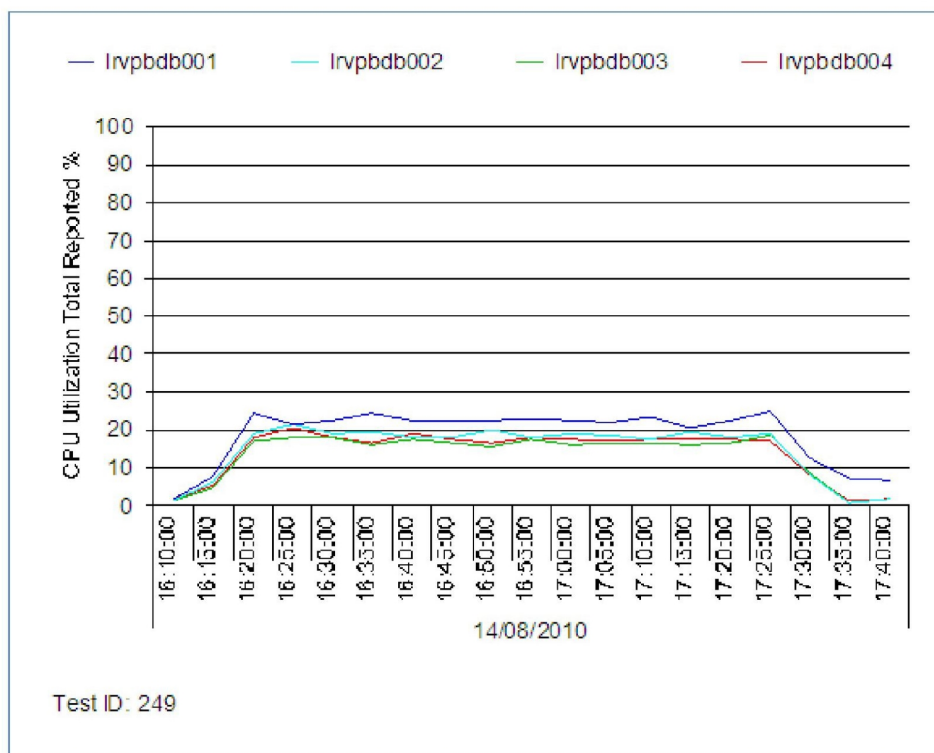
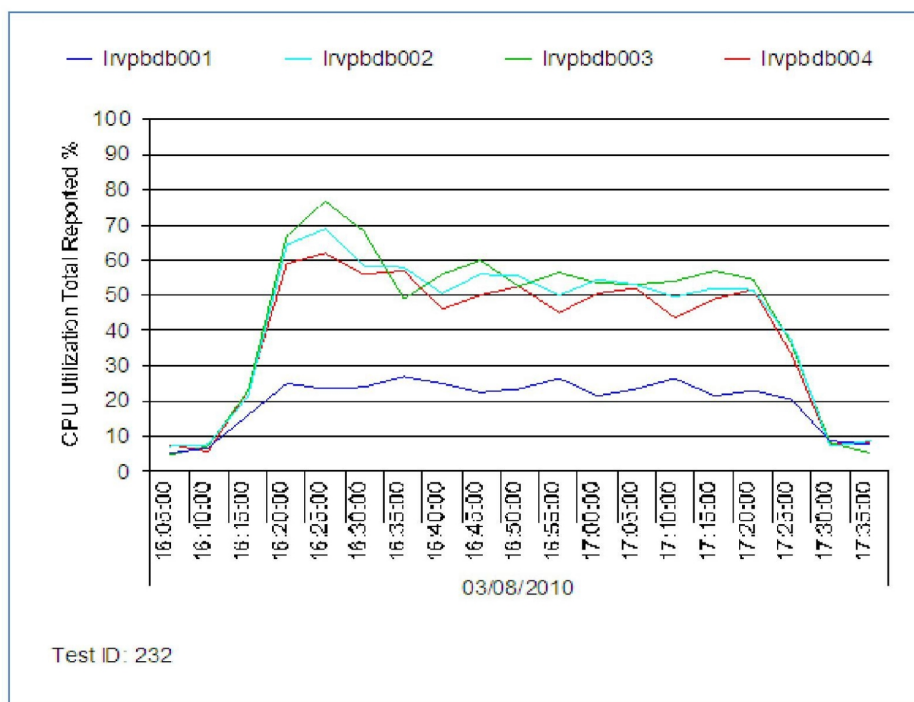
### 5.14.3.1.2 BRDB CPU Utilisation





VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

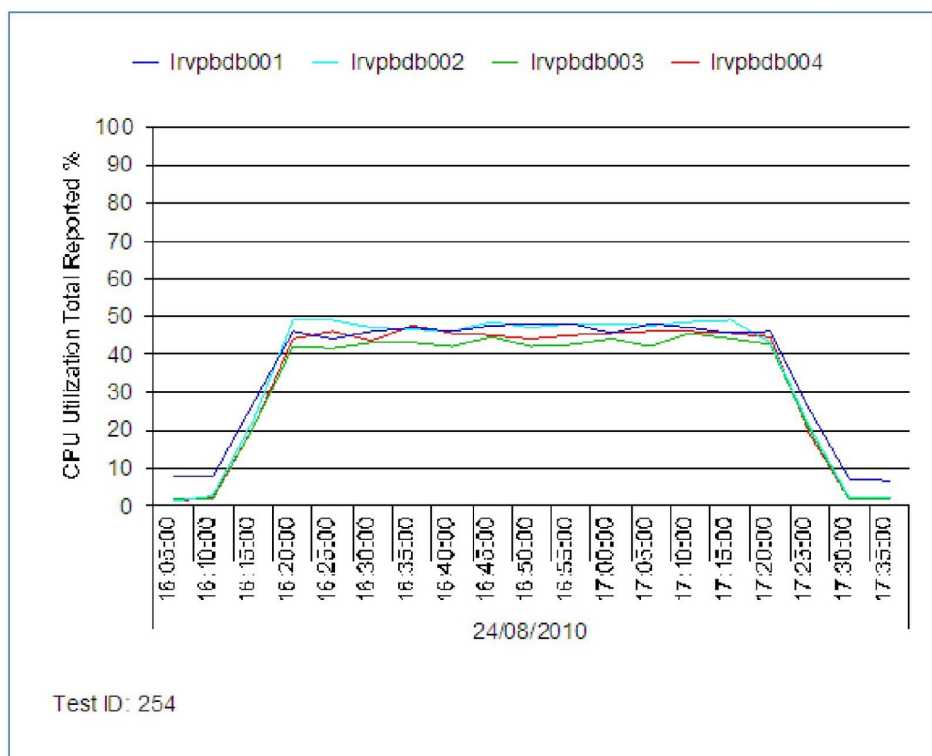
COMMERCIAL IN CONFIDENCE





## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



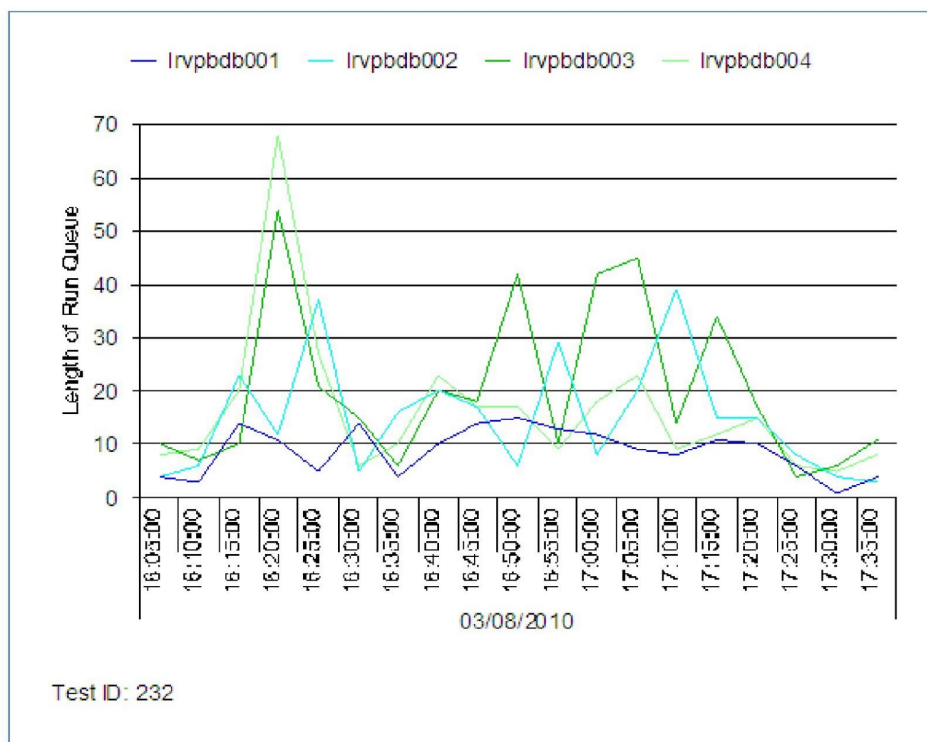
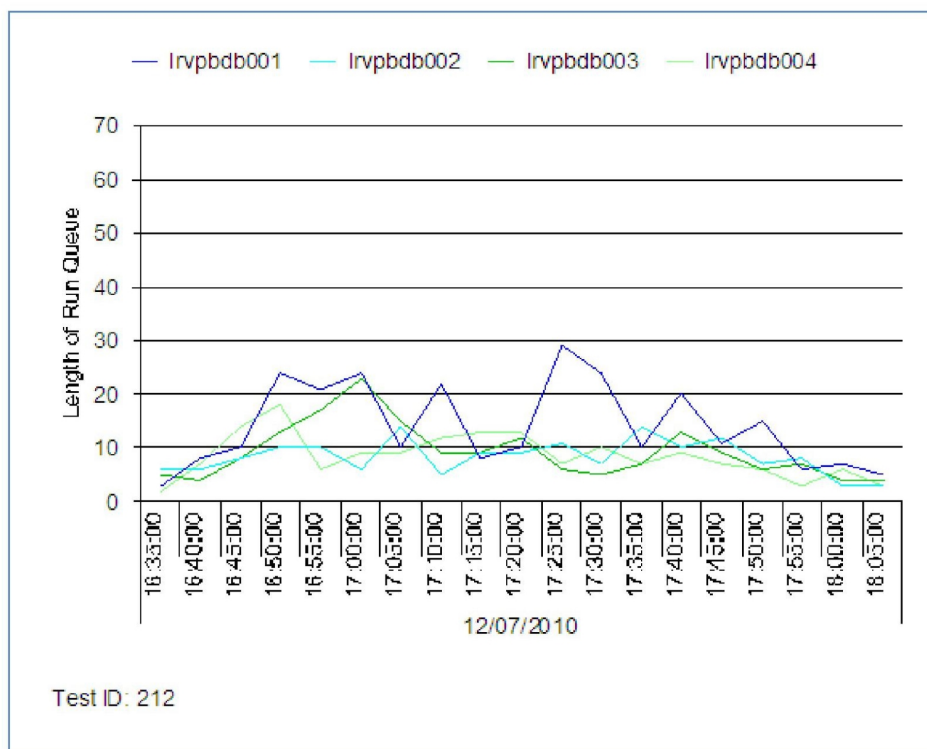
CPU Utilisation on the BDB layer has increased (inline with packets/in). ORM did NOT kick-in during the run.

#### 5.14.3.1.3BRDB Run Queue



VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE

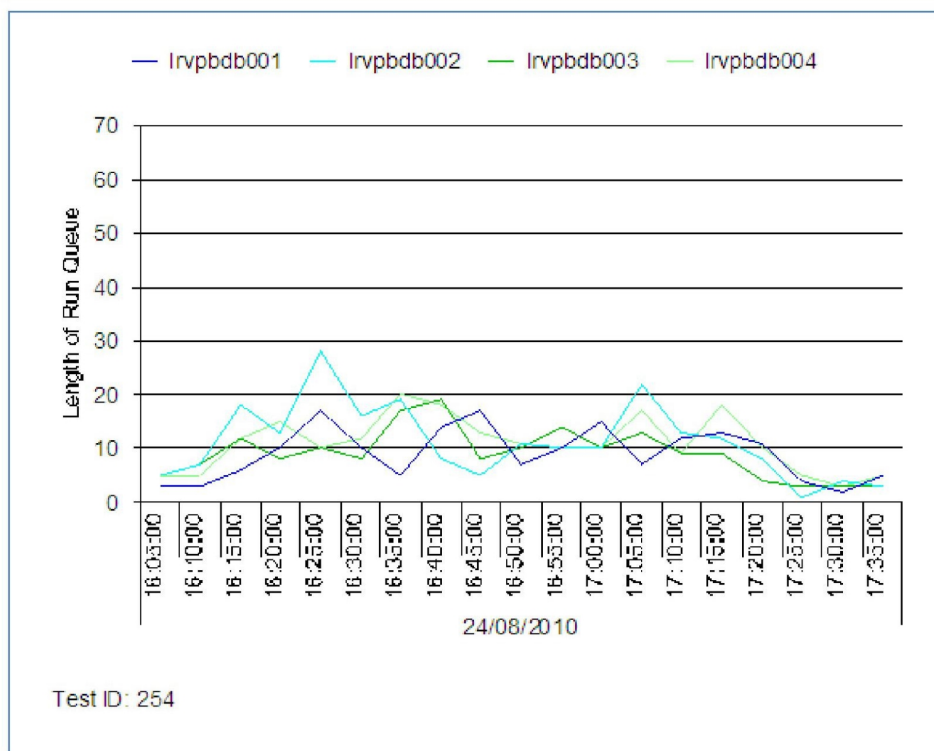
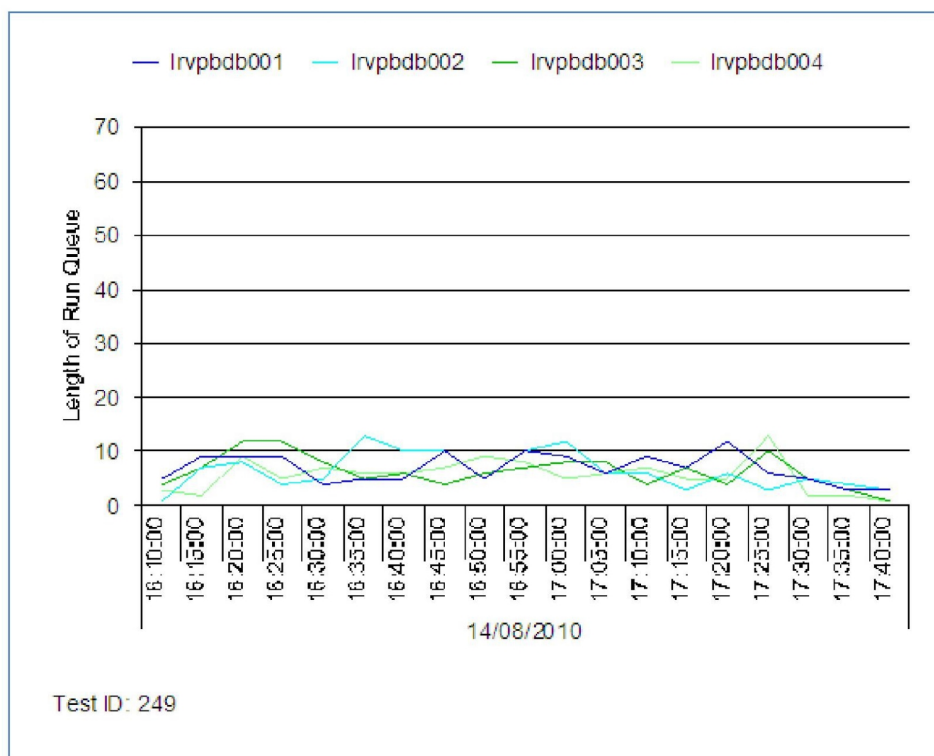






VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



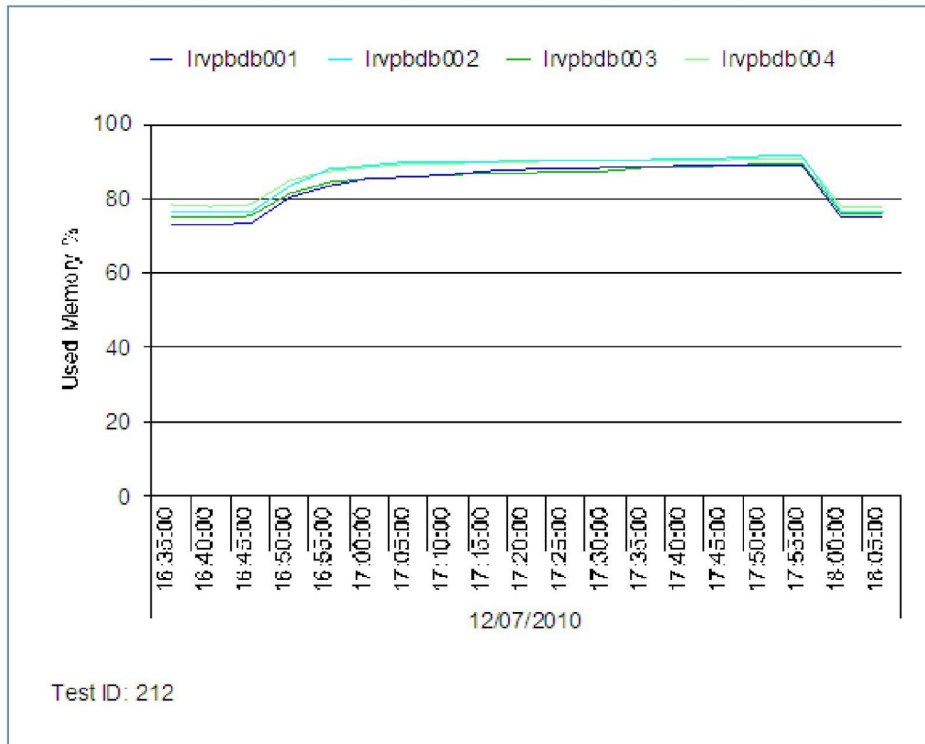


VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



As expected, there was an increased level of queuing in TestID 254, but not at levels to cause concern.

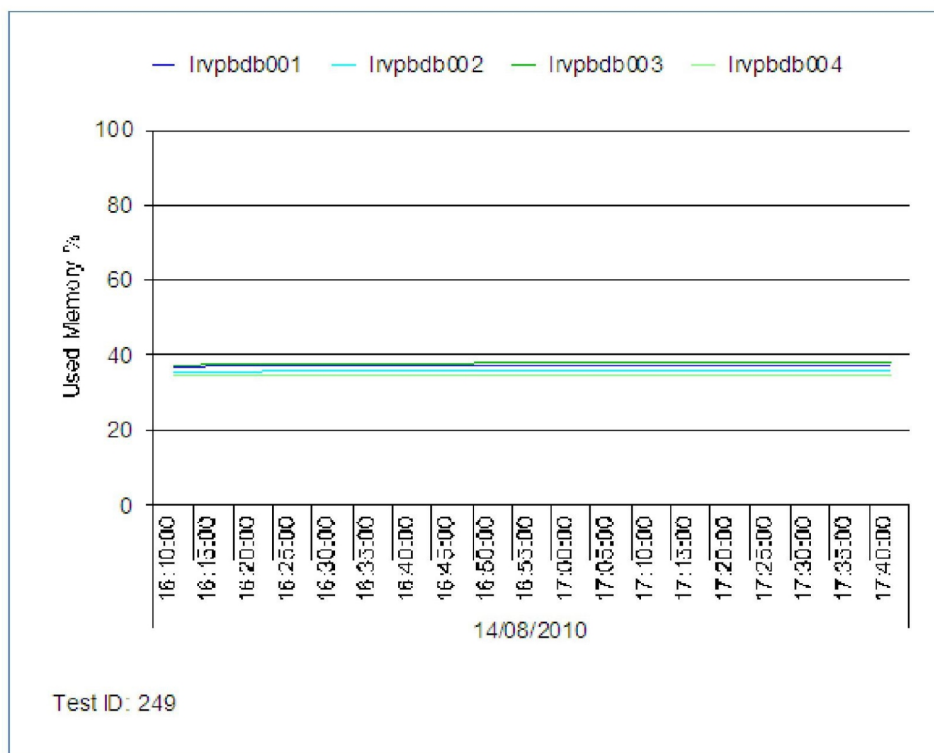
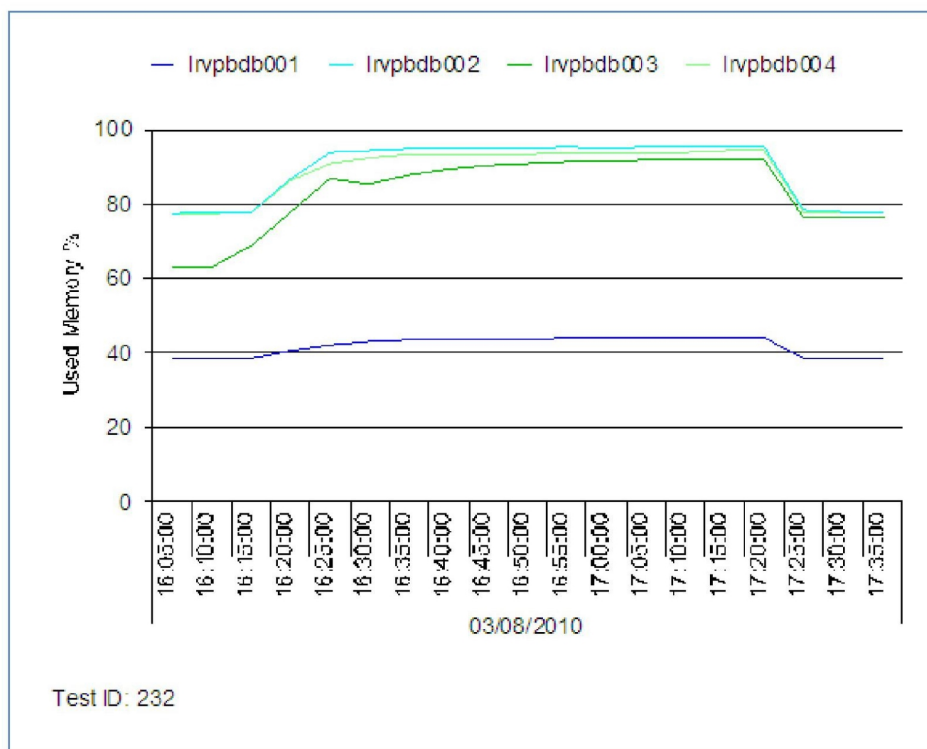
#### 5.14.3.1.4BRDB Used Memory





VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

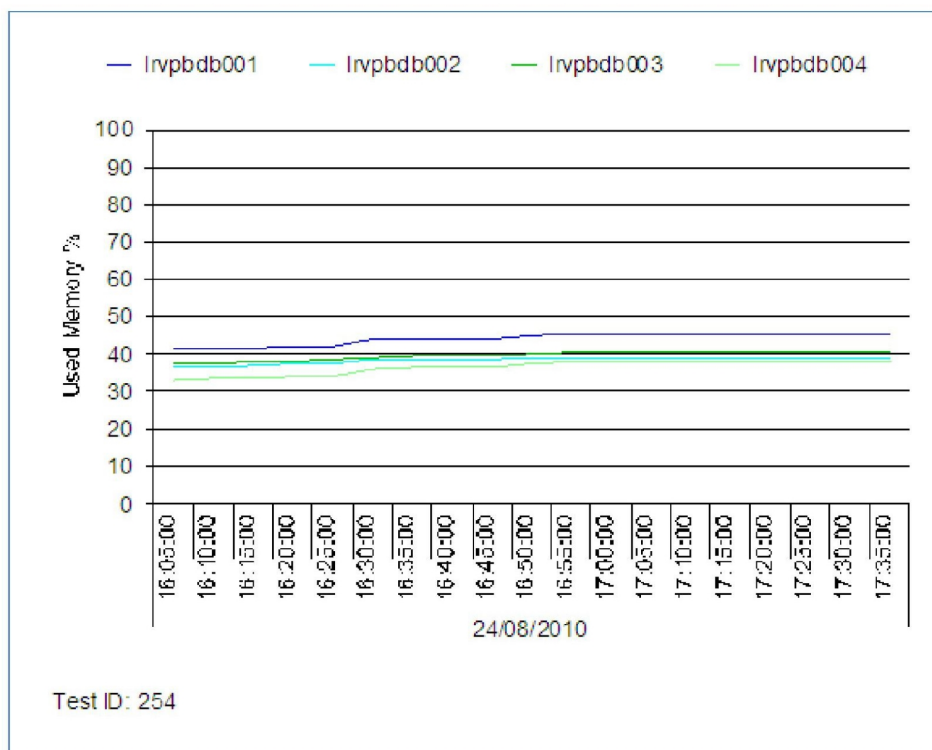
COMMERCIAL IN CONFIDENCE





## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



## 5.15 Test Group X12 – BAL & BRDB Stress Test

### 5.15.1 BAL & BRDB Stress Test

The objective of this test was to take the workload of the BAL and BRDB layers beyond Design Limits up to a rate at which either

- the service is no longer able to support the transaction load and thus identifying the maximum headroom capacity limit, or
- a notional transaction rate (as agreed with Capacity Management) such that, if achieved, it would demonstrate sufficient headroom capacity for future growth without needing to find the absolute breaking point

This test gradually increased the load until all Loadrunner VUsers were running and was maintained for 30 minutes before ramping down. The 'mid-day' transaction mix was used for this test, which was run with all 4 BRDB nodes on the new v249 blades.

The limiting factor in this test was the number of LoadRunner VUsers available. A higher throughput could have been sustained had it been possible to generate a greater load on the system. However, the throughput actually achieved is well above design limit and demonstrates significant headroom capacity





## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

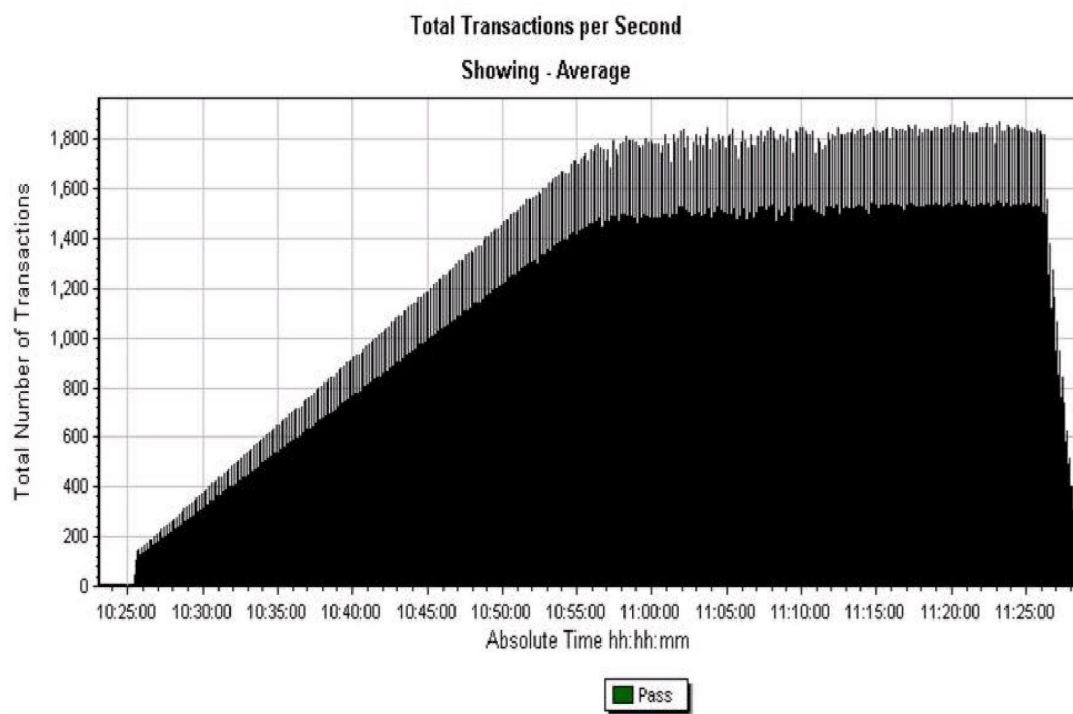
COMMERCIAL IN CONFIDENCE



Layer	Historical Peak		Contractual Limit		Design Limit			Sustained	H/R %
	Hour	5 min	Hour	5 min	Hour	5 min	Per sec peak		
BAL	n/a	n/a	932	940	1119	1128	1466	1800	59.57%
BRDB	n/a	n/a	not spec'd	not spec'd	not spec'd	1068	1388	1800	68.54%

HR% above is the sustained tps rate % increase over and above the Design Limit Peak 5 min rate.

The total rate (at 5 second granularity) shows spikes over 1800 tps

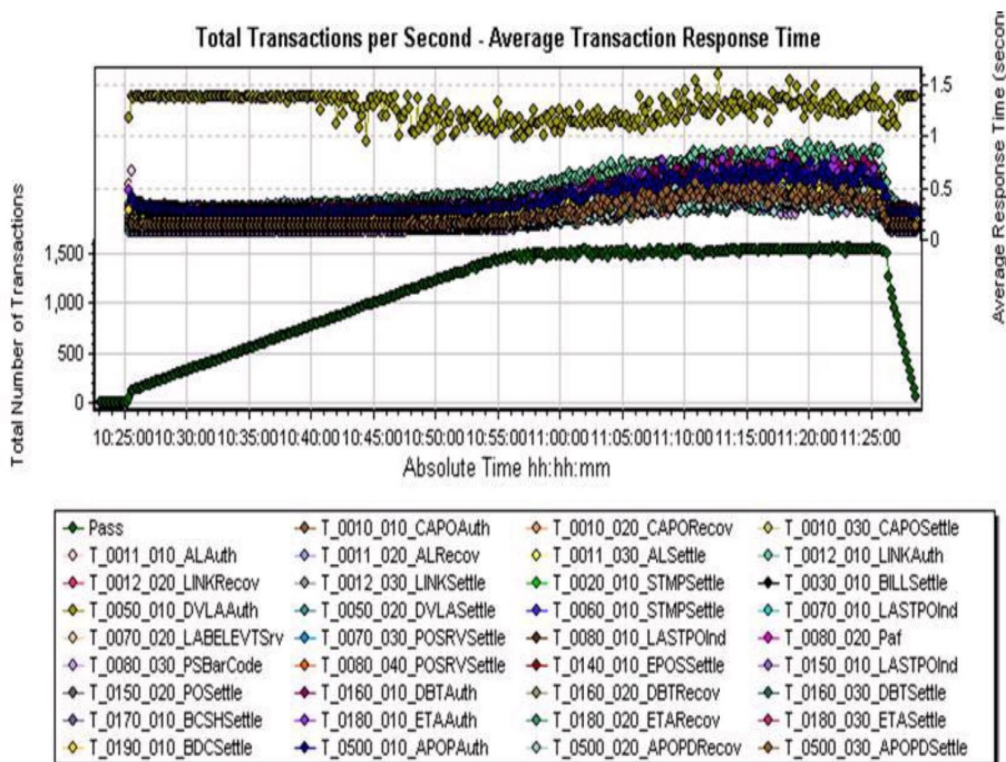


The response times across the transactions can be seen to increase and plateau in line with the increasing transaction load.



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



The table below is a summary of the test; showing the response time (min/avg/max/90th percentile) for each transaction and also the number of transactions which 'passed' & 'failed'. The response times were good and the number of failures were low; 25 logoffs failures which was due to a data issue with the user details for those particular branches, and not a genuine issue. There were no other failures.

Transaction Name	Minimum	Average	Maximum	Std. Deviation	90 Percent	Pass	Fail
C_010_FirstLogon	0.125	0.2	3.237	0.193	0.328	1000	0
C_020_SecondLogon	0.124	0.27	6.292	0.303	0.439	1000	0
C_030_GetMemos	0.07	0.145	3.302	0.316	0.23	1000	0
C_040_CountSusp	0.072	0.13	3.141	0.26	0.168	1000	0
C_050_Logoff	0.084	0.14	3.249	0.215	0.199	975	25
T_0010_010_CAPOAuth	0.168	0.521	9.508	0.487	0.692	428505	0
T_0010_020_CAPORecov	0.106	0.251	10.874	0.441	0.341	428505	0
T_0010_030_CAPOSettle	0.121	0.274	9.403	0.455	0.361	428505	0
T_0011_010_ALAuth	0.176	0.476	9.227	0.485	0.602	55433	0
T_0011_020_ALRecov	0.104	0.244	9.041	0.425	0.341	55433	0
T_0011_030_ALSettle	0.122	0.271	9.096	0.447	0.361	55433	0
T_0012_010_LINKAuth	0.165	0.597	9.71	0.504	0.813	131971	0
T_0012_020_LINKRecov	0.105	0.249	8.99	0.439	0.341	131971	0
T_0012_030_LINKSettle	0.122	0.273	9.133	0.453	0.371	131971	0
T_0020_010_STMPSettle	0.093	0.328	10.666	0.478	0.431	817029	0
T_0030_010_BILLSSettle	0.1	0.349	9.224	0.486	0.451	63509	0



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



Transaction Name	Minimum	Average	Maximum	Std. Deviation	90 Percent	Pass	Fail
T_0050_010_DVLAAuth	0.407	1.242	9.764	0.527	1.552	74608	0
T_0050_020_DVLASettle	0.108	0.26	9.147	0.441	0.351	74608	0
T_0060_010_STMPSettle	0.096	0.34	20.658	0.49	0.441	80691	0
T_0070_010_LASTPOInd	0.072	0.298	8.974	0.46	0.401	56641	0
T_0070_020_LABELEVTSrv	0.088	0.247	9.003	0.455	0.34	56641	0
T_0070_030_POSRVSettle	0.105	0.267	8.977	0.466	0.361	56641	0
T_0080_010_LASTPOInd	0.072	0.259	9.065	0.407	0.361	61886	0
T_0080_020_Paf	0.153	0.304	9.106	0.419	0.411	61886	0
T_0080_030_PSBARCode	0.07	0.195	8.986	0.404	0.29	61886	0
T_0080_040_POSRVSettle	0.129	0.25	9.152	0.397	0.351	61886	0
T_0140_010_EPOSSettle	0.095	0.334	9.303	0.482	0.431	256781	0
T_0150_010_LASTPOInd	0.072	0.301	9.143	0.466	0.401	56025	0
T_0150_020_POSettle	0.105	0.266	9.034	0.452	0.361	56025	0
T_0160_010_DBTAuth	0.211	0.449	8.124	0.434	0.582	50396	0
T_0160_020_DBTRecov	0.104	0.215	9.057	0.382	0.31	50396	0
T_0160_030_DBTSettle	0.129	0.249	9.019	0.406	0.341	50396	0
T_0170_010_BCSHSettle	0.104	0.353	9.696	0.491	0.461	52121	0
T_0180_010_ETAAAuth	0.186	0.44	9.252	0.45	0.561	42336	0
T_0180_020_ETARecov	0.099	0.239	9.179	0.432	0.33	42336	0
T_0180_030_ETASettle	0.11	0.259	6.051	0.445	0.351	42336	0
T_0190_010_BDCSettle	0.101	0.35	9.823	0.482	0.461	52556	0
T_0500_010_APOPAAuth	0.189	0.439	9.144	0.468	0.551	55949	0
T_0500_020_APOPDRecov	0.105	0.247	9.12	0.429	0.341	55949	0
T_0500_030_APOPDSettle	0.123	0.279	9.019	0.46	0.371	55949	0

Test Status: Passed

Date of Final Run: 17<sup>th</sup> August 2010 at 10:23 to 11:28

Build Release: 01.22.00 / OSRs at 01.23.01.00 (all 4 BRDB nodes on new v249 blades)

TestID: 251

## 5.16 Test Group X13 – Logon / Logoff

### 5.16.1 Logon / Logoff Contracted / Design Limit Peak 5 Minutes

The test target was to achieve 100 logons & Logoffs per second (i.e. giving 200 business operations per second), which is the design limit target. Transaction rates were ramped up as follows:

50 login/logoff per second for 5-minutes

60 login/logoff per second for 5-minutes

100 login/logoff per second until test stopped.

Each logon comprises 3 x XML requests and each logoff comprises 2 x XML requests so the total hits/sec when running at full load was 500.





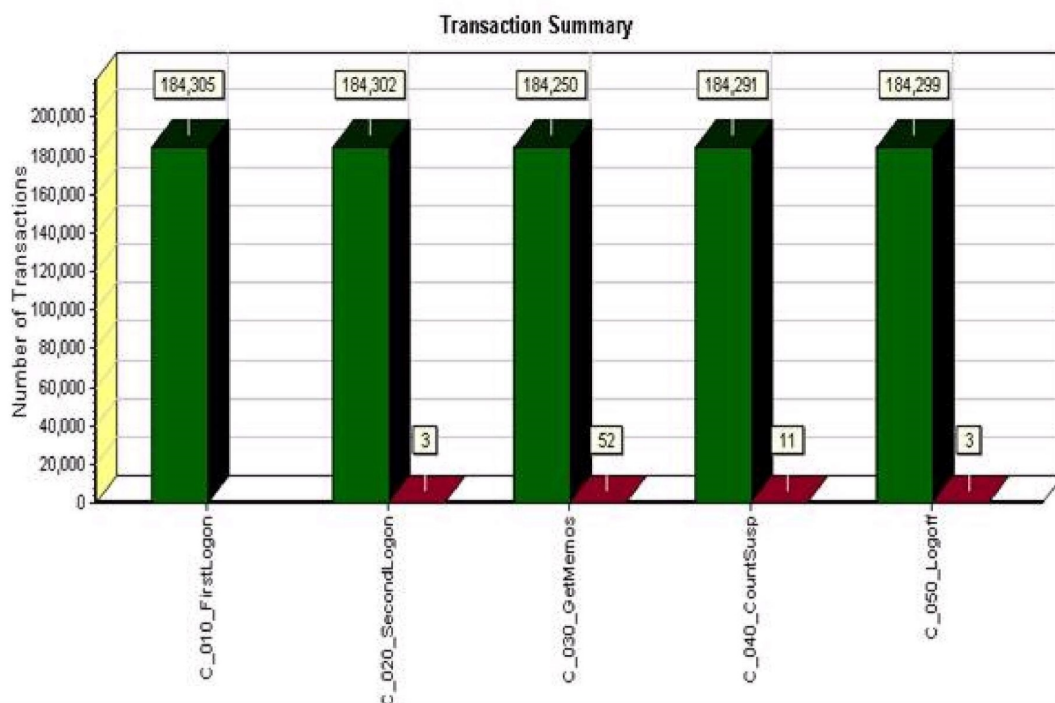
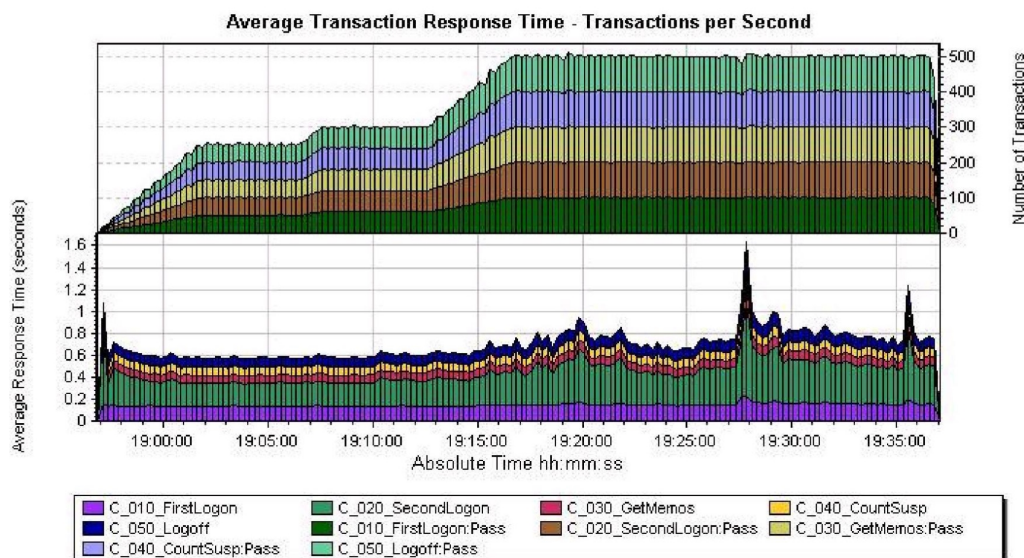
## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



Due to limitations of the test tooling available, it was not possible to design a test that would do all logons or all logoffs to test each individually. The above scenario was therefore considered to be a reasonable compromise.

The test was run against only 3 active BRDB nodes and for longer than it needed to be, so as to give added confidence that the rates could be sustained. The response times were acceptable and there were only a very small number of failures..







## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



Test Status: Passed

Date of Final Run: 10<sup>th</sup> March 2010 at 18:56 to 19:57

Build Release: 01.08.03 / CTR25.07

TestID: 072

### 5.16.2 Logon / Logoff Stress Test

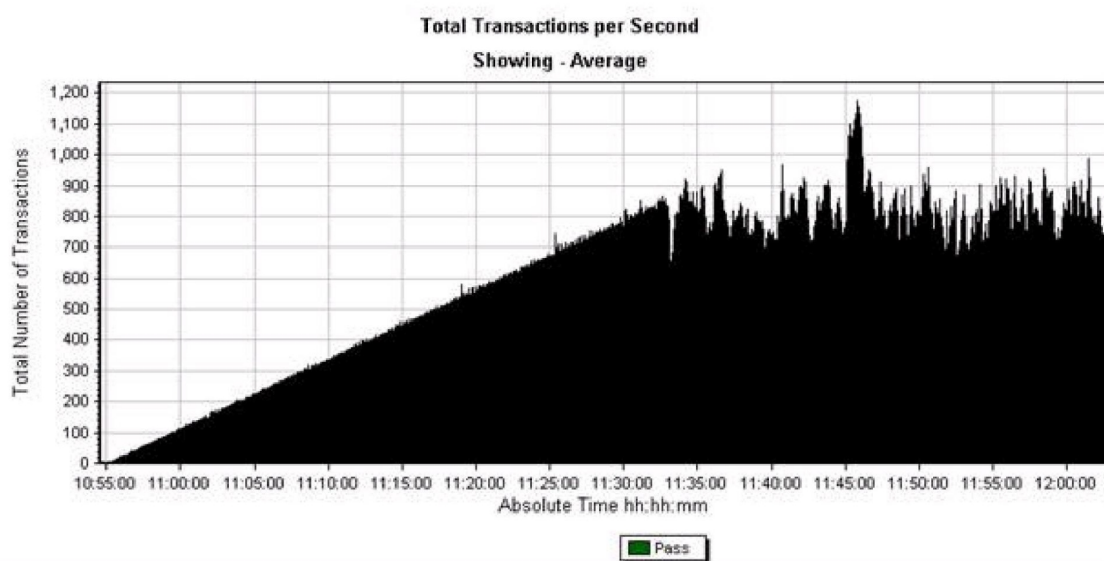
The objective of this test was to take the user logon/logoff service beyond Design Limits up to a rate at which either

- the service is no longer able to support the transaction load and thus identifying the maximum headroom capacity limit, or
- a notional transaction rate (as agreed with Capacity Management) such that, if achieved, it would demonstrate sufficient headroom capacity for future growth without needing to find the absolute breaking point

The ceiling target rate for the test was to attempt to reach 300 logons plus 300 logoffs per second for a combined total 600tps. The actual rate sustainable before the response times increased and the throughput struggled was 170 logons plus 170 logoffs per second.

Service	Historical Peak		Contractual Limit		Design Limit			Sustained	H/R %
	Hour	5 min	Hour	5 min	Hour	5 min	Per sec peak		
Logon								170	
Logoff								170	
<b>TOTAL</b>	not spec'd	77	not spec'd	100	not spec'd	120	200	<b>340</b>	183.33%

Each logon comprises of 3 x XML requests and each logoff comprises of 2 x XML requests. The load was increased steadily throughout the test but began to struggle at just below 900 hits/sec, The equivalent combined 340tps sustained is well in excess of design limits. There were no failures.



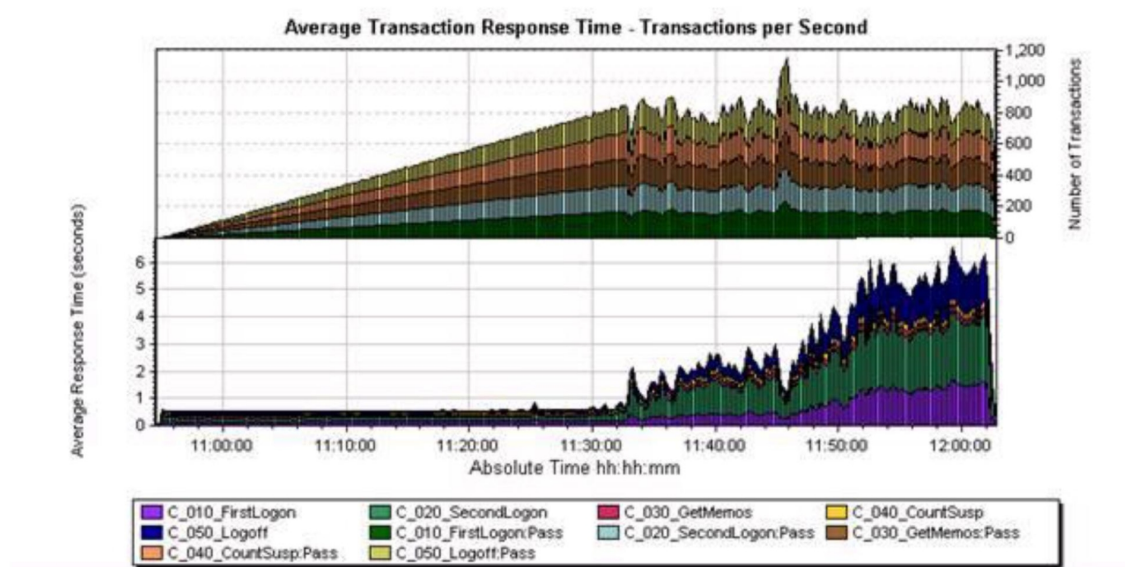


## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



The response times remained steady up until the load reached approximately 170 logon/sec plus 170 logoffs/sec (i.e. 240 operations/sec) with the response times then increasing as the load further increased.



The following gives the summary of the response times (min/max/avg/90th percentile) for all the transactions including total passes and failures.

Transaction Name	Minimum	Average	Maximum	Std. Deviation	90 Percent	Pass	Fail
C_010_FirstLogon	0.124	0.525	13.471	0.651	1.46	483420	0
C_020_SecondLogon	0.126	0.961	10.196	1.547	3.686	483420	0
C_030_GetMemos	0.07	0.151	7.583	0.226	0.451	483420	0
C_040_CountSusp	0.07	0.152	8.165	0.227	0.451	483420	0
C_050_Logoff	0.086	0.512	13.033	0.736	1.531	483420	0

Test Status: Passed

Date of Final Run: 1<sup>st</sup> July 2010 at 10:54 to 12:02

Build Release: 01.22.00 / OSRs at 01.23.01.00

TestID: 203

### 5.16.3 Maximum Concurrent Sessions

The objective of this test is to have 30,000 counter positions logged onto the Data Centre.

Over a period of time, logon of 30,000 counter positions was attempted and there were 241 failures. However, this test is somewhat irrelevant because having 30,000 counter positions logged in does not mean there are 30,000 open sessions from the BALs to the BRDB. The maximum number of sessions possible at any one time is 20 (the max osr connections parameter) multiplied by 16 (number of active OSRs during the test) multiplied by 4 (BRDB nodes) which equals 1280 concurrent connections. This has



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

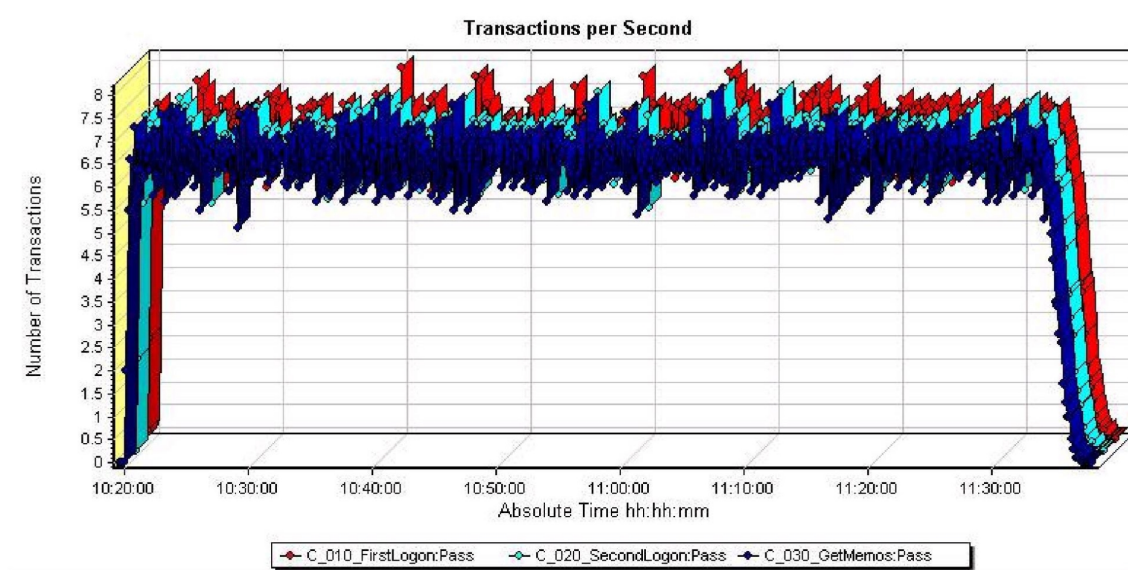
COMMERCIAL IN CONFIDENCE



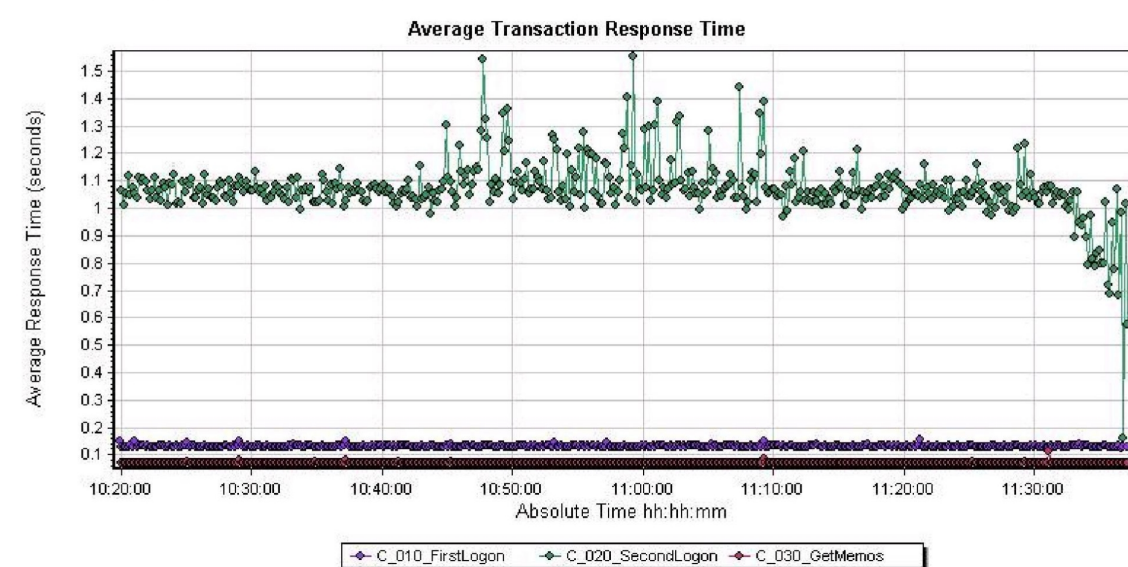
already been achieved during many other tests. The fact this test is counter positions logging in is neither here nor there because it is treated as just another online transaction.

However, the results of the test are reported below for completeness.

The graph below shows the transaction rates for the duration of the test. Logins are characterised by 3 XML submissions; FirstLogon, SecondLogon and GetMemos.



The following graph shows the response times during the test.





**VOLUME AND PERFORMANCE TEST REPORT - PHASE 2**  
**COMMERCIAL IN CONFIDENCE**

The table below is a summary of the test; showing the response time (min/avg/max/90th percentile) for each transaction and also the number of transactions which 'passed & 'failed'. 29,759 successful logins were completed.

Transaction Name	Minimum	Average	Maximum	Std. Deviation	90 Percent	Pass	Fail
C_010_FirstLogon	0.124	0.132	0.64	0.017	0.14	29999	1
C_020_SecondLogon	0.135	1.077	17.404	0.524	1.339	29759	240
C_030_GetMemos	0.069	0.072	2.961	0.018	0.08	29759	240

The 241 failed transactions related to branches that mapped to Fad\_Hash 0. This was a known issue (fix still pending) as at the date and build against which the test was run.

Test Status: Passed

Date of Final Run: 23<sup>rd</sup> April 2010 at 10:19 to 11:38

Build Release: 01.20.00 / CTR25.11

TestID: 145

## 5.17 Test Group X15 – Reports

### 5.17.1 Reports Contracted / Design Limit Peak 5 Minutes

These tests are covered by the Reports stress test. See section 5.17.2 below for detailed test results.

### 5.17.2 Reports Stress Test

This test was run twice; firstly with ORM ON (TestID 198) and then repeated with ORM OFF (TestID 199).

The following report types were included in the test. These comprise of 2 or 3 XML requests.

Report Type	Description
1800_CDCHL_RPT	Counter Daily Cheque Listing
2100_BALSS_RPT	Balance snapshot
2400_OFFSS_RPT	Office snapshot
2800_CSH_DEC	Cash Declaration
2900_STK_DEC	Stock Declaration
3000_STP_DEC	Stamp Declaration

For each report type, branches were logged on, the report repeated 10 times and branches then logged off.

The transaction rate sustainable versus the contractual and design limit was as shown below. The peak reporting period is relatively short each day, therefore values are only specified for the peak 5 Minutes





## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



transaction rates. It should be noted that the actual per second variance is much higher than for transactional online services.

	Historical Peak	Contract Limit	Design Limit		Test 198 Sustained **		Test 199 Sustained **		H/R %
Report XML Type	5 min	5 min	5 min	Per sec peak	By XML	By Rep Type	By XML	By Rep Type	
T_1800_10_CDCHLRepServ					34	34	34	34	
T_1800_20_CDCHLCutOff					34		34		
T_2100_10_BALSSRepServ					34		34		
T_2400_10_OFFSSRepServ					34	34	34	34	
T_2800_010_GetDec					34	34	34	34	
T_2800_020_RecDec					34		34		
T_2800_030_UpdBarCode					34		34		
T_2900_010_GetDec					34	34	32	32	
T_2900_020_RecDec					34		32		
T_2900_030_UpdBarCode					34		32		
T_3000_010_GetDec					34	34	33	33	
T_3000_020_RecDec					34		33		
T_3000_030_UpdBarCode					34		33		
TOTAL XML Requests / sec							444		
TOTAL Reports / sec	109	125	150	300 *		204		201	36%

HR% above is the sustained tps rate % increase over and above the Design Limit Peak 5 min rate

\* The Branch Access Layer should allow for an actual per second peak of 300 reports a second whilst other transaction levels are low, otherwise 250.

\*\* This test was constrained by the available number of Loadrunner VUsers, which limited the transaction rate achievable rather than system resources being the constraint.

The graphs below show the combined rates of all the XML steps for each Report.



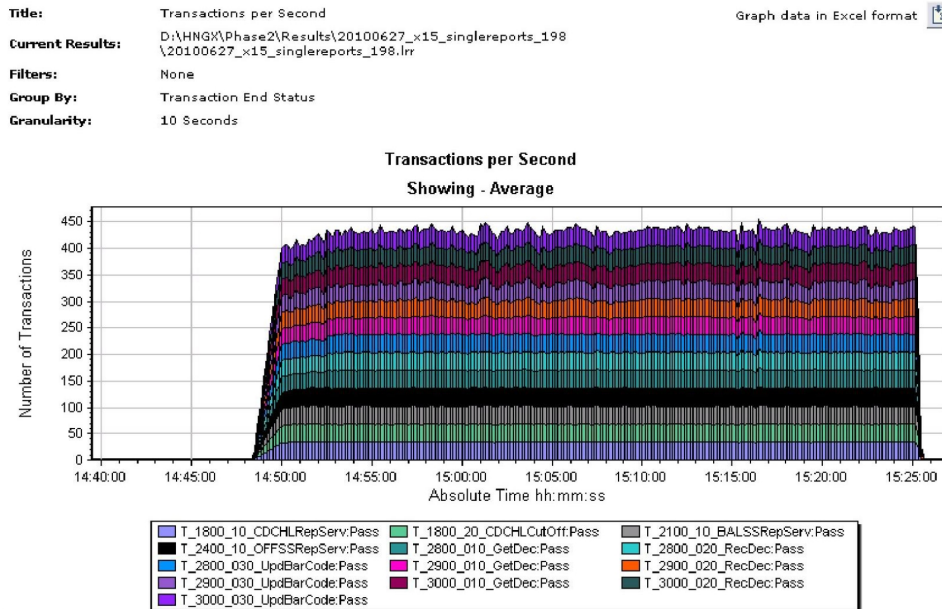
## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

### COMMERCIAL IN CONFIDENCE

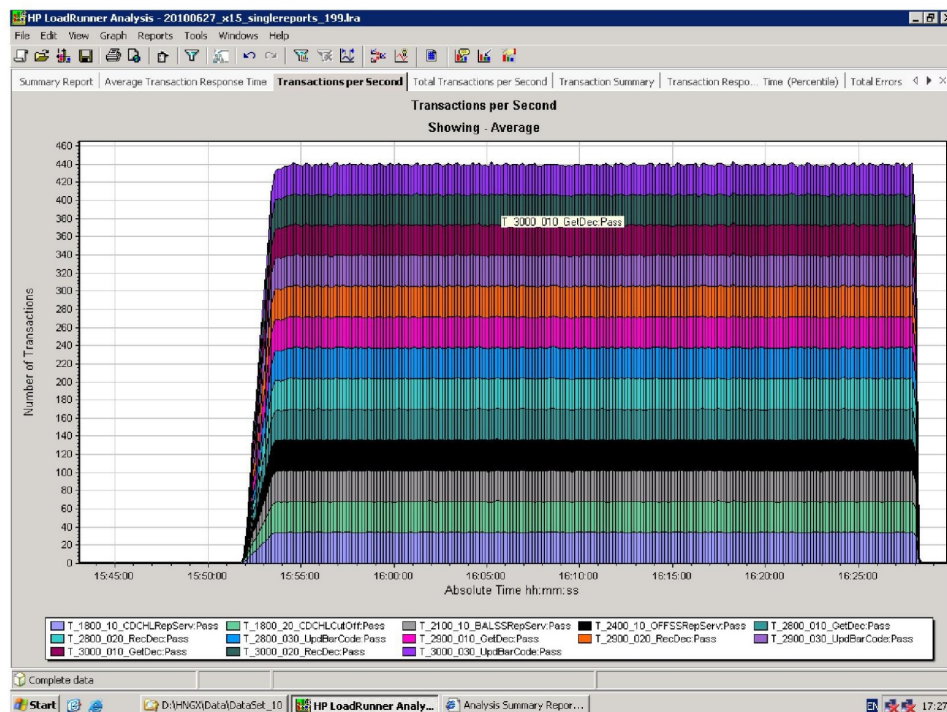


TestID 198 (ORM ON)

#### Transactions per Second



TestID 199 (ORM OFF)





## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

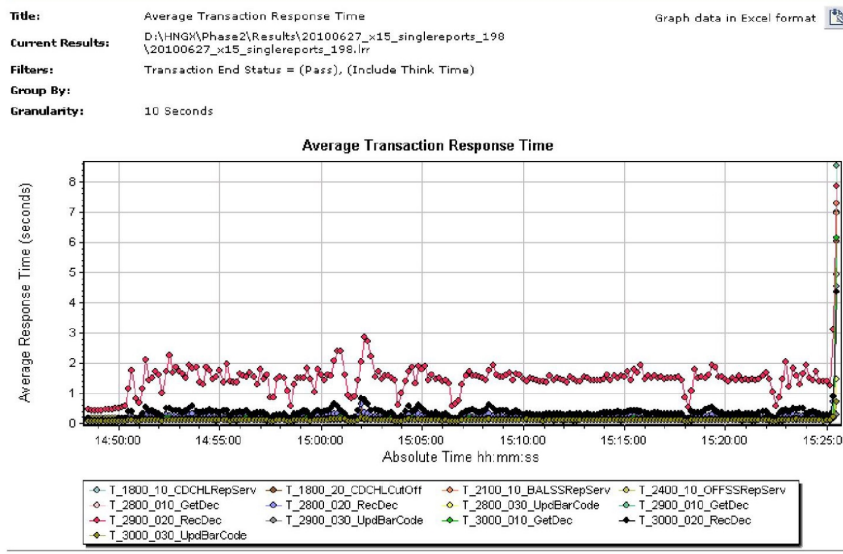
### COMMERCIAL IN CONFIDENCE



The graphs below show the response times for the report steps.

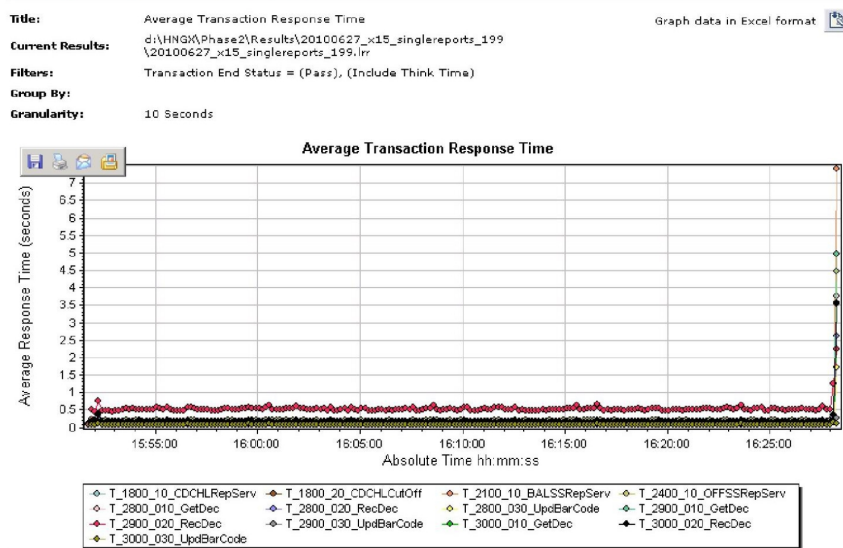
#### TestID 198 (ORM ON)

##### Average Transaction Response Time



#### TestID 199 (ORM OFF)

##### Average Transaction Response Time



The tables below provide a summary of each test; showing the response time (min/avg/max/90th percentile) for each 'step' of the reports run and, also, the number of steps which 'passed & failed'.



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



## TestID 198 (ORM ON)

Transaction Name	Minimum	Average	Maximum	Std. Deviation	90 Percent	Pass	Fail	%Fail
C_010_FirstLogon	0.095	0.199	7.253	0.279	0.32	1,231	5	0.4
C_020_SecondLogon	0.144	3.914	20.02	3.996	10.232	1,116	115	9.34
C_030_GetMemos	0.07	0.079	0.521	0.033	0.08	1,104	12	1.08
C_040_CountSusp	0.072	0.308	9.829	0.899	0.35	849	0	0
C_050_Logoff	0.085	0.546	10.687	1.065	0.903	849	0	0
T_1800_10_CDCHLRepServ	0.087	0.197	7.612	0.123	0.35	73,661	1	0
T_1800_20_CDCHLCutOff	0.089	0.125	10.573	0.126	0.21	73,658	4	0.01
T_2100_10_BALSSRepServ	0.11	0.227	10.391	0.141	0.371	73,580	1	0
T_2400_10_OFFSSRepServ	0.115	0.232	7.96	0.125	0.381	73,410	3	0
T_2800_010_GetDec	0.076	0.155	6.932	0.089	0.19	72,677	0	0
T_2800_020_RecDec	0.091	0.215	9.108	0.258	0.592	72,676	1	0
T_2800_030_UpdBarCode	0.084	0.115	10.621	0.1	0.19	72,676	1	0
T_2900_010_GetDec	0.076	0.152	10.886	0.095	0.18	69,851	1	0
T_2900_020_RecDec	0.341	1.492	13.439	2.165	5.305	69,850	2	0
T_2900_030_UpdBarCode	0.067	0.108	5.608	0.075	0.17	69,851	1	0
T_3000_010_GetDec	0.076	0.155	9.413	0.091	0.2	71,724	2	0
T_3000_020_RecDec	0.098	0.372	10.57	0.487	1.166	71,726	0	0
T_3000_030_UpdBarCode	0.084	0.115	7.385	0.092	0.2	71,726	0	0

## TestID 199 (ORM OFF)

Transaction Name	Minimum	Average	Maximum	Std. Deviation	90 Percent	Pass	Fail	%Fail
C_010_FirstLogon	0.097	0.183	7.3	0.293	0.23	1,209	13	1.06
C_020_SecondLogon	0.141	3.601	20.007	3.919	9.13	1,115	94	7.78
C_030_GetMemos	0.07	0.082	6.961	0.208	0.08	1,106	9	0.81
C_040_CountSusp	0.072	0.217	7.152	0.553	0.247	849	0	0
C_050_Logoff	0.085	0.33	7.783	0.635	0.47	849	0	0
T_1800_10_CDCHLRepServ	0.086	0.153	3.582	0.038	0.16	72,269	1	0
T_1800_20_CDCHLCutOff	0.089	0.096	5.196	0.039	0.11	72,266	4	0.01
T_2100_10_BALSSRepServ	0.11	0.186	8.358	0.058	0.2	72,195	1	0
T_2400_10_OFFSSRepServ	0.116	0.189	4.992	0.049	0.21	72,300	2	0
T_2800_010_GetDec	0.077	0.142	3.747	0.041	0.15	71,723	1	0
T_2800_020_RecDec	0.091	0.105	5.793	0.049	0.13	71,722	2	0
T_2800_030_UpdBarCode	0.084	0.091	26.015	0.106	0.1	71,723	1	0
T_2900_010_GetDec	0.076	0.143	7.281	0.057	0.15	72,399	0	0
T_2900_020_RecDec	0.328	0.524	6.126	0.14	0.652	72,399	0	0
T_2900_030_UpdBarCode	0.083	0.091	2.819	0.028	0.1	72,399	0	0
T_3000_010_GetDec	0.076	0.142	3.805	0.033	0.15	70,557	0	0
T_3000_020_RecDec	0.098	0.144	7.257	0.063	0.19	70,557	0	0
T_3000_030_UpdBarCode	0.084	0.091	2.421	0.026	0.1	70,555	2	0



**VOLUME AND PERFORMANCE TEST REPORT - PHASE 2**  
**COMMERCIAL IN CONFIDENCE**

The graphs below show the total errors per second during the run. They were mostly concerned with the logons at the beginning and logoffs at the end of the run. Issues with logon / logoff failures have been resolved since this test was run.

TestID 198 (ORM ON)

**Total Errors per Second**

**Title:** Total Errors per Second

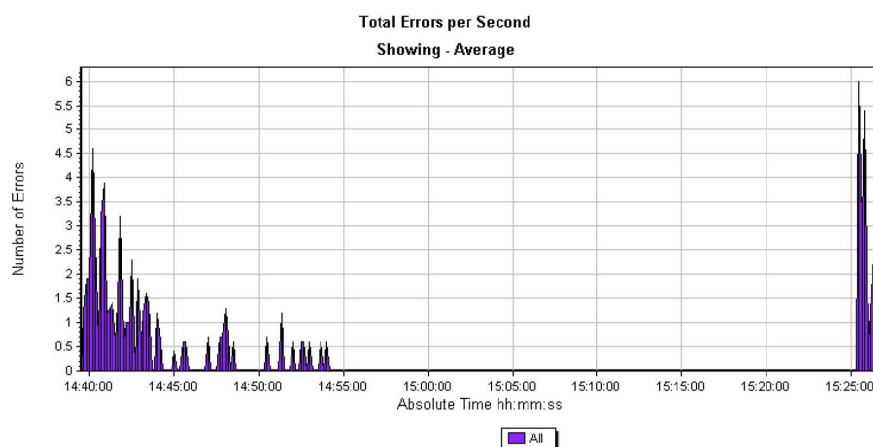
Graph data in Excel format

**Current Results:** D:\HNG\Phase2\Results\20100627\_x15\_singlereports\_198  
20100627\_x15\_singlereports\_198.lrr

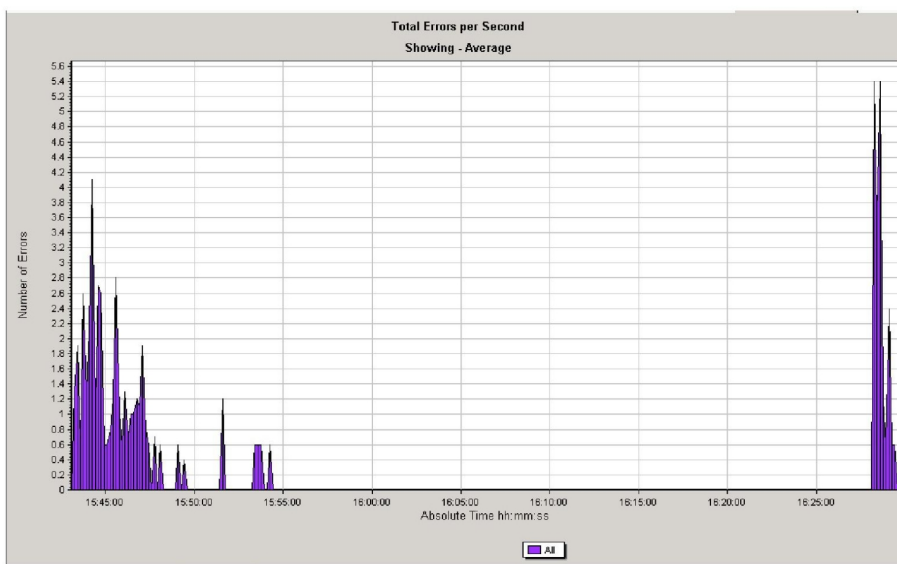
**Filters:** None

**Group By:**

**Granularity:** 10 Seconds



TestID 199 (ORM OFF)





VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



Test Status: Passed

Date of Final Run: 27<sup>th</sup> June 2010

Build Release: 01.22.00 / OSRs at 01.23.01.00

TestID: 198 (ORM ON) and 199 (ORM OFF)

## 5.18 Test Group XCB – HNG-X Combined Banking

### 5.18.1 HNG-X Combined Banking Contracted / Design Limit Peak Hour / Peak 5 Minutes

These tests are covered by the Combined Banking stress test. See section 5.18.2 below for detailed test results/:

### 5.18.2 HNG-X Combined Banking Stress Test

The objective of this test was to take the Banking service beyond Design Limits up to a rate at which either

- the service is no longer able to support the transaction load and thus identifying the maximum headroom capacity limit, or
- a notional transaction rate (as agreed with Capacity Management) such that, if achieved, it would demonstrate sufficient headroom capacity for future growth without needing to find the absolute breaking point

The ceiling target rates for the test were as follows.

Basket	Hits/sec	Auth/sec
0010_BKT01_CPO_WDL – CAPO	900	300
0012_BKT01_LNK_WDL - LINK	300	100
0011_BKT01_AL_WDL – A&L	90	30
	1290	430

Transaction rates for CAPO, Link and A&L were taken through their respective contractual and design limits before the following rates were sustained.

Service Type	Historical Peak		Contractual Limit		Design Limit			Sustained	H/R %
	Hour	5 min	Hour	5 min	Hour	5 min	Per sec peak		
CAPO	109	124	134	160	161	192	250	225	17.19%
LINK	14	17	27	32	33	39	51	70	79.49%
AL	6	7	10	12	12	14	19	30	114.29%
TOTAL *	110	176	171	204	206	245	not specified	325	32.65%

:\* The target for combined total banking is not the same as the sum of individual parts

NB: design limit values for LINK are incorrectly stated in ARC/PER/ARC/0001. The numbers here are as advised by Capacity Management and are derived from those specified in PA/PER/033

For CAPO, whilst a rate of 225tps was sustained (exceeding the Design Limit for Peak 5 minutes of 192tps), an actual per second peak of 260tps was achieved (exceeding the Design Limit for actual per second peak of 250tps)..

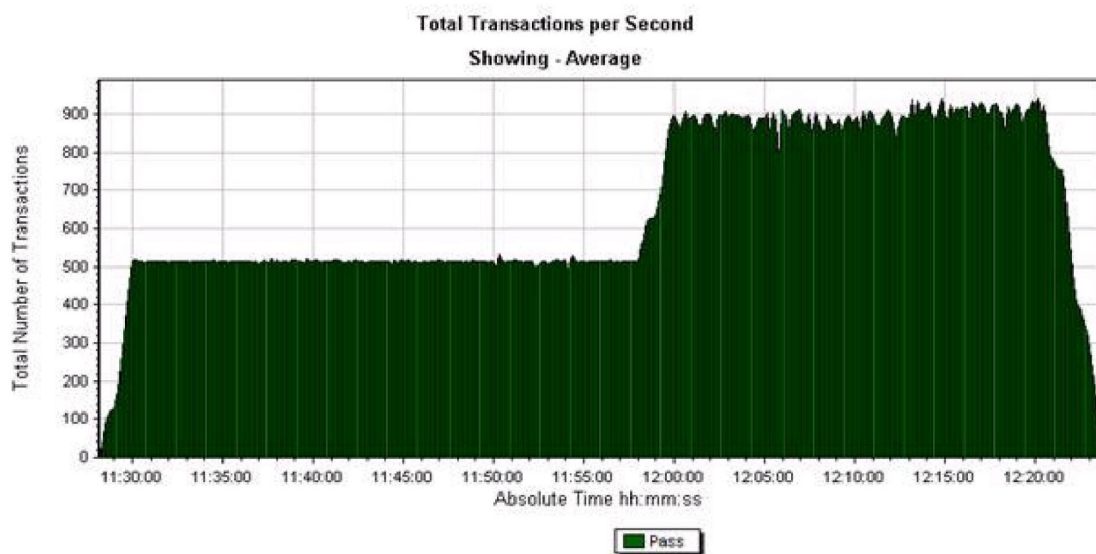


## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE

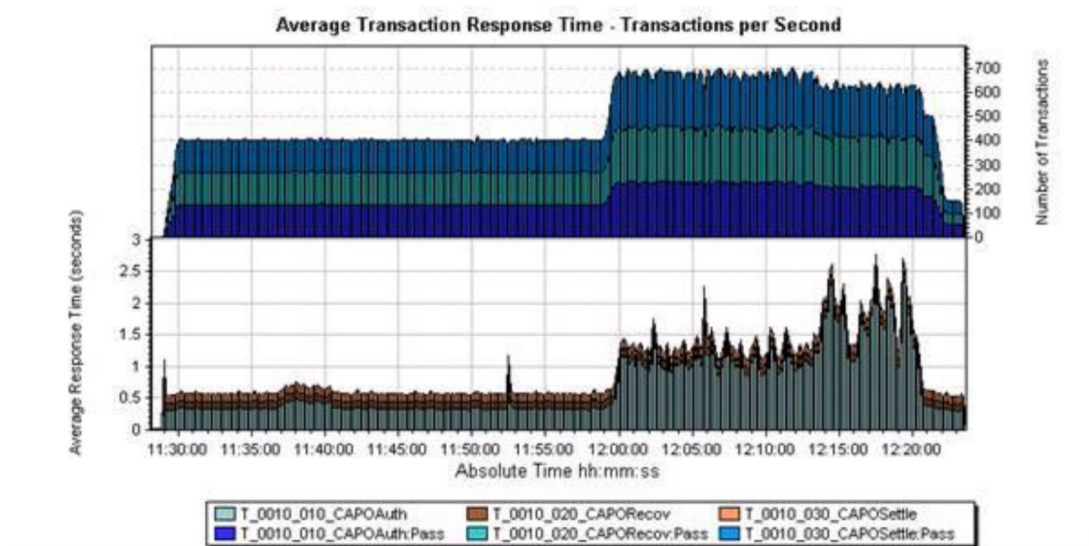


The following graph shows the overall transaction rate for the run. The ceiling target limit was NOT reached.



The following graph shows the transaction rates for CAPO and the response times. Between 12:00 and 12:15 CAPO should have been running at the target rate of 250 Auths/sec which equates to 750 hits/sec across the Authorisation/recovery/settlement XML. This was NOT achieved; at its maximum 225 Auths/sec was sustained.

After 12:15 when additional load to CAPO was applied the response times increased and the actual throughput reduced.





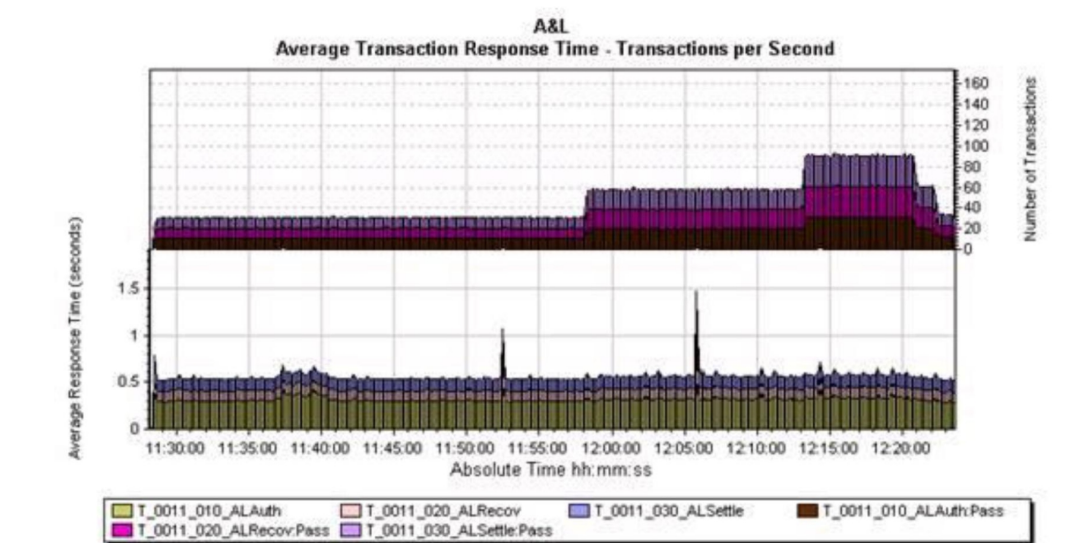


## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

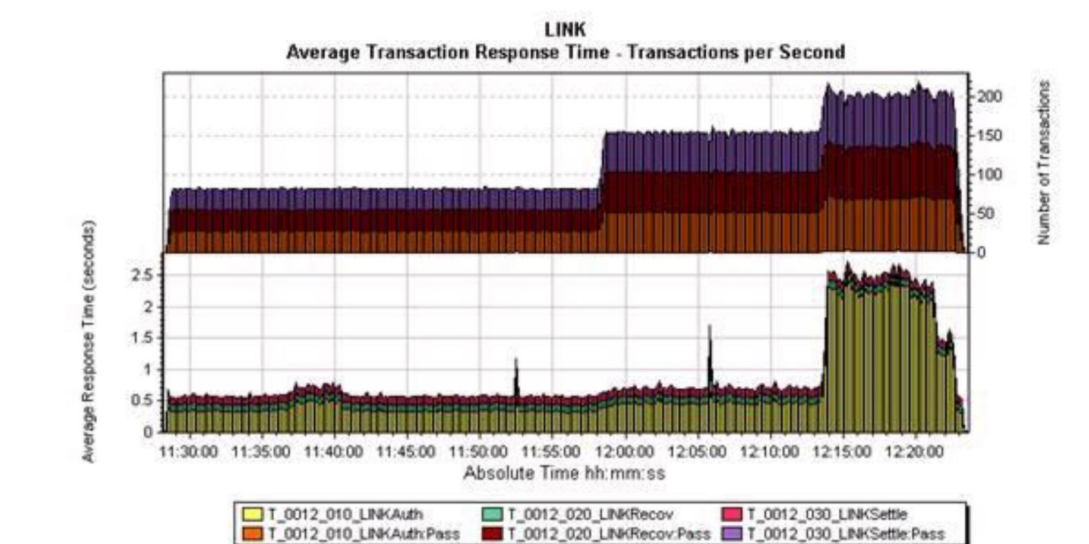
COMMERCIAL IN CONFIDENCE



The following graph shows the transaction rates for A&L and the response times. It can be seen from the graph that the target rate of 30 Auth/sec equating to 90 hits/sec across the Authorisation/recovery/settlement XMLs was achieved



The following graph shows the transaction rates for LINK and the response times. It can be seen from the graph that the target rate of 100 Auth/sec equating to 300tps across the Authorisation/recovery/settlement XMLs was NOT achieved because the Authorisation response times increased dramatically after 12:14. However a rate of around 70Auths/sec was achieved which equates to 210 hits/sec across the Authorisation/recovery/settlement XMLs



The following gives the summary of the response times (min/max/avg/90th percentile) for all the transactions including total passes and failures. All failures occurred with CAPO.





## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



Transaction Name	Minimum	Average	Maximum	Std. Deviation	90 Percent	Pass	Fail	%Fail
C_010_FirstLogon	0.125	0.148	0.28	0.022	0.18	1000	0	0
C_020_SecondLogon	0.13	0.198	0.682	0.054	0.269	1000	0	0
C_030_GetMemos	0.07	0.079	0.545	0.03	0.09	1000	0	0
C_040_CountSusp	0.072	0.079	0.548	0.026	0.09	1000	0	0
C_050_Logoff	0.083	0.103	0.402	0.037	0.149	1000	0	0
T_0010_010_CAPOAuth	0.165	0.803	20.334	1.485	1.339	535857	717	0.13363
T_0010_020_CAPORecov	0.09	0.12	4.453	0.079	0.13	536574	0	0
T_0010_030_CAPOSettle	0.121	0.134	3.365	0.04	0.14	536573	1	0.00019
T_0011_010_ALAuth	0.17	0.317	3.322	0.096	0.401	51412	0	0
T_0011_020_ALRecov	0.104	0.115	2.996	0.069	0.13	51412	0	0
T_0011_030_ALSettle	0.122	0.133	3.336	0.044	0.14	51412	0	0
T_0012_010_LINKAuth	0.181	0.864	10.335	1.567	0.884	132538	0	0
T_0012_020_LINKRecov	0.105	0.115	4.005	0.07	0.12	132538	0	0
T_0012_030_LINKSettle	0.122	0.131	3.247	0.04	0.14	132538	0	0

Analysis of Athene Data showed no bottleneck in terms of the system performance characteristics of any of the system components. Instead, the limitation was confined to the performance capability of the agent code. However, each banking service type individually and combined exceeded the respective design limits.

Test Status: Passed

Date of Final Run: 30<sup>th</sup> June 2010 at 11:28 to 12:23

Build Release: 01.22.00 / OSRs at 01.23.01.00

TestID: 202



## 6 Additional Testing

Over and above the planned tests specified in the HLTP, additional testing was also conducted in support of the following:

- Red Alert Peak list
- Various Oracle Patches
- Streams Fixes
- ORM configuration settings
- BAL/OSR Fixes
- pblade v249 upgrade

Specific test details for any of the above are available on request.

## 7 Lessons Learned

- The usefulness of the VOL testing should not be underestimated. For example, many examples of "timing" issues were found during VOL testing that could not otherwise have been identified.
- Original project plans did not make sufficient allowance for volume and performance testing. The test cycles were 'squeezed' only for reality to bite later.
- Expectations of performance testing was sometimes unrealistic; The team were often requested / expected to run tests for other teams at 'the drop of a hat' without prior warning or planning. On occasions the requests were not supportable as appropriate test data could not be prepared in the time available.
- During the early stages of testing in particular, development of counter changes invalidated the prepared Loadrunner test scripts and rendered them unusable. This resulted in considerable re-work having to re-capture the XML that forms the basis of the scripts. Later developments tended to be backwards-compatible.
- Whilst testing achieved the aim of understanding the performance profile of the solution, it is not possible to truly replicate behaviour of a live estate due to the considerable variances in day to day activity, the complexities of the solution, and the limitations of test tooling. Expectations in this respect sometimes needed to be managed.
- In some cases, the limitation of available Loadrunner VUser licenses constrained the amount of load that system components could be subjected to.



VOLUME AND PERFORMANCE TEST REPORT - PHASE 2  
COMMERCIAL IN CONFIDENCE



## 8 Recommendations

- **Consider upgrade of the pblade for BRS to v249:**  
The performance improvements demonstrated on the upgraded BRDB nodes suggests that an upgrade of the BRSS would further improve Streams performance.
  - **Review ORM configuration settings for min / max servers:**  
A number of ORM configuration settings were exercised during the Red Alert testing phase with settings of Low=7 and High=16 being selected for deployment into the Live estate. Once the new hardware v249 blades were available, further ORM configuration testing was conducted including with ORM switched off. The Technical Review group concluded that the optimal configuration settings were Low=16 High=32. TestID:240-246 record the ORM test results.  
  
During the tests above, ORM did not activate at all. The Technical Review group were unable to identify a test which would "force ORM to invoke". It is felt that there is a degree of risk in terms of not being able to observe the solution behaviour of ORM activating on the new hardware. It is recommended that further reviews of the need for ORM are conducted with a decision to
    - (a) switch off ORM, or
    - (b) remain with the current settings, or
    - (c) change the settings to the optimal determined during TestID:240-246.
- NB: Further to the above, the settings have now been changed in 'live' to settings of low=16 and high =32. This was applied by MSC043J0277083 on 15<sup>th</sup> September 2010.**
- **Review OSR min / max connection settings:**  
Tests have been conducted with various min / max connection settings up to 30 / 30. The optimal settings should be considered in light of the test results observed.
- NB: Further to the above, the min connection setting has now been changed in 'live' to a value = 20. This was applied by MSC043J0277111 on 17<sup>th</sup> September 2010.**
- **Update Operations Support Guide for re-introducing a previously failed BRDB node during the on-line day:**  
If a previously failed node is to be re-introduced during the on-line business day (the current recommendation in the Operations Support Guide is to only reintroduce a node overnight), then careful consideration needs to be made as to the potential impact on service. The amount of time it will take for live service to recover from either a node failure or reintroduction of a node, will be higher or lower depending on the transaction load at the time. Also, in terms of reintroducing the node, recovery time will depend on how long the node has been down. This is because the longer an oracle instance has been unavailable, the more time it will take to go through a re-mastering exercise with the other nodes. This has an impact on the node performance and will in turn impact the transaction load it can process. A FadHashRefresh on the BAL servers to pick up the reintroduced node should not be performed until re-mastering activity on the BRDB nodes has completed. The Operational Support Guide should be updated to note all relevant considerations when re-introducing a node.
  - **Implement Egenera recommended configuration settings:**  
The Egenera recommended configuration settings aimed at preventing BDB node evictions (as proven by Peak testing against PC0197725) should be applied to the Live estate at an appropriate time during Release 2 timescales. The possible exception being the changes to CPU affinity.
  - **Consider upgrade of all BAL servers to v216**  
The current BAL server estate is a mixture of v216 and v411 servers. Testing has demonstrated that the v216 servers have double the processing capacity of the v411 servers. At peak



## VOLUME AND PERFORMANCE TEST REPORT - PHASE 2

COMMERCIAL IN CONFIDENCE



transaction volumes, as the 411's reach saturation, the amount of packets they take in stops increasing. The 216's having double the power, can take in double the amount. This leads to an in-balance of workload across the estate at peak volumes

- **Consider life without VOL**

Future performance testing or modelling capability should be carefully considered, not only for future releases but also in support of 'live' as full rollout continues to maturity.





## 9 Conclusions

A significant number of performance related issues have been identified and resolved throughout VOL testing. Additional testing over and above that specified in the HLTP has also been conducted to support further 'tuning' of performance characteristics. As at completion of Cycle 3, testing has demonstrated ability of the solution to support full contractual and design limit workloads for each of the service types under test. Stress testing has also identified the headroom capacity to support future growth in business volumes.

Some Peaks remain open which would deliver further performance improvements. Whilst desirable, they are not deemed critical to be able to support current live volumes.