

# LTSP Benchmarking on a zSeries Mainframe and xSeries 335



This paper presents the personal opinions of the author who acknowledges his debt to the efforts of GNU and open-source developers and users who have made their work and experience freely available to the public. Trademarks are owned by their owners. There is no warranty associated with the information contained in this document. Use and distribute at your own risk. License information is in the appendix.

Jordan Rosen  
[Jordan.Rosen@lillecorp.com](mailto:Jordan.Rosen@lillecorp.com)  
August 15, 2005

## Table Of Contents

Mainframe zVM Environment	1
zVM Environment	1
User Image Environment	1
Benchmark Goals	2
Benchmark Environment	2
Simultaneous Desktops	2
OpenOffice	2
Mozilla	2
Evolution	2
Data to be captured	2
Commands to access Perfkit	3
Data to be captured	4
Test Machines	4
Test	4 – 8
Summary	8 – 9
Appendix - Public Documentation License Notice	10

# Benchmark for LTSP Desktop Environment on the Mainframe

## I. Mainframe zVM Environment

Hardware Environment

zSeries 890

8GB of Memory

1x IFL Engine

20MB half ESCON Disk Storage

1Gb/S OSA Network

## II. zVM Environment

3GB IFL Memory

1GB zVM Swap Memory

1x IFL Engine dedicated

zVM User Images of Interest

PSPLTSP - LTSP Desktop Environment

PSPPRINT - Printer / File / Samba Server

PSPNETSV - DNS / TFTP Server

## III. User Image Environment

PSPLTSP

1. NFS server to serve the root filesystem for Diskless Thin Clients
2. GDM - Gnome Login Display Manager
3. ICEWM - ICE Windows Manager (replaces Gnome Metacity WM)
4. FreeNX - X Compression Optimizer, allows decent X performance across WAN
5. OpenOffice - Office Suite
6. Mozilla - Web Browser
7. Evolution - Email Client

PSPPRINT

1. CUPS - Print Server software
2. Samba - File / Print server software that mimics a Windows File / Print server

PSPNETSV

1. Bind9 - DNS server
2. ATFTP - Advance TFTP server

#### **IV. Benchmark Goals**

1. Determine the number of simultaneous desktops that can run without any perceived degradation in user perceived performance.
2. Determine the number of OpenOffice/Mozilla/Evolution sessions that can run.

#### **V. Benchmark Environment**

1. The controlling terminal will be operated over a VPN via the Internet to the mainframe.
2. The limiting available bandwidth is a T1 located at the controlling terminal end at the speed of 1.54 Mbps
3. The terminal will access the mainframe via SSH, VNC, and NX.
4. Each session will be displayed on a stateless vncserver environment. This will remove the network traffic load and latency of the VPN from the equation.

#### **VI. Simultaneous Desktops**

1. 10 ICEWM Launch
2. 100 ICEWM Launch
3. 1000 ICEWM Launch

#### **VII. OpenOffice**

1. 10 Launches performing copy and paste of a 100 column by 1000 row spreadsheet.
2. 100 Launches performing copy and paste of a 100 column by 1000 row spreadsheet.
3. 1000 Launches performing copy and paste of a 100 column by 1000 row spreadsheet.
4. 10 Launches opening OpenOffice.
5. 100 Launches opening OpenOffice.
6. 1000 Launches opening OpenOffice.

#### **VIII. Mozilla**

1. 10 Mozilla Launch opening random websites
2. 100 Mozilla Launch opening random websites
3. 1000 Mozilla Launch opening random websites

#### **IX. Evolution**

1. 10 Evolution Launch
2. 100 Evolution Launch
3. 1000 Evolution Launch

#### **X. Data to be captured**

1. Peak CPU Usage
2. Normal CPU Usage
3. Memory Usage
4. Paging
  1. If paging is done?
  2. At what point
  3. How much paging is done?

## XI. Commands to access Perfkit

Connect via 3270 to x.x.x.x

1. logon: xxxxx
2. password: xxxxx
3. enter "i cms"
4. enter "profile"
5. enter "=> monitor"

Scripts to test system load

systest.pl

```
#!/usr/bin/perl
```

```
print "xhost +\n";
print "killall -9 Xvnc\n";
print "rm -rf /tmp/.X*\n";
$num = 200;
$start = 1;
for ($i=$start;$i<$num;$i++)
{
    print "vncserver -kill :$i\n";
    print "rm -rf /tmp/.X$i-lock\n";
    print "rm -rf /tmp/.X11-unix/X$i\n";
    $uid = $i+2000;
    print "/usr/sbin/userdel user$i\n";
    print "rm -rf /home/user$i\n";
    print "/usr/sbin/useradd -u $uid -m user$i -p GKQkCwheDnDys\n";
    print "mkdir -p /home/user$i/.vnc\n";
    print "cp /test/passwd.vnc /home/user$i/.vnc/passwd\n";
    print "cp /test/xstartup /home/user$i/.vnc/xstartup\n";
    print "cp -a /test/evolution/.g* /home/user$i\n";
    print "cp -a /test/evolution/.e* /home/user$i\n";
    print "chown -R user$i /home/user$i\n";
}
print "sleep 5\n";
for ($i=$start;$i<$num;$i++)
{
    print "echo user$i\n";
    print "su -l user$i -c \"vncserver -depth 32 :$i\"\n";
    print "sleep 1\n";
}
```

```
xstartup
```

```
#!/bin/sh
```

```
xrdb $HOME/.Xresources  
xsetroot -solid grey  
#evolution &  
#mozilla &  
#opt/OpenOffice.org/program/swriter &  
#icewm-session &  
#x3270 &  
#gnome-terminal &  
#nautilus &  
#xterm &
```

```
lp.pl
```

```
#!/usr/bin/perl
```

```
$num = 1000;  
for ($i=0;$i<$num;$i++)  
{  
    print "lp -h x.x.x.x -d lillecorp /test/di808HV_manual_100.pdf\n";  
}
```

## **XII. Data to be captured**

Context Switching  
Memory Utilization

## **XIII. Test Machines**

Single Xeon 2.8 with 1GB RAM – no swap  
Single IFL with 1GB RAM – no swap

## **XIV. Test**

### **Test 1**

Running as many ICEWM sessions as possible without a perceived slow down by the user.

1 IFL with 1GB RAM – No Disk Swap

100 Sessions, Linux Peak Load: 2.61, Linux Idle Load: <1, zVM PerfKit: 17%  
200 Sessions, Linux Peak Load: 5.38, Linux Idle Load: 4.5, zVM PerfKit: 19%  
300 Sessions, Out of Memory at 250 Sessions

250 Absolute Maximum Users with 1GB of RAM  
200 Suggested Maximum Users with 1GB of RAM (80% of Absolute Maximum)

ICEWM Minimum Memory consumption: 1GB / 250 Users = 4MB / User  
ICEWM Suggested Memory consumption: 1GB / 200 Users = 5MB / User

## Test 2

Running as many OpenOffice sessions as possible

1 IFL with 1GB RAM – No Disk Swap

100 Sessions, Out of Memory at 56 Sessions

10 Sessions, Linux Peak Load: 3.28, Linux Idle Load: <1, zVM Perfkit: 1.48%

20 Sessions, Linux Peak Load: 5.49, Linux Idle Load: <1, zVM Perfkit: 1.95%

30 Sessions, Linux Peak Load: 4.44, Linux Idle Load: <1, zVM Perfkit: 2.75%

40 Sessions, Linux Peak Load: 3.74, Linux Idle Load: <1, zVM Perfkit: 3.38%

50 Sessions, Linux Peak Load: 4.52, Linux Idle Load: <1, zVM Perfkit: 4.04%

56 Absolute Maximum Users with 1GB of RAM

40 Suggested Maximum Users with 1GB of RAM (71.4% of Absolute Maximum)

OpenOffice Minimum Memory consumption: 1GB / 56 Users = 17MB / User

OpenOffice Suggested Memory consumption: 1GB / 40 Users = 25MB / User

## Test 3

Running as many Mozilla sessions as possible

1 IFL with 1GB RAM – No Disk Swap

100 Sessions, Out of Memory at 62 Sessions

62 Absolute Maximum Users with 1GB of RAM

40 Suggested Maximum Users with 1GB of RAM (80% of Absolute Maximum)

Evolution Minimum Memory consumption: 1GB / 62 Users = 16MB / User

Evolution Suggested Memory consumption: 1GB / 50 Users = 20MB / User

## Test 4

Running as many Evolution sessions as possible

1 IFL with 1GB RAM – No Disk Swap

100 Sessions, Out of Memory at 50 Sessions

50 Absolute Maximum Users with 1GB of RAM

40 Suggested Maximum Users with 1GB of RAM (80% of Absolute Maximum)

Evolution Minimum Memory consumption: 1GB / 50 Users = 20MB / User

Evolution Suggested Memory consumption: 1GB / 40 Users = 25MB / User

**Test 5**

Running as many x3270 sessions as possible

1 IFL with 1GB RAM – No Disk Swap

100 Sessions, Linux Peak Load: 3.28, Linux Idle Load: <1, zVM Perfkit: 1.48%

200 Sessions, Linux Peak Load: 5.49, Linux Idle Load: <1, zVM Perfkit: 1.95%

300 Sessions, Out of Memory at 260 Sessions

260 Absolute Maximum Users with 1GB of RAM

208 Suggested Maximum Users with 1GB of RAM (80% of Absolute Maximum)

x3270 Minimum Memory consumption:  $1\text{GB} / 260\text{ Users} = 4\text{MB} / \text{User}$

x3270 Suggested Memory consumption:  $1\text{GB} / 208\text{ Users} = 5\text{MB} / \text{User}$

**Test 6**

Running as many gnome-terminal sessions as possible

1 IFL with 1GB RAM – No Disk Swap

100 Sessions, Out of Memory at 64 Sessions

64 Absolute Maximum Users with 1GB of RAM

52 Suggested Maximum Users with 1GB of RAM (82% of Absolute Maximum)

Gnome Terminal Minimum Memory consumption:  $1\text{GB} / 64\text{ Users} = 16\text{MB} / \text{User}$

Gnome Terminal Suggested Memory consumption:  $1\text{GB} / 52\text{ Users} = 20\text{MB} / \text{User}$

**Test 7**

Running as many Nautilus sessions as possible

1 IFL with 1GB RAM – No Disk Swap

100 Sessions, Out of Memory at 52 Sessions

52 Absolute Maximum Users with 1GB of RAM

42 Suggested Maximum Users with 1GB of RAM (81% of Absolute Maximum)

Nautilus Minimum Memory consumption:  $1\text{GB} / 52\text{ Users} = 16\text{MB} / \text{User}$

Nautilus Suggested Memory consumption:  $1\text{GB} / 42\text{ Users} = 24\text{MB} / \text{User}$

## Test 8

Running as many xterm sessions as possible

1 IFL with 1GB RAM – No Disk Swap

100 Sessions, Out of Memory at 100 Sessions

100 Absolute Maximum Users with 1GB of RAM

80 Suggested Maximum Users with 1GB of RAM (80% of Absolute Maximum)

xterm Minimum Memory consumption:  $1\text{GB} / 100\text{ Users} = 10\text{MB} / \text{User}$

xterm Suggested Memory consumption:  $1\text{GB} / 80\text{ Users} = 13\text{MB} / \text{User}$

## Test 9

Running as many Xvnc sessions as possible

1 IFL with 1GB RAM – No Disk Swap

300 Sessions, Out of Memory at 288 Sessions

288 Absolute Maximum Users with 1GB of RAM

230 Suggested Maximum Users with 1GB of RAM (80% of Absolute Maximum)

xterm Minimum Memory consumption:  $1\text{GB} / 288\text{ Users} = 3\text{MB} / \text{User}$

xterm Suggested Memory consumption:  $1\text{GB} / 230\text{ Users} = 4\text{MB} / \text{User}$

## Test 10

Send as many 50k large postscript printer jobs as possible to the CUPS printer server

1000 Jobs – Linux CPU Load < 2, Memory: < 256M: zVM Perfkit: 25% CPU

10000 Jobs – Linux CPU Load 2.50, Memory: < 256M: zVM Perfkit: 30% CPU

Send as many 13M large PDF printer jobs as possible to the CUPS printer server

1000 Jobs – Linux CPU Peak Load: 6, Memory: < 400M: zVM Perfkit: 57% CPU

10000 Jobs – Out of disk space at 1174 Jobs, no difference in CPU performance.

## Test 11

Run as many Win4Lin sessions as possible.

Single Xeon CPU

100 Sessions – Processor grinds to a halt at 40 sessions, Memory is not a factor

~400MB RAM Used

## Test 12

Run as many NX sessions as possible

Mainframe

100 Sessions – Connections begin to fail at 40 sessions. Memory is not a factor  
~600MB RAM Used

## Summary

Memory Consumption

Suggested Maximum = 80% of Absolute Maximum  
Exception: OpenOffice.org is 71%

Mainframe

Single IFL – 312 MIPS  
1GB RAM  
No Swap

	Minimum Memory w/ Xvnc (MB / User)	Minimum Memory w/o Xvnc (MB / User)	Suggested Memory w/ Xvnc (MB / User)	Suggested Memory w/o Xvnc (MB / User)	Maximum Sessions (Users / GB)	Suggested Maximum Sessions (Users / GB)
Xvnc	-	3MB	-	3MB	288	-
ICEWM	4MB	1MB	5MB	2MB	250	200
xterm	10MB	7MB	13MB	10MB	100	80
x3270	4MB	2MB	5MB	2MB	260	208
OpenOffice.org	17MB	14MB	25MB	22MB	56	40
Evolution	20MB	17MB	25MB	22MB	50	40
Mozilla	17MB	14MB	20MB	17MB	62	52
Nautilus	16MB	13MB	24MB	21MB	52	42

xSeries 335

Single 2.8GHz Xeon  
1GB RAM  
No Swap

	Minimum Memory w/ Xvnc (MB / User)	Minimum Memory w/o Xvnc (MB / User)	Suggested Memory w/ Xvnc (MB / User )	Suggested Memory w/o Xvnc (MB / User)	Maximum Sessions (Users / GB)	Suggested Maximum Sessions (Users / GB)
Xvnc	-	3MB	-	3MB		-
ICEWM	4MB	1MB	5MB	2MB	200	180
xterm	10MB	7MB	13MB	10MB	90	72
x3270	4MB	1MB	5MB	2MB	252	201
OpenOffice.org	17MB	14MB	25MB	22MB	75	60
Evolution	20MB	17MB	25MB	22MB	50	40
Mozilla	17MB	14MB	20MB	17MB	62	52
Nautilus	16MB	13MB	24MB	21MB	52	42

### Processor Limited Services

Defined by the user unable to perform any task due to load.

### Win4Lin

Single Xeon Processor

40 Absolute Maximum Sessions

30 Suggested Maximum

### FreeNX

Mainframe

40 Absolute Maximum Sessions

30 Suggested Maximum

## **Appendix – Public Documentation License Notice**

### **Original Documentation**

The contents of this Documentation are subject to the Public Documentation License Version 1.0 (the “License”); you may only use this Documentation if you comply with the terms of this License. A copy of the License is available at <http://www.openoffice.org/licenses/pdl.pdf>

The Initial Writer of this Documentation is Jordan Rosen.  
(Initial Writer contact [Jordan.Rosen@lillecorp.com](mailto:Jordan.Rosen@lillecorp.com))

