

# Scalability and performance of HP ProLiant BL35p server blades with AMD Opteron Model 250 (2.4 GHz/1 MB) processors in an HP SBC environment



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## Executive summary

The new HP ProLiant BL35p two-way server blade delivers uncompromising manageability, maximum computing density, and breakthrough power efficiencies to the high-performance data center. Offering customers a modular, space-saving design, the HP ProLiant BL35p server blade consumes less power, enabling denser rack architectures.

The HP ProLiant BL35p shares the same infrastructure components as all BL p-Class server blades, allowing customers to enjoy additional benefits from the HP BladeSystem p-Class rack-centralized power sub-system and network interconnect options.

A two-way HP ProLiant BL35p server blade with 2.4 GHz/1 MB processors can provide optimal support for up to 123 users<sup>1</sup> in an HP SBC environment.

## Introduction

HP offers a broad range of HP ProLiant servers that are ideal for particular HP SBC environments. To help customers select the appropriate server for their environment, HP publishes a series of performance briefs that characterize individual server performance and scalability. Each performance brief includes the following information:

- An outline of the benefits and features introduced with the new server
- A description of the test environment and test scenarios used to determine the optimal number of users supported by the particular server in an HP SBC environment

HP also publishes a companion [white paper](#) that serves as a high-level summary of overall HP ProLiant server performance and scalability in an HP SBC environment.

## This performance brief

This performance brief focuses on the two-way HP ProLiant BL35p server blade with 2.4 GHz/1 MB processors, providing information on the following topics:

- [Overview](#) – Summarizes the benefits and key features of the HP ProLiant BL35p server blade
- [Performance testing](#) – Outlines the test tools and scripts implemented by HP to simulate an HP SBC environment; describes the Heavy, Medium, and Light User profiles used to create the appropriate workloads
- [Tested environment](#) – Provides more information on the HP SBC environment used to test this server
- [Performance test results](#) – Provides sample test results; summarizes the optimal numbers of users supported
- [Summary](#)

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### Note:

HP refers to an application server in an HP SBC environment as an HP SBC server. Microsoft refers to this server as a Terminal Server; Citrix as a MetaFrame Presentation Server.

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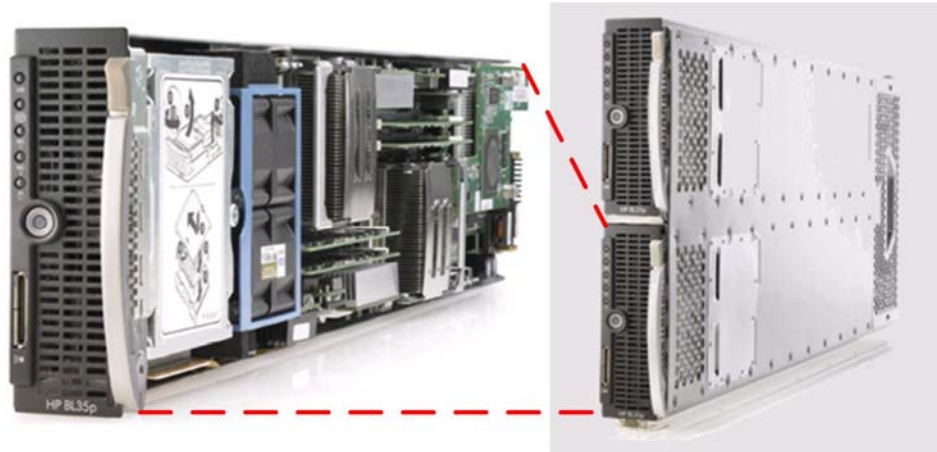
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<sup>1</sup> Heavy Users, as defined [later](#) in this Performance Brief

# Overview

This section outlines the benefits and key features of the HP ProLiant BL35p server blade, shown in Figure 1.

**Figure 1:** HP ProLiant BL35p server blade, showing a single blade and two blades in an HP BladeSystem p-Class Blade Sleeve



## Benefits

HP introduces the new HP ProLiant BL35p server blade, which delivers maximum computing density and breakthrough power efficiencies to the enterprise data center or high-performance technical computing environments. Benefits include:

### Price/performance

- Up to two AMD Opteron™ 200 Series processors running at 2.4GHz, each with 1 MB L2 cache
- Up to 8 GB of PC3200 DDR (400 MHz) memory

### Density and power efficiency

- Ultra-dense design supports up to 96 servers in an industry-standard rack
- Lower power consumption per server (68 W per processor)

### Management

- HP Integrated Lights-Out (iLO) Advanced standard
- Support for HP ProLiant Essentials Rapid Deployment Pack (RDP)

### Options

- Fibre Channel support for SAN implementations and clustering

## Ideal environment

### Medium to large enterprise data center customers requiring dense two-way server performance

- Maximum 32-bit or 64-bit two-way performance for load-balanced or front-end applications
- Ultra-dense design supports up to 96 servers (192 processors) in a standard rack
- Lower power consumption per server (68 W per processor) enables denser rack architectures

### High Performance Technical Computing (HPC) environments

- Support for up to two Opteron 200 Series processors with on-board memory controllers running at processor speed
- Optimal solution for applications that require high bandwidth and low-latency access to system memory
- Typical applications: financial, life and materials sciences, mechanical engineering/virtual prototyping, electronic design automation, and high-end film and video

### Enterprise data center or HPC environments that optimize external storage architectures

- Dual-port Fibre Channel connectivity option with no trade-offs on other features
- Support for HP and third-party SANs
- Support for boot from SAN

## Features

Table 1 summarizes key features of the HP ProLiant BL35p server blade.

**Table 1:** Key features

Component	Description
Processor	Opteron Model 250 (2.4 GHz)
	Support for one-way and two-way server configurations
	1 MB L2 cache per processor
	AMD HyperTransport™ (HT) speed: 800 MHz
	Up to 192 processors in a 42U rack
Chipset	Opteron 8000 Series
Memory	ECC PC3200 (400 MHz) DDR
	Expandable to 8 GB
Network	Two NC7781 PCI-X Gigabit NICs (deployed on a Mezzanine card)
	One 10/100 NIC dedicated to remote management
Internal storage	Integrated storage controller
	Maximum 120 GB (2 x 60 GB ATA 5,400 rpm drive)
SAN connectivity	Optional Dual Port Fibre Channel Adapter (2 Gb)
Remote management	Integrated Lights-Out (iLO) Advanced

# Performance testing

HP continues to upgrade existing HP ProLiant servers and introduce new servers to meet particular business needs. To help customers select the appropriate server for their particular HP SBC environment, HP publishes this and other performance briefs to characterize individual server performance and scalability.

This section describes the test environment and test scenarios used to determine the optimal number of users supported by an HP ProLiant BL35p server blade in an HP SBC environment.

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## Note:

HP makes a distinction between the optimal number of users that can be supported on a particular server configuration and the maximum number. The optimal number is a more practical metric that reflects the number of users that can be supported *without impacting user response times*.

Historically, HP has defined the optimal value as the number of users that are active when processor utilization reaches 80%. After processor utilization passes 80%, additional users are supported; however, response times may become unacceptable.

Scalability metrics specified in this Performance Brief reflect the optimal number of users.

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## Test tools and scripts

HP used a range of test tools and scripts to simulate typical HP SBC user workloads.

### Tools

Terminal Services Scalability Planning Tools (TSScaling), a suite of tools developed by Microsoft®, helps organizations with Microsoft Windows® Server 2003 Terminal Server capacity planning. These tools facilitate the placement and management of simulated loads on an HP SBC server.

Table 2 outlines the components of the TSScaling suite.

**Table 2:** Components of TSScaling

TSScaling suite component		Description
Automation tools	Robosrv.exe	Drives the server-side of the load simulation
	Robocli.exe	Helps drive the client-side of the load simulation
Test tools	Qidle.exe	Determines if any scripts have failed and require operator intervention
	Tbscript.exe	A script interpreter that helps drive the client-side load simulation
Help files	TBScript.doc	Terminal Server bench scripting documentation
	TSScalingSetup.doc	A scalability test environment set-up guide
	TSScalingTesting.doc	A testing guide

### More information on the test tools

- Roboserver (Robosrv.exe) and Roboclient (Robocli.exe): [Terminal Server capacity planning](#)
- TSScaling: [Windows Server 2003 Terminal Server Capacity and Scaling](#)

### Test scripts

HP used test scripts that simulated the activities of three types of users (Heavy, Medium, and Light). Table 3 describes these users and their simulated activities.

**Table 3:** Simulated user activities

User Type	Activities
Heavy User	<p>Heavy Users (also known as Structured Task Workers) tend to open multiple applications simultaneously and remain active for long periods. Heavy Users often leave applications open when not in use.</p> <p>Heavy users have an average typing speed of 40 – 50 words per minute.</p> <p>The Heavy User script included the following activities:</p> <ul style="list-style-type: none"><li>• Creating, saving and printing documents using Microsoft Word</li><li>• Browsing web pages, and sending and receiving e-mail using Microsoft Outlook</li><li>• Performing extensive Microsoft Excel activity (using PivotTable dynamic views, graphing and charting data, and so on)</li></ul>
Medium User	<p>Medium Users (also known as Knowledge Workers) are defined as users who gather, add value to, and communicate information in a decision-support process. Cost of downtime is variable but highly visible. These resources are driven by projects and ad-hoc needs towards flexible tasks. These workers make their own decisions on what to work on and how to accomplish the task.</p> <p>Sample tasks include: marketing, project management, sales, desktop publishing, decision support, data mining, financial analysis, executive and supervisory management, design, and authoring.</p> <p>Medium Users tend to open and close applications more quickly than Heavy Users. These users typically do not leave applications open when not in use; they have an average typing speed of 35 – 40 words per minute.</p> <p>The Medium User script included the following activities:</p> <ul style="list-style-type: none"><li>• Creating small documents with Microsoft Word</li><li>• Performing simple data entry with Microsoft Excel</li><li>• Sending and receiving e-mail with Microsoft Outlook</li><li>• Engaging in minimal browsing of an intranet site using Microsoft Internet Explorer 6.0</li></ul>
Light User	<p>Light Users (also known as Data Entry Workers) input data into computer systems. Activities include transcription, typing, order entry, clerical work and manufacturing.</p> <p>The Light User script simulated simple Microsoft Excel data entry, entering 10 rows of data.</p>

## Test scenarios

HP deployed the configuration shown in [Figure 2](#) to simulate an HP SBC environment. To simulate typical HP SBC workloads, HP ran a series of performance tests based on the Heavy, Medium, and Light User scripts described in [Table 3](#).

For each test scenario, HP began by running the appropriate script with a group of ten simulated users. Start times were staggered to eliminate authentication overhead. After the sessions finished, HP added ten more users, then repeated the testing.

### Monitoring processor utilization

Primarily, HP monitored processor utilization to establish the optimal number of users supported by the HP SBC server. By definition, the optimal number of users is active when processor utilization reaches 80%<sup>2</sup>.

To obtain this key performance metric, HP used the Windows Performance Monitor (Perfmon) analysis tool to monitor % Processor Time values.

### Validation using a canary script

To validate the scalability metrics obtained using % Processor Time, HP also ran canary scripts to characterize Heavy User response times for discrete activities (such as the time taken for an application to be invoked or for a modal box to appear).

By monitoring these response times as more and more users logged on, HP was able to obtain further scalability metrics.

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#### Note:

When using canary scripts, HP considers optimal user scalability to be reached when response times increase markedly over a baseline measurement.

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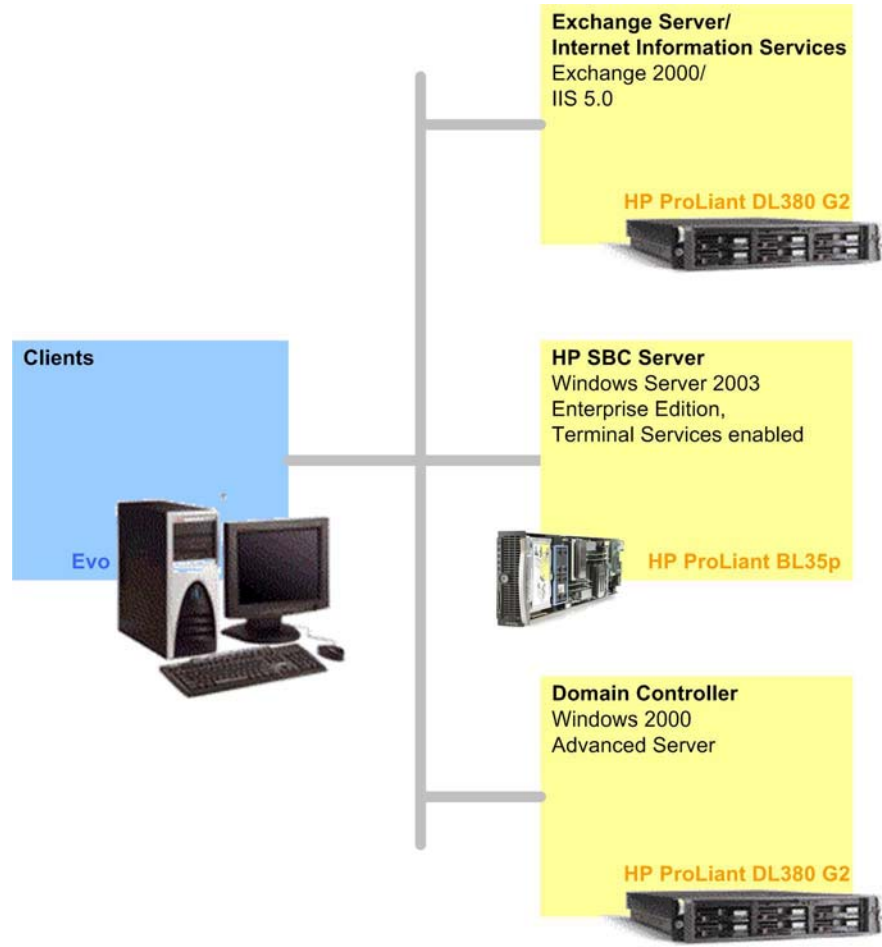
<sup>2</sup> Historically, HP has defined the optimal number of users as the number of users that are active when processor utilization (% Processor Time) reaches 80%. Additional users are supported but response times may become unacceptable.



## Tested environment

Figure 2 illustrates the HP SBC test environment.

**Figure 2:** The tested environment



**Note:**

Test environments such as that shown in Figure 2 are available to customers at [HP Solution Centers](#) to help solve a wide variety of business problems.

## Guidelines

HP followed these guidelines when configuring servers for the test environment:

- **Memory**

Since all applications reside and are executed on the HP SBC server, memory resources on this server must be sufficient in order to optimize system performance. HP offers the following recommendations based on user type:

- 5 – 6 MB for each active Light User
- 8 – 10 MB for each active Medium User
- 12 – 15 MB for each active Heavy User

For more information on these user types, refer to the section on [Test Scripts](#).

- **NIC speed**

Since network traffic is light (only keystrokes, mouse clicks and display updates), HP set all server NICs to 100 Mbps.

## Configurations

Table 4 summarizes the configurations of systems used in the test environment.

**Table 4:** System configurations

Server	Configuration
HP SBC server	<p>Two-way HP ProLiant BL35p server blade with:</p> <ul style="list-style-type: none"> <li>• 2.4 GHz/1 MB AMD Opteron processors</li> <li>• 1 MB L2 cache</li> <li>• 4096 MB RAM</li> <li>• One 60.0 GB 5,400 rpm ATA hard drive</li> </ul> <p>Microsoft Windows Server 2003 Enterprise Edition, Terminal Services enabled Microsoft Office XP</p>
Exchange Server/ Internet Information Services	<p>HP ProLiant DL380 G2 server with:</p> <ul style="list-style-type: none"> <li>• Two-way 1.4 GHz Intel® Pentium® III processor</li> <li>• 512 KB L2 cache</li> <li>• 2304 MB RAM</li> <li>• Two hot plug 36.4 GB 15,000 rpm Ultra3 SCSI hard drives</li> <li>• Integrated Smart Array 5i controller with RAID 1</li> <li>• NC3163 10/100 Fast Ethernet NIC</li> </ul> <p>Microsoft Windows 2000 Advanced Server Microsoft Exchange Server 2000 Microsoft Internet Information Services 5.0</p>
Domain Controller	<p>HP ProLiant DL380 G2 server with:</p> <ul style="list-style-type: none"> <li>• Two-way 1.4 GHz Pentium III processor</li> <li>• 512 KB L2 cache</li> <li>• 2304 MB RAM</li> <li>• Two hot plug 36.4 GB 15,000 rpm Ultra3 SCSI hard drives</li> <li>• Integrated Smart Array 5i controller with RAID 0</li> <li>• NC3163 10/100 Fast Ethernet NIC</li> </ul> <p>Microsoft Windows 2000 Advanced Server</p>
Client	<p>Variety of Pentium-based 600 MHz – 2.533 GHz Compaq Evo workstations, each with:</p> <ul style="list-style-type: none"> <li>• At least 128 MB of memory</li> <li>• 640×480/256-color resolution</li> <li>• 100 Mbps NIC</li> </ul> <p>Microsoft Windows 2000 Professional</p>

## System summary

Table 5 summarizes the configuration of the HP SBC server.

**Table 5:** HP SBC server configuration

Component	Description
Operating system	Microsoft Windows Server 2003, Enterprise Edition
Version	5.2.3790 Build 3790
System name	BL35p
System manufacturer	HP
System model	ProLiant BL35p G1
System type	x86-based PC
Processor (each)	x86 Family 15 Model 5 Stepping 10 AuthenticAMD ~2405 MHz
BIOS version/date	HP A03, 2/15/2005
SMBIOS version	2.3
Windows directory	C:\WINDOWS
System directory	C:\WINDOWS\system32
Boot device	\Device\HarddiskVolume1
Locale	United States
Hardware abstraction layer version	5.2.3790.0 (srv03_rtm.030324-2048)
User name	Not available
Time zone	Central Standard Time
Total physical memory	4,096.00 MB
Available physical memory	3.54 GB
Total virtual memory	16.50 GB
Available virtual memory	16.08 GB
Page file space	12.66 GB
Page file	C:\pagefile.sys

## Performance test results

HP tested a two-way HP ProLiant BL35p server blade with 2.4 GHz/1 MB Opteron processors to determine the optimal number of users supported in an HP SBC environment.

This section provides information on the following topics:

- **% Processor Time** – Shows % Processor Time values for a typical test scenario – the Heavy User scenario in this example
- **Canary script response times** – Shows response times for a sample canary script that used Excel charting functions
- **Summary** – Summarizes test results for Heavy, Medium, and Light Users

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### Note:

HP determined that there were no disk, memory, or network bottlenecks in the test environment.

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## % Processor Time

Figure 3 shows % Processor Time values for Heavy Users.

**Figure 3:** % Processor Time values for Heavy Users – showing an optimal level of 123 users

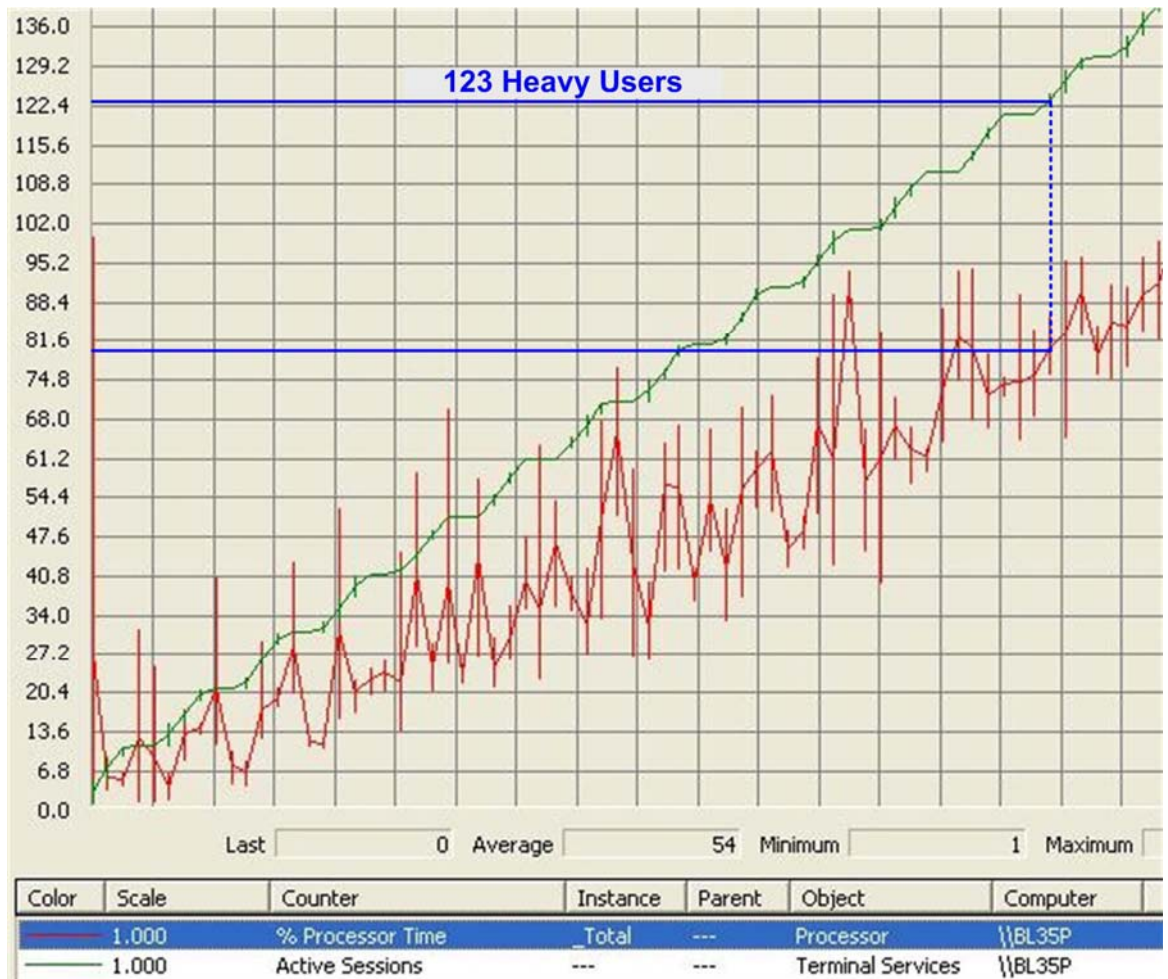


Figure 3 indicates that an HP ProLiant BL35p server blade can support 123 Heavy Users before the % Processor Time value reaches 80%.

## Canary time

Figure 4 shows sample results for an HP ProLiant BL35p server blade running a typical canary script. Individual user response times are shown in blue, with a yellow line depicting average response times.

HP analyzed Figure 4 to determine when response times began to increase markedly and consistently over a baseline level, providing an indication of optimal scalability.

**Figure 4:** Canary time values – showing an optimal level of 141 Heavy Users

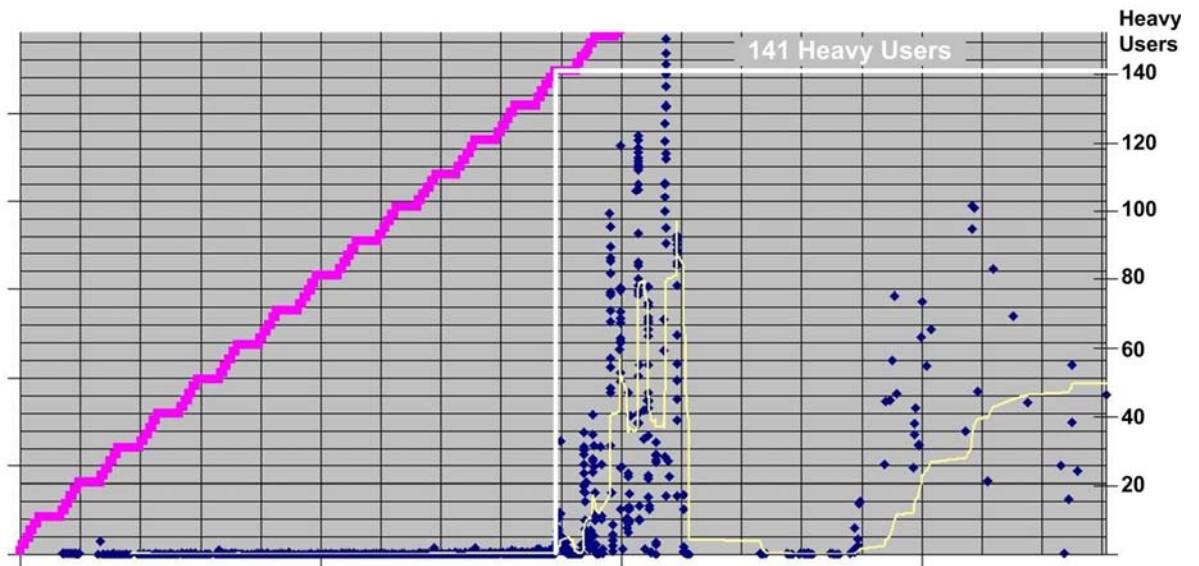
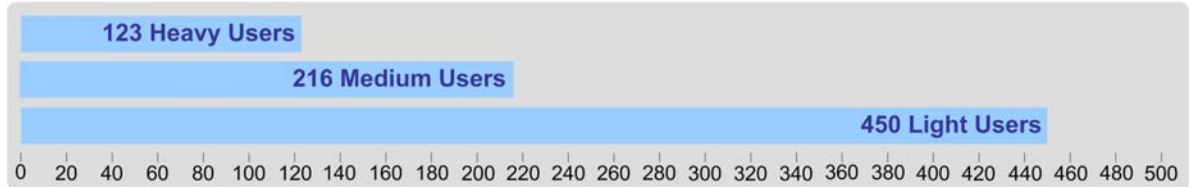


Figure 4 indicates that an HP ProLiant BL35p server blade can support 141 Heavy Users before response times start to increase significantly, validating the value of 123 Heavy Users derived using % Processor Time.

## Results summary

Figure 5 summarizes the optimal numbers of users supported by an HP ProLiant BL35p server blade (based on % Processor Time values).

**Figure 5:** Optimal numbers of users supported



### IMPORTANT:

As with any laboratory benchmark, the performance metrics quoted in this performance brief are idealized. In a production environment these metrics may be impacted by a variety of factors. For more information, refer to [Appendix B – SBC solution sizing](#).

## Summary

To characterize the performance of the HP ProLiant BL35p server blade, HP selected a metric that relates directly to the user experience – the number of Heavy Users that can be supported before response times start to become unacceptable. Test results show that a two-way HP ProLiant BL35p server blade with Opteron 2.4 GHz/1 MB processors can support 123 Heavy Users, making this system ideal for an enterprise HP SBC environment.

Customers can take advantage of test environments like the one described in this Performance Brief – and solve many other business problems – at over 80 strategically-located HP Solution Centers.



## Appendix A – AMD Opteron processors

The AMD Opteron processors deployed in the latest HP ProLiant servers help advance the future of industry-standard servers. Key benefits include:

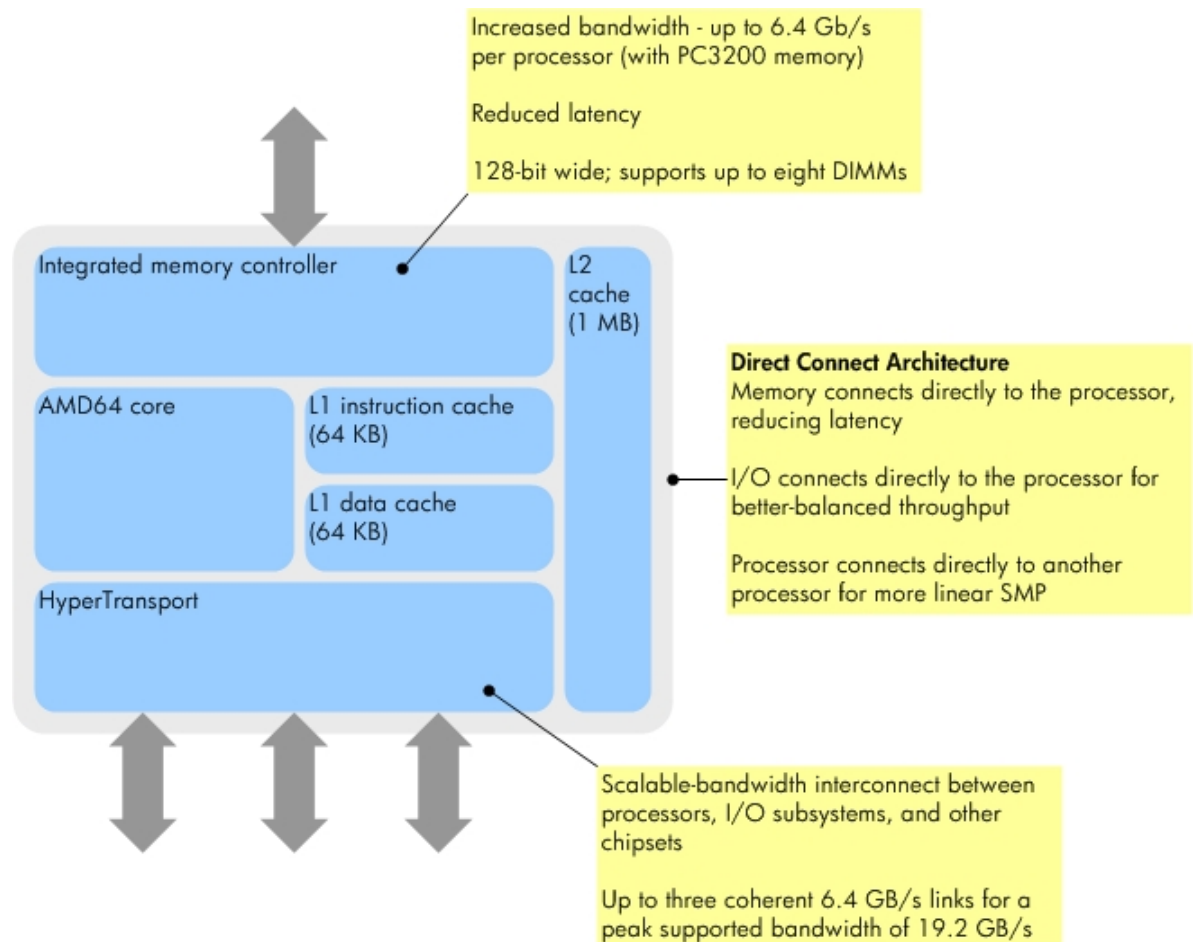
- Improving the performance of existing 32-bit applications
- Supporting 64-bit addressing – breaking the 4 GB limit inherent in earlier x86 processor implementations

By supporting simultaneous 32- and 64-bit processing, the Opteron processor provides a bridge to full 64-bit computing.

### Features

Figure A-1 illustrates key features of the Opteron architecture

**Figure A-1:** Key features of the Opteron architecture



## Benefits

Table A-1 outlines key benefits of the Opteron processor.

**Table A-1:** Key benefits of the Opteron processor

Feature	Benefit
Simultaneous 32- and 64-bit computing capabilities	Users can run 32-bit and/or 64-bit applications and operating systems – without sacrificing performance.
Direct Connect Architecture helps reduce performance bottlenecks	Direct Connect Architecture can reduce memory latency, provide better balance for throughput, and support more linear symmetrical multiprocessing.
Support for up to three coherent HyperTransport links, providing up to 19.2 GB/s peak bandwidth per processor	HyperTransport links provide substantial I/O bandwidth for current and future application needs.
256 Terabytes (TB) of memory address space	More memory space creates a significant performance benefit for applications where large datasets – or a large number of datasets – are stored in memory.
Scales from one-way to eight-way	The scalability of the processor helps maximize flexibility in the IT infrastructure.
Integrated memory controller reduces latencies during memory access	Reduced memory latency translates to increased performance and productivity.
Low-power processor models are available <ul style="list-style-type: none"><li>• HE – 55 W</li><li>• EE – 30 W</li></ul>	Low-power processor models can increase server density and reduce the Total Cost of Ownership (TCO) for data centers with limited power budgets. For example, more servers can be supported at a data center with utility power constraints.

## Breaking the 4 GB address limit

Opteron processors take advantage of the 64-bit addressing capabilities of Windows Server 2003 to break the 4 GB direct-addressing limit inherent in earlier x86 implementations.

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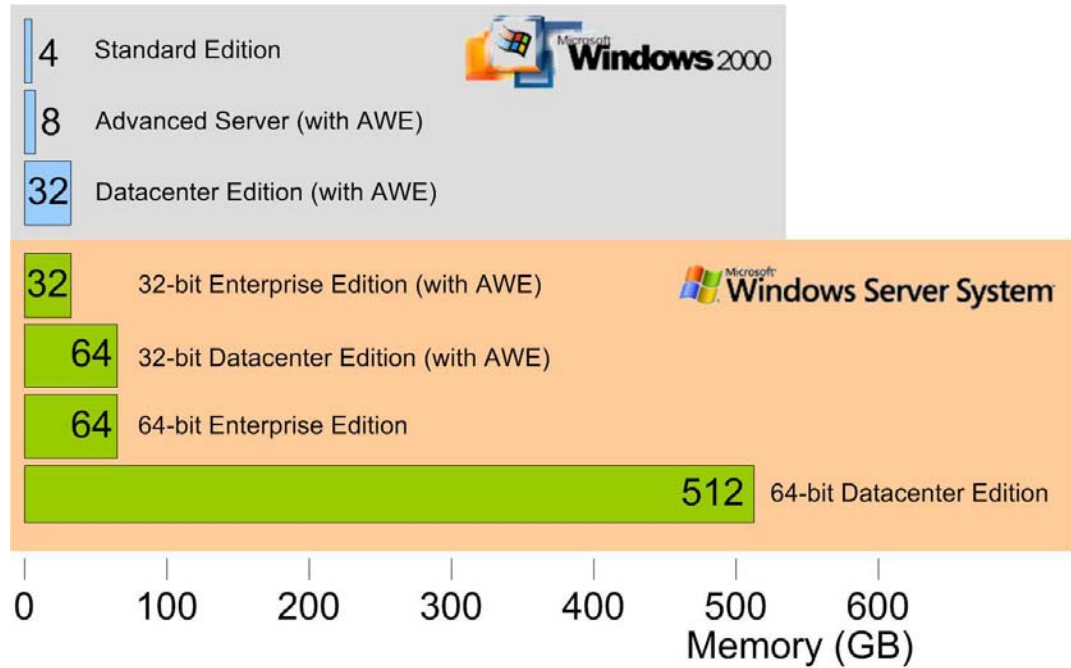
### Note:

Windows Server 2003 for 64-Bit Extended Systems is required to extend memory space for x86 processors featuring 64-bit extension technologies. Information on the release of this operating system is available on the [Microsoft website](#).

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Figure A-2 shows the approximate amount of directly-addressable memory available with various Windows operating systems.

**Figure A-2:** Memory limits with Windows operating systems



While 32-bit Windows operating systems can address a maximum of 4 GB directly, memory space can be extended with certain operating systems through the use of Address Windowing Extensions (AWE).

Windows Server 2003 introduced 64-bit addressing, shattering the earlier 4 GB direct-addressing limitation. Windows Server 2003 Datacenter Edition can address 512 GB directly – and up to 256 TB indirectly.

## Appendix B – SBC solution sizing

As with any laboratory benchmark, the performance metrics quoted in this Performance Brief are idealized. In a production environment, these metrics may be impacted by a variety of factors, including the following:

- **Overhead**  
Agents and services (virus scanning, backup and restore, provisioning, security, management and more) automatically consume overhead. Rogue applications can consume additional overhead. The system architect may wish to provide a 25% – 30% buffer to accommodate this overhead.
- **Future growth**  
To accommodate future growth, the system architect may wish to provide an additional buffer. Alternatively, servers can be added as needed, taking advantage of the server farm's inherent ability to scale out.
- **User profiles**  
The particular application in use directly impacts the number of users supported by a particular server. Further, user behavior can also impact scalability:
  - Increased typing rates correspond to fewer users.
  - Opening and closing applications (rather than switching between them) or moving quickly between tasks can place a heavier load on the server.
  - For accurate sizing, system architects must closely match their user profiles with the Heavy, Medium, and Light User [profiles](#) used by HP during performance testing. If the profiles do not match, more are available using the online sizer tool (described below); alternatively, the system architect can consult [HP Services](#) for more information.
- **Background grammar checking**  
Background grammar checking can significantly impact scalability, reducing the number of users supported by as much as 50%. HP disabled background grammar checking for the testing described in this Performance Brief.

### Online sizer tool

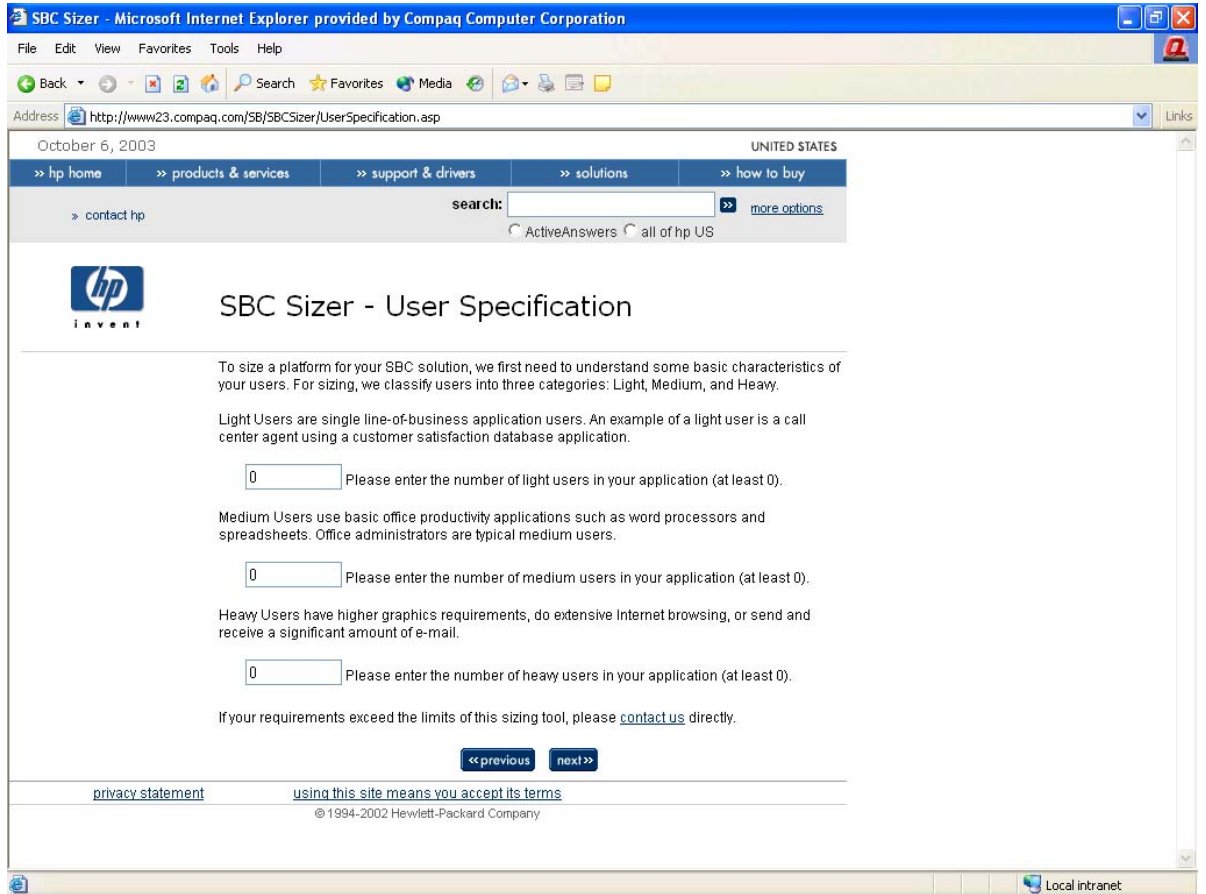
To minimize risk, HP offers automated, online tools that can help the customer size an HP SBC solution. The algorithms and methodology used by the sizer are based on the results of customer surveys and thorough testing.

Sizers are available for the following HP SBC environments:

- [Enterprise](#)
- [Small and Medium Business \(SMB\)](#)

Figure B-1 shows a typical HP SBC sizer screen.

**Figure B-1:** The HP SBC sizer's **User Specification** dialog



Based on information provided by the customer, a sizer can provide a quick, consistent mechanism for identifying the “best-fit” server for a particular HP SBC environment and generate a Bill of Materials (BOM) for that server.

The algorithms and methodology used by the sizers are based on the results of customer surveys and thorough testing.

## For more information

HP ProLiant BL35p server blade	<a href="http://h18004.www1.hp.com/products/servers/proliant-bl/p-class/35p/index.html">http://h18004.www1.hp.com/products/servers/proliant-bl/p-class/35p/index.html</a>
HP ProLiant Essentials Rapid Deployment Pack (RDP)	<a href="http://h18013.www1.hp.com/products/servers/management/rdp/index.html">http://h18013.www1.hp.com/products/servers/management/rdp/index.html</a>
HP SBC online sizer tool for enterprise environments	<a href="http://h71019.www7.hp.com/ActiveAnswers/Render/1,1027,2858-6-100-225-1,00.htm">http://h71019.www7.hp.com/ActiveAnswers/Render/1,1027,2858-6-100-225-1,00.htm</a>
HP SBC online sizer tool for Small and Medium Business (SMB) environments	<a href="http://h71019.www7.hp.com/ActiveAnswers/Render/1,1027,6645-6-100-225-1,00.htm">http://h71019.www7.hp.com/ActiveAnswers/Render/1,1027,6645-6-100-225-1,00.htm</a>
HP Services	<a href="http://www.hp.com/hps/">http://www.hp.com/hps/</a>
HP Solution Centers	<a href="http://www.hp.com/products1/solutioncenters/index.html">http://www.hp.com/products1/solutioncenters/index.html</a>
Microsoft Windows Server 2003	<a href="http://www.microsoft.com/windowsserver2003/evaluation/overview/family.mspix">http://www.microsoft.com/windowsserver2003/evaluation/overview/family.mspix</a>
Overview of Windows Server 2003 Terminal Server	<a href="http://www.microsoft.com/windowsserver2003/techinfo/overview/termserv.mspix">http://www.microsoft.com/windowsserver2003/techinfo/overview/termserv.mspix</a>
Citrix MetaFrame Presentation Server 3.0	<a href="http://www.citrix.com/site/PS/products/feature.asp?familyID=19&amp;productID=186&amp;featureID=4110">http://www.citrix.com/site/PS/products/feature.asp?familyID=19&amp;productID=186&amp;featureID=4110</a>
AMD Opteron processors	<a href="http://www.amd.com/us-en/Processors/ProductInformation/0,,30_118_8796,00.html">http://www.amd.com/us-en/Processors/ProductInformation/0,,30_118_8796,00.html</a>

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