Intel® L440GX+ DP Server Board Performance Brief

ServerBench* and WebBench*

550 MHz/512KB Intel® Pentium® III processor

Revision 1.0
July 1999

intel

Revision History		
Date	**Rev**	**Modifications**
6/17/99	0.5	Preliminary
7/8/99	0.9	Preliminary Reviewed and edited
7/13/99	1.0	1st Release

Table of Contents

1. INTRODUCTION

1.1 Scope

The information contained in this performance brief is intended to assist in characterizing the application, performance features, and price of the L440GX+ DP Server board when compared to various other system designs. The L440GX+ DP Server architecture features dual Intel® Pentium® III processors with a 100MHz front side bus. This entry-level server offers traditionally high-end reliability, availability, serviceability, usability, and manageability (RASUM) features at an affordable price range.

This performance brief includes results from the following benchmarks: ServerBench*and WebBench*. The configurations used for these benchmarks were designed to put maximum stress on the system and achieve reasonable performance results. These results are referred to as baseline numbers. These baseline numbers represent results that should be duplicated when using the configuration identified in the specific benchmark. No special modifications were made to any BIOS, software, or hardware in order to achieve these baseline numbers.

Benchmark tests are generally updated from time to time with different configurations of hardware and software in an effort to achieve a “true benchmark” status. Therefore, this performance brief may be updated periodically with new data for additional hardware and software configurations. Additionally, the versions of the benchmarks may have been updated since testing was conducted and reported in this document.

1.2 The True Benchmark

The phrase "true benchmark" is a misnomer. Numerous committees, forums, individuals and companies have allocated vast resources attempting to develop a "true benchmark" for computer systems. While no benchmark has completely achieved the desired result, these efforts have not been completely in vain. Many different methods, techniques and approaches for benchmarking have been developed. Choosing an appropriate server depends on the desired performance level and monetary investment. Buying higher performance does not always guarantee a faster system. For this reason, buyers must understand and characterize the applications being measured. The task is to select the benchmarks that test and simulate the desired computing environment in which the server will eventually be placed.

Many of the more popular benchmarks are associated with workstations. Workstations and servers have a completely different set of requirements. Blindly using workstation benchmarks to determine purchases of servers may result in dissatisfaction as the purchase will not necessarily be based upon appropriate information. In general, quality server benchmarks are based on the use of workloads related to the specific elements and subsystems of the server. These elements, which may include the processor, cache, memory, I/O subsystem bandwidth, disk subsystem, and the network operating system, are stressed by the benchmark routines and thus provide a more appropriate means of evaluation for the prospective server purchaser. Furthermore, while many of the market-driven factors (e.g. high performance, low cost, and standard components) which have affected purchases of PC desktops and workstation products, apply to the server market segment, additional criteria including reliability, availability, serviceability and scalability, usability, manageability (RASUM), must be considered when evaluating server products.

1.3 L440GX+ DP Server Features

The L440GX+ DP Server board is a high integration entry-level Pentium III processor-based server that provides a low-cost entry-level path to the performance premium of the Pentium III processor with 100MHz System Bus.

Features	Benefits
Supports dual Intel Pentium II or Pentium III processors at 350 MHz and beyond with 512 Kbytes of ECC L2 cache	Build entry-level servers with plenty of headroom for growth
100 MHz Front Side Bus	Higher system bandwidth, highest performance in the marketplace today, using Pentium III processors at 450MHz and beyond
Advanced Intel 82440GX AGPset	Support for the latest Intel Pentium III processors, memory, and drive technologies
Advanced Emergency Management Port (EMP)	Remote management lowers cost of ownership
Integrated dual-channel SCSI, LAN, and graphics (with 2 MB SGRAM)	Intel validated and tested SCSI, LAN, and graphics support saves integration time and money.
DIMM sockets support 2 GB SDRAM ECC memory	Greater memory expandability and reliability
Seven full-length slots: Four -33 MHz 32-bit PCI, Two- 66 MHz 32-bit PCI, One -ISA	On-board integration yields more available slots for greater configuration flexibility
Intel Server Control (ISC) Server Manager software	Built-in server management features for lower cost of ownership.
Modified server AT form factor	Easy, low-cost integration into ATX compatible chassis

The primary IO for the L440GX+ DP Server Board utilizes two separate PCI peer busses. The primary bus is a 33MHz 32 bit PCI bus that can support up to 10 devices providing up to 133MB/sec throughput. The second PCI peer bus is provided by coupling the AGP port of the 440GX chipset with a high speed AGP-PCI bridge giving the server board a separate 66MHz 32 bit PCI bus supporting two PCI slots. Combining the highest possible throughput for both PCI busses results in a total maximum PCI throughput of near 400 MB/sec.

The L440GX+ has 2 separate and independent SCSI channels. Channel A is an Ultra-2 SCSI channel that is capable of supporting transfer rates of up to 80 MB/sec. Channel B is an Ultra Wide SCSI channel that is capable of supporting transfer rates of up to 40 MB/sec. The L440GX+ has on board support for a low cost 0-channel RAID solution from Adaptec*, the ARO-1130U2 RAID Port III card.

The L440GX+ has an integrated Intel® Pro 100+ PCI network controller. The Pro 100+ supports the following performance features:

- Full duplex support at both 10 and 100 Mbps operation
- IEEE 802.3u Auto-Negotiation support
- 3 Kbyte Transmit FIFO and 3 Kbyte Receive FIFO
- Back-to-back transmission support with minimum interframe spacing
- IEEE 802.3x 100BASE-TX Flow Control support
- TCP/UDP checksum off-load capabilities

1.4 Test Platform Configurations

The following platform and network configurations were used for both ServerBench and WebBench testing. Duplicating these benchmark tests uing these configurations should produce similar results. All products used in the test were shipping versions available to the general public.

Server	
Platform	Intel® L440GX+ DP Server
BIOS	Production Release 6.1
Processor(s)	Intel® Pentium® III 550MHz
L2 cache	512KB
Memory	512 MB
Disks	
	SCSI: Seagate* Barracuda Model ST32272WXc x 3
	IDE: Western Digital* Caviar 32100 (OS installed)
RAID Controller	
	1 AMI* Series 438 MegaRaid ULTRA 2/5, version 1.24 3 controller channels
	Megaraid.sys 8/7/98 4:05PM NT Driver
RAID Drives	15 drives, 5 per channel
Network Adapters	
	1 Intel® EtherExpress® PRO 100+, 2.55 driver
	1 Intel 82559-Based Integrated Fast Ethernet, 2.55 driver
OS	Windows* NT Server 4.0 (SP4)
OS Tuning	Set to maximize throughput for file sharing, rebooted server after every test
Clients	
Machine Type	Micron* Client Pro CS
Processor	1 350MHz Intel® Pentium® II
L2 Cache	512 KB
Memory	64 MB
Network Adapter	1 Intel® EtherExpress® PRO 100+, version 2.55 driver
OS	Windows* NT Workstation 4.0 (SP4)
Network	
Media	Switched Fast Ethernet half-duplex
Switches	2 48 port Extreme Summit48 switches (Layer 2 mode)
Segments	2 30 client network segments
Controller	
Machine Type	IBM* PC Server 325
Processor	2 200Mhz Intel Pentium Pro
L2 Cache	512 KB
Memory	64 MB
Network Adapters	2 Intel EtherExpress PRO 100+, version 2.55 driver
OS	Windows* NT Workstation 4.0 (SP4)

2. Performance Test Results and Analyses

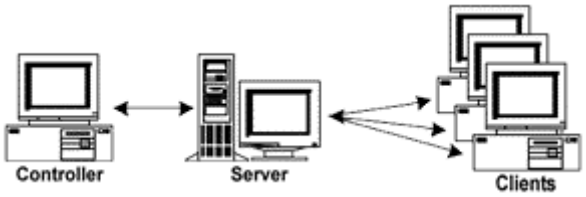
2.1 ServerBench* 4.02 Test Suite; Benchmark Description

ServerBench is a Ziff-Davis* benchmark that lets you measure the performance of a server in a client/server environment. ServerBench can be executed on: SCO UNIX*, SCO UnixWare*, IBM OS/2*, Novell NetWare*, or Microsoft Windows* NT. The clients can be running either Windows* 95 or Windows NT. The Intel Software Performance Lab (iSPL) chose to execute this application server benchmark suite with the Microsoft Windows NT 4.0 version. More information can be obtained on these and other Ziff-Davis benchmarks on the World Wide Web at [http://www.zdnet.com/zdbop/]

ServerBench produces numerous results. One of its primary results is an overall ServerBench score for a server. ServerBench's test setup is similar to an application server environment. In this environment, data and applications exist on the server. The client desktop systems are primarily a front-end to provide an access point into the applications. ServerBench lets the tester determine the exact blend of requests the clients make of the servers. Tests can involve requests that hit only a single server subsystem, such as the disk subsystem, or a mixture of all three subsystems and varying numbers of clients. ServerBench reports the test results as ServerBench transactions per second (TPS). It combines the TPS scores for different transactions using a weighted harmonic mean.

ServerBench comes in three main parts:

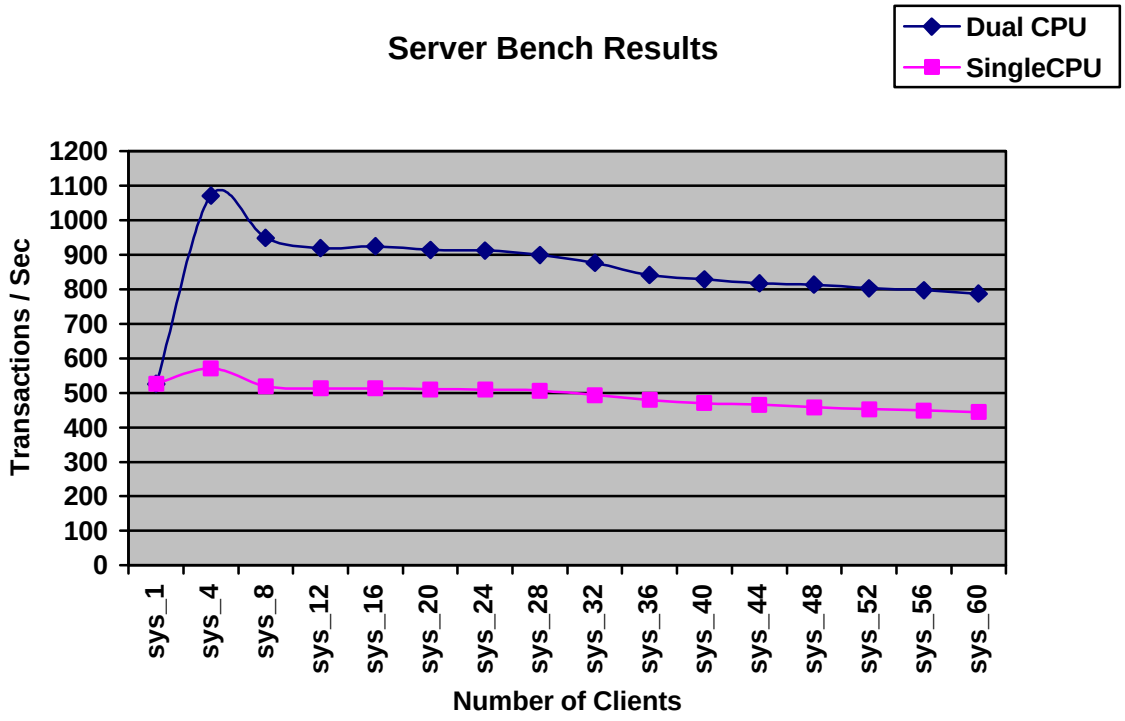
1. **Server Software:** The first part is a specially written piece of software that can stress any or all of the three main subsystems of a server: the processor, disk, and network. Instead of running server-based applications, ServerBench uses its own programs to exercise a server. The processor test behaves much like the processor-intensive portions of typical database servers. The test includes data searches, sorts, and integer arithmetic. During its work each processor test program on the server consumes about 400K of RAM.
2. **Client Software:** The client software lets the clients ask for a mix of processor, disk, and network services. The disk tests can perform random or sequential read or write operations, as well as file appends. ServerBench lets the tester determine such characteristics as the size of the test file each client uses, the size of the chunks in which the test moves data, and the placement of the files on the server's disks.
3. **Controller Software:** Testers control the whole show from a single PC that runs the controller software. The network tests basically read and write data to the server using the client-to-server network connection. Like the disk tests, the network tests let testers determine key test parameters, such as the total amount of data to move over the network and the size of the chunks the data should move.



For benchmark purposes on the L440GX+, Microsoft* Windows NT 4.0 was used as the primary test operating system. ServerBench 4.02 was used running the standard test file, "sys60.tst". No modifications to the standard test suite were made.

2.1.1 ServerBench Results[1], Single and Dual Processor

Overall ServerBench Results Graph Data Measured in Transactions/Sec or TPS		
Mix Name	**Dual CPU - 550 MHz**	**SingleCPU - 550 MHz**
sys_1	525.754	525.967
sys_4	1070.19	571.211
sys_8	948.408	519.239
sys_12	918.923	512.826
sys_16	924.172	513.136
sys_20	914.278	510.396
sys_24	912.877	508.923
sys_28	899.718	505.997
sys_32	876.023	493.296
sys_36	840.655	479.049
sys_40	829.108	469.882
sys_44	817.008	465.793
sys_48	813.473	458.421
sys_52	802.862	452.685
sys_56	797.655	448.816
sys_60	787.645	444.43



[1] Testing was performed without independent verification by ZD. ZD makes no representations or warranties as to the result of the test

2.1.2 ServerBench Results Analysis

ServerBench reports its test results as transactions per second (TPS). It combines the TPS scores for different transactions using a weighted harmonic mean. The results indicate how well the server handles a variety of client/server operations. Higher numbers indicate better performance. The mixes in the standard test suite are the same except for the number of clients running them and the length (in seconds) of each mix. The first mix has one client, the second has four clients, and each mix after that increments the number of clients by four so that the final mix has 60 clients.

The graph in the previous section shows that for single processor configurations the L440GX+ server reaches a peak while processing over 570 transaction/sec. Adding additional clients, up to a maximum of 60, results in the number of transactions/sec slowly diminishing down to a low of 470 transactions/sec. Adding a second processor to the configuration increases the number of transactions processed to a peak at over 1000 transactions/sec.

In the L440GX+ DP server, adding a second processor resulted in an increase of 1.8 times peak throughput as compared to a single processor configuration. With a maximum of 60 clients, a dual processor configuration resulted in a similar increase of 1.8 times the throughput of the single processor configuration.

2.2 WebBench* 2.0 Test Suite; Benchmark Description

Ziff-Davis' WebBench provides a way to measure the performance of Web servers. It uses client PCs to send requests to the server for static files that you place on the server when you install WebBench, or for a combination of static files and dynamic executables that run in order to produce the data the server returns to the client.

When you run WebBench's e-commerce test suites, the clients issue a combination of secure and unsecure requests for static and dynamic data. These clients simulate Web browsers. When the server replies to a client request, the client records information such as how long the server took and how much data it returned and then sends a new request. When the test ends, WebBench calculates two overall server scores; requests per second and throughput in bytes per second.

You can use WebBench:

- To measure the performance of different Web server software packages by running WebBench tests on the different software packages using the same server hardware.
- To gauge how well different hardware systems perform as Web servers by running a single Web software server package and WebBench test on the different hardware systems.

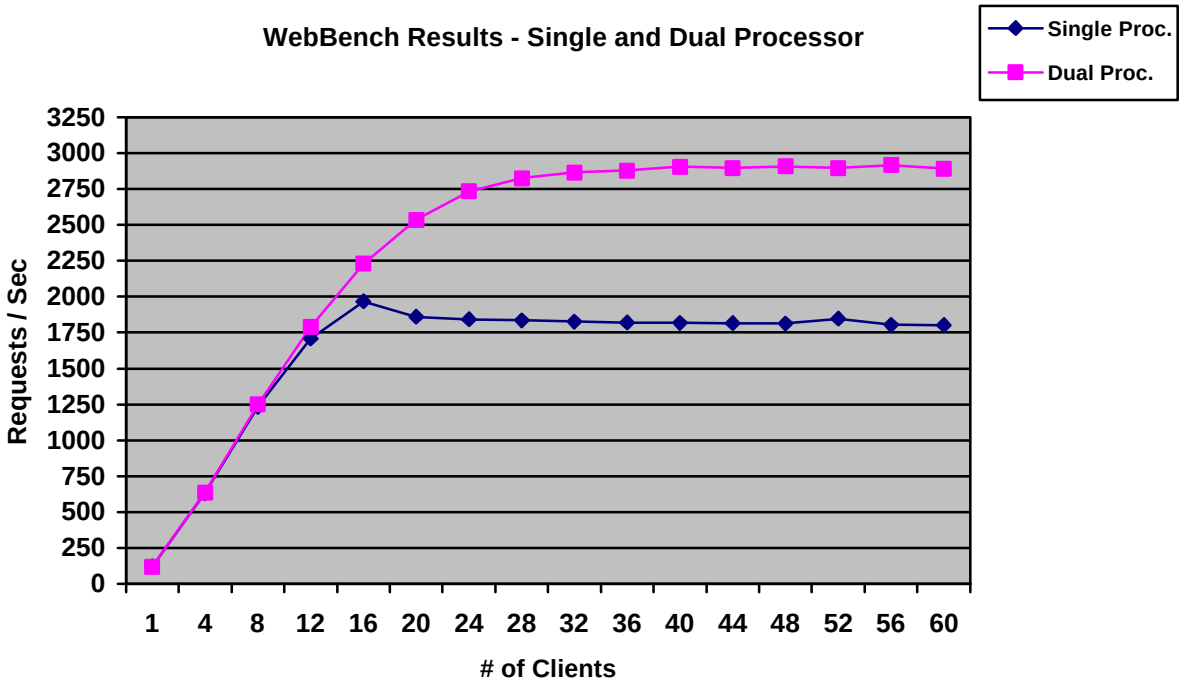
The dynamic test suites access Common Gateway Interface (CGI) executables, Internet Server API (ISAPI) and Netscape Server API (NSAPI) dynamic link libraries, NSAPI shared objects, an IntranetWare local-CGI NetWare Loadable Module (NLM), and a WebStar API plug-in module. Due to the nature of the dynamic executables, these test suites are platform dependent. WebBench provides dynamic test suites using a CGI application for the following server platforms:

Apple's Mac OS 7.53 (or greater)
Mac OS X (Rhapsody)
Digital UNIX with Alpha processors
IBM's OS/2 Warp Server
Linux with x86 processors
Microsoft's Windows NT 3.51/4.0 with x86 processors
Silicon Graphics' IRIX
Sun's Solaris 2.6 on SPARC or Intel processors

For benchmark purposes on the L440GX+, Microsoft* Windows NT 4.0 was used as the primary test operating system. WebBench 2.0 was used running the standard test file, "zd_static_v20.tst". No modifications to the standard test suite were made.

2.2.1 WebBench Results[2], Single and Dual Processor

Overall WebBench Request Graph Data		
# of Clients	Dual – Pentium III 550 MHz	Single – Pentium III 550 MHz
1	118.658	120.013
4	635.977	630.213
8	1248.088	1232.683
12	1789.400	1708.321
16	2230.619	1967.252
20	2535.677	1859.479
24	2735.544	1842.623
28	2826.457	1836.134
32	2865.880	1826.823
36	2880.009	1820.713
40	2907.025	1818.330
44	2897.579	1814.613
48	2908.877	1812.706
52	2896.679	1846.410
56	2917.015	1804.182
60	2892.233	1801.936



[2] Testing was performed without independent verification by ZD. ZD makes no representations or warranties as to the result of the test

2.2.2 WebBench Results Analysis

The WebBench results graph in the previous section shows the number of Requests Per Second the L440GX+ server was able to process for each group of clients ranging from 1 up to 60 in increments of 4. The “Requests / Sec” value shown on the graph is the sum of the requests per second score for each client that participated in that mix. This score represents the rate at which the L440GX+ based Web server serviced requests from all clients during the valid portion of the test. The numbers in the graph are the mean average of 2 test runs for each of Single and Dual processor configurations.

Adding clients increases the total requests per second and throughput scores up to a point of saturation. When the overhead of managing the additional clients outweighs the advantage of having more clients, these two numbers cease to increase. This is the point in the “Results” curve where it starts to flatten out. With WebBench you normally see a rising slope at low client counts followed by a flat line once the server becomes saturated. In the graph we see that in a single processor configuration the server reaches a saturation point with about 16 clients attached. At this point the web server peaks and is servicing over 1900 requests/sec. In a dual processor configuration, the graph shows the Web server reaching its saturation point with about 40 clients and peaks by servicing over 2900 requests/sec.

3. Appendix A - References

The Ziff-Davis Benchmark Operation (ZDBOp), "Understanding and Using ServerBench 4.0"
The Ziff-Davis Benchmark Operation (ZDBOp) URL: http://www.zdnet.com/zdbop/
The Ziff-Davis Benchmark Operation (ZDBOp) URL: http://www.zdnet.com/zdbop/webbench/webbench.html
http://www.intel.com/PROCS/PERF/index.htm