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IBM's x3950 M2 Raises the Bar For Industry-Standard Scalability

Jim Burton, Vice President and Senior Analyst

Recently, IBM previewed its upcoming System x3950 M2 industry-standard server. Based on the Intel "Tigerton" quad-core Xeon processor, the high-end System x3950 M2 will be formally announced at a later date and is scheduled to ship in Q4. This server is IBM's flagship for the System x product line, scaling to four chassis and 64 cores. IBM developed the x3950 for customers who need to run Linux or Windows applications in large, scale-up Xeon environments. Because of its scalability, the x3950 M2 is ideal for large deployments of applications such as Microsoft SQL Server or SAP. IBM is seeing the demand for these large, scale-up servers increase rapidly as customers virtualize and consolidate their datacenters. IBM is also experiencing an acceleration of UNIX customers moving large applications over to industry-standard servers.

For Linux and Windows deployments, the System x3950 competes with the Unisys ES7000, the HP Integrity Superdome, the HP Integrity rx8640, the HP ProLiant DL580 G5, the Sun Fire X4600, the Dell PowerEdge 6850, and the Dell PowerEdge 6950. While all of these servers are System x3950 competitors, only three – the Superdome, the rx8640, and the ES7000 – can truly compete on scalability. The other servers are four- or eight-socket servers that are constrained to a single chassis. As other vendors begin to incorporate quad-core Xeon and Opteron proces-

sors into their servers, more servers may join this group of competitors.

IBM is one of the few vendors that engineers the chipset and motherboards for Xeon servers. Such engineering allows IBM to incorporate features and innovations into the System x3950 M2 that other vendors who use the standard Intel components cannot match. As a result, the System x3950 M2 features some very interesting capabilities, especially in the memory area. IBM also created a very "green" server by minimizing the power consumption of the memory and incorporating very efficient (90%) power supplies. These features make the System x3950 M2 a strong competitor in the high-end x86/x64 server market compared to servers from vendors who choose not to innovate.

IBM X4 Architecture

At the heart of the new System x3950 is IBM's X4 Architecture. This is the fourth generation of IBM's X-Architecture chipset, which was originally developed in 2001 to enable Netfinity servers to scale up. The first Enterprise X-Architecture servers supported Intel's Xeon MP "Foster" processor and leveraged NumaQ technology (which IBM obtained through the acquisition of Sequent in 1999) to allow multiple boxes to be configured into a single global memory server of 16 processors. IBM calls this capability XpandOnDemand.

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[IBM's x3950 M2 . . . continued from page 1]

The goal of X-Architecture is fourfold – to bring high availability to industry-standard computing, to lower the cost of enterprise computing, to make IBM a performance leader in industry-standard computing, and finally to make servers easier to deploy and use. All of IBM's investments in the System x servers support these goals. IBM also draws technology from its other product lines, such as System p, System z, and IBM Storage solutions, to continually bring new technology into the System x servers.

With this generation of the x3950, a single 4U chassis features the improved X4

“Hurricane 4.1” chipset with a 1066 MHz front-side bus. Each chassis supports up to four quad-core Intel Series 7300 “Tigerton” processors and 32 DDR2 memory slots. Up to four 2.5 inch hot-swap SAS hard disk drives can be configured. Rounding out the package is seven PCI Express x8 half-length slots. Using the X4 ScaleXpander option, up to four chassis can be linked together via IBM's NUMA technology to form a single, large server. Once fully configured, the System x3950 M2 is able to pack 64 cores into a 16U package. The X4 Architecture can actually support up to eight chassis, but operating system support tops out at 64 threads. In the Intel Xeon

space, only Unisys can rival that level of scalability.

Unique Memory Advantages

One of the unique capabilities of this generation x3950 M2 is the use of DDR2 registered DIMM technology. The standard Intel Clarksboro 7300 chipset, which is part of the Caneland platform, moved from DDR2 to fully buffered (FB) DIMMs. For the X4 Architecture, however, IBM chose to stay with DDR2 technology. A special SMI chip in the IBM chipset acts as an Advanced Buffer eXecution (ABX) chip, performing many of the same functions as the buffers

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INSIDE IDEAS

IDEAS Launches Online Research Store

Recently, IDEAS made a small sampling of research available for purchase through an online research store. The new store enables prospective buyers to benefit from selected research papers without committing to a full IDEAS Research and Advisory subscription. Featuring an introductory price range of \$95 to \$295 USD per report, the online store is an ideal solution for IT users looking to supplement their internal market research with an outside analyst perspective. The featured reports offer insight into several key technology issues, including virtualization, blade servers, enterprise storage, and software pricing and licensing. Armed with a credit card or Pay Pal account, users can quickly browse, buy, and receive research online without the need to submit a purchase order or consult an IDEAS salesperson.

The screenshot shows the IDEAS International Research Store homepage. At the top, there is a navigation bar with a 'VIEW CART' button. Below the header, a welcome message provides contact information: 'Welcome to the Ideas International research store. Click the links below to browse by category. If you need further assistance, please e-mail cust_service@ideasinternational.com or call +1 914 937 4302 in the Americas, +612 9472 7777 in Asia/Pacific, or +44 (0) 1235 462 890 in EMEA.' Navigation links for 'Servers', 'Storage', and 'System Software' are visible. The main content area is divided into two sections: 'Servers' and 'Storage'. Under 'Servers', there are two featured reports: 'Blade Servers Reach Maturity' by Jim Burton for \$295 USD (14 pages) and 'Dell Outlines Plan for Resurgence' by Tony Iams for \$95 USD (3 pages). Under 'Storage', there are two featured reports: 'Changing Metrics in Enterprise Software Pricing and Licensing' by John Young for \$295 USD (10 pages) and 'Primary Drivers of Storage Technology' by Sal Capizzi for \$195 USD (8 pages). Each report listing includes a 'More Info / Terms of Use' link and an 'ADD TO CART' button. On the right side of the page, there is a 'FEATURED RESEARCH' section for 'User Perceptions on Virtualization and Systems Management' by Tony Iams (10 pages, \$295 USD) with a 'BUY NOW' button. Below this is a 'NEED HELP?' section with a 'CONTACT IDEAS NOW' button and a 'FREE NEWSLETTER' section with a 'GET NEWSLETTER' button.

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<http://www.ideasinternational.com/store/>. IDEAS plans to update the store with new reports as they become available. ■

The System x3950 is an impressive server that lives up to IBM's claims and provides a much needed path for industry-standard server users who need to scale up.

[IBM's x3950 M2 . . . continued from page 2]

located on FB-DIMMs. The result is IBM achieves similar functionality to FB-DIMMs using less expensive DDR2 DIMMs. In addition, each FB-DIMM draws an average of 11 watts while each DDR2 DIMM draws only 5 to 9 watts, according to IBM. That delta results in 25 to 30% less memory power consumption for the IBM server running at idle compared to servers that use FB-DIMMs and the Clarksboro 7300 chipset; however, the consumption delta narrows to more like 10% as the memory becomes fully utilized. Combined with IBM's use of 90% efficient power supplies, IBM feels the x3950 M2 is a much "greener" alternative to servers that use the Intel chipset.

Up to 32 DIMM slots are available on each system board. With 4 GB DIMMs becoming more common and 8 GB DIMMs scheduled to arrive by year's end, the memory capacity of the x3950 M2 could be boosted to 256 GB per chassis or 16 GB per core using the 8 GB DIMMs. By supporting a large number of memory slots, IBM customers can utilize smaller, cheaper DIMMs in the x3950 M2 to achieve the same amount of memory. More importantly, most of these servers will likely be virtualized and memory is often a serious bottleneck to virtualization. By supporting more memory, the x3950 M2 will be a strong choice for virtualization.

A final memory advantage for IBM is Memory ProteXion™. The Clarksboro chipset can correct single-bit errors and detect double-bit errors. It also includes

Intel's x4 and x8 Single Device Data Correction (SDDC), which provides error detection and correction for one to eight data bits within a single device. IBM's Memory ProteXion, also known as redundant bit steering, allows the memory controller to reroute data around a failed chip on a DIMM through the spare bits. The server continues to function smoothly and does not alert the administrator until a second DIMM fails (at which time IBM's Predictive Failure Analysis turns on the Light-Path Diagnostics). Memory ProteXion effectively doubles the error correction capabilities of Chipkill. As server memory grows ever larger, memory failures will become more common. IBM has found a way to keep the x3950 M2 up and running through many of those failures.

Embedded Hypervisor

In this generation of the x3950, IBM has embedded the low-profile VMware ESX 3i hypervisor, allowing the server to boot as a virtualized platform. Including a hypervisor appears to be a growing trend in today's server market. In the case of the x3950 M2, a 4 GB USB device with embedded ESX 3i virtualization software is plugged into an internal USB port on the motherboard, allowing users to quickly and easily install virtualization without reaching out to hard drives, CD-ROMs, or network connections. The rationale for this approach is to make virtualization installation much easier for first time users; it also opens the way for other vendors to add value on top of the base virtualization. IBM is also planning to

pre-install I/O virtualization at some time in the future.

Scalability

For connecting multiple chassis, IBM has three generations of experience to draw upon. When it purchased Sequent in 1999, IBM obtained NumaQ technology, which enabled multiple servers to be connected together into a single, large server. With the third generation of the x3950 servers, IBM introduced a technology taken from its System z group. The Virtual XceL4v Dynamic Server Cache, or "XceL4v cache," replaced the previous generation's large L4 cache (implemented with actual cache memory chips) with a dynamically resizable virtual cache carved from main memory. Additionally, IBM refined a technique called "snoop bus filtering." With snoop bus filtering, the system can see what is in the other caches without having to send traffic across the front-side bus by using an embedded DRAM chip to store a processor cache directory. Snoop bus filtering helps to minimize front-side bus congestion and reduce system latencies, resulting in improved performance. IBM has further refined these technologies and continues to use them on the fourth generation of these servers. The x3950 M2 scales very well as a result.

Serviceability Improvements

IBM continues its focus on serviceability with this generation of the x3950. Many features are carried over from prior generations and new capabilities have been

[Continued on page 6]

Deja Vu: HP ProLiant ML350 G5 Sets a New TPC-C Price/Performance Record

HP has narrowly broken its own TPC-C price/performance record with this latest benchmark result for the ML350 G5 server. The configuration used in this test closely resembles the one used to capture the price/performance record back in August, the primary difference being the software suite used. For this latest test, Oracle Database 11g Standard was run on Windows 2003 Standard while the August result utilized Oracle Database 10g Standard on Oracle Enterprise Linux.

New vs. Old

This is the third TPC-C benchmark result for the ML350 G5 system and the second to feature the Xeon X5355 processor chip. Table 1 (below) compares these three results, which all feature quad-core processors. As shown in the table, this latest result configured with the most recent release of the Oracle database and MS Windows Server surpasses both the performance and price/performance of the August result by the barest of margins.

Table 1. HP ProLiant ML350 G5 TPC-C Results Compared

Date	Configuration	tpmC	\$/tpmC	DB	OS	Total Cost
Sep 07	1 x 2.66 GHz Xeon X5355	102,454	\$0.73	1	1	\$74,556 NEW
Aug 07	1 x 2.66 GHz Xeon X5355	100,926	\$0.74	2	2	\$74,368
Mar 07	1 x 1.86 GHz Xeon E5320	82,774	\$0.94	3	3	\$77,172

Database Key:

- 1 - Oracle Database 11g Standard Edition One
- 2 - Oracle Database 10g Standard Edition One
- 3 - Microsoft SQL Server 2005 Standard x64 Edition SP1

Operating System Key:

- 1 - Microsoft Windows Server 2003 R2 Standard x64 Edition SP1
- 2 - Oracle Enterprise Linux
- 3 - Microsoft Windows Server 2003 Standard x64 Edition SP1

TPC-C Price/Performance Top Ten

As stated hitherto this new result now claims the top rank in the TPC-C price/performance top ten, supplanting a previous result by the same system. The ProLiant ML350 G5 now holds three positions in the TPC-C Overall Price/Performance Top Ten table (below), including the top two. ■

Table 2. TPC-C Overall Price/Performance Top Ten

Rank	Company	Configuration	tpmC	\$/tpmC	Database
1	HP	ProLiant ML350 G5 (1ch / 4co)	102,454.00	\$0.73	1 NEW
2	HP	ProLiant ML350 G5 (1ch / 4co)	100,926.00	\$0.74	2
3	Dell	PowerEdge 2900 (1ch / 4co)	69,564.00	\$0.91	3
4	HP	ProLiant ML350 G5 (1ch / 4co)	82,774.00	\$0.94	3
5	Dell	PowerEdge 2900 (1ch / 2co)	65,833.00	\$0.98	3
6	Dell	PowerEdge 2800 (1ch / 2co)	38,622.00	\$0.99	3
7	Dell	PowerEdge 2800 (1ch / 1co)	28,244.00	\$1.29	4
8	Dell	PowerEdge 2900 (1ch / 4co)	126,371.00	\$1.33	3
9	Dell	PowerEdge 2800 (1ch / 1co)	28,122.00	\$1.40	5
10	Dell	PowerEdge 2850 (1ch / 1co)	26,410.00	\$1.53	5

RESULT SUMMARY*

Date:	September 12, 2007
TPC-C:	ProLiant ML350 G5
Company:	HP
tpmC:	102,454.00
\$/tpmC:	\$0.73
Database:	Oracle Databases 11g Standard Edition One
Operating System:	Microsoft Windows 2003 R2 Standard x64 Edition SP1
Availability Date:	December 31, 2007
DB Server Config:	ProLiant ML350 G5 (1 x 2.66 GHz Xeon X5355 processor [1ch, 4co] with 2 x 4 MB L2 cache, 24 GB memory)
Client Config:	2 x ProLiant ML110 G4 (each with 1 x 2.8 GHz Pentium D 915 processor with 2 x 2 MB L2 cache)
Cost of Ownership:	\$74,556
Total Storage:	3,960.60 GB
Benchmark Rev:	5.9
*All prices in USD.	

Database Key for Table 2:

- 1 - Oracle Database 11g Standard Edition One
- 2 - Oracle Database 10g Standard Edition One
- 3 - Microsoft SQL Server 2005 Standard Edition
- 4 - Microsoft SQL Server 2005 Workgroup Edition
- 5 - Microsoft SQL Server 2000 Standard Edition

“The sense at VMworld was that an entire industry is **emerging** that is retooled around virtual **infrastructure**.”

From “Users Committed to Virtualization Offered Broad Array of Solutions at VMworld”
 Tony Iams | September 14, 2007
<http://ideasint.blogs.com/ideasinsights/2007/09/users-committed.html>



“Virtualization is not a product per se, but actually a means to an end. Virtualization simplifies other tasks.”

From “Storage Is a Key Aspect of Server Virtualization”
 Sal Capizzi | September 13, 2007
<http://ideasint.blogs.com/ideasinsights/2007/09/storage-is-a-ke.html>



“Another benefit is that Sun is able to get Solaris into the hands of **millions** of potential customers.”

From “Sun’s Crisper Positioning of Solaris and OpenSolaris”
 Jim Burton | September 7, 2007
<http://ideasint.blogs.com/ideasinsights/2007/09/suns-crisper-po.html>



“Rather than relegating storage managers to manage only **storage**, sever managers to manage only **servers**, and network managers to manage only **networks**, Fujitsu provides total autonomous management of the entire infrastructure.”

From “Fujitsu Offers a Solid Storage Virtualization Solution”
 Sal Capizzi | August 21, 2007
<http://ideasint.blogs.com/ideasinsights/2007/08/fujitsu-offers-.html>



[IBM's x3950 M2 . . . continued from page 3]

added. Foremost on the list of existing features is the ability to "call home" to IBM when a problem arises. This capability gives the customer direct access to Level 2 support, along with assistance for Director and system software configuration. The first year of this service is included in the price of the server and subsequent years may be purchased. This generation x3950 features an updated BIOS that allows changes to be replicated throughout the whole server.

Previously, each chassis had to be updated individually. Finally, IBM's PowerExecutive, which allows for direct power monitoring through IBM Director, is now supported on a single node. IBM is working on supporting multiple nodes in the near future.

The IDEAS Bottom Line

IBM has had six years to perfect its scalable industry-standard servers. The current generation System x3950 M2 incorporates all of the lessons learned from previous

generations, plus new technology taken from some of IBM's other product groups, such as the System z. The decision to continue to develop its own chipset and motherboard not only allows IBM to scale beyond the four sockets of the standard Intel products, but also gives IBM advantages in key areas such as memory. The System x3950 is an impressive server that lives up to IBM's claims and provides a much needed path for industry-standard server users who need to scale up. ■



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