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# 64-Bit Apps Are Here

Is it time to make the leap to the next generation of x86 processors?

AT MICROSOFT'S ANNUAL WINDOWS HARDWARE ENGINEERING conference (WinHEC) in April 2005, Bill Gates predicted that 64-bit hardware, operating systems, and software would “transform the way we work and play.” Systems using 64-bit processors would

be mainstream by the end of 2006, he said, and 64-bit computing at the server level would happen more quickly than any other platform changeover in the past.

Certainly, the building blocks for enterprise 64-bit computing on volume processors are falling into place. Today, enterprises have a wide choice of reasonably priced server and desktop hardware based on AMD64 and Intel EM64T architectures.

By adding 64-bit extensions to the existing IA-32 (x86) instruction set,

these systems run most legacy 32-bit operating systems and software with few or no hiccups.

In fact, both AMD and Intel have been upgrading their x86 processor lines so quickly that it's becoming difficult to find any new server or workstation hardware that isn't 64-bit enabled. Undoubtedly, desktops are poised to follow suit.

As of May 2005, users now have a choice between 64-bit versions of Linux, Windows XP Professional, and Windows 2003 Server. The final build-

BY LEON ERLANGER | ILLUSTRATION BY BORIS LYUBNER

ing block, and the one that takes the longest, is software.

“One thing we’ve learned,” says Nick Carr, marketing manager at Linux vendor Red Hat, “is that ISVs don’t like to support any more OSes than they absolutely have to.”

Linux users have a pretty good supply of 64-bit database and other enterprise applications (see table “Vendors Ramp Up for 64-Bits,” page 26), since the 64-bit kernel has been around since AMD’s Opteron launch in April 2003. Windows x64 applications have begun trickling in, with the notable

ating systems and software can address directly rises to 128GB for desktops and 1TB for servers. The theoretical memory-addressing limitations of 64-bit processing are actually on the order of 18 exabytes; the limit for Intel’s 64-bit Itanium chip, for example, is 1,024TB. For most of today’s mainstream desktop and server applications, however, that much memory will probably not make much of a difference.

“In most enterprise environments, file serving, Web serving, and traditional infrastructure applications will have no reason to move to 64-bit for a long time,”

processing) performance of 32-bit and 64-bit Oracle 9i Database Release 2 on a Dell PowerEdge 2850 server running Red Hat Enterprise Linux AS 3. It found that “OLTP performance on the 64-bit configuration was observed to scale 25 percent to 50 percent better for a database cache size of 9GB in both medium and heavy workloads, compared to the 32-bit configuration.”

Scalability in number of simultaneous users is another memory benefit that is particularly important for large Web and e-commerce sites. For example, testing done by Performance Tuning (with sponsorship by Dell and Microsoft) on a quad-processor Dell PowerEdge 6850 found a limit of 1,300 simultaneous connections on Windows 2003 Server x64 running 64-bit Oracle 10g, versus anywhere from 101 to 1,000 for a 32-bit Windows/Oracle configuration, depending on the server’s extended memory configuration.

These scalability benefits were not lost on MySpace, a fast-growing music and social networking Web site running 15 billion transactions a day. “With 1,000 Web servers connecting to our database servers, we were eating up memory so fast that SQL Server was ejecting things from the procedure cache in order to handle all those connections,” says MySpace CTO Aber Whitcomb.

After migrating its connection-intensive databases to 64-bit SQL Server 2005 running on Windows 2003 Server x64, MySpace saw “a huge gain in stability,” says Aber, adding that “we’re benefiting from the space and power savings we’ve been able to realize through hardware consolidation.” MySpace also discovered another use for all that memory addressing capability: its middle-tier caching servers. “We’re now using 16GB RAM on each

## Databases can gain significant performance and scalability advantages by dumping their huge data sets directly into memory.

addition of Microsoft SQL Server 2005 in early November.

So, is it time to make the switch to 64-bit hardware and software? Will you really see great leaps in application performance and stability? Which applications should you focus on first? And what are the issues that are likely to come up in the process? The answer is actually a mixed bag.

### Thanks for the Memory

Memory addressing is one of the primary benefits of 64-bit computing. The maximum memory today’s 32-bit processors, operating systems, and applications can address directly is 4GB. Intel’s 32-bit Xeon provides a work-around called Paging Address Extensions, which ups the limit to 8GB, but it’s a clumsy work-around at best.

With 64-bit EM64T and Opteron chips, the amount of memory that oper-

says Jay Bretzmann, director of IBM’s xSeries high-performance division. If you’re running applications and workloads that need and can benefit directly from such massive amounts of memory, however, you’ll see a definite benefit in performance and scalability.

What applications are those? The obvious ones frequently cited are large database implementations, which can gain significant performance and scalability advantages by dumping their huge data sets directly into memory. Memory can be accessed 10,000 times faster than disk drives, so the more data that can be stored in memory, the better the query response, particularly for query-intensive decision-support systems. In particular, queries that require large data sorts will benefit if the sorting is done in memory.

A 2004 study commissioned by Dell compared OLTP (online transaction

## Microsoft's upcoming Exchange Server 12 will be available only in a 64-bit version, as will Windows Compute Cluster 2003.

cache server" to rocket up its caching performance, Aber says.

All the major database vendors have either released or plan to release 64-bit versions for both Linux and Windows x64, including CA, IBM, MySQL, and Oracle. Microsoft has released a 64-bit version of SQL Server 2005 for Windows only.

### More Benefit Than Meets the Eye

Other, similar applications can also benefit. "We see strong benefits for business intelligence, supply chain management, and ERP applications," says Lorie Wigle, Intel's marketing director for server software and technology. Data warehousing is another category that is frequently cited.

Does that mean we'll see a mass migration to 64-bit databases? "As usual, most enterprise customers will probably take a very cautious approach," says Al Gillen, research director for system software at IDC. "Most won't rush in unless they absolutely have to for performance and scalability reasons, especially if it's a deep software stack on top of the operating system. They'll be too concerned about software incompatibilities." Gillen adds that many will wait for Longhorn to make the 64-bit transition and kill two birds with one stone.

But Insight64 analyst Nathan Brookwood disagrees. "There's always that initial reluctance, but the payoff is humongous, especially if you look at

Oracle and IBM pricing schemes," he says. "If you can run the same workload on a dozen 64-bit processors that takes 50 or 100 processors on a 32-bit machine, you'll be highly motivated."

Another category that can benefit significantly from all that memory is thin client computing using solutions such as Citrix Presentation Server or Microsoft Terminal Services, which require a certain allocation of memory per user. "You can get 170 percent more Terminal Services users on a single server with Windows 2003 Server x64 than you can with 32-bit Windows," says Bob Kelly, general manager of infrastructure server marketing at Microsoft. Citrix similarly estimates the benefit as anywhere from 65 to 300

## 64-Bit Upgrades: A Measured Approach

A GROWING NUMBER OF VOLUME SYSTEMS ON THE MARKET today are incorporating the new 64-bit architectures from AMD and Intel. When you buy new hardware, you're part of the 64-bit revolution almost by default. But you still have a choice to make: Should you flip on those extra 32 bits by running 64-bit versions of your operating systems and applications?

Benchmarks can reveal part of the picture. Pay attention not just to the results but to the system configurations vendors used to run their tests. SPEC (Standard Performance Evaluation Corporation) ranks among our favorite synthetic benchmarks ([infoworld.com/3645](http://infoworld.com/3645)). We used SPEC's query engine to pull up the best results among AMD's tests of Opteron CPUs and found something that may surprise you: Some of AMD's brag-worthy results come from benchmarks run on stock systems loaded with 32-bit Windows.

Why? Because, in addition to 64-bit processing, the new crop of x86 systems brings additional benefits, including dual-core processors, faster buses, and more room in each system for memory. Except in rare circumstances, you'll experience a more noticeable performance increase from doubling up on cores than from adding a second dual-processor server to a cluster. Likewise, AMD's AMD64 and Intel's EM64T architectures up the speed limit on pathways

between CPUs and system memory. The resulting increase in RAM access speed is felt across all application types, without special tuning or architecture-specific software upgrades.

The only real caveat is that wiping out performance bottlenecks could expose I/O bottlenecks. For example, the slower x86 servers you're running now may already perform calculations and access memory fast enough to keep their Ethernet or Fibre Channel interfaces running at top speed. Increasing the number of cores and the speed of RAM will raise the stress on those existing peripherals. If they have no headroom to spare, you won't see improvements in a switch to 64-bit x86 systems because the CPUs will waste time waiting for peripherals to respond to requests.

Beyond the ancillary benefits of new x86 architectures, the biggest gains will come when you switch to true 64-bit software, both OSes and applications. Unfortunately, there's no right course here. Understanding the effort and benefits of going pure 64-bit requires discussions with your software and peripheral suppliers, just as if you were switching from x86 to Sparc or another platform. Costly upgrade license fees may be enough to convince you to wait. The good news is that 64-bit systems perform well enough on older code that you shouldn't feel pressured to leave 32 bits behind just because you see 64 bits everywhere you look.

— Tom Yager

percent more users as 32-bit versions of Presentation Server.

Microsoft and AMD point to another database-centric category: messaging. "Many organizations don't like to run lots of Exchange users on a single server, but if you do, a 64-bit platform makes a lot of sense," says Margaret Lewis, AMD's commercial marketing strategist.

Microsoft's Kelly agrees. "There's a real benefit [to 64-bit computing] in Exchange in terms of being able to consolidate servers and mailboxes. It's also easier to give end-users much larger mailboxes," he says.

In fact, Microsoft is forcing the issue. Its upcoming Exchange Server 12 will be available only in a 64-bit version, as will Windows Compute Cluster 2003.

The other principal benefit to the new generation of 64-bit processors is that they add eight additional general-purpose registers to the x86 design, for a total of 16. All of the general-purpose registers have also been upgraded from a width of 32 bits to 64 bits. In addition, there are also eight new 128-bit registers, called XMM registers.

Again, for applications and tasks that are not register-intensive, this is not particularly relevant. What is? "Anything graphic intensive, such as modeling applications for financial markets and the aeronautics industry," says Red Hat's Carr. Add technical applications, including high-performance design, 3-D animation, mechanical CAD/CAE, 3-D rendering, and high-end digital

video editing to the list. Many of these applications also use large data sets and would benefit significantly from the extra memory addressing.

Digital media management company Agnostic Media has increased media transcoding performance 40 percent following a move to 64-bit Opteron systems. They've also seen a 200 percent performance increase for database transactions after moving from Microsoft SQL Server 2000 to SQL Server 2005, according to CEO Jason Turner.

Similarly, MESoft, another media technology company that offers software and services for the feature film and television broadcast industries, found it was able to encode, encrypt,

## Vendors Ramp Up for 64-Bits Many major software vendors already provide 64-bit versions of key products, and many more are in the works.

	■ Yes □ No	BEA Systems	Citrix Systems	Computer Associates			IBM	Microsoft			
Product		BEA WebLogic Server 9.0	Citrix Presentation Server 4.0	BrightStor SAN Manager	BrightStor Storage Resource Management	eTrust AV	DB2 Universal Database	BizTalk Server	Exchange Server 12	SQL Server 2005	Virtual Server 2005 R2
Product category		Web application server	Application virtualization	SAN management	SRM	Anti-virus	RDBMS	Integration	E-mail	RDBMS	Virtualization
Linux/AMD64		Planned	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Linux/Intel EM64T		Planned	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Windows 2003 Server x64/AMD64		Planned	■	■	■	■	■	Planned	Planned	■	Planned
Windows 2003 Server/Intel EM64T		Planned	■	■	■	<input type="checkbox"/>	■	Planned	Planned	■	Planned
Windows XP Professional x64/AMD64	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	■	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Windows XP Professional x64/Intel EM64T	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Solaris/AMD64	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Solaris/Intel EM64T	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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and compress high definition media almost in real time on the 64-bit Opteron platform. “Previously, it took six hours to compress one hour of video,” says CEO Mark Kapczynski.

### Porting Challenges Remain

As with any platform migration, moving operating systems and applications to 64-bit processors causes organizations to bump up against unforeseen issues. For example, the Performance Tuning/Dell testing previously cited actually found decreased query performance with a 64-bit configuration, which it eventually traced to a flawed Fibre Channel driver. Driver issues will probably be less severe in server environments than with the plethora of dif-

ferent desktop configurations in many enterprises, however, and 64-bit versions of Windows ship with a hefty supply of drivers. Still, migrating to the new platform will not necessarily be as easy as simply ripping and replacing CPUs.

“Thirty-two-bit applications that violate the user kernel space will have trouble running on 64-bit platforms,” says AMD’s Lewis. “AutoCAD has lots of plug-ins that want to address the same memory as the application. If AutoCAD goes 64-bit, all those plug-ins will have to be upgraded as well to function properly.”

“The challenge for writing 64-bit code is to make sure it’s actually taking advantage of all the 64-bit performance benefits,” says MESoft’s

Kapczynski. “You need hard-core programmers that really understand memory management, and you have to keep iterating and testing. It took us three times longer than we expected, but that is the nature of development on a new platform.”

The users we talked to, however, had relatively few problems with their migrations. “We had some issues with Fibre Channel drivers and with full-text indexing of SQL Server, but they were quickly resolved,” says MySpace’s Whitcomb. “Installing 64-bit Windows and SQL Server took about a day.”

Agnostic’s Turner agrees. “We had some minor driver incompatibilities, but in my experience, the platform is mature and ready for prime time.”

	Novell			Oracle	SAP	Siebel Systems	Sophos	Sun Microsystems		Sybase	Symantec
Visual Studio 2005	ZENworks	eDirectory	Novell Identity Manager	Oracle Database 10g Release 2	NetWeaver	Siebel 7.8	Sophos Anti-Virus Version 6.0	Solaris Enterprise System	Sun Java StorEdge Software	Adaptive Server Enterprise	Symantec Antivirus Corporate Edition
IDE	Resource management	Identity and security	Identity and security	RDBMS	EAI	CRM, analytics	Anti-virus	Infrastructure suite	Storage management	RDMS	Anti-virus
<input type="checkbox"/>	Planned	■	■	■	■	Planned	N/A	<input type="checkbox"/>	<input type="checkbox"/>	■	<input type="checkbox"/>
<input type="checkbox"/>	Planned	■	■	■	■	Planned	N/A	<input type="checkbox"/>	<input type="checkbox"/>	■	<input type="checkbox"/>
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- |                                  |                                |                            |
|----------------------------------|--------------------------------|----------------------------|
| 01. \$100 million or more        | 06. \$5,000,000 to \$9,999,999 | 11. \$100,000 to \$399,999 |
| 02. \$50,000,000 to \$99,999,999 | 07. \$2,500,000 to \$4,999,999 | 12. \$50,000 to \$99,999   |
| 03. \$30,000,000 to \$49,999,999 | 08. \$1,000,000 to \$2,499,999 | 13. Less than \$49,999     |
| 04. \$20,000,000 to \$29,999,999 | 09. \$600,000 to \$999,999     | 14. None                   |
| 05. \$10,000,000 to \$19,999,999 | 10. \$400,000 to \$599,999     |                            |

Product category	Write code in box
Large systems	<input type="text"/>
Client computers	<input type="text"/>
Networking / Telecom (including servers)	<input type="text"/>
Wireless	<input type="text"/>
Internet / Intranet / Extranet	<input type="text"/>
Security	<input type="text"/>
Storage	<input type="text"/>
Peripheral equipment	<input type="text"/>
Software	<input type="text"/>
Service/Support / Outsourcing	<input type="text"/>

**2. What is your primary job title? (PLEASE CHECK ONE ONLY)**

- |   |   |
|---|---|
| <b>IT / Technology Management</b>                                     | <input type="checkbox"/> 10. IT Staff                                   |
| <input type="checkbox"/> 01. CTO, CIO, CSO, Vice President            | <input type="checkbox"/> 11. Other IT Professional                      |
| <input type="checkbox"/> 02. Director                                 | <b>Corporate / Business Management</b>                                  |
| <input type="checkbox"/> 03. Manager / Supervisor                     | <input type="checkbox"/> 12. CEO, COO, President, Owner, Vice President |
| <input type="checkbox"/> 04. Network Manager / Director               | <input type="checkbox"/> 13. CFO, Controller, Treasurer                 |
| <input type="checkbox"/> 05. Engineer                                 | <input type="checkbox"/> 14. Director                                   |
| <input type="checkbox"/> 06. Systems Analyst / Programmer / Architect | <input type="checkbox"/> 15. Manager / Supervisor                       |
| <input type="checkbox"/> 07. Other IT Management                      | <input type="checkbox"/> 16. Other Business Management Title            |
| <b>IT / Technology Professional</b>                                   |   |
| <input type="checkbox"/> 08. Consultant / Integrator                  | <input type="checkbox"/> 98. Other Title                                |
| <input type="checkbox"/> 09. Developer                                | (specify) _____   |

**3. Please indicate your job function(s)? (PLEASE CHECK ALL THAT APPLY):**

- |  |  |
|--|--|
| <b>IT / Technology Functions</b>   | <b>Corporate / Business Functions</b>                          |
| <input type="checkbox"/> 01. Executive   | <input type="checkbox"/> 09. Executive                         |
| <input type="checkbox"/> 02. Department Management - IT                                  | <input type="checkbox"/> 10. Department Management - Business  |
| <input type="checkbox"/> 03. Networks / Systems Management                               | <input type="checkbox"/> 11. Financial / Accounting Management |
| <input type="checkbox"/> 04. Applications Development                                    | <input type="checkbox"/> 12. Research / Development Management |
| <input type="checkbox"/> 05. Management of Enterprise Applications (CRM, ERP, SCM, etc.) | <input type="checkbox"/> 13. Sales / Marketing Management      |
| <input type="checkbox"/> 06. Research / Development Management                           | <input type="checkbox"/> 14. Other Business Functions          |
| <input type="checkbox"/> 07. Consultant / Integrator                                     |  |
| <input type="checkbox"/> 08. Other IT Functions  | <input type="checkbox"/> 98. Other Functions                   |
|  | (specify) _____  |

**4. Are you involved in buying, specifying, recommending or approving the following IT products / services?**

(PLEASE CHECK ALL THAT APPLY):

- |   |  |
|---|--|
| <b>Software / Products / Technologies</b>   | <input type="checkbox"/> 18. Web / Video Conferencing                |
| <input type="checkbox"/> 01. Customer Relationship Management                       | <input type="checkbox"/> 19. Storage                                 |
| <input type="checkbox"/> 02. Enterprise Resource Planning                           | <input type="checkbox"/> 20. Disaster Recovery                       |
| <input type="checkbox"/> 03. Business Process Management / Outsourcing              | <input type="checkbox"/> 21. Security                                |
| <input type="checkbox"/> 04. Business Intelligence / Data Mining / Data Warehousing | <input type="checkbox"/> 22. Anti-Virus / Content Filtering          |
| <input type="checkbox"/> 05. Portals  | <input type="checkbox"/> 23. Firewall                                |
| <input type="checkbox"/> 06. Financials / Payroll / Billing                         | <input type="checkbox"/> 24. VPN                                     |
| <input type="checkbox"/> 07. Performance / Application Management                   | <input type="checkbox"/> 25. Identity Management                     |
| <input type="checkbox"/> 08. .NET   | <input type="checkbox"/> 26. Authentication / Authorization          |
| <input type="checkbox"/> 09. Other Software   | <input type="checkbox"/> 27. Intrusion Detection & Prevention        |
| <input type="checkbox"/> 10. Networking   | <input type="checkbox"/> 28. Encryption                              |
| <input type="checkbox"/> 11. Web Services   | <input type="checkbox"/> 29. Other IT Products / Technologies        |
| <input type="checkbox"/> 12. Content Delivery Networks                              | <b>Hardware / Peripherals</b>  |
| <input type="checkbox"/> 13. Network and Systems Management                         | <input type="checkbox"/> 30. Servers                                 |
| <input type="checkbox"/> 14. VoIP (Voice Over IP)                                   | <input type="checkbox"/> 31. Notebooks / Laptops                     |
| <input type="checkbox"/> 15. Telecommunications                                     | <input type="checkbox"/> 32. PDAs / Handhelds / Pocket PC / Wireless |
| <input type="checkbox"/> 16. Wireless   | <input type="checkbox"/> 33. Printers                                |
| <input type="checkbox"/> 17. Remote Access  | <input type="checkbox"/> 34. Other Hardware / Peripherals            |

**5. What is your organization's primary business activity at this location? (PLEASE CHECK ONE ONLY):**

- |  |  |
|--|--|
| <b>General Business Industries</b>   | <b>Technology Providers</b>  |
| <input type="checkbox"/> 01. Defense Contractor / Aerospace                            | <input type="checkbox"/> 12. Service Provider (MSP, BSP, ISP, ASP, etc.)                     |
| <input type="checkbox"/> 02. Retail / Wholesale / Distribution (non-computer)          | <input type="checkbox"/> 13. Computer / Network Consultant                                   |
| <input type="checkbox"/> 03. Pharmaceutical / Medical / Dental / Healthcare            | <input type="checkbox"/> 14. Systems / Network Integrator, VAR / VAD                         |
| <input type="checkbox"/> 04. Financial Services / Banking                              | <input type="checkbox"/> 15. Technology Manufacturer (hardware, software, peripherals, etc.) |
| <input type="checkbox"/> 05. Insurance / Real Estate / Legal                           | <input type="checkbox"/> 16. Technology - Related Retailer / Wholesaler / Distributor        |
| <input type="checkbox"/> 06. Transportation / Utilities                                | <b>Government / Education</b>  |
| <input type="checkbox"/> 07. Media (print / electronic)                                | <input type="checkbox"/> 17. Government: federal (including military)                        |
| <input type="checkbox"/> 08. Communication Carriers (telecomm, data comm., TV / cable) | <input type="checkbox"/> 18. Government: state or local                                      |
| <input type="checkbox"/> 09. Construction / Architecture / Engineering                 | <input type="checkbox"/> 19. Education   |
| <input type="checkbox"/> 10. Manufacturing & Process Industries (non-computer)         | <input type="checkbox"/> 98. Other   |
| <input type="checkbox"/> 11. Research / Development                                    | (specify) _____  |

**6. How many people are employed at this organization, including all of its branches, divisions and subsidiaries?**

(PLEASE CHECK ONE ONLY):

- |   |  |
|---|--|
| <input type="checkbox"/> 1. 20,000 or more  | <input type="checkbox"/> 5. 500 - 999    |
| <input type="checkbox"/> 2. 10,000 - 19,999 | <input type="checkbox"/> 6. 100 - 499    |
| <input type="checkbox"/> 3. 5,000 - 9,999   | <input type="checkbox"/> 7. 50 - 99      |
| <input type="checkbox"/> 4. 1,000 - 4,999   | <input type="checkbox"/> 8. Less than 49 |

**7. Which of the following operating systems are in use or planned for use at this location?**

(PLEASE CHECK ALL THAT APPLY):

- |  |   |
|--|---|
| <input type="checkbox"/> 01. Windows XP    | <input type="checkbox"/> 04. Linux / Unix / Solaris |
| <input type="checkbox"/> 02. Other Windows | <input type="checkbox"/> 05. Other                  |
| <input type="checkbox"/> 03. Mac           | (please specify) _____                              |

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