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The Linux Tipping Point

Helping Business Thrive On Technology Change

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The Linux Tipping Point

Linux brings seductive Intel economics into the Unix heart of the datacenter. To avoid the chaos of unbridled Linux growth, CIOs must lead a shift to managed Linux deployment. The payoff? A fast track to Organic IT.

2

INTERVIEWS

Linux Is Spilling Into The Datacenter

Global 3,500 companies are increasingly turning to cheap Intel-based Linux servers to run a variety of datacenter apps -- replacing both Windows and proprietary Unix platforms. Though enterprise support remains a concern, most interviewees are charging ahead with Linux.

LINUX IS STILL IN ITS INFANCY

The explosion of Linux hype suggests that Linux is all over the enterprise datacenter. Not so. Forrester found that only about half of the large North American companies in our random sample had Linux experience or plans. In the end, we found 50 IT executives using Linux in the datacenter, who described to us how they got started.

> "We went to Linux for stability and because we could leverage our existing hardware. We've started with small implementations and prototypes to see if Linux can do the job. We're now running both the DNS and the SMTP servers on Linux." (Business services company)

> "We piloted Linux a year ago and are already two-thirds of the way through rolling it out. We made our rollout decision based on a number of criteria: Linux was the best fit for our application, plus it has price and security advantages." (Manufacturing company)

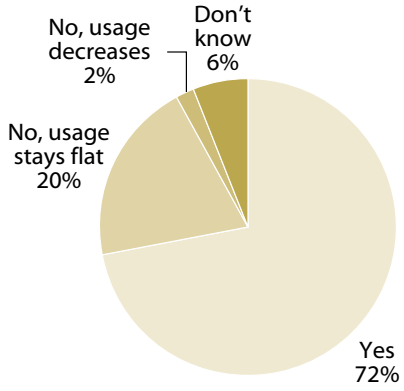
> "We already have some test servers running Apache and Tomcat, though we're really just starting with Linux. Assuming tests go well, we'll put the servers into production. Philosophically, we've already made the decision to use Linux wherever it's appropriate." (Financial company)

But Linux Users Love The Operating System -- For Lots Of Applications

The execs we spoke with are enthusiastic about their Linux experience so far -- and 72% plan to increase their investments in Linux (see Figure 1). They're using it for a broad spectrum of apps, including some that will terrify Microsoft: Thirteen of our 50 respondents are using Linux on the desktop or for number-crunching end-user workstations.

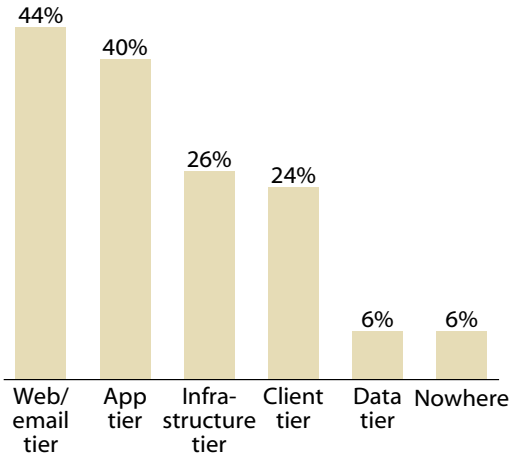
Figure 1 Linux Carries Every Datacenter Workload

1-1 "Are you planning to increase your Linux usage in the next two years?"



Base: 50 $1 billion-plus companies

1-2 "Where are you running Linux today?"



Base: 50 $1 billion-plus companies (multiple responses accepted)

Source: Forrester Research, Inc.

"We use Linux in production and manufacturing areas -- and we've seen a tremendous price-performance benefit. Using Oracle on Red Hat Linux, we've cut our costs by 30% to 49%." (Wholesaler)

"In the Web tier, we see real Linux benefits. After all, there's no huge value from commercial apps here. I have 20 load balancers running Linux and if one dies, the others compensate so it doesn't affect production." (Financial company)

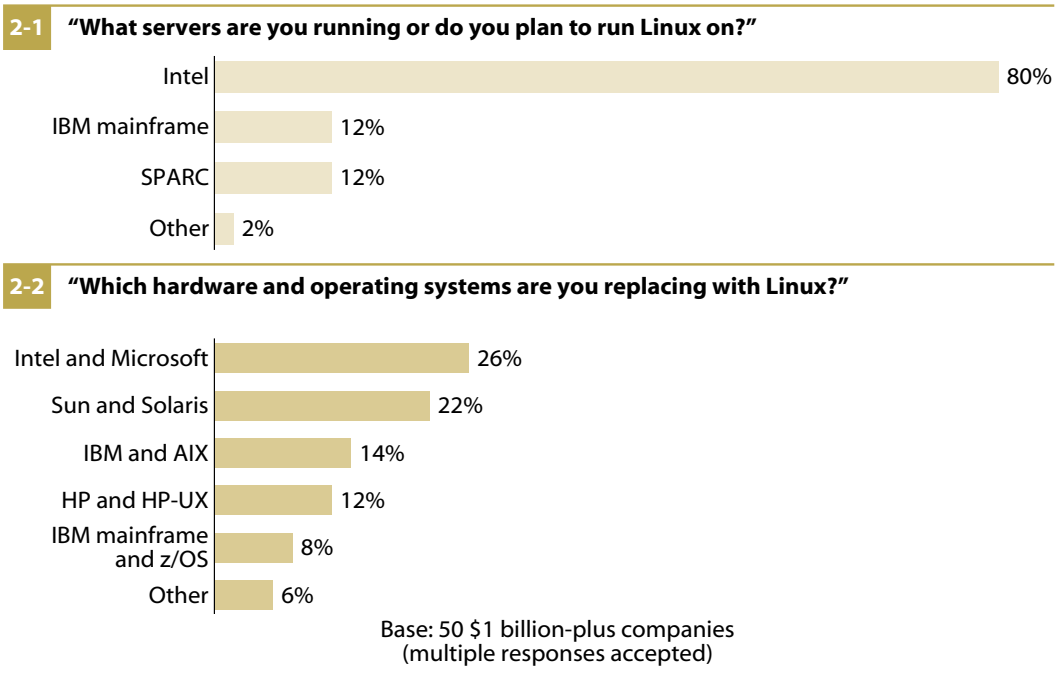
"Our objective is to increase the presence of Linux. Our first inroad was a firewall, but we're all excited as database admins to run Oracle 9*i*RAC on Linux." (Business services company)

"Linux just works -- we have a Linux system that has gone through dozens of service upgrades without a reboot in more than two years. We expect to use the OS in similar -- and new -- ways in the future." (Computer equipment company)

Firms Are Replacing Both Unix And Windows With Linux On Intel

Eighty percent of our interviewees are running Linux on Intel (or Intel-compatible AMD) servers, with the remainder running on IBM mainframes or Sun/SPARC boxes (see Figure 2). More than half are using Linux to boot out other platforms.

Figure 2 Every Operating System Is Losing Ground To Linux



Source: Forrester Research, Inc.

"We're putting Linux on Intel and nothing else. We're trying to get rid of mainframes because of their high maintenance costs." (Food company)

"We've moved a lot of our Web tier stuff to Linux -- applications like mailing lists and email archives. Over the next two years we will convert a double-digit percentage of our NT servers to Linux and Apache." (Chemicals company)

"Our motivation for Linux is server consolidation -- we have umpteen Solaris, HP-UX, and AIX machines running, and we're trying to simplify. We also want to consolidate our Windows NT machines on Linux." (HMO)

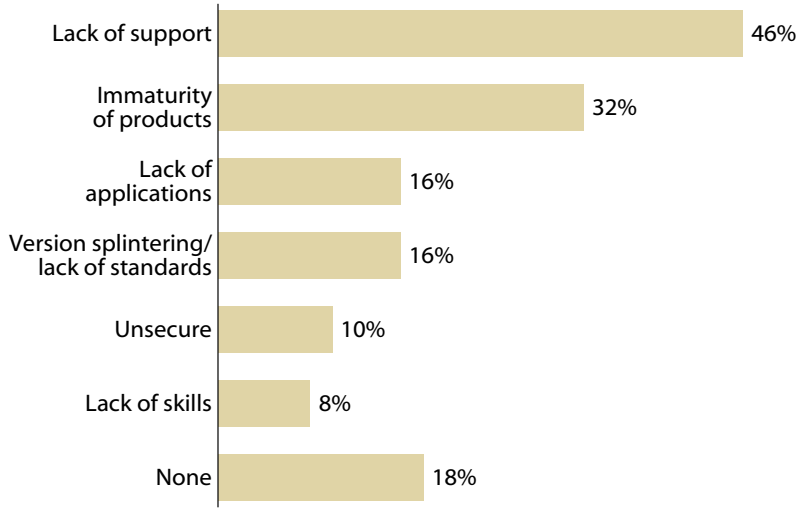
"We have an initiative to replace desktops with Linux. I don't think it's going to happen everywhere, but we can use Linux on some machines where we just need email -- not Microsoft Word." (Utility company)

THE PROBLEM? A LACK OF ENTERPRISE SUPPORT

What prevents our interviewees from deploying more Linux? Nearly half cited worries about enterprise support, while others worry about a lack of applications, operating system immaturity, and version fragmentation (see Figure 3).

Figure 3 Support Leads The List Of Enterprise Concerns

"What are your biggest concerns in using Linux and open source software?"



Base: 50 $1 billion-plus companies (multiple responses accepted)

Source: Forrester Research, Inc.

"Support is our biggest concern. I wouldn't consider Red Hat in the same service class as IBM or HP. I wouldn't even consider Microsoft in the same service class!" (Transportation company)

"Who do you call when there's a breakdown? It helps that IBM and HP have endorsed Linux, but I doubt that we would go directly to Red Hat with an issue." (Wholesaler)

"Application support is close to the top of our list of concerns -- we wonder whether we'll be able to run and port all our apps to the Linux platform." (Financial company)

"There are too many versions of Linux -- Red Hat standard, Red Hat Advanced Server, SuSE. We would like to have a fixed configuration that we can use for all apps. The more versions of Linux that we run, the higher the complexity and the higher our costs." (Durable goods company)

INTERVIEW CONCLUSIONS

Based on our interviews with IT executives at large North American companies, Forrester concludes that:

- **Linux is ready for more datacenter workloads.** Firms have grown comfortable using Linux for Web servers and are now looking at moving applications and databases to Linux.
- **Both Windows and Unix installations are at risk.** Companies are replacing Windows servers as well as migrating Sun and HP workloads to Linux.
- **Enterprise support is firms' biggest concern.** IT professionals are wary of a lack of commercial Linux support.

ANALYSIS

Linux Brings The Luxury Of Intel Economics To Unix

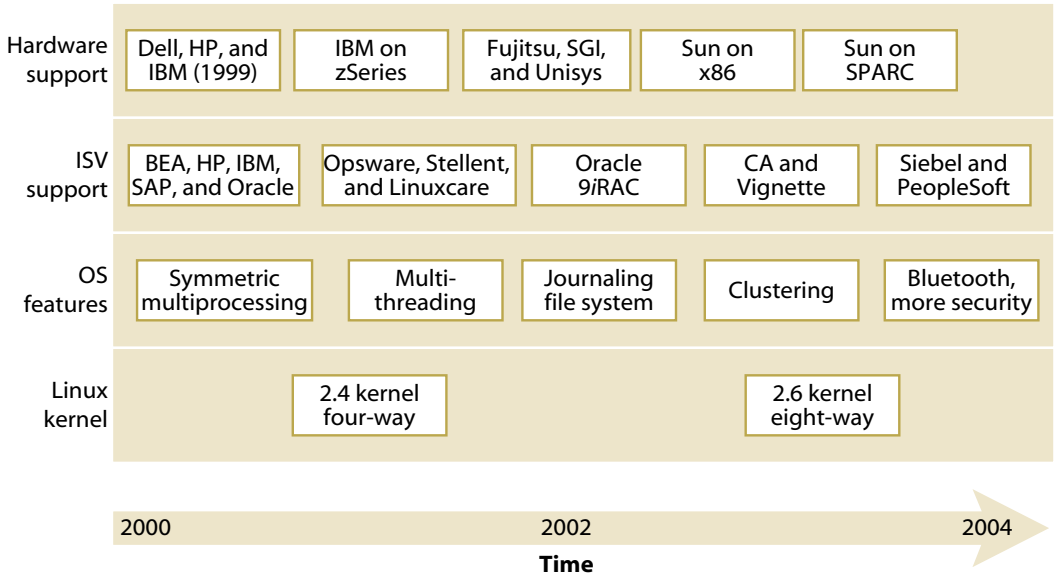
The good news: Linux is ready for the mainstream enterprise. But the hidden costs of unbridled Linux growth can spoil the party. CIOs must charter a new "managed deployment" strategy that keeps a rein on purchasing while delivering the benefits of automated Linux provisioning and management. The payoff? A steady march to Organic IT.

LINUX STRIKES AT THE UNIX HEART OF THE DATACENTER

Linux gained a foothold when companies realized that they could run huge Web server farms on Linux on Intel (see the October 17, 2002 Forrester Brief "Linux Finds Its Footing In The Enterprise").[1] This early success drove commercial contributions -- ideas, code, and coders -- from HP, IBM, Oracle, and SAP (see Figure 4 and see the November 22, 2002 Forrester Brief "IBM Wields Open Source As A Weapon").[2] Three powerful forces will cause Linux to tip in 2003 -- and sweep new Unix installs out of the datacenter on all but the data tier by 2007 (see Figure 5):

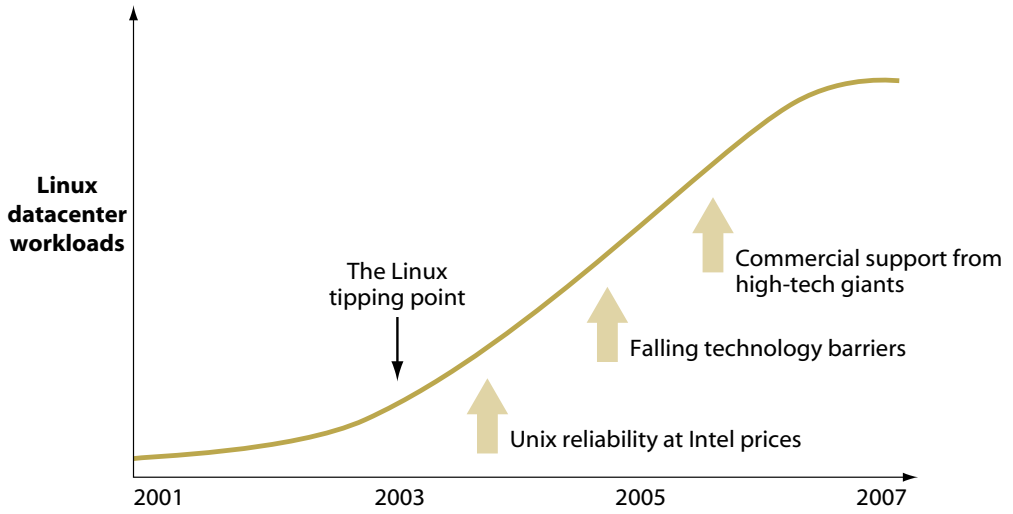
1. **Unix reliability at Intel prices.** Four years ago, firms that wanted Intel economics with enterprise-class support had to embrace Microsoft Windows -- a tough choice for hardcore Unix shops.[3] But today, Linux on a two-way Dell PowerEdge can handle the same workload as Solaris on a four-way Sun box -- at a fraction of the cost.[4] With economics like this, and Intel performance doubling every 12 to 18 months, Linux is "good enough" for most workloads.
2. **Falling technology barriers.** Linux has grown up at rocket speed (see the January 24, 2003 Forrester Brief "Executive Overview: Linux And Open Source").[5] In 10 years, the OS has achieved four-way CPU support, a sophisticated threading model, and enterprise-class security -- not to mention support from ISVs like IBM WebSphere, BEA WebLogic, and Oracle 9*i*RAC. New datacenter tooling from firms like Linuxcare and Opsware make 2003 a watershed year when Linux clears the good-enough bar for mission-critical apps.
3. **Commercial support from high-tech giants.** Enterprise support leads the list of our interviewees' concerns. But Linux has enterprise support today -- from Red Hat, as well as trusted vendors like Dell, HP, and IBM. And the ISVs are onboard, as well: Oracle has supported its database on Linux since 2000, while app ISVs like SAP and Vignette have ported to Linux or will in 2003.

Figure 4 Linux Is Rapidly Gaining Enterprise Features



Source: Forrester Research, Inc.

Figure 5 Linux Will Tip In The Datacenter In 2003



Source: Forrester Research, Inc.

But Chaos, Cost, And Complexity Await An Unsuspecting CIO

So it's clear sailing, right? Wrong. Unbridled, unmanaged Linux growth will lead to proliferation hell -- an experience all too familiar to CIOs still whipping thousands of internal Web sites into shape. The biggest lurking costs come from:

- **Too many Linux distributions -- and configurations.** IT fought for 10 years to put a single operating system on every desktop. Why? To bring software consistency and reduce management costs. The same problems will plague uncontrolled Linux configurations. And don't count on the consistency of the Linux kernel to protect you. Linux packages -- even from market leaders Red Hat and SuSE -- are not interchangeable.
- **Too many hardware configurations.** Imagine letting every application team spec, buy, and configure their own hardware from a supplier like Dell, HP, or IBM. Even at a $3,000 price point, the sheer cost of spare parts for each configuration will swamp the break-fix budget.
- **Too much Linux outside the datacenter.** IT lost control over Web sites -- and is losing control over Wi-Fi -- because the technology is cheap and simple enough for any departmental developer or user to deploy. But when Linux problems pop up, datacenter professionals get the call to fix the problem.

MANAGED DEPLOYMENT IS THE ANSWER TO LINUX CHAOS

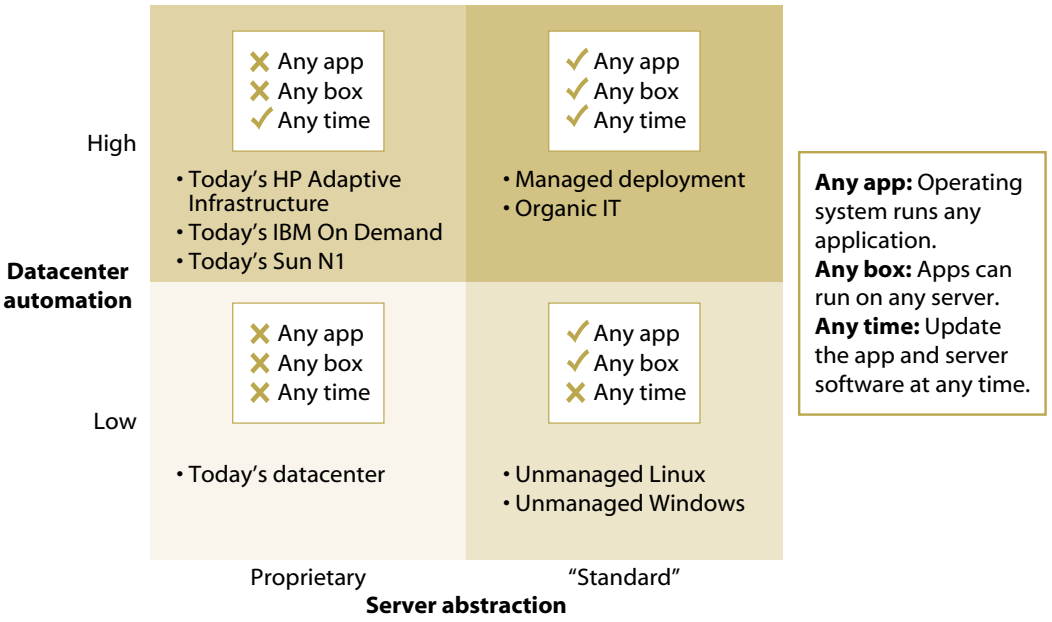
Forrester believes that CIOs can avoid the chaos and cost of uncontrolled Linux growth -- and automate the datacenter one server at a time -- with a new *managed deployment* strategy, defined as (see Figure 6):

> *Building a shared server pool by automating server procurement and operation.*[6]

With managed deployment, application teams can focus on building applications while datacenter professionals focus on operating them (see Figure 7). Managed deployment has three charters:

1. **Build a managed deployment playbook.** IT must optimize procurement and operating processes that help both datacenter pros and application teams work efficiently and economically.
2. **Plot a migration road map.** The transition to Linux won't be a rip-and-replace -- instead, firms must balance their apps, skills, and technology maturity.
3. **Assemble a vendor portfolio.** Managed deployment won't work with a hodgepodge of vendors -- instead, firms must concentrate their purchases with a small coterie of strategic suppliers.

Figure 6 Managed Deployment Automates Datacenter Servers



Source: Forrester Research, Inc.

Charter No. 1: Build A Managed Deployment Playbook

Managed deployments start with a playbook that details the processes for purchasing, provisioning, and managing Linux applications. Four principles anchor the playbook:

1. **Treat Linux as commercial software.** Most firms should treat Linux like commercial software to take advantage of the testing and packaging that a distributor like Red Hat or SuSE performs. This means -- at most -- annual upgrades and careful testing before deploying patches. And don't modify the code unless you want to join the open source community.
2. **Create cookie-cutter configurations.** Three hardware configurations and system images should cover 90% of your workloads. Make each configuration -- whether on multiway Intel or AMD boxes or on zSeries -- highly standard and reproducible. And the other 10%? Well, it often points the way to an emerging class of applications that may deserve its own configuration.
3. **Wield an iron fist over hardware purchases.** To build a shared server pool -- where any application can run on any box at any time -- firms must keep the hardware simple.[7] First steps? Negotiate enterprise hardware deals for cookie-cutter configurations and host a server procurement process using software from a vendor like Datastream Systems or ePlus.

Figure 7 The Benefits Of Managed Deployment

	Datacenter professionals	Application teams
Key benefit	IT retains control over the server as part of a managed server pool.	Application team focuses on functionality rather than operations.
Purchasing	Datacenter pros strike an enterprise agreement on pricing and support.	Offload procurement hassles to IT -- and get a better price.
Provisioning	Automated provisioning means IT can dynamically allocate processors.	Focus on app performance -- rely on datacenter pros for operations.
Management	Manage patches, operating system configurations, and network security.	Manage user- and role-based security and application configuration.

Source: Forrester Research, Inc.

4. **Offer a velvet glove for Linux installations.** To keep application teams from buying their own gear -- and contributing to Linux chaos -- IT must offer good prices, rapid provisioning, and guaranteed maintenance. Managed deployment relies on automated Linux provisioning and patch administration from a vendor like HP or Opsware -- or a Linux specialist like Covalent, Linuxcare, or Red Hat.

Charter No. 2: Plot A Migration Road Map

Managed deployment doesn't dictate moving every Unix app to Linux. Instead, firms should take a rational approach to Linux cost savings -- which means not rushing into projects before you've acquired Linux skills and mastered its quirks. Leave it to aggressive early adopters like Oracle and Yahoo! to move all their systems to Linux in 2003. Most firms should instead plot a three-phase migration road map:

1. **2003-2004: Master Linux basics with Web servers, email, and infrastructure.** Even open source newbies can save money by moving Web servers and infrastructure workloads to Linux. Use this period to build vendor relationships, work the kinks out of hardware and software configurations, and master a new Unix dialect. It's also easier to establish managed deployment processes when the applications are already the responsibility of datacenter professionals.
2. **2004-2006: Use Linux for portals, call centers, and commerce sites.** After mastering the Linux basics, firms should migrate Unix apps as servers reach end of life. Stop investing in midrange Unix/RISC platforms and instead bet on Intel or AMD for commodity server loads and a mainframe-class machine like IBM's zSeries, HP's Superdome, or Sun's Sun Fire 15K for business-critical workloads. And don't fear for ISV support. By 2004, every ISV will have a Linux strategy -- and be thinking about making Linux a reference platform, as SAP already does.

3. **2006+: Migrate core transaction systems.** By 2006, 64-bit commodity chips, clustering technology, and 16-way support in the Linux kernel itself will make Linux the workhorse of many transactional systems. You'll know the technology is ready for anything when a Fortune 100 company runs its core apps on Linux and the high-performance Linux community -- spearheaded by HP and Gelato.org -- simplifies 64-bit clustering.

Charter No. 3: Assemble A Vendor Portfolio

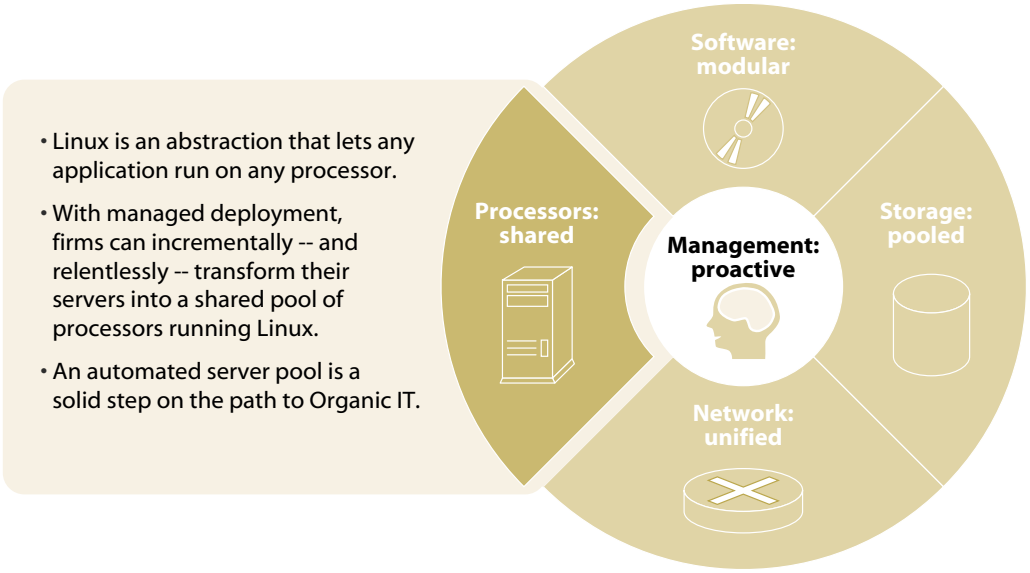
Managed deployment depends on standardized configurations and automated provisioning -- and some strategic vendor relationships (see the December 2002 Forrester Report "Which Provisioning Vendor?").[8] To be successful, CIOs must:

- **Bet on a single Linux distribution.** To avoid the portability hassles of different Linux distributions, choose either Red Hat Advanced Server or SuSE's Enterprise Server -- but not both. And if the distributor goes belly up or fails to scale to meet your support needs? Make that your hardware supplier's problem. They are motivated to keep you afloat and help you make the swap.
- **Find a primary and secondary hardware supplier.** To simplify configurations and provisioning, firms should limit their hardware suppliers to two. Because Linux on Intel is good enough for most workloads, the server decision boils down to price, service, datacenter automation strategy, and breadth of offering -- not sheer performance. Start with a shortlist of Dell, HP, and IBM, but don't overlook Fujitsu, NEC, Sun, SGI, and Unisys.
- **Fund platform and application provisioning.** The benefits of managed deployment materialize only when every server is wired into the same command and control system -- and is part of the same server pool. Bet on a provisioning vendor like HP, Opsware, or VERITAS/Jareva that can help you with Linux, Windows, and Unix deployments. Smart firms will make sure every new Linux server is part of the same management environment (see the December 2002 Forrester Report "Managing Organic IT Infrastructure").[9]

LINUX LEADS GRACEFULLY TO ORGANIC IT

Managed deployment will lead firms to a new computing architecture that Forrester calls Organic IT (see Figure 8 and see the October 2002 Forrester Report "The Organic IT Voyage").[10] Organic IT has three big payoffs: lower cost infrastructure due to a doubling or tripling of utilization; lower labor costs due to radically enhanced administrator efficiency; and much faster response to variable business needs because of shared pools of servers, storage, and network access. Managed Linux deployment fits neatly into Organic IT.

Figure 8 The Role Of Linux In Organic IT



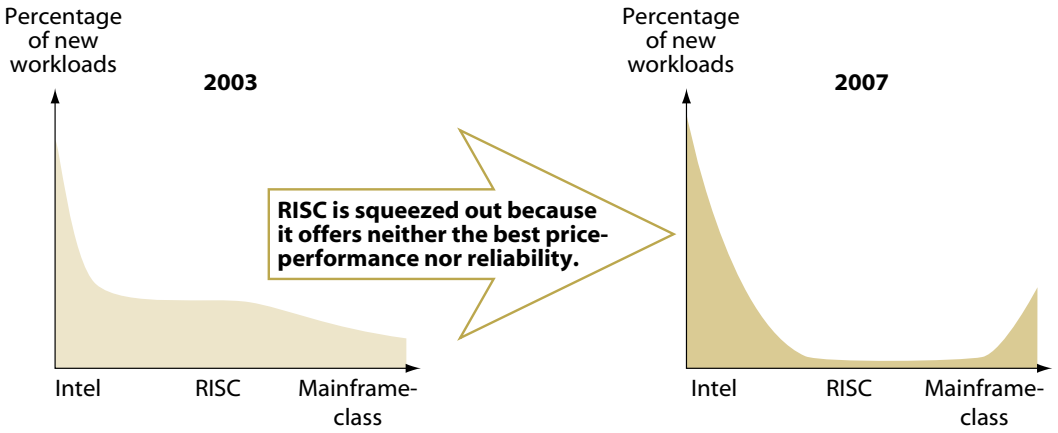
Source: Forrester Research, Inc.

- **Linux is an abstraction that separates applications from servers . . .** Because Linux makes the same APIs available on every server platform, it lets application teams build applications while datacenter pros choose where to run them. One important note: While a Windows instance can run only on Intel and AMD chips, Linux instances can run on almost any server, greatly expanding its flexibility.
- **. . . and makes every server part of a server pool.** Because an application is tied to Linux and not to a particular server, servers can be added or swapped out as needed. But make sure that your provisioning tool kit can handle both Windows and Linux apps, permitting your datacenter operators to use the same managed pool of servers for both.

Linux Will Hollow Out The Server Market

Intel performance doubles every 12 to 18 months, and 64-bit Itanium 2 with new 300mm fabs will bring a step function in price-performance. These changes, coupled with the rapid maturation of Linux on 32-bit and 64-bit processors, will have dramatic, disruptive effects on the server market (see Figure 9). Proprietary Unix on RISC will all but disappear by 2007. So what should firms do?

Figure 9 Linux Will Hollow Out The Server Market



Why do midrange RISC servers fade while both Intel and mainframe-class thrive? Because:

1. Linux makes it possible to run any application on any server -- servers will win based on their price and operating characteristics.
2. Intel's scale advantage guarantees that its processors will surpass RISC in price-performance.
3. Mainframe-class machines offer the highest grace under load and best business reliability.

Source: Forrester Research, Inc.

- **Make Intel your preferred Linux server platform.** Forrester believes -- along with early adopters like FedEx, Merrill Lynch, and Morgan Stanley -- that Linux on multiway Intel boxes can carry most application workloads today. What about AMD? For firms that want rock-bottom white box servers or that want to move large numbers of 32-bit applications to a faster 64-bit architecture without hassle, AMD is a solid choice. But Intel's scale and OEM relationships make it the safest path for most firms today and in the 64-bit future.
- **Stop buying proprietary Unix on midrange RISC as soon as possible.** No company can turn off its Unix pipeline overnight. But three factors seal Unix's fate: 1) Linux is "good enough" for most workloads; 2) because app teams don't care which server the app runs on, datacenter pros get to choose servers based on price and operating characteristics; and 3) Intel's price-performance is already dramatically better than RISC's -- and improving faster. The tightly coupled benefits of proprietary Unix on RISC aren't enough to overcome this deficit.
- **Use Linux on mainframe-class machines for its operating benefits.** In direct analogy to utility power generation, Forrester believes that mainframe-class machines like IBM's zSeries, HP's Superdome, and Sun's Sun Fire 15K will thrive as Linux utilities. Why? Because some workloads require five 9s business

reliability, grace under load, and mature management tools -- even at two or three times the price of Intel.

- **Don't overlook Microsoft Windows.** Linux is an easy decision for Unix shops. But you'll live with these application decisions for a long time. It's the right time to ask if the workload should remain in the operations-focused Java/Linux architecture. Don't forget about the development-focused benefits of the Microsoft architecture: strong developer tools, pre-integrated servers, and a consistent programming model on every tier.

ACTION

Microsoft: Open source the common language runtime.

Microsoft faces a broad spectrum of threats from open source software -- in the datacenter, on the desktop, and on devices like handhelds and phones. One action will overcome all three threats and reinforce Microsoft's developer-focused benefits: Put the CLR into open source where it can be ported to devices, and accelerate the Mono project to replicate the .NET Framework on Linux. The payoff? Companies will buy Microsoft tools and servers to build applications for all of those platforms.

Sun: Just say "yes" to Linux on SPARC . . . everywhere.

Sun is in a quandary: It can't openly support Linux on its SPARC servers without cannibalizing its profitable server business. But the combination of good-enough Linux and Intel's massive investments in price-performance will undermine Sun's midrange server margins and make Sun's decision to back Linux on SPARC inevitable -- only the timing is in question.

To thrive, Sun must go beyond basic Linux on Intel support to emulate IBM: Adopt a dual OS strategy to help customers migrate core apps to mainframe-class servers running Linux or Solaris. And instead of using its $4.9 billion war chest to prop up server business margins, Sun should invest heavily in software and services to make N1 datacenter automation a success (see the February 7, 2003 Forrester Brief "Sun Puts Organic IT Muscle Behind N1").[11]

SIs: Turn managed deployment into a business strategy.

Systems integrators like CSC and Accenture already have strong Linux strategies, but they have yet to capitalize on the growing demand for automated provisioning and management. Managed deployment turns Linux migrations into a much bigger opportunity to help customers build organic datacenters.

Mr. Torvalds: Keep the Linux umbrella open to the enterprise.

Linus Torvalds is the Linux creator and maintainer. He has done a remarkable job of inviting the enterprise interests of HP, IBM, Oracle, and SAP into the Linux community without losing the open source dynamic -- or licensing model. Keep up the good work. If the Linux open source community starts rejecting enterprise features, the hardware vendors will be forced to co-opt Linux for their own purposes, and we'll be right back to proprietary Unix. Only Microsoft wins in that scenario.

WHAT IT MEANS

Linux adoption will drive dramatic shifts in the hardware and software industry.

Unix will be stone-cold dead by 2007 . . .

Linux has hit a tipping point where it is good enough for most workloads on commodity hardware. Already, IT executives with Unix workloads are asking "Why not run this on Linux on Intel?" before considering other servers. The falloff in proprietary server sales in 2004 will shock even proponents HP and IBM. What will happen? Deep server discounting and an acceleration of HP's strategy to unify Unix and Linux under one virtual machine.

. . . but mainframe-class machines will live on.

Some workloads will remain impervious to the alluring price-performance characteristics of Intel servers. Workloads that can only scale up, that require a bulletproof testing environment, that require five 9s of business reliability, or that must degrade gracefully under load will run better on machines like IBM's zSeries, HP's Superdome, or Sun's Sun Fire 15K. But firms should still move these workloads to mainframe Linux partitions with the help of a vendor like Linuxcare to gain the advantages of consistent management, application portability, and skill set simplification.

Red Hat and SuSE will annoy their channel partners.

Linux distributors are stuck -- if they bundle open source software like the JBoss app server to compete with Microsoft, they also compete with ISV partners BEA, IBM, and Oracle. If they add too much management software, they'll compete with hardware partners HP and Dell. If they don't add anything, they're trapped in a small sliver of the software stack. The way forward? Create open source provisioning and management interfaces to give customers a path to heterogeneous provisioning, and spend real effort on customer service.

Laggard ISVs will kick themselves for not adopting Linux sooner.

ISVs like i2, PeopleSoft, and Siebel reassuringly say that they can quickly port to Linux when their customers need it. The problem with delaying the port is that managed Linux deployments -- where apps and platforms are provisioned automatically -- require additional software hooks and software partnerships. And these take more than a quarter to achieve. The risk? That customers postpone upgrades -- or worse, defect to a Linux-friendly competitor.

RELATED MATERIAL

Companies Interviewed For This Report

Advanced Micro Devices
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BEA Systems
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BearingPoint
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Cap Gemini Ernst & Young
www.cgey.com

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Related Research

January 24, 2003 Forrester Brief "Executive Overview: Linux And Open Source"
December 2002 Forrester Report "Managing Organic IT Infrastructure"
December 2002 Forrester Report "Which Provisioning Vendor?"
October 17, 2002 Forrester Brief "Linux Finds Its Footing In The Enterprise"
October 2002 Forrester Report "The Organic IT Voyage"

GRAPEVINE

Where's Tiger Woods right now?
Steve Evans, VP of information services for the PGA Tour, is tapping hundreds of volunteers to follow every golf pro around with Palm Pilots and survey-grade range finders. The resulting pgatour.com service offers real-time coverage of every player -- not just the front-runners. So how do you handle 100,000 subscribers during the golf season without buying boxes that sit idle most of the year? Outsource it to IBM's Virtual Linux Services, of course. If you can't tell the difference between a virtual server and a real server, then you might as well rent the server capacity on demand.

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What were those numbers again?
Marc Andreessen, chairman of Opsware, joined Forrester on stage at our February 2003 Technology Leadership Forum in Scottsdale, Ariz. He described his vision for Organic IT and the role that datacenter provisioning vendor Opsware will play in it. Some shockingly good numbers: Using Opsware, News Corp consolidated 110 servers running at 25% utilization from three online businesses into 34 servers that serve all three businesses running at 80% capacity. The savings? A 60% cost reduction. And Opsware customer EDS expects to save $100 million by automating 154 datacenters. Even if the savings are only half true, payoffs like these should make every CIO giddy with automation excitement.

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Linux, a family affair.
Erik Troan, director of product marketing for Red Hat, told us that when he joined Red Hat in 1995, his father looked at him "like he had three heads." Open *what*? Ri-i-ight. But that was then, and this is now. Troan's dad, a 32-year veteran of IBM, now works for Red Hat giving its tier one partners -- including IBM -- the service they need.

.....

HP is looking like a Linux genius.
A conversation with HP's Linux business strategist, Mike Balma, showcased HP's Linux technique. Along with nearly $2 billion in Linux business, HP has invested to allow HP-UX and Linux run the same binaries on Itanium 2. It is also leading the Open Single System Image project to turn Linux into a high-availability cluster foundry. Why is this important? Because with this technology, HP can offer its customers a migration strategy off of proprietary RISC onto Itanium 2.

ENDNOTES

1 This analysis describes the state of Linux in the enterprise.

2 IBM has mastered open source development: Linux to bring consistency to its server platforms, open source implementation of Web service standards to promote adoption, and 3 million lines of developer workbench code to unite the Java and Unix tools vendors against Microsoft.

3 We are capturing both Intel and AMD under the "Intel" label as the most recognizable label for commodity processors. However, firms should be aware of four differences in the new 64-bit chips from the two companies: 1) AMD's 64-bit Opteron chip will run 32-bit applications without a recompile. Firms must recompile their 32-bit apps to run on Intel's 64-bit Itanium 2; 2) Microsoft Windows Server 2003 will support both AMD's and Intel's 64-bit chips; 3) Red Hat and other Linux distributors will support both Itanium 2 and Opteron; and 4) Most ISVs will treat Intel's Itanium 2 as their primary commodity platform and will port to AMD's Opteron second. What does this mean for companies? To simplify their server commitments, CIOs should target one processor or the other -- but not both. Intel has the most tier one OEM support today, but AMD has strong white box manufacturer support and is making inroads into tier one OEMs.

4 Many sources cite the improved price-performance of Linux on Intel over proprietary Unix on RISC. Deutsche Bank's research shows that Intel-based servers offer four to 15 times the price-performance improvement over Sun's servers. And E*TRADE successfully migrated from 80 $250,000 Sun boxes to 90 $4,000 Dell servers.

5 This research introduces open source dynamics and describes the way in which open source development differs from commercial development -- and what open source means for IT execs.

6 Managed deployment is also the right strategy for Windows servers. The same principles -- cookie-cutter configurations and automated provisioning and management -- apply to Windows.

7 Morgan Stanley uses the "any app, any box, any time" framework to describe its strategy for Linux. Forrester gratefully acknowledges Morgan Stanley's pioneering approach to Linux.

8 "Which Provisioning Vendor?" evaluates platform provisioning and application provisioning vendors. The platform provisioning shortlist includes HP, Opsware, and VERITAS/Jareva; the application provisioning leaders are BladeLogic, IBM, and Opsware.

9 Organic IT benefits come when every infrastructure asset -- servers, storage, and network access -- is proactively managed. This analysis introduces a new architecture that uses management middleware to help firms corral their datacenter chaos. The early leaders include HP and VIEO.

10 This analysis describes how firms can save money in each year of a 10-year journey to a fully automated datacenter. The secrets? Stop buying proprietary technologies like direct-attached storage and wire all new gear into an automated provisioning and management system.

11 Sun has made smart acquisitions to accelerate its N1 datacenter automation business, but the company lags behind HP and IBM as an Organic IT prime contractor.