IBM & Linux – 10 Years Later

In 1999, IBM issued a series of announcements fully committing the company to supporting Linux. IBM vowed to Linux-enable all of their hardware platforms, including their non-x86 based mainframe, mini, and RISC-based systems. They also promised to release Linux versions of their software products and develop Linux-centric service practices. Moreover, they pledged significant resources to the Linux community with the goal of advancing Linux and open source technology.

So, a decade later, did IBM deliver on these promises? Was their commitment to Linux genuine or just lip service? This report examines IBM's current Linux products, services, and community support in light of the promises they made in 1999…

Linux has carved out a substantial niche in data centers both large and small, and at this point, no one disputes either the importance or the staying power of the Linux operating system. But this wasn't always the case. Enterprise adoption of Linux wasn't immediate, nor was it anywhere close to universal. In 1999, only a small portion of enterprise customers had any interest in Linux and open source at all. There were few 'brand name' applications available, and even fewer applications that could support large enterprise workloads. Another concern was the lack of 'accountable' third party O/S and application support. While community support is both free and usually efficient, the lack of recourse and accountability made Linux difficult for business customers to rely on when it came to important workloads. Finally, there were also customer questions around how to best integrate Linux into data centers that were already bulging with too many dissimilar operating systems. While Linux is a solid choice for many workloads, it wasn't (and isn't) a panacea; thus most organizations will still have heterogeneous infrastructures for the foreseeable future.

In light of the challenges above, IBM's early commitment to Linux appeared odd, or even ominous, to some industry observers. It was hard to understand why a company that made a lot of money on operating system and application software would actively support a free alternative – it seemed to be a potential no-win situation. They believed that if Linux wasn't successful, then IBM would have wasted significant resources and time that could have been better used improving IBM products. On the other hand, if IBM helped drive Linux demand, it could lead to the decline of IBM's software and hardware revenue. Others suggested that IBM had an ulterior motive, that they were looking to perhaps fork Linux so that the end result would be a number of incompatible versions – much like the Unix market of old. There was also talk of IBM throwing lots of resources at Linux with the goal of gaining control of Linux development. Although much of this discussion was driven by IBM competitors, there were real concerns surrounding IBM's new Linux adventure.

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The risks to IBM in going down this uncharted road were also considerable. At the time, conventional wisdom said that broad adoption of Linux and open source software would spell the end of the industry as we knew it. Traditional (read: proprietary) hardware and software vendors would quickly succumb to competitive pressure from commoditized systems and inexpensive or free software. Among the major IT vendors, IBM probably had the most to lose (with the possible exception of Microsoft) and yet made the earliest and strongest commitment to Linux and open source. Their competitors chose different courses. Sun, the darling of the dot-com boom, alternately embraced and attacked Linux (sometimes during the same week) while watching their system sales and revenues plummet. Dell resisted the pull of Linux the longest, limiting their O/S menu to Microsoft products until only recently. Hewlett-Packard staked out a mostly passive position, supporting Linux and open source from a systems standpoint, but has never overwhelmed the Linux community with support either on the technical or financial front.

Linux & Community Citizenship

Major vendor backing of Linux and the open source movement was critical in the early days. IBM's 1999 wide-ranging pledge of support was a huge endorsement, but was there going to be tangible investment to back up IBM's rhetoric? IBM answered this question early on by establishing the Linux Technology Center, which began life in 1999 and quickly grew to 200 employees dedicated to improving all aspects of Linux, but particularly those that are most relevant to enterprise computing. For example, the LTC is working closely with the Linux community to improve scalability, stability, security, and systems management, with the overarching goal of expanding the reach of Linux and ensuring that the O/S can handle the most demanding enterprise computing chores. The LTC also actively collaborates with customers to develop and test Linux solutions both large and small.

The LTC is also responsible for making sure that IBM systems are Linux compliant, and it serves as the conduit for funneling advanced IBM technology into the Linux community. As the center has grown, now with over 600 employees in 16 different countries, it has assumed an increasingly important role in the Linux community. IBM's expertise in enterprise computing isn't a secret; they've been working on cutting-edge systems for more than 40 years, and now that knowledge is being transferred into Linux development.

This activity is paying dividends to the Linux community. According LWN.net, an internet site that closely tracks Linux O/S development, IBM employees submitted more than 8% of the total changesets (code changes, as reported 9/11/07) in the 2.6.23 version of Linux. The only other corporation higher than IBM was Red Hat, with a 12% share. IBM's contributions, by this measure, are more than twice that of Intel and 7x the number of changes submitted by SGI (the next highest system vendor on the list). The authors break the list down into subcategories, and it's interesting to note that IBM has contributed more in the highly technical /arch and /kernel sections of the code than any other vendor (with the exception of Red Hat in the /kernel category).

It's also interesting to note who isn't on the list. Hewlett-Packard is conspicuously absent as a significant contributor. They did contribute 2% of the changes to the /net section of the code base, but were well under IBM's 6.4% contribution. However, HP employees did not do enough work to land the company any position in the overall rankings of changesets submitted. Sun Microsystems is also missing in action, despite their professed newfound love for Linux. Both

HP and Sun have the resources to devote to community efforts, and loudly espouse their undying support for Linux, but, at least right now, they aren't putting much skin in the game.

Linux & Systems

All of the major systems vendors have at least one thing in common when it comes to Linux – they want it to run on their systems. While IBM was out front with their promise to Linux-enable all of their various server families, other vendors lagged. Sun hasn't devoted much time or money towards pushing SPARC Linux; they're much more intent on pushing their more profitable Solaris x86 product. Dell didn't make Linux a factory option until they were, assumedly, dragged there by customer demand. Hewlett-Packard was relatively early on the Linux bus for their x86-based systems, but didn't push hard to bring Linux on Itanium to life – at least for non-HPC customers.

It's important to keep in mind that while there's a version of Linux that will run on pretty much any processor and system architecture, from massive supercomputers to garage door openers, true Linux enablement is much more than just ensuring that Linux will run on a particular box. Enterprise customers don't buy servers to run operating systems; they buy servers to solve business problems. A system that runs Linux, but not much else, is a waste of money. IBM, compared to their competitors, seems to have taken this rather obvious concept to heart and has invested quite a bit of money and manpower into ensuring that each of their system families has a wide range of Linux application, middleware, and management software. While this is much more expensive than simply making sure that Linux runs, and then waiting for ISVs to bring applications to the platform, IBM has reaped benefits from this approach as it has given some of these systems entirely new value propositions.

Probably the best example of this is the venerable mainframe. Since being formally announced in 2000, Linux on the mainframe has become an increasingly popular option with enterprise customers. Several Linux distributions now run on the mainframe; the most popular are SUSE and Red Hat. These are the same Linux distributions, utilizing the same routines and tools, that Linux developers and administrators have grown to love – which means they don't have to learn the ins and outs of mainframes in order to use the system. There are also thousands of ISV applications that have been recompiled to run on mainframe Linux, so most enterprises will find that many of the Linux apps running on their current x86 gear can be re-hosted onto their mainframes.

IBM mainframe systems, combined with Linux, bring capabilities and features to the table that simply can't be matched by competitors HP, Sun, or Dell with their x86 or even Unix systems. The mainframe is the undisputed king of virtualization. It can run hundreds of simultaneous workloads, ensuring that each workload is isolated from the others and gets the correct level of system resources according to business needs. Mainframe system management is highly automated, requiring far fewer administrators per system or workload when compared with x86 systems. These advanced virtualization and management capabilities, coupled with the mainframe's vast scalability and industry-leading availability, make it a compelling platform for any Linux consolidation.

Mainframe Linux makes massive consolidation projects a reality. All of the vendors are touting their ability to reduce server sprawl by consolidating workloads onto fewer servers – particularly x86 workloads. Perhaps the best example of this is IBM's own project consolidating 3,900 x86

and Unix workloads onto ***only 30*** System z mainframes running Linux. IBM estimates overall cost savings in the vicinity of 40% - a total of $250,000,000 over five years. These calculations include labor savings of around 50% and software costs reduced by more than a third. What's really astounding is the impact on facilities. Due to the extremely high utilization rates that the mainframe's sophisticated virtualization can provide, IBM will reduce IT floor space requirements by 85% and system energy use by 80%.

HP has also announced plans to consolidate their own IT infrastructure, but, so far at least, they haven't disclosed anything that approaches the scale of IBM's mainframe Linux consolidation. While they will certainly be able to reduce their IT costs, it isn't likely that they will be able to tout consolidation ratios of 130:1 (3,900 system images onto 30 mainframes) using their current x86 or Unix servers; these systems simply lack the scalability, availability, and virtualization features needed to achieve such high consolidation ratios on Linux workloads.

IBM's other non-x86 system architecture, the POWER processor based System p (recently renamed 'Power'), is also Linux-enabled. Performance, scale, and virtualization capability are the biggest advantages offered by Linux on IBM's Power servers. These systems run IBM's AIX Unix operating system, along with Linux distributions from Red Hat and SUSE (plus others). Since 2000, IBM's Power servers have held the performance high ground against HP, Sun, and other system vendors. IBM has also aggressively added virtualization and management features, generally ahead of their competitors. IBM has invested heavily to both build a POWER (the processor) based Linux ecosystem and to ensure strong Linux O/S performance. An interesting data point on Linux vs. native Unix performance is found by comparing SPECint_rate2006 and SPECfp_rate2006 benchmark results on competing IBM and HP systems. On the HP side, benchmark results for identical systems running HP-UX and Linux are, on average, 10% better on HP-UX. For IBM, the difference is much smaller, with only a 2% advantage for AIX vs. Linux. This is at least one objective indication that Linux on IBM Power has been better matched to the system than Linux running on HP's Itanium hardware.

Linux on Power began as a grassroots effort with HPC (high performance computing = supercomputing) customers who wanted to use their large and speedy Power systems to run Linux workloads. As the main benefits - performance and the ability to run many simultaneous Linux instances on single systems - became more apparent, IBM and their partners began to support the usage model. Over time, this momentum has resulted in an attractive market opportunity for ISVs to port native x86 Linux software over to Linux on POWER. Currently there are at least 1,200 ISVs providing thousands of IBM Power Linux packages ranging from HPC programs to general business applications.

Linux on Power appeals to customers in two broad categories. The first segment is HPC customers who run large-scale scientific workloads that require the highest performance and throughput. The scalability of Power servers, with large memory and I/O capacity, coupled with the new POWER6 processors (currently clocked at an industry-leading 4.7GHz), is very attractive to these performance-hungry customers (more on this later).

Another large set of customers use IBM's Power systems primarily as a general purpose Unix system, but they're beginning to add Linux applications in order to consolidate their infrastructure onto fewer systems. The Power hypervisor allows customers to run multiple AIX and Linux environments on a single system, with the system automatically adjusting to ensure that each application has enough resources to meet business goals. IBM is generally in front of

HP and Sun with these capabilities, and has distanced themselves further with the introduction of their Live Partition Mobility feature. This lets customers move active partitions from one physical system to another, seamlessly, with no lost transactions. Using this capability, customers can move Linux or AIX partitions around to increase energy efficiency or take particular systems down for maintenance – with no application downtime.

Another Linux option for Power customers is a mechanism called PowerVM Lx86, which allows customers to run native x86 Linux applications on Power servers. This is very useful for customers who would like to consolidate Linux applications onto Power servers, but have not yet acquired or configured the proper Linux on Power applications.

System x is IBM's line of servers that utilize Intel and AMD processors, generally referred to as "x86-based servers." These systems range in size from single-socket, rack-mounted systems all the way up to a massive 32-socket server that supports up to half a terabyte of memory – which makes it the largest x86-based system in the industry. With the move towards virtualization, system size becomes more important as larger systems can run multiple applications more efficiently and deliver higher utilization rates. It's interesting to note that IBM's major competitors (HP and Dell) abandoned the large (greater than 4-socket) x86 server market several years ago. HP is rumored to have had a change of heart on this score and is supposedly preparing an 8-socket server for introduction later this year. This move, if true, validates IBM's large scale x86 system strategy and may indicate that this segment of the market is poised for growth.

As x86 servers play more important roles in enterprise data centers, technology, rather than cost, will become more of a differentiator. Unlike most of their competitors, IBM designs their own server chipsets rather than relying on commodity components. Because of this, System x servers offer performance and availability features that aren't available from other vendors. For example, IBM x86 systems generally offer several more hot-swappable devices than other competitors, including HP and Sun – meaning that parts can be replaced without taking an outage. IBM also offers memory protection technology that can detect and correct multibit memory errors, a first in the x86 market.

Linux is the most prevalent operating system in many SMB (Small- & Medium-Sized Business) accounts, and many of these customers are choosing blade systems to host their infrastructure and business applications. IBM has built an industry-leading blade business that is rooted in efficiency, flexibility, and investment protection. IBM's Blade Center chassis boasts of industry-best energy efficiency and heat dissipation, which makes for an easy fit into almost any data center. On the flexibility front, IBM offers blades that are based on a wide variety of processors, from Intel or AMD to POWER to Cell Broadband Engine CPUs – all of which run Linux variants.

Customers tend to choose IBM blades not only for technical sophistication, but also due to the support and investment protection that IBM provides. IBM has retained blade compatibility much longer than any other vendor. Blades that were purchased five or six years ago will slide right into current chassis. Other vendors, including HP, Sun, and Dell, have introduced new blade systems that are incompatible with their previous blades – thus negating significant customer investment. One of the biggest selling points of blades is that a customer can start with a chassis and a couple of blades, and then add more inexpensive blades as their needs grow. The inherent value in this model is destroyed each time the vendor redesigns their chassis and forces customers to buy new blades.

Systems Management

Every reasonably-sized IT infrastructure contains a wide variety of disparate systems, ranging from mainframes and Unix systems on the high end to racks of x86-based servers and blade systems at the low end. Each system type was purchased for a reason, and in most cases is uniquely suited to the tasks it performs. However, all of the different hardware architectures, different operating systems, and different capabilities add up to a very complex system management task. Each type of system generally has its own tools and management suites that require specialized knowledge and skills. Adding Linux to this mix just makes things that much more complicated – a new O/S to learn about, maintain, and secure.

At about the same time IBM was committing to Linux, they were also looking at ways to attack the complexity inherent in today's heterogeneous data centers. The result is IBM Director, a systems management suite that can monitor and manage every IBM system, from mainframes to rack-mounted x86 servers, using a single GUI and a single set of tools. Director is standards-based and fully compatible with all of the major enterprise system management suites (OpenView, Tivoli, Unicenter, etc.). It can also monitor and manage other standards-based competitive systems.

The benefits of the Director approach are significant. From a single console, administrators can view, track, and change a wide range of systems, either locally or remotely. The user interface and tool operations are the same, regardless of the system being managed, which means that admins don't need to learn a unique set of tools for every system or task. Each administrator can manage more systems with less effort. Director extensions allow customers to add more capabilities to the suite. These extensions include, for example, capacity planning and software deployment.

One of the newest, and most timely, Director extensions is the Active Energy Manager (formerly IBM Power Executive). This is a software package that actively measures and manages energy used by IBM servers. Currently, it runs on IBM's System x and p servers, with full support for Windows and Linux. Future plans include support for System z mainframes running Linux. What's interesting about Active Energy Manager is that it allows customers to measure energy consumption in real time and track trends – data that is vital in order to optimize usage. With this information in hand, customers can juggle workloads to better utilize slack system capacity, and then power down under-utilized systems to save energy.

Chip Hopping & Market Momentum

As we discussed above, IBM has followed through on their promise to make Linux a viable option on each of their platform families. We also touched on the point that just having a system boot Linux doesn't make it a viable Linux option. At the risk of being redundant, let's talk about ecosystems a bit more. System vendors have learned through hard experience that they can't simply just throw a product out the door and expect customers to automatically start using it. Successful products require ecosystems, and ecosystems rarely build themselves.

Customers buy servers in order to run applications that provide business value. If the applications aren't there for a particular system, customers won't buy it – makes sense, right? ISVs (Independent Software Vendors) are looking at the same factors when deciding if they want to port applications to new systems (like Linux on a mainframe, for example). The ISV's criteria come down to the size of the market, how much it will cost them to build and support the new version, and the profit potential. To summarize: customers won't buy a new system without applications;

ISVs won't produce the applications unless there's a sizeable potential profit in it for them. So what is a system vendor to do? Change the rules of the game.

IBM did this with the introduction of their Chiphopper program. Chiphopper makes it much easier for ISVs to develop one set of code with versions that will run on all of IBM's Linux servers. On the front end, IBM offers free porting and testing tools that analyze code for potential porting problems and provide fixes. Developers can also use IBM testing centers to test scalability, performance, and availability on a variety of systems. IBM provides business side help for 'chiphoppers' with co-op advertising, along with sales and marketing support. ISVs reap the benefits of lower porting costs, plus the expanded sales opportunities that come with being 'blessed' by IBM and promoted to IBM's huge customer base. It's also a win for customers, who get access to a much broader and deeper range of Linux applications that will run on any of their IBM systems. IBM is the only vendor to tackle this 'porting problem' with a systematic and comprehensive program – and the payback is a thriving Linux ecosystem for their System p and System z Linux servers.

Linux is making huge inroads not only in the enterprise, but also in smaller organizations who are attracted by easy entry and low costs. While IBM is synonymous with the large enterprise IT market, they have also built a presence in the growing SMB market, which generated almost 20% of their 2006 revenue. IBM's intention is to increase their share of the SMB market over time – eventually to a point where sales account for as much as half of IBM's revenue. Linux will certainly play an important role in this effort, given SMB's propensity for products that provide superior price/performance. Much of what IBM has done with Linux to date is aimed enhancing the Linux value proposition by expanding Linux options (with systems and software) and reducing complexity in both development and management.

While the market for enterprise and SMB technology tends to get most of the press, Linux has come to dominate another, lesser publicized computing segment – supercomputing. The supercomputer (or HPC) market is estimated to account for almost 20% of total server spending (approaching $15 billion in '06) and is growing at a 15% annual clip. Perhaps the best source of information on HPC trends is the semi-annual Top500 Supercomputer Sites list, available at www.top500.org. Since 1993, these folks have been surveying the largest computing sites in the world to track system size, manufacturer prevalence, operating systems, and a bunch of other useful and interesting information.

In the 1990s, Unix operating systems dominated supercomputing, with over 99% of the systems on the June '98 Top 500 list. This list also marks the first appearance by Linux – on *one* Top 500 system, yielding a .20% share of the total. Fast-forward to November 2007, and we see that Linux now accounts for an astounding 85% of the Top 500, with Unix relegated to a mere 6%. It's obvious that the scientific and technical computing community has embraced Linux in a big way.

There have also been big changes in the HPC system vendor landscape. In November '98, Sun Microsystems was the 500 list leader with 25% share, followed by SGI and IBM at 21%, Cray at 16%, and Hewlett-Packard trailing with 4%. Ten years later, IBM dominates the list with 232 of 500 total systems (46%), four of the top ten, and the top two systems. Sun has faded to less than one percent of the list. IBM's nearest competitor, HP, accounts for 33% of system installations. However, in total processor count, IBM leads HP by more than 3x (963,520 to 293,726), meaning that not only does IBM have more systems on the list, but those systems are, on average, three times larger than those from Hewlett-Packard.

Linux Software: Where's the Code?

So far, we've talked about IBM's commitment to Linux from primarily a hardware perspective and community perspective – and it looks like they've delivered on their promises in these areas. However, IBM also has one of the largest, and most profitable, software organizations in the industry – how well have they kept their promise to "Linux-ize" their applications, management, and middleware offerings? From all angles, it looks like the IBM software organization has shifted towards Linux in a big way, bringing out Linux versions of legacy software and introducing new packages that make it easier for their customers to take advantage of Linux benefits.

- IBM's Rational software development line of products is fully Linux-enabled. These offerings are focused on two main goals: Providing the best and most comprehensive Linux application development products in the industry and helping customers use Linux to reduce their software development costs. Rational offers a Linux-centric, fully integrated development environment with a full slate of Linux tools, including requirements management and business modeling, software design/construction tools, and testing and quality assurance suites, plus project and process management packages. Taken as a whole, Rational brings sophistication and rigor to Linux development that just isn't available from anyone else – much less from another system vendor.

- IBM's database product, DB2, has been available in Linux trim since 1999. The major focus areas for DB2 in the Linux market are sophistication and total cost of ownership (TCO). While this may seem like a paradox, it makes sense when you dig beneath the surface. First, DB2 is a very sophisticated product, with scalability that exceeds competitive products, and the flexibility to handle both transactional and business intelligence usage models. DB2 has also become a performance leader in the open system database world, regularly turning in industry-leading benchmark scores both on raw performance and price/performance metrics.

- Tivoli is IBM's answer to simplifying and automating IT monitoring and management. Tivoli products provide integrated management of all aspects of IT, including performance, configuration, security, and availability monitoring and optimization. Tivoli is designed to help customers manage heterogeneous data centers with a consistent set of tools. With this in mind, IBM's Tivoli products all recognize and support the major Linux distributions – allowing customers the same range of management features they have with closed-source commercial operating systems. Tivoli goes a bit further than its competitors in that it has specialized tools for managing Linux on non-native platforms, like IBM's mainframe and RISC-based systems.

- IBM's WebSphere is sort of the Swiss Army knife of middleware, with individual products that include application servers, e-commerce, portals, and cross-platform data exchange. WebSphere has been open-standards based since it was first introduced in 1998 as a simple application server. It has also offered Linux support almost from the start, beginning with version 2 in 2000. WebSphere plays a key role in enabling data interchange between disparate systems and applications. This capability is crucial in building flexible IT infrastructures where information can be quickly accessed by decision makers in a form that is instantly usable. WebSphere applications provide mechanisms that enterprises can use to securely move, process, and verify internal and external data from a wide variety of applications and systems. WebSphere brings these same functions to Linux-based systems

and applications, allowing them to be fully integrated into the existing enterprise IT infrastructure.

IBM's approach to Linux, from a software perspective, shows how the company has evolved over the past decade. Software products adhere to open industry standards and run on a wide variety of systems – including non-IBM gear. While security and reliability are still at the forefront, cost reduction is also emphasized – a topic seldom discussed by the IBM of old. Another new wrinkle is IBM's attention to the SMB market. Most of IBM's enterprise software products are also available in much less expensive SMB versions. These packages retain the quality of the larger products, but eliminate features or functionality that just don't make sense for SMB customers. IBM also provides the fullest suite of cross-platform Linux applications, middleware, and management tools.

Where's the Service?

Like the software side of the house, IBM's service organization (IBM Global Services) has also moved to embrace Linux. IBM's menu of Linux services is lengthy and ranges from full turnkey Linux infrastructure revamps to set-price assessments that help customers decide if, where, and how to adopt Linux. These are quick, high-impact engagements that are very cost-effective.

IBM GS has plenty of Linux experience, gained through both their work with existing clients and their management of IBM's own Linux-heavy internal IT operations. In fact, IBM GS is leading IBM's effort to consolidate 3,900 applications onto 30 Linux mainframes, as discussed above. In addition to actually implementing the consolidation, IBM GS also did all of the work involved in justifying the initiative. This involved examining the entire IBM infrastructure, characterizing applications, selecting the right application candidates, cross-system sizing, and justifying the entire effort based on TCO savings. This was, and still is, a big and highly complex undertaking, but one that will result in $250 billion plus savings over the coming years. Of course, these same services, along with many others, are available to any IBM GS customer.

IBM's service organization has a number of advantages over their competitors, particularly those who are also system vendors. IBM's scale allows them to handle very large projects that often require services to be performed in far-flung locations. Other vendors would need to contract with local providers to provide these services, with perhaps uneven results. IBM's size also pays off on smaller projects. Their huge number of individual engagements has given them the experience they need to build a set of fixed-price, fixed-scope offerings that give smaller customers the ability to engage IBM GS incrementally to solve specific problems.

IBM's large outsourcing organization, coupled with thousands of other client engagements, has also given IBM GS experience with a massive number of platform/workload combinations – experience that competitors, with their smaller service organizations and limited engagement types, are hard-pressed to match. Hewlett-Packard is probably the closest competitor in the services field, but they can't offer the same range and depth of services and expertise. On the Linux front, IBM's experience with both large and small Linux implementations means that customers can rely on GS to deliver the right Linux, on time, and on budget.

IBM Financing

IBM Financing provides customers a comprehensive menu of financing options, and not just on hardware – deals can include software and services as well. The flexibility of in-house financing means that IBM can tailor agreements to provide customers with precisely what they need: the right terms, the ability to match payments with the anticipated financial benefits of the purchase, and even trade-in allowances. Let's say a customer wants to install Linux in order to save money. That customer can arrange to have the payments begin when the cost benefits from the Linux purchase are realized. IBM competitors who work with third-party financial organizations don't have nearly this kind of flexibility with terms and conditions. Competitors who do operate their own financial services don't have the scale necessary to take on the risk of custom terms.

Promises Kept? Promises Broken?

IBM has delivered on their pledge to reorient the company towards Linux. All of their systems, software, and service brands are Linux-enabled – and fully backed up by significant IBM resources. When Linux first emerged, traditional system vendors had four broad choices: fight to protect their proprietary products; pigeonhole it in a niche; ignore it and hope for the best; or embrace the trend. Sun, for example, tried all four strategies, losing market share all the way. Dell mostly ignored it until recently, and HP pigeonholed Linux into their x86 product line. IBM's choice was to fully embrace Linux – despite the perceived risk to their legacy lines of business. As a result, they now have the widest and deepest set of Linux products and services, enjoy support from the Linux community, and are well-positioned to continue to prosper. All of which makes their public commitment to Linux back in '99 seem like a pretty good call.

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