Virtualization & TCO: Linux vs. Microsoft

Analysis of results from our 2008 x86 Vendor Preference Survey shows interesting and significant differences in virtualization adoption for customers who predominantly use Linux vs. customers who have standardized on Windows operating systems. We found that Linux-centric customers in our survey have implemented virtualization in greater numbers, to a greater extent, and are getting more benefits from virtualization technology. Windows-centric customers have also adopted virtualization, but not to the same degree, and they do not report receiving the same level of benefit. We believe that this disparity results in a TCO advantage in favor of Linux in many cases, and that as virtualization makes its way into smaller data centers, it may even signal a move towards Linux as the more virtualization-friendly alternative for smaller IT shops.

In the 2008 edition of our x86 Server Vendor Preference survey, we asked 187 real-world x86 data center personnel about a wide range of technical, support, and industry issues. (Details on survey demographics are included as an appendix to this report.) This is a large research vehicle for us, we ask a wide range of questions covering technical challenges, vendor satisfaction, and future IT plans. As part of the survey, we asked customers about the mix of Windows vs. Linux operating systems on their servers. Virtually every customer in our survey has some flavor of both operating systems in their data center – there are very few 'MS only' or 'Linux only' shops. However, there were significant numbers of customers who had decided to standardize on one o/s or the other, and our survey structure gave us the ability to cut results by operating system preference.

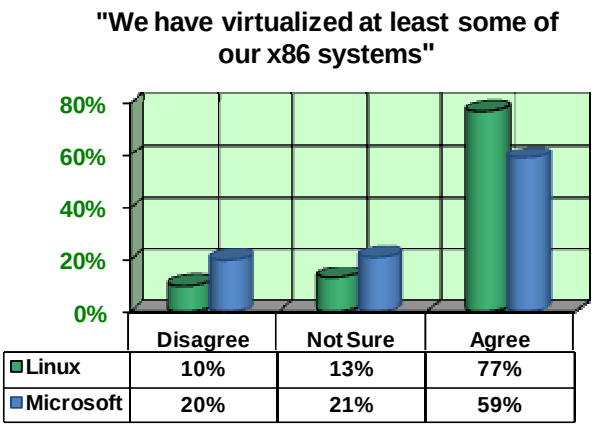
With those preferences in hand, we then took a look at how these distinct sets of customers are adopting x86 virtualization technology. Virtualization refers to using an enterprise system to run multiple workloads simultaneously. As is now almost universally acknowledged, implementing virtualization can have a large and favorable impact on capital expenditures, operating costs, facilities requirements, and manageability/administration. It can even help data centers roll out new applications faster and with less effort. In our view, the move towards virtualization is easily the most significant data center trend in the last decade; already it's had a considerable beneficial impact on customer IT costs.

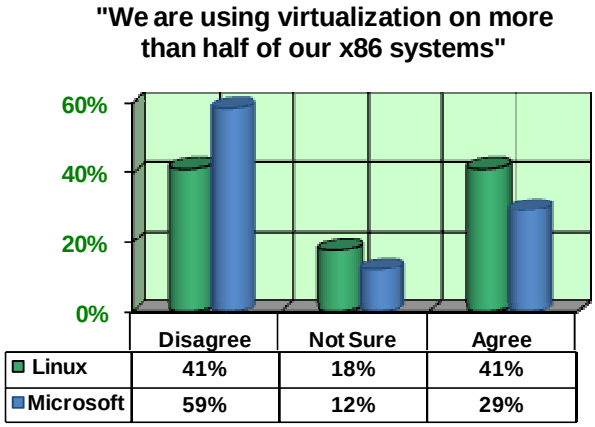
Gabriel
CONSULTING GROUP

Our survey results were extremely interesting: there are significant differences between Linux and Windows respondents in virtualization adoption rates and the degree to which they have virtualized their x86 infrastructures.

Linux vs. Windows: Virtualization Adoption & Implementation

As can be seen on the chart below (left), customers who predominantly use Linux over Windows are employing x86 virtualization in some form at a significantly higher rate: 77% vs. 60% - almost 30% higher.





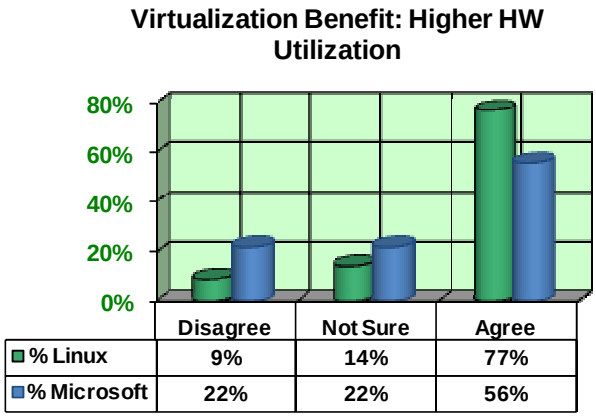
So heavy Linux users are more likely to be taking advantage of virtualization compared with heavy Microsoft o/s users, but to what degree? The chart at above right asks these customers to what magnitude they have virtualized their x86 infrastructures. Over 40% of heavy Linux users have virtualized more than half of their x86 systems. By comparison, only 29% of heavy Microsoft users have reached this level of implementation. According to our survey results, Linux users have clearly both adopted virtualization at a greater rate and embraced it to a greater extent than customers who have standardized on Microsoft operating systems.

Why do we see such a difference in virtualization adoption rates between Linux and Microsoft 'standardizers'? The major reason is that until recently, Microsoft was less than open to virtualization. By this we mean that the company was very reluctant to formally support any non-Microsoft virtualization mechanism – which meant that customers who were running VMware or Xen with Microsoft workloads would either have to troubleshoot and fix their own problems, or remove the virtualization layer and then replicate the problem to receive Microsoft service support.

With the introduction of their Hyper-V virtualization product, Microsoft has become more supportive of the virtualization trend – extending grudging support for customers using VMware and Xen. However, Hyper-V is still quite a ways behind both VMware and Xen in terms of features, functions, and manageability, meaning that die-hard Microsoft standardizers are probably behind the curve in terms of virtualization implementation. Hyper-V is even farther behind VMware in terms of market share, with VMware owning as much at 80% of the x86 virtualization market overall and definitely owning the high ground in terms of enterprise mindshare. Even giving away Hyper-V essentially for 'free' has done little to build buzz for the product.

The Linux o/s and development model has some natural advantages over that of Microsoft when it comes to virtualization. Linux is open source and free, which gives developers a view into the innards of the code so that they can easily design their virtualization mechanisms to maximize performance and availability. Windows is closed source, meaning that developers have a more difficult time getting intimate with the o/s. There are also licensing differences that bear directly on comparative costs. With Microsoft, users who don't have volume agreements or who haven't purchased the more expensive Enterprise or Datacenter editions will have to purchase licenses for every system and each of the virtual machines running on those systems. Linux, on the other hand, can be essentially free, meaning that companies can deploy it on multiple systems or in virtual machines at no cost.

Linux vs. Windows: Virtualization Benefits

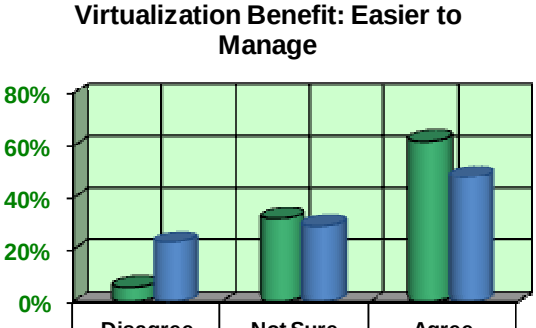


	Disagree	Not Sure	Agree
% Linux	9%	14%	77%
% Microsoft	22%	22%	56%

The adoption of virtualization has significant implications on TCO and operational differences between Linux and Microsoft operating environments. One of the first aspects to consider is the impact that virtualization can have on hardware costs. In our survey, Linux users are realizing benefits from higher hardware utilization rates at a much higher level than Windows server users. It's important to keep in mind that the typical x86 server has an average CPU utilization rate of around 6%; this means that these systems are simply idling as much as 94% of the time.

With virtualization, multiple workloads run on single systems, which drives utilization rates up without compromising individual application performance. It's common to see consolidation ratios of 5 or 10 to 1, meaning that customers can radically reduce the number of physical systems they have to support. Just the cost savings arising from fewer system purchases, along with reduced vendor maintenance charges and software licenses, can add up quickly. Given that Linux users are reporting higher hardware utilization and are virtualizing at greater rates, we believe we can conclude that Linux standardizers enjoy lower hardware costs than Microsoft standardizers.

One of the biggest headaches for data centers is managing server sprawl. Administration and management labor is one of the largest components in IT total cost of ownership as well. With virtualization and the associated automation of routine management tasks, most data centers see the ratio of servers to system administrators increase significantly. In other words, virtualization allows them to manage many more workloads with the same number of people. The chart at right shows that Linux standardizers see significantly higher manageability benefits than Microsoft standardizers. Moreover, four times as many

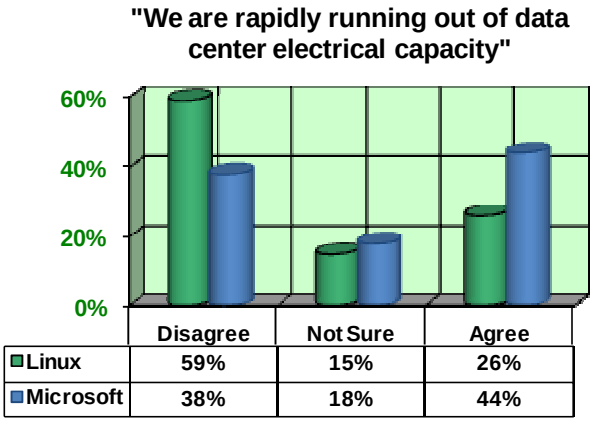


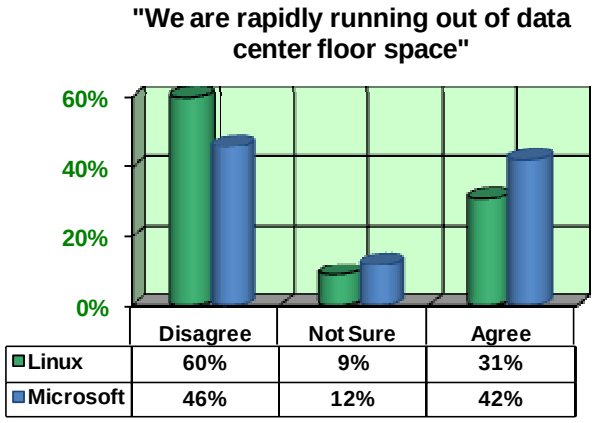
	Disagree	Not Sure	Agree
Linux	6%	32%	62%
Microsoft	23%	29%	48%

Microsoft respondents say that virtualization is actually more difficult to manage – which may point to the difficulty inherent in trying to virtualize Microsoft-based infrastructures. It certainly implies that Linux may have both a cost and operational advantage over Microsoft on this basis as well.

Facilities costs are another category of expense that can be beneficially impacted by virtualization. As server sprawl spiraled out of control, more and more data centers suddenly found themselves hitting the wall – literally – as they realized that they were having problems fitting their servers and associated IT gear into their data centers. The answer to that problem seemed to be increasing server density by deploying small 1U rackmount servers and then ultradense blade form factors. This brought about another problem, however: data centers found that they were pushing the limits of their electrical capacity. For those that weren't running out of juice, the added cost of power and extra cooling load opened up many eyes in the CFO suite.

One of the biggest benefits of virtualization is the potential to significantly reduce floor space needs and electrical usage by combining workloads onto single systems and decommissioning excess servers. As we touched on above, 5 to 1 or 10 to 1 server consolidations are not unusual at all when implementing x86 virtualization; and those ratios, when applied to a large number of servers, can cut floor space requirements and electric costs considerably.





This is another area where Linux adherents seem to be ahead of the game when compared to heavy users of Microsoft operating systems. Almost 60% of Linux users report no problems with data center power requirements, while only 38% of Microsoft users say the same. Almost 45% of Microsoft customers say that power is becoming critical in their shops, compared with about a quarter of data centers where Linux is dominant. In fact, virtualizing applications is one of the best and easiest ways to reduce data center electrical requirements. The situation is a little better for Microsoft users when it comes to floor space, with almost half saying that floor space isn't a problem. However, 60% of Linux users say the same thing – a significant difference. The virtualization advantage enjoyed by Linux users seems to have a positive TCO impact when it comes to facilities as well.

So how much money are we talking about, anyway? Quite a bit, as it turns out. Total TCO savings arising from full virtualization implementations can approach 60% in some cases. This, of course, depends upon where you're starting from, the degree of server sprawl, and how good a job you do of optimizing and managing the virtualized infrastructure. We find that average savings tend to be in the range of 20-30%, and we believe that these numbers are both reasonable and achievable.

According to our research, Linux standardizers have a significant virtualization advantage over Windows standardizers. Linux users are doing more virtualization and reaping higher levels of benefit, according to our survey respondents. As we discussed above, the Linux respondents are seeing higher system utilization levels and believe that virtualization is making their systems management chores easier; both of these benefits go right to the bottom line. By the same token, the heavy Linux users are also suffering less from power and floor space consumption than their Microsoft-centric counterparts.

The early adopters in virtualization have primarily been large data centers. While virtualization hits at problems that occur in both large and small IT operations, the larger shops generally had more motivation to implement virtualization, as their problems with server sprawl are generally more acute. Having 5,000 underutilized servers is a bigger issue than having 100 underutilized servers, and the benefits from virtualizing a huge number of systems have a much larger impact than virtualizing a small set of systems. But the virtualization trend is spreading to smaller data centers over time. And while Microsoft is certainly more virtualization-friendly, it likely won't ever equal Linux in this area – mainly because Microsoft wants and needs to realize revenue on every single Windows server instance, while Linux can be free for use. These factors lead to an interesting question: Does the move towards virtualization make it more likely that customers will eschew Microsoft in favor of a more virtualization-friendly Linux solution? As more Microsoft-centric customers become convinced that virtualization is the way reduce costs, will this prompt them to give Linux a try in an order to reduce costs even more?

Linux vs. Microsoft: Other TCO Factors

One topic that we haven't yet addressed is acquisition cost. While it seems that this should be a straightforward analysis, in the real world it can get fairly complicated fairly quickly. The Linux side is pretty easy to understand: basic Linux is free. However, most enterprises want at least some level of support from a vendor that will stand behind the product. The leading Linux vendor, Red Hat offers different levels of service, ranging from $799 for basic support to $2,499 for unlimited incidents and 24x7 phone support per year. In some situations, there are limitations on the number of guest RHEL instances that can be deployed and some additional charges for the privilege. Novell's SUSE Linux Enterprise Server comes in $349 for unlimited use per server, with an additional charge of $1,499 per year for priority support – very attractive from a cost standpoint for customers who virtualize. Of course, these are all list prices; volume pricing agreements coupled with sharp negotiating can bring this number down considerably.

On the Microsoft side, things are a bit more complicated. Microsoft is offering five different flavors of Windows Server 2008, ranging in price from $469 for a web server-only product up to $3,999 for their full-on enterprise edition. This covers only the software; support is an additional charge. Each package supports a certain number of CALs (Client Access Licenses), which can be either a device or a user. For example, their Windows Server 2008 Standard product includes five CALs, while the Enterprise edition comes with 25 CALs. Extra CALs cost $199 for five CALs or $2,979 for 20 extra CALs. Most customers desiring support will probably

opt for some version of Microsoft's Software Assurance program, which offers phone support along with upgrade rights. There are many different options and, for a large enough organization, prices can be negotiated; but for server products the annual cost is around 25% of the base licensing cost.

Depending upon the assumptions used, a case can be built in favor of either operating system in terms of acquisition cost. The differences lie mainly in the number of users supported (CALs in Microsoft's case, which can drive up costs considerably) and in the level of support desired. With Linux, it's easy to imagine customers buying minimal or no support for some deployments, while opting for full enterprise support for others. It's obvious, to us at least, that Microsoft has taken a sharp pencil to its price structure in an effort to level the playing field with at least supported Linux distributions. They can't, of course, afford to release a free version of Windows Server.

Acquisition and support costs are only part of the criteria that customers will use in making a Microsoft vs. Linux decision. Factors like virtualization, as we discussed at length above, will also play a role. And there are several other differences between the two operating systems that have a big impact on IT operations and business value, but that are less easy to quantify. For example:

Security Although both operating systems have reached a solid level of security, Microsoft products are generally perceived as being more vulnerable to attack because so many hackers have made it their prime target. Both operating systems can be secured, but it's generally believed that Linux is a bit easier to secure than Windows.

Flexibility Linux, because it is open source, is almost infinitely flexible. It's used in applications ranging from embedded systems to enterprise applications to supercomputing (a market that Microsoft is feverishly trying to penetrate, mainly because it represents the future of business computing). The impact on TCO arises from the ability of data center personnel and application developers to use a single tool – Linux – to address a huge range of IT needs. Users can customize Linux to shape it to almost any task because, again, it's open source. Even though there are multiple Windows Server editions, it isn't nearly as malleable.

Performance This is kind of tied in with the flexibility point above, but it's a bit more technical. With Linux, it is relatively easy to use only as much or as little of the operating system as is needed for the specific task. In fact, there are third-party tools that perform this task behind the scenes; they examine the application stack and then load only the necessary Linux o/s components. This can greatly reduce the software load on the system, thus improving performance. It is possible to do the same thing with Windows, but it can be more difficult to achieve the same levels of performance.

The extent to which these 'soft' factors add to the business value of Linux when compared to Windows Server will vary according to the customer situation. For some customers, like service providers, the factors above are very important, and they have overwhelmingly voted in favor of Linux. Other, smaller customers may well find the Linux value proposition persuasive as they grow and their IT infrastructures become more complex. The current economic difficulties will also play a role in convincing customers of all sizes to take a closer look at reducing costs and increasing efficiency.

GCG Summary and Recommendations

The difference in virtualization implementation rates and the benefits received from virtualization between Microsoft and Linux standardizers is interesting and somewhat surprising. We believe that this data implies that Linux-centric shops enjoy a significant cost advantage over those who have standardized on Microsoft operating systems. Aside from virtualization, other factors tend to favor Linux. Linux is simply much more flexible and offers customers more options for deployment and cost management than Microsoft alternatives. All of these characteristics factor into the Linux vs. Microsoft decisions that enterprises are making day in and day out. Most customers have a mix of the two operating systems, but we believe that the differences in things like virtualization friendliness, deployment options, and cost efficiency may cause market share changes over time.

In general, we find that very small shops and very small organizations are probably best served by Windows. They generally have peer-to-peer networks, and their most complicated IT operation might be attaching and sharing a network attached storage device. But larger organizations tend to move towards mixed environments. As companies grow, their IT infrastructures become commensurately more complex; on the cost side, licensing fees can become more onerous and carry restrictive usage terms. The ability to implement technologies such as virtualization, for example, tends to be easier with Linux. Several years ago, a case could be made that it was difficult to find skilled Linux administrators; however, that certainly isn't the case today. Likewise, pretty much any enterprise application has a Linux version.

As organizations grow and IT becomes a point of differentiation, they tend to gravitate towards Linux, finding it to be not only less expensive in hard dollar costs but also more flexible, giving them greater control over their IT. While Microsoft has come a long way in reducing the cost of their Windows Server operating systems and increasing the business value, they haven't – and probably can't – match the combination of low cost and high capability offered by Linux.

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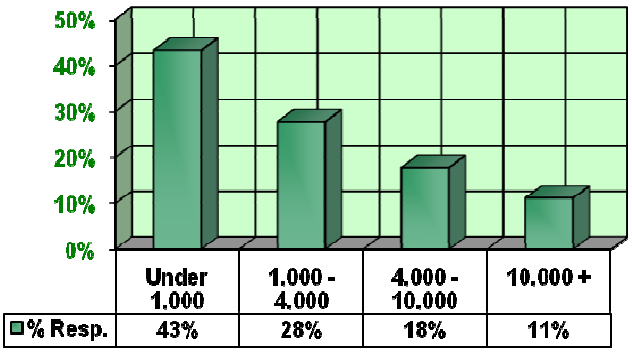
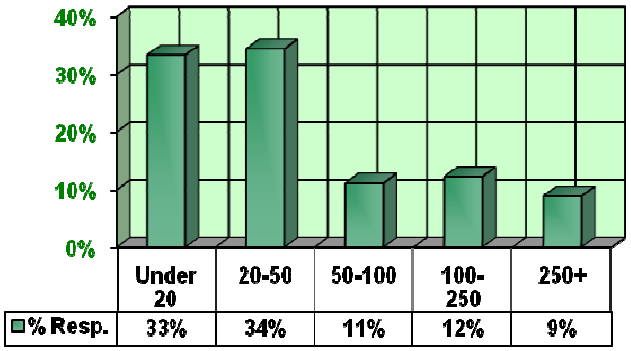
GCG's Server Vendor Preference Surveys track trends and issues in the x86 market – and the ups and downs of the four major vendors – by going to the experts. Our survey participants are IT managers, architects, and administrators who work with the systems and know what's happening in the data center.

2008 x86 Server Vendor Preference Survey Demographics

Organization Size (employees)

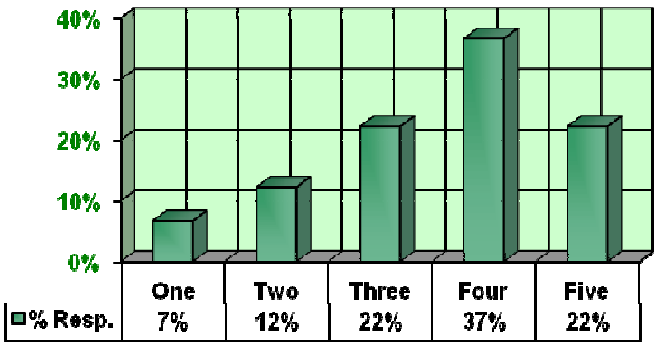


Servers Managed by Respondent

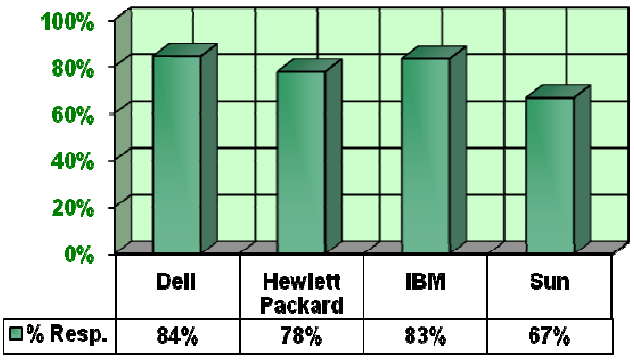


There were a total of 187 enterprise x86 respondents to this survey. SMBs (Small- and Mid-sized Businesses) were well-represented in the survey, making up 43% of total participants. This survey also had a reasonable number of very large enterprise participants, at a little over 11%. The "Servers Managed by Respondent" chart refers to the number of servers that the individual participant is responsible for or has detailed knowledge about. An interesting data tidbit from this survey is that some of the SMBs with relatively few employees had fairly large server counts, in some cases a hundred or more x86 servers. Given this, it isn't hard to understand why the server vendors are rushing to produce SMB-friendly offerings.

Number of x86 Vendors



"We have at least some x86 servers from..."



Over 81% of our respondents own x86 servers from three or more vendors. Almost a fourth have systems from five or more vendors, including white box or 'built it ourselves' systems. Only a very small portion – 7% - has managed to completely standardize on a single x86 vendor. Drilling down a little deeper, we find that the major vendors are present in pretty much every account. This isn't too surprising, given the fact that such a large proportion of customers have servers from three or more vendors.