

Virtually Possible: Virtual Appliances Ready to Shake Up Application Delivery

The Bottom Line:	Virtualization doesn't just impact infrastructure. It also can affect the way software applications are built and delivered through JeOS concepts and virtual appliances. However, the road to mainstream acceptance will not be easy or quick as entrenched interests and certain market players will resist this change to the established market structure.
Key Concepts:	JeOS, virtual appliances, server virtualization, operating systems
Who Should Read:	ISV, OS vendor, virtualization vendor, virtual machine cloud service provider, CIO

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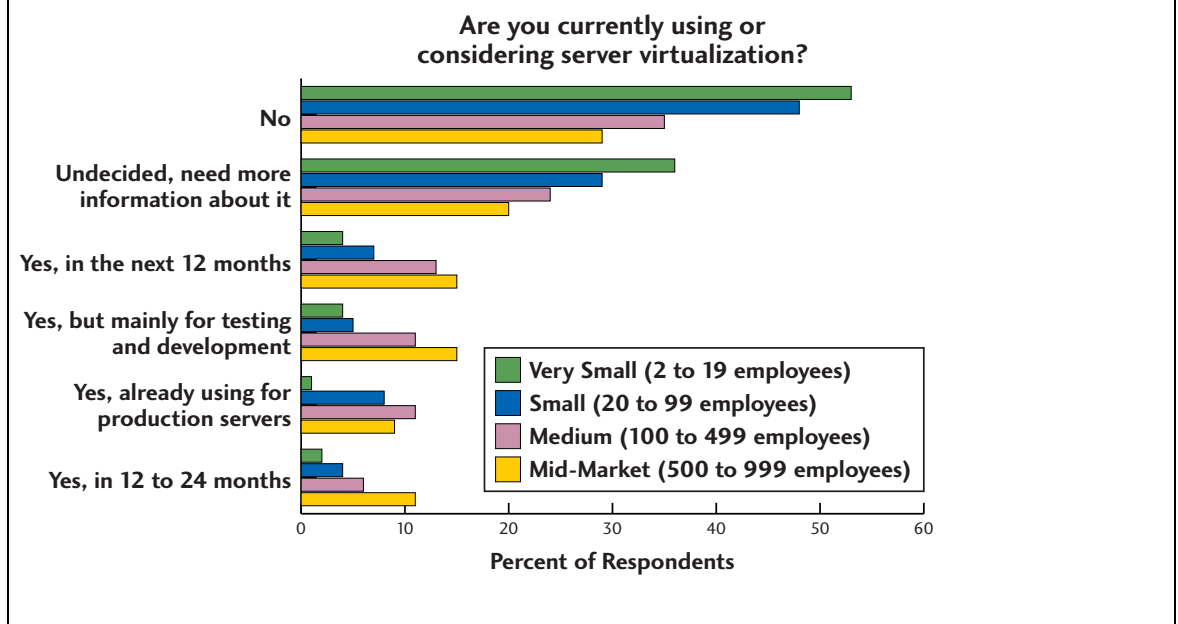
Executive Summary

Software delivery has not changed much since commercial boxed software became widely available in the early 1980s. Bits are obtained and installed on top of an OS running on a piece of hardware. Appliances soon became vogue, due to the ISV being able to control the entire operating environment from hardware to OS to application. However, this software delivery process meant that a software company would have to get into the business of hardware, which is unappealing in many ways.

Exhibit 1.

Server Virtualization Rapidly Gaining Interest in SMB and Mid-Market

Source: Yankee Group 2006 SMB IT Infrastructure Survey



Now, the newest delivery platform, SaaS, leverages the power of the web to deliver software remotely, but on-premises software delivery has seen little innovation. Meanwhile, applications and OSs have gotten larger and more complex, leading to increased bugs, security risks, support issues, and time and cost to implement and maintain. Modern OSs are so large and complex that Microsoft took 5 years to produce the next versions of the Windows desktop and server lines. With the rise of anywhere computing, enabled by server virtualization, IT infrastructure and its relationship with applications have dramatically changed. ISVs have a new and better way of delivering their software through virtual appliances, which puts OSs into a very different role. ISVs and customers, particularly SMBs, stand to reap tremendous benefits from virtual appliances. But the road to mainstream adoption will not be easy as virtual appliances challenge the large and established ecosystem and business models of OS vendors, ISVs and enterprise IT.

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I. The OS Goes on a Diet

A virtual appliance is a virtual machine image that consists of an application and an integrated OS. A customer-created virtual machine would normally consist of an OS such as Windows or Linux, on top of which is installed an application. With a virtual machine, the user is responsible for managing and installing the OS, whereas with a virtual appliance, the entire stack of OS and app is delivered as a single preinstalled and preconfigured unit to the customer by the ISV.

Before virtualization allowed system administrators to carve up a server into multiple slices, a server could only run one OS. If your server utilization was low, you could consolidate by installing multiple applications on top of the OS. However, these applications would not be fully isolated from each other as applications running on the same OS can conflict with each other and have less security separation. Virtualization allowed you to install multiple OSs and run each application in a separate VM, allowing for complete isolation. However, you were now running multiple copies of a fat OS, resulting in an inefficient use of memory, CPU and storage resources, and forcing you to manage more logical machines.

Virtual appliance OSs can be made more efficient by embracing what VMware has dubbed JeOS (pronounced “juice”) concepts. JeOS stands for “Just Enough Operating System”, which means that the OS should be tailored to fit a specific application. JeOS makes it possible for an OS to be built from the ground up to only run one application such as BEA’s Liquid VM, which was made solely to run BEA’s Java app server. JeOS can also take an existing general-purpose OS such as Linux and strip it down to only what that application requires.

II. ISV Benefits

Moving to a virtual appliance software model will change the way ISVs design, maintain and distribute software. Initially the virtual appliance will be just another platform for most ISVs as they continue to support existing OSs and port existing software to this model, which may limit some of its benefits. But as virtualization progresses and the concept gains acceptance, virtual appliances may become the predominant and only platform for ISVs, with products built from the ground up to fit this model. Some of the benefits that virtual appliances bring are:

- **Lower support costs:** Supporting a myriad of customer OSs, each with various patch levels and configurations, can quickly become a nightmare for ISVs. Additionally, the ISV is also faced with determining if the problem is due to an OS issue or an application issue. By offering a virtual appliance with a single OS version and configuration that is under the control of the ISV, support costs can be reduced.
- **Better performance:** Some applications can benefit performance-wise from OS optimizations. Building a custom OS like BEA’s requires a lot of investment. It would only be appropriate for a very small number of applications, but can certainly have dramatic effects. Most applications wouldn’t need this level of OS tuning, but could benefit from custom configurations of a general purpose OS such as Linux. In general, a JeOS platform will give better performance due to the smaller footprint of the OS, even if no deeper modifications are made.
- **Better quality software:** By removing the variables due to customer-installed and -configured OSs, ISVs can have complete control of the operating environment for their software. This allows ISVs to deliver a better user experience and ultimately higher quality software. By targeting a single controlled platform, ISVs can better test and qualify their software and deliver a consistent experience.
- **More secure software:** Reducing the OS to the minimum required components for a single application reduces the attack surface and allows the ISV to harden the OS. This will benefit SMB users in particular, who often don’t have the expertise to lock down their own systems.
- **No hardware to manage:** Although physical appliances offer some of the same benefits of virtual appliances, getting into the hardware business is outside of the core competency and business models of most software vendors. What virtualization offers is a standard layer of infrastructure that ISVs can build upon. Moving from physical to digital distribution will also allow ISVs to reach new markets that they wouldn’t be able to with physical boxes.
- **An effective sales tool:** Due to the plug-and-play nature of virtual appliances, demos, proof of concepts and software evaluation have never been easier. Reducing the investment in time and resources to demo an evaluate software can expose the ISV’s product to a wider audience and shorten sales cycles.

III. Customer Benefits

By combining a new infrastructure architecture (virtual infrastructure) with a new software delivery platform (virtual appliances), customers stand to radically change the way applications are deployed and managed. Virtual appliances offer many application improvements such as:

- **Easy scalability:** Traditional applications have been difficult to scale because the OS was tied so closely to the hardware that it was difficult to move to a faster machine. Physical appliances suffered a similar problem because the only way to get more performance was to swap out for a faster model. Virtual appliances can easily be moved to faster machines, even on the fly using something like VMware's VMotion, or additional instances spun up at a moment's notice.
- **Quick deployment:** Virtual appliances plug into existing virtual infrastructure and come preconfigured and ready to start—a value proposition that has made physical appliances and SaaS so popular. Users can immediately jump into the application rather than having to first install and configure an OS, then install and configure an application. SMB users will particularly benefit, as they often struggle with technology deployments with their limited resources and expertise.
- **Single vendor support:** Because the entire software stack from OS to application comes from one source, administrators have a single point of contact to go to for support issues. Additionally, a virtual appliance is inherently supported in virtual environments, something that many applications have yet to fully support.
- **Easier management:** Customers do not have to manage or patch the OS in a virtual appliance model and can concentrate solely on application performance and management. ISVs take on the management of the OS from the user and shield the user from this layer of software.
- **Leverage existing virtualization features:** All the features and functionality of a customer's virtual infrastructure are instantly available to a virtual appliance. Key virtualization functionality, such as backup, disaster recovery and resource scheduling, are automatically made available to customers and their applications. High availability/disaster recovery and scalability are the most critical features inherited from the virtualization platform that are not available with hardware appliances or traditional software models.

IV. Redefining the OS

From an ISV and customer perspective, it is hard to argue with the benefits that virtual appliances bring. However, this is a major shift in the software stack as control of the OS passes from the customer to the ISV. The role of the OS itself is dramatically changed. The traditional fat OS had to run on every piece of hardware and be able to run the entire gamut of applications. Virtualization presents a standard set of hardware to the OS. Virtual appliances only require an OS to run a single application, so much of the fat OS becomes dead weight. As the demarcation line changes between the OS and app, and customer versus ISV control of the OS, many questions as to what the OS will now become still need to be answered.

As the OS in a virtual appliance passes out of customer control, issues remain as to whether a single OS image can accommodate all users. IT departments may have implemented system policies or require various agents to be installed. There is certainly a large ecosystem of OS add-ins that many enterprises have invested in. However, making the OS too open to users and modifications counters the goals of an appliance-like experience and creates too much variability in the OS layer. Yankee Group feels that users should move beyond OS management because there is little real need for users to have root access. However, some type of extensibility is needed as ISVs will not be able to meet every customer OS, policy or management need. This extensibility should not corrupt the core OS as that would defeat having a controlled OS environment. The functionality should be loosely coupled, perhaps living outside the virtual appliance and somewhere else in the virtualization stack. There also remains the issue of discovering and setting environmental context. That is, upon booting a virtual appliance, having a standard way for the appliance to obtain the configurations and policies, such as directory services or network settings, that it needs to run and comply with the customer environment's rules.

V. Overcoming Entrenched Interests

Although virtual appliances offer exciting advances in software delivery, many barriers to adoption exist. An entire culture and ecosystem has been built around the traditional roles of the OS and application management and development. Overcoming this legacy will not be an easy or quick task.

Passing control of the OS to the ISV changes the fundamental business model of an OS vendor who typically sell to hardware OEMs and end users. This has been a long and lucrative business for OS vendors. They may not be very motivated to move to a radically different model. Additionally, IT culture may slow adoption because administrators may be reluctant to cede control of the OS, especially in large enterprises where teams that specialize solely in management of OSs are threatened. For ISVs, assembling and managing the lifecycle of an OS may not be strategic and outside their core competency. For the OS, many will partner with third-party JeOS providers, such as rPath, which offer services and tools for ISVs to build a customized Linux image and manage it over the lifecycle of their application.

Virtual appliances also escalate the war between Windows and Linux. Linux is currently the overwhelming favorite choice for a JeOS because open source licensing and the modularity of Linux lends itself perfectly to a virtual appliance platform. The current architecture and business model of Windows is not a good fit for JeOS. Few ISVs have based virtual appliances on Windows. However, there exists a large ecosystem of Win32 applications, many of which may not be easily ported to Linux. Microsoft has shown little interest in embracing the JeOS and virtual appliance model, so these ISVs are either forced to port to Linux or try and use Windows for their appliances, neither of which may be attractive options. Additionally, even if an ISV wants to embrace Linux for virtual appliances, existing partnerships may hinder that adoption. Many ISVs have strong business partnerships with OS vendors and changing platforms would jeopardize that relationship. The channel may also resist because a certain part of its revenue stream feeds off the complexity of implementations.

A standard format for virtual machines is absolutely critical to the success of virtualization and virtual appliances. Fortunately, it appears that the industry is rapidly converging around Open Virtual Machine Format (OVF) as a standard format, co-authored by VMware and XenSource and backed by all the major virtualization vendors such as Dell, HP, IBM, Microsoft and the Distributed Management Task Force (DMTF).

VI. Conclusions and Recommendations

The virtual appliance and the JeOS concept is an emerging and exciting development for the software industry. The development, delivery and management of on-premises software has seen little change and innovation, while software and IT complexity has grown, leading to long and difficult deployments, higher management costs and lower-quality software. These drivers have made SaaS attractive to many businesses. Now, virtual appliances running on virtual infrastructure offer many of the same value propositions without having to outsource. Virtual appliances combined with virtual machine clouds (VMCs) enable a powerful one-two punch resulting in a SaaS and on-premises hybrid computing model. However, it brings dramatic changes to an entrenched ecosystem of OS vendors, ISVs and IT departments. Changing the culture and businesses of these parties will not be easy.

Recommendations for Enterprises

- **Take a test drive.** Virtual appliances are rapidly spreading and VMware's [Virtual Appliance Marketplace](#) is a good place to start. After evaluating the benefits firsthand of this new software model, you can begin to plan how virtual appliances can be adopted in your organization and how they fit within your overall IT and applications strategy.
- **Pressure your ISVs for virtual appliances.** Tell your software vendor about your preference for this new delivery platform. As this model evolves, ISVs need to see the demand and the benefits from their customers. Give feedback to your ISV on what you need from a JeOS, in terms of control, functionality and extensibility. JeOS is a new concept and ISVs are still trying to figure out the details.
- **Change your IT mind-sets and cultures.** For things to get better, things have to change. Virtual appliances may threaten some within your IT organization and changing decades of traditional methodology won't be easy. But the benefits of virtualization and virtual appliances are too great to ignore. Eventually, enterprises are just going to have to bite the bullet and do what is best.
- **Lose the OS religion.** Most virtual appliances are going to be built on open source OSs, particularly Linux. Enterprises have to relax illogical OS policies and preferences and trust the ISV to do what is best for their application. The application is ultimately what should dictate the OS requirements.

Recommendations for ISVs

- **Invest R&D into virtual appliance and JeOS concepts for your application.** The cost savings and customer benefits are too large to ignore. Consider how new applications could be built from the ground up to take advantage of this model and perhaps as even the preferred and only platform. Existing applications will have to be carefully evaluated as how they can be effectively ported to a JeOS platform.
- **Carefully evaluate OS options.** Assuming responsibility for an OS is not a task to be taken lightly. ISVs must just not consider building the OS, but updating it and managing it over the lifetime of the appliance. Most ISVs should enlist the help of a partner for a JeOS and focus their own resources on their core business, the application. ISVs must carefully weigh open versus closed source and licensing models as well as the impact on existing OS vendor and channel relationships.
- **Promote the concept to customers.** Virtual appliances will be a foreign concept initially to many customers and they will need to be educated on the benefits. Feedback from current users shows a great user experience and a myriad of benefits realized. Make available both concise, high-level and technically detailed informational materials such as white papers and webinars to prospects, along with real-world customer case studies.
- **Target SMB and mid-market customers.** SMB and mid-market enterprises have the least requirements for the OS and management and the highest need for an appliance-type experience. Large enterprises will eventually come around, but several issues regarding control, extensibility and demarcation still need to be resolved.
- **Partner with virtual machine cloud (VMC) service providers.** The combination of VMC computing (such as Amazon's EC2 and services built around VMware's VSSP) and virtual appliances enable a powerful, hybrid form of computing that embraces the best qualities of both SaaS and traditional software. These services are in their infancy, but as these services gain acceptance, they can be a powerful channel for software distribution.

- **Offer subscription licensing to better compete with SaaS.** The days of owning software may soon come to an end as many customers clearly like the subscription model of SaaS. Offering software subscriptions instead of selling licenses allows ISVs to better compete against SaaS vendors with a hybrid offering and gives them greater reach into the SMB market.

Recommendations for Virtualization Vendors

- **Embrace and drive standards.** Standards such as OVF are essential to accelerating adoption of virtualization and virtual appliances. A fractured and incompatible virtual infrastructure kills much of the value of virtualization. Standards for extensibility and setting context for virtual appliances are also needed, none of which exist today.
- **Educate the market.** Being such a new concept, building both ISV and customer awareness is currently the most crucial factor. Information, communities, and better tools are required to get the market educated and enabled to move to this new model.
- **Build a community.** A large and active community can accelerate adoption of new technologies and concepts. New ideas need places where people can discuss, refine and help each other as they experiment with new technology models.

Recommendations for OS Vendors

- **Embrace creative destruction: Rethink your software architectures and business models.** Existing fat OSs don't fit the bill in a JeOS world. Virtual appliances are a big game changer for the OS and vendors must begin this transition. For some of these vendors, turning around a large ship takes a long time. JeOS will require modularity, customizability and openness, as well as a different licensing model. Additionally, OS vendors must learn to cater to a new customer, ISVs. Linux and open source currently have the lead, but the market is just emerging and it's anyone's game still. Even traditional Linux leaders such as Red Hat and Novell have major rethinking ahead to fit into this new architecture. Red Hat has announced an appliance version of RHEL, but this offering appears to be still more of a legacy OS than a modern JeOS. Red Hat has focused on maintaining RHEL compatibility and certifications rather than slimming down the OS to enable application-specific tailoring. Microsoft faces being locked out if it can't make fundamental changes to Windows.
- **Learn the lessons of the past.** The database wars of the 1990s are a perfect example of how powerful ISVs can be. Sybase Inc. focused on the features and functionality of the database software and had a superior database to Oracle. However, Oracle focused on the needs of ISVs such as SAP and PeopleSoft. Its database product was pulled through by ISVs and enterprises that focused on application functionality, not the underlying technology. As a result, Oracle became the dominant database vendor.

VII. Further Reading

Yankee Group Link Research

[Citrix Shakes Up Virtualization Market with Acquisition of XenSource](#), Note, April 2007

[SMB Infrastructure Goes Virtual](#), Report, January 2007

[Server Virtualization Creates New Opportunities for Fault-Tolerant Servers](#), Note, January 2007

[2006 Small & Medium Business IT Infrastructure Survey](#), Note, November 2006

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