



# Understanding, Building and Deploying Virtual Appliances

Reduce Development Costs and Time to Market

WHITE PAPER

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## Executive Summary

Virtual appliances help reduce complexity, increase productivity and accelerate innovation in software development and deployment. Developers and their partners use virtual appliances to bring scalable, robust software and hardware solutions to market faster while reducing development costs. Organizations of all kinds use virtual appliances to simplify software installation and management and to leverage the full capabilities of leading virtualization platforms such as VMware vSphere®.

This paper covers what virtual appliances are and how they are changing the way software is developed, distributed, deployed and managed. It provides a glossary of terms—distinguishing virtual appliances from related technologies such as virtual machines and vApps—and outlines virtual-appliance benefits to both software and hardware developers. In addition, this paper explains why Open Virtualization Format (OVF) is becoming the platform of choice for packaging and distributing virtual machines. It then introduces the leading tools—including VMware Studio™—for creating virtual appliances. It concludes by providing links to key virtual-appliance resources such as the VMware Solution Exchange (VSX), the industry's largest marketplace of virtual appliances and partner solutions.

## Understanding Virtual Appliances

To understand virtual appliances and their benefits, it is important first to become familiar with some of the key terms and concepts that define software development and deployment in virtualized environments.

### Virtual Appliances Defined

**Virtual appliances** are prebuilt software solutions comprising one or more **virtual machines** that are packaged, updated, maintained and managed as a unit. Software developers create virtual appliances by developing self-contained and optimized application stacks that are customized for their workload and embedded with an operating system (OS) of choice.

Virtual appliances are fundamentally changing how software is developed, distributed, deployed and managed. For developers and the organizations that license their software, the benefits of virtual appliances include a reduction in development and distribution costs, accelerated time to market, a more secure software delivery system, and the ability to leverage industry-leading virtualization platforms.

In addition, virtual appliances are more secure and reliable than traditional software and easier to install and manage. Because virtual appliances are preconfigured, they help organizations reduce the time and expense associated with application deployment—including the patching and ongoing management of the software. Organizations use virtual appliances to gain access to the advanced capabilities of virtualization platforms—such as high availability, scalability, backup and live migration—while gaining greater flexibility and freedom of choice as to how and where they run their applications.

### Virtual Appliances Compared to Virtual Machines

A **virtual machine** is a tightly isolated software container created to run on virtualized platforms. It has four key virtualized resources (CPU, RAM, storage and networking). It requires the installation of an OS and runs one or more applications. A **virtual appliance** functions much like a virtual machine, possessing the four key characteristics of compatibility, isolation, encapsulation and hardware independence. However, a virtual appliance contains a preinstalled, preconfigured OS and an application stack that is optimized to provide a specific set of services.

Because virtual machines contain a general-purpose OS that can run multiple applications, the patches for virtual machines are delivered by both OS vendors and application software vendors. IT administrators, in turn, might need to test these patches for compatibility. In contrast, virtual appliances are a unified offering of Just Enough Operating System (JeOS, pronounced “juice”) and a single application. The application-software vendor needs only to provide a single pretested update (containing relevant patches), thereby eliminating the need for testing.

**JeOS** is a stripped-down version of an OS. Several software vendors are creating JeOS variants to support the virtual-appliance paradigm. Examples include Ubuntu 7.04, 7.10 and 8.04, Lime JeOS from Novell, and Appliance Operating System (AOS) from Red Hat.

### Virtual Appliances and Application Virtualization

**Application virtualization** is an umbrella term referring to technologies that improve application compatibility and manageability by encapsulating applications from the underlying OS on which they are executed. Technology categories that application virtualization subsumes include

- **Application streaming** – The application is delivered in a package that can include a subset of OS files and configuration settings. Running the package requires the installation of a lightweight client application. Packages are usually delivered over a protocol such as HTTP or Real Time Streaming Protocol (RTSP).
- **Desktop virtualization and VMware View™** – The application is hosted in a virtual machine or blade PC that also includes an OS. These solutions include a management infrastructure for automating the creation of virtual desktops and for providing access control to target virtual desktops. VMware View solutions can usually fill the gaps where application streaming falls short.
- **Self-contained virtual-machine packages such as VMware ACE** – These packages are typically launched with a small runtime player (which can be bundled with the package). They can be launched from a portable USB flash drive.

### vApps: The Next-Evolution of Virtual Appliances

**vApps** are software solutions optimized for cloud computing. They consist of multiple virtual machines, packaged and maintained as a single entity in Open Virtualization Format (OVF).

Analogously to a UPC bar code containing all information about a product, a vApp gives application owners a standard way to describe operational policies for an application that the cloud computing OS can automatically interpret and execute. In other words, vApps are self-describing to, and self-managing on, the platform on which they run.

vApps can comprise any applications running on any OS. They also provide a mechanism for organizations to move their applications between internal clouds or external clouds while retaining the same service levels. vApps are considered to be the next generation of virtual appliances. They encompass a broad and diverse range of virtual applications that independent software vendors (ISVs), developers, enterprise administrators or other IT professionals can create. Given the flexibility of vApps, virtual appliances can be viewed as “closed” vApps.

### Open Virtualization Format

OVF—a soon-to-be-released preliminary specification developed by the Distributed Management Task Force (DMTF)—details a portable packaging format for virtual machines. It describes how virtual appliances can be packaged in a platform-neutral format to be run on any hypervisor. When a virtual appliance is packaged in OVF format, organizations can deploy a virtual appliance on their virtualization platform of choice, gaining ultimate freedom from vendor lock-in. DMTF is the industry organization leading the development, adoption and promotion of interoperable management standards and initiatives. For more information on OVF and DMTF, visit <http://www.dmtf.org>.

OVF enhances your customers' virtualization experience, offering improvements in portability, platform independence, verification, signing, versioning and licensing terms. OVF lets you

- Improve the user experience with streamlined installations
- Offer your customers virtualization platform independence and flexibility
- Create complex preconfigured multitiered services more easily
- Efficiently deliver enterprise software through portable virtual machines
- Offer platform-specific enhancements and easier adoption of advances in virtualization through extensibility

### Comparing OVF to Virtual Machine Disk

Virtual Machine Disk (VMDK) is a file format that encodes a single virtual disk from a virtual machine. A VMDK does not contain information about the virtual hardware of a machine, such as the CPU, memory, disk and network information. A virtual machine can include multiple virtual disks or VMDKs. An administrator who wishes to deploy a virtual disk must then configure all of this information, often manually, using incomplete documentation.

The OVF format, in contrast, provides a complete specification of the virtual machine. This includes the full list of required virtual disks plus the required virtual-hardware configuration, including CPU, memory, networking and storage. An administrator can quickly provision this virtual machine into virtual infrastructure with little or no manual intervention. In addition, the OVF is a standards-based, portable format that allows the user to deploy this virtual machine in any hypervisor that supports OVF.

## Benefits of Building Virtual Appliances

Delivering software as a virtual appliance has numerous business and technical benefits that can result in higher conversion rates, shorter sales cycles and increased renewals. Virtual appliances enable you to address new customer segments, expand channels of distribution, and provide easy-to-use evaluation and proof-of-concept editions. Because virtual appliances are packaged as simple files, your customers can download the file and then click “power on” to get a demonstration, evaluation or fully licensed application up and running instantaneously—without the need for an onsite sales engineer.

### Simplifying Development

In the virtual-appliance model, you can enable greater usability out of the box by optimizing the application for one of several VMware supported OSs. You can make the OS thinner and more secure by removing unnecessary components. By working with a single OS, you can significantly shorten development cycles and simplify your testing matrixes. This leads to lower overall development costs and a more stable and reliable solution for your customers. By delivering software that is preintegrated and preconfigured in a virtual appliance, you can reduce the costs of supporting applications.

Similar benefits extend to hardware appliance developers. All of the VMware virtualization platform offerings share a core set of functionality (IA-32 x86 virtualization, virtual SCSI controller, virtual Ethernet controller, virtual mouse/keyboard/screen, etc.), bringing “build once, run anywhere” hardware abstraction to the rapidly evolving physical server space. This gives hardware appliance vendors an opportunity to cost-effectively explore customer segments in which dedicated physical appliances might be impractical.

## Benefits to Software Developers

Virtual appliances help lower the cost of developing and distributing enterprise software by abstracting applications and OSs from underlying hardware—reducing the need for hardware testing, and reducing the number of platforms that developers must support.

- **Reduce Development and Distribution Costs**

Patching becomes easier because you can ensure compatibility among application, OS and virtual-machine components while distributing updates to customers as a single preconfigured package. In addition, virtual appliances help to reduce support costs. You get more control over the OS and virtual hardware configuration while reducing problems introduced by customer-installed device drivers or patches with unknown compatibility implications.

- **Accelerate Time to Market and Expand Customer Reach**

Virtual appliances are ideal for distributing enterprise software demos and evaluation versions because they are prepackaged and ready to run on virtualized hardware. By eliminating the time and complexity that customers face in evaluating software, you can target new accounts, penetrate deeper into existing accounts and expand your reach to markets that otherwise might be beyond your scope. Virtual appliances can also help you target small-business markets in which customers have neither the time nor the budget to participate in traditional customer pilot programs.

- **Increase Security and Control**

Virtual appliances enable you to maintain control over the integrity of your products. Support for content verification and integrity checking based on industry-standard public-key infrastructure—along with a built-in scheme for management of software licensing—help you deliver appliances in a more secure and controlled manner.

## Benefits to Hardware Appliance Developers

For hardware appliance vendors, virtual appliances offer a way to eliminate many hardware-related costs and complexities while gaining the ability to distribute products through the Internet. Retaining control of OS and virtual hardware configuration ensures the performance, security and stability of the solutions you offer.

- **Reduce Development and Distribution Costs**

Like software developers, hardware appliance vendors can use virtual appliances to reduce the costs associated with hardware testing, patch updates and technical support. Virtual appliances also help to reduce or eliminate the burden of managing physical inventory and supporting hardware components, without sacrificing the ability to encapsulate the application OS and virtual machine together as an integrated, prefabricated product.

- **Accelerate Time to Market and Expand Customer Reach**

Virtualization and virtual machines have been a boon for sales teams that like to deliver on-site demos of complex multitiered software using a single laptop or server. Virtual appliances make this even easier by packaging entire software stacks that sales professionals can carry around and share with colleagues and prospects in a secure and controlled manner. Virtual appliances also make it possible for you to make your software available online for download, trial and purchase. This helps you to increase awareness and reach out to customers that would not normally evaluate or purchase software appliances.

- **Increase Security and Control**

Virtual appliances allow you to maintain control over the integrity of your products while giving your customers the freedom and flexibility to use the hardware of their choice. Support for content verification and integrity checking based on industry-standard public key infrastructure—along with a built-in scheme for management of software licensing—help you deliver appliances in a more secure and controlled manner, relieving you of the burden of securing hardware components that you don't have physical access to.

## Benefits of Deploying a Virtual Appliance

Virtual appliances relieve organizations from the headaches of software installation and maintenance so they can focus on leveraging the value that software provides. Organizations can deploy the application within minutes and begin using it immediately. Every component of the virtual appliance is preconfigured and optimized by the ISV, which eliminates interoperability issues. The ISV also serves as the single point of contact for the virtual appliance, reducing the number of vendors the organization must engage with. In addition, security is improved because the organization's data remains onsite with the virtual appliance in the organization's datacenter. Virtual appliances are also built with a thinner, more secure OS.

### Simplifying IT Management

Virtual appliances enable organizations to simplify and speed deployment with preinstalled and preconfigured software. IT can apply patches directly against the application and OS and use vendor-supplied patches to eliminate compatibility problems. In summary, deployment and management benefits of virtual appliances include

- **Simpler deployment for enterprise-class applications** – Because software applications are preinstalled and preconfigured, include an OS, and are packaged in a run-to-ready format, virtual appliances eliminate complex, expensive, and lengthy, error-prone installation and configuration cycles. Simple deployments enable organizations to quickly deploy new builds and applications to remote-office and branch-office environments.
- **Simplified patch management** – Virtual appliances are supported by patches and service packs provided directly by the software developer. The patches can be applied against the application and the OS, relieving the organization of incompatibility problems that could have occurred if separate patches had been provided. Any upgrades to the virtual appliance are also handled directly by the software developer.
- **Enhanced security** – Virtual appliances running on JeOSs are less vulnerable to security breaches. Because the JeOS includes only the programs and components required to support the specific application, it occupies a much smaller footprint than a general-purpose OS and, therefore, a smaller attack surface.
- **Easier IT management** – By running production ready-virtual appliances on virtual infrastructure, organizations need not depend on third-party tools for IT management. By deploying virtual appliances on virtual infrastructure, they can leverage key capabilities by default such as VMware vSphere vMotion, vSphere [High Availability](#), vCenter Server, vSphere [Distributed Resource Scheduler](#) and [Consolidated Backup](#). A JeOS is also much easier to maintain and manage, because fewer updates are required for a slimmer OS.
- **Portability and vendor independence** – OVF-formatted virtual appliances deliver the greatest level of flexibility for organizations deploying enterprise software. They can deploy an OVF-formatted virtual appliance on the virtualization platform of their choice, gaining vendor independence and the ability to select the platform that best meets their needs.

## Benefits of OVF

OVF describes an open, secure, portable, efficient and flexible format for the packaging and distribution of one or more virtual machines. Key benefits of OVF to developers and their customers include

- **Enables optimized distribution** – OVF enables the portability and efficient distribution of virtual appliances. It supports compression for more-efficient package transfers as well as industry-standard content verification and integrity checking. It also provides a basic scheme for the management of software licensing.
- **Provides a simple, automated user experience** – OVF offers a robust and user-friendly approach to streamline the installation process. During installation, metadata in the OVF file can be used by a customer's management infrastructure to validate the entire package and confidently determine whether each virtual machine should be installed. Compatibility with the local virtual hardware is also verified.

- **Supports both single and multiple virtual-machine configurations** – Virtual-appliance solution stacks can consist of one or many virtual appliances. With OVF, software developers can configure complex multitiered services consisting of multiple interdependent virtual appliances.
- **Enables portable virtual-machine packaging** – OVF is virtualization-platform- independent while also enabling platform-specific enhancements to be captured. It supports the full range of virtual hard-disk formats used for virtual machines today, and is extensible to deal with future formats. Virtual-machine properties are captured concisely and accurately.
- **Affords vendor and platform independence** – OVF does not rely on the use of a specific host platform, virtualization platform or guest OS.
- **Supports localization** – OVF supports user-visible descriptions in multiple locales and localization of the interactive processes during installation of an appliance. This allows a single packaged appliance to serve multiple market opportunities for the developer.
- **Offers future extensibility** – OVF is extensible. It is designed to be extended as the industry moves forward with virtual-appliance technology.

## Virtual Appliance Authoring Tools

Below is a select list of virtual-appliance authoring tools designed to simplify the creation of virtual appliances, extend the manageability of virtual appliances and enhance the overall user experience.

### VMware Studio

VMware Studio provides software developers and hardware appliance vendors with an easy-to-use tool for creating, managing, distributing and deploying production-ready virtual appliances. VMware Studio leverages the industry's leading virtualization platform—VMware Infrastructure—and offers built appliances all the management services that VMware Infrastructure offers including vSphere Distributed Resource Scheduler, Consolidated Backup, vSphere High Availability, Fault Tolerance, and disaster-recovery solutions. VMware Studio is free of charge and delivers



- A Web console with appliance templates
- Virtual appliance customization and build engine
- Patch repository creation and publication
- Build process automation using a command-line interface
- OVF support
- Integration with VMware Infrastructure
- Integration with third-party management software

### CohesiveFT

CohesiveFT's Elastic Server platform offers an automated assembly environment in which developers, IT professionals and system administrators can construct a custom-built stack reflecting a VMware supported guest operating system, middleware and application stack, and immediately deploy it as a VMware Ready virtual appliance. Because the Elastic Server platform supports on-demand and dynamic assembly, it is the fastest





method for deploying to VMware Infrastructure. Automated rules are built into the Elastic Server platform to ensure the final image meets VMware Ready standards for operation. To get started, visit <http://www.cohesiveft.com/vmwareready>.

## JumpBox

Powered by JumpBox helps ISVs close sales and lower support costs by removing the friction associated with deploying software. The Powered by JumpBox service packages an ISV's application into a VMware Ready "JumpBox" (a virtual appliance)—a prebuilt, preconfigured software application for virtual computing that deploys in less than three minutes. The ease of deployment encourages prospects to demonstrate software in-house and motivates purchase.

<http://www.jumpbox.com/poweredby>



## rPath

rBuilder enables application providers to combine their software with additional components and JeOS to create a VMware Ready virtual appliance that is ready to deploy on VMware Infrastructure in minutes. Its extensive feature set includes policy-based application image creation, license management and compliance, and the ability to generate many different image types from a single image definition. rBuilder is the only platform available today that offers automated and repeatable build processes to ensure the highest-quality images every time.

<http://www.rpath.com/corp/products/rbuilder>



## SUSE

SUSE Studio is the first tool to enable developers to quickly create and test tailored, fully supported variants of SUSE Linux Enterprise. SUSE Studio is the fastest and easiest way for business users, ISVs and developers to configure and optimize a SUSE Linux Enterprise variant with just the code they need for a specific use case, thereby improving performance, simplifying maintenance and increasing security. SUSE Studio creates images for a complete range of devices and uses, from thin-client desktops and purpose-build Linux servers, to VMware Ready Virtual Appliances and cloud computing platforms.

SUSE Studio offers a simple, intuitive interface for building and testing Linux configurations and appliances, and for sharing and downloading those images.

<http://www.susestudio.com/>



## VirtualAppliances.Net

VirtualAppliances.net builds, distributes and supports open-source- infrastructure VMware Ready virtual appliances designed for perpetual operation, minimal footprint and excellent user experience. The worldwide user community has been enjoying these appliances for hundreds of purposes for more than two years on all VMware virtualization products. These appliances are free to use, and paid support options are available from

<http://VirtualAppliances.net>.



## Virtual Appliance Resources

### VMware Solution Exchange (VSX)

Only VMware offers the industry's largest marketplace of virtual appliances and partner solutions on the [VMware Solution Exchange \(VSX\)](#), giving users the quickest way to browse and try applications designed to run best in a virtual machine. Both Technology Alliance Partners and individual Virtual Appliance developers can list their virtual appliances on the VSX. Go to <http://solutionexchange.vmware.com> and click "Register" to begin. Whether you are already building and deploying virtual appliances or just getting started, these resources are sure to help. Visit our [Virtual Appliances Blog](#) or [subscribe](#) to our [RSS feed](#) to be notified of updates.

### OVF Technical Resources

#### DMTF Virtualization Management (VMAN) Initiative

Visit the [DMTF VMAN Initiative site](#) for up to date OVF white papers, technical notes, specifications and more.

- [DSP0243](#) 1.1.0 Open Virtualization Format Specification
- [DSP2017](#) 1.0.0 Open Virtualization Format White Paper
- [DSP2021](#) 1.0.0 Open Virtualization Format Examples .tar file
- [DSP8023](#) 1.1.0 Open Virtualization Format Envelope Schema
- [DSP8027](#) 1.1.0 Open Virtualization Format Environment Schema

#### VMware OVF Tool

VMware OVF Tool is a command-line utility that supports importing and exporting of OVF packages for a wide variety of VMware platforms, including VMware Workstation, VMware Server 2.0, vSphere 4.0, and earlier versions of VMware ESX Server and VMware VirtualCenter.

- [Download](#) this tool (Windows, Linux and Mac versions available).
- [Visit](#) the OVF Tool Community for OVF documentation and discussions.

### Market Research

Learn what these industry analysts have been saying about VMware and virtual appliances.

Forrester: [Virtual Appliances Are Coming](#)

Taneja Group: [VMware Virtual Appliances 2.0: Ready for Broad-Scale Adoption](#)

Forrester: [Virtual Appliances as the new Distribution Model for ISVs \(Web-based seminar\)](#)

Forrester: [The Case for Virtual Appliances: How Hypervisors Simplify Software Distribution](#) (white paper)

Yankee: [Virtual Appliances to Shake up Application Delivery: An ISV and Customer View](#) white paper

## Multimedia and Webcasts

See how virtual appliances are fundamentally changing how software is developed, distributed, deployed and managed in these podcasts and webcasts.

[Virtual appliances: Strategy, Solutions and Programs - Webcast](#)

[An Overview of Virtual Appliances - Webcast](#)

[eWeek Podcast: The new trend in IT](#)

[BEA Redefines Virtualized Software Appliances for Java with WebLogic Server Virtual Edition - Webcast](#)

[SpamTitan Gains by Developing SpamTitan for VMware Virtual Appliance - Webcast](#)

[Zimbra Collaboration Suite: Building Virtual Appliances - Webcast](#)

[How Cincinnati Bell Leverages Proofpoint's Messaging Security Platform - Webcast](#)

## VMware Contact Information

For additional information or to learn more about VMware solutions for building and deploying virtual appliances, visit [www.vmware.com/go/virtualappliances](http://www.vmware.com/go/virtualappliances).

For assistance in listing a virtual appliance on the VSX, or to provide feedback, send email to [vsxalliance@vmware.com](mailto:vsxalliance@vmware.com).



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