

OPEN VIRTUALIZATION: MORE INNOVATION WITHOUT VENDOR LOCK IN

Open Virtualization
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Abstract

For many organizations, virtualization is an attractive strategy to ensure that datacenter assets are better utilized. Virtualization solutions can also enable businesses to better manage their IT resources and achieve greater reliability. But today, open-source virtualization solutions from Sun offer organizations feature-rich, high-functionality software that provides innovative technologies developed in the open-source community as well as freedom from vendor lock-in.

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Executive Summary

Virtualization has become indispensable to getting the most from today's typically underutilized computing resources. Underutilization is common because computers are so powerful; even an inexpensive computer running a typical Web application is only about 5% utilized. Virtualization is a means of making one computer appear to be multiple systems, thus allowing it to host multiple services. This saves money by allowing organizations to fully utilize existing resources and make the most of new investments in servers.

In addition, organizations are finding virtualization valuable as a way to improve:

- IT management, since virtualization allows for more flexible management of resources
- Reliability, because it is easy in a virtual environment to failover to another virtual machine when necessary and to quickly restart virtual machines and applications
- Flexibility, by being able to readily build up and tear down virtual datacenters based on changing business needs

For even greater flexibility and the advantage of more functionality, businesses are discovering the advantages of open-source virtualization. In particular, Sun open-source solutions for virtualization at the server, client, and operating system levels have become increasingly popular, offering degrees of functionality and flexibility that often far surpass those offered by proprietary solutions.

Virtualization Throughout the Technology Environment

To understand why open source is valuable in operating system and hardware virtualization, it helps to understand how virtualization is used at the server, client, and OS levels.

- *Server virtualization* makes it possible to run several separate OS instances concurrently on the same server, rather than having to have different servers to run different OS's and applications. This enables enterprises to cut costs and decrease complexity while also improving business agility through shortened server provisioning time. By moving to fewer physical servers but a larger number of virtualized servers, enterprises can simplify their operations, lower the costs of power and cooling, and reduce the size of their datacenters. Having multiple OS instances makes it easier to consolidate existing environments; the tradeoff is that there is additional overhead compared to OS virtualization.
- *Client virtualization* targets the desktop. Virtualizing servers is important, but there are far more desktops than servers. Virtualizing desktops can provide value in terms of power savings, ease of management, and increased flexibility and employee mobility. Virtualization at this level makes it possible to run different OS's on one desktop or laptop to meet the needs of different types of computing environments. For example, a developer may run a separate development

environment on a laptop without interfering with or putting at risk personal applications such as email and office software; desktop virtualization keeps the two environments separate.

- *OS virtualization* is a means of using resources more efficiently by creating multiple application containers on a single OS, making it appear that there are multiple computers where there is really only one. A single computer running a single copy of an operating system could then host multiple applications such as a database, an application server, and a Web server—but with each administered separately in order to provide full resource, fault, and security isolation.

Why Open Source for Virtualization?

Open source offers several advantages over proprietary development of virtualization solutions.

- **Flexibility.** Proprietary virtualization solutions are generally designed to work with a particular OS and/or hardware platform and are not easily portable to other platforms. Most enterprises prefer heterogeneous environments running multiple operating systems that can interoperate, because this reduces dependency on a single vendor's virtualization technology. Open-source virtualization avoids vendor lock-in, which helps minimize financial risk.
- **Functionality.** Proprietary virtualization solutions don't have the advantage of the wealth of contributions that comes from a large and diverse development community. For example, Sun's VirtualBox™ solution for desktop virtualization includes extensive APIs that make it easy for developers to incorporate the technology into their own solutions.
- **Feedback.** Having a community development model helps to ensure that the features and functions that are included in open virtualization solutions are exactly those that users need. It also helps ensure that issues with these features and functions can be identified and addressed in a timely way. Through this model, feedback from users about what they require in a product is immediate and direct, and the development community can respond to it rapidly and effectively.
- **Free.** Proprietary virtualization solutions can be costly upfront; open-source solutions typically offer as much or more value without the high acquisition cost. A proprietary solution for server virtualization, for example, can carry licensing and other costs amounting to \$3,000 a server. True, it may deliver far higher value in increased utilization and efficiency, but so will an open-source, freely available solution with as much or more functionality.

Sun Open Source Virtualization Solutions

Sun offers open-source virtualization offerings that have been widely praised by industry observers and embraced by users. For example, the Solaris technology that our hypervisor is based on wins awards year after year, from the *InfoWorld* Technology of the Year award to the *Wall Street Journal* Innovation award. All of Sun's open-source virtualization offerings have the feature-rich, high-functionality advantage of being the products of open-source communities, and all of them are freely available as part of Sun's free and open operating systems.

The OpenSolaris™ Hypervisor

The OpenSolaris hypervisor is Sun's server-side virtualization solution based on open-source development by the Xen.org community, the largest open-source server virtualization project. With Xen virtualization, a thin software layer—the hypervisor—is inserted between the server hardware and the OS, thus separating the server from the OS and its applications and enabling each server to run one or more virtual servers. Xen virtualization was developed collaboratively by the Xen community and engineers from more than 20 leading datacenter vendors, including Sun.

The OpenSolaris hypervisor distinguishes itself from other Xen-based solutions available today by integrating several unique OpenSolaris technologies, including:

- The built-in Solaris ZFS™ distributed file-system technology, which provides data protection at the hypervisor level so that all virtual machines receive the benefits of ZFS on guest operating systems, (such as Linux or Windows). Solaris ZFS software also makes it possible to create instant snapshots of virtual machines, a capability that proprietary solutions usually offer only at an additional charge.
- Fault Management Architecture (FMA), which enables the OpenSolaris hypervisor to work around hardware failures with no effect on virtual machines that are running.

Because the OpenSolaris hypervisor is based on the OpenSolaris open-source operating system, it automatically gets all of the new optimizations for the latest chips from Intel and AMD.

The OpenSolaris hypervisor also offers a level of compatibility with other virtualization solutions not typically found in proprietary offerings. For example, if you decide you don't want to use it, you can move to one of the other Xen-based solutions available today.

Sun VirtualBox

Sun VirtualBox software is Sun's enterprise-class, open-source virtualization solution for desktops and laptops. It runs multiple OS's at the same time on the same hardware; enables cross-platform, multi-tier applications; supports virtual server environments; and provides remote access to guest virtual machines from anywhere.

VirtualBox software was selected Virtualization Product of the Year in the 2008 LinuxQuestions.org Members Choice Awards. It's the first application of its kind to support the most popular host OS's, including Windows, Mac OS X, Linux, Solaris, and OpenSolaris, and the first virtualization platform to support the new Open Virtual Machine Format (OVF) portability standard. It has been rapidly growing in popularity, surpassing 11 million downloads worldwide (as of April 1, 2009) and 25,000 downloads a day.

Solaris Containers

Solaris Containers is Sun's OS virtualization solution that's part of the Solaris and OpenSolaris OS's, which were also developed in open-source communities. This feature has been the #1 Sun virtualization technology deployed by Sun customers since its introduction in 2005.

Solaris Containers works by using flexible, software-defined boundaries to isolate software applications and services. This allows many private execution environments to be created within a single instance of the OS. Each environment has its own identity that is separate from the underlying hardware, so it behaves as if it's running on its own system, making consolidation simple, safe, and secure. OS virtualization with Solaris Containers provides a way to maintain the one-application-per-server deployment model while allowing hardware resources to be shared.

What to Consider When Evaluating Open Virtualization

If you're thinking of incorporating open-source virtualization solutions in your virtualization strategy, there are several things to consider to ensure that you make the most effective choices. The first thing to look at is the hardware environment for the applications that you want to virtualize — i.e., server or desktop.

Applications Running on Servers

For applications running on servers, think about how many copies of a particular application you are running. For example, an enterprise may have more than 100 instances of an Apache Web server serving multiple internal and external Web sites. If each of these Web sites is running on its own server, tremendous economies of scale can be gained by virtualizing the application with low-overhead, OS-based virtualization and by consolidating on fewer servers.

On the other hand, if you have many applications tied to different OS platforms that can't be easily consolidated on a common platform, consider a hypervisor-based solution for running multiple OS versions on a single machine. With this type of consolidation, it's important to review your application software licenses; all vendors treat running their software in virtualization differently, and you could incur additional software licensing fees if you move to a larger server to consolidate the

Incorporating Sun Open Source Offerings in Other Solutions

One of the advantages of Sun open source virtualization offerings is the ease with which they can be incorporated into other products to extend their functionality—whether those products are open source or not.

For example, Sun's Virtual Desktop Infrastructure (VDI) software is built on Sun's VirtualBox open source solution for desktop virtualization. VDI extends the use of VirtualBox beyond the desktop to also include running on servers in the datacenter.

While not an open-source offering itself, VDI relies on multiple open-source technologies from Sun including VirtualBox, Java, and MySQL™ technologies. It's an excellent example of how open-source products can be used to drive commercial offerings.

applications. This may also be a good time to examine the applications you want to consolidate and see if there is an open-source alternative that doesn't carry the harsh terms imposed by proprietary software vendors for running applications in virtual machines.

Applications Running on Desktops

For desktop virtualization, you need to first set a goal:

- Are you trying to cut down the number of systems your developers need to build and maintain applications and give them more flexibility in what they run as their primary workstation? If so, look at a solution like Sun VirtualBox software.
- If your goal is to reduce IT desktop management costs and get better IT effectiveness, consider a Sun Virtual Desktop Infrastructure (VDI) solution (see sidebar). This will move most of your critical desktop applications into virtual servers in the datacenter, while allowing users to access the desktop from traditional PCs or remotely through the Web and mobile devices.

Open Virtualization Case Study

Northern Arizona University Goes Green and Saves Money Through Virtualization

Northern Arizona University's W.A. Franke College of Business built a virtual desktop solution with Sun hardware and software to provide students with access to Windows and UNIX® desktop environments hosted on Sun servers and storage. The solution consists of Sun Ray™ thin clients, PCs, and mobile computers, as well as the Solaris 10 OS, Sun Secure Global Desktop Software, and Sun VirtualBox software.

The Sun virtual desktop solution has enabled the college to:

- Reduce the carbon footprint and annual electrical costs of individual desktops by 95% by decreasing the number of "always-on" PCs and using Sun Ray thin client devices instead
- Provide anytime-anywhere access to Windows and UNIX desktops without adding staff, expanding lab space, or paying for an expensive Citrix upgrade
- Decrease IT costs and increase ROI by reducing time and resources spent dealing with hardware failures



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