RED HAT®
ENTERPRISE LINUX®

USING CONTAINERS WITH RED HAT ENTERPRISE LINUX

Lightweight isolation and packaging make application delivery easier

TECHNOLOGY BRIEF

CONTAINERS SIMPLIFY SECURE AND RELIABLE APPLICATION DELIVERY BY PROVIDING:

- Lightweight application isolation
- Complete runtime encapsulation
- Image-based deployment and update capabilities

Traditional application deployment models move applications from development through testing and into production. Along the way, the application and the runtime environment must be kept in alignment to ensure that testing and certification done in the prior step remains valid. This required coordination is error prone, time consuming, and requires setting up and configuring each environment along the way. Additional challenges arise when applications demand different or conflicting environments. Packaging applications with Linux containers addresses these problems and provides an easier and faster application deployment model.

TRADITIONAL APPLICATION PACKAGING AND DEPLOYMENT

Applications, whether developed in-house or provided by a third party, demand a specific runtime environment to ensure proper performance. Some third-party applications require a specific environment to ensure the provider can and will support them.

Promoting an application from development through testing to production requires implementing the correct runtime environment in all three stages. The runtime environment might require a specific deployment of the operating system, shared libraries, supporting programs or scripts, and resource configurations. Determining the exact runtime environment can be a challenge, requiring IT staff to spend time delving into the exact versions of all the various components. Manually implementing the required environment is time consuming and error prone and must be done in a consistent manner across all three stages.

Problems with a manual approach lead many to consider automation. However, even with automation, the process is often fragile and doesn't always result in a consistent implementation. This can lead to subtle or hard-to-diagnose problems in production deployments.

Keeping environments consistent can be even more difficult when you need to deploy multiple applications or perform required runtime maintenance. Applications often require different libraries, configurations, or supporting programs, which results in a larger set of items to consider, as shown in Figure 1. Maintenance requirements aggravate this problem, as various components may require updating at different times, but all stages must be kept in sync.

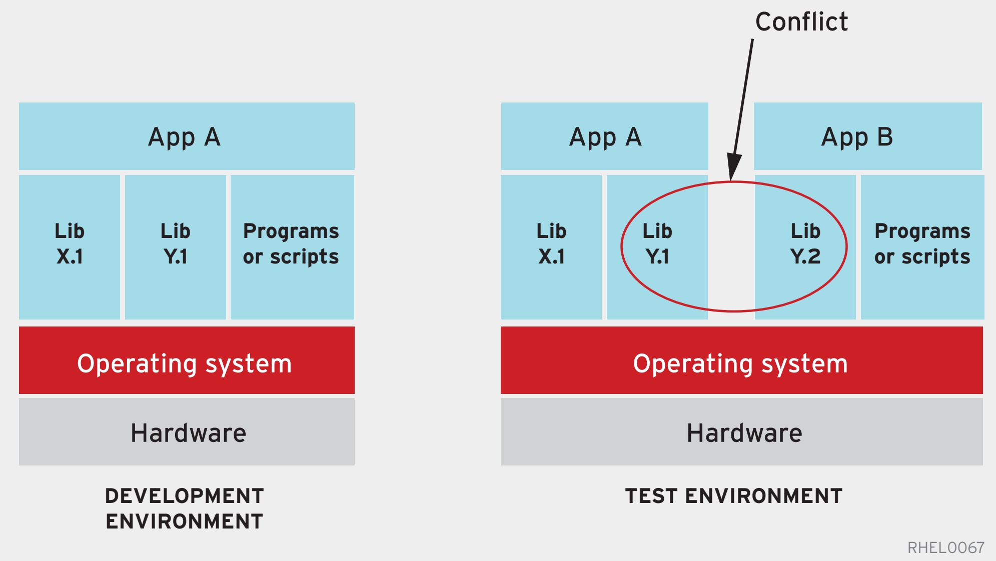


Figure 1. Achieving a consistent runtime environment across deployments can be difficult and time-consuming. Here, application A's library version (Y.1) conflicts with application B's version (Y.2) once they are moved into the same environment. Containers prevent this kind of conflict.

When applications demand different configurations or versions of the same resource, it can be very hard to avoid conflicts. These conflicts ultimately lead to applications that are isolated in separate deployments or a least-common-denominator approach to deployments. The former can lead to server or virtual machine sprawl, as each application requires its own isolated environment. The latter can constrain the development progress, forcing new applications to fit an existing runtime environment.

APPLICATION DEPLOYMENT WITH CONTAINERS

Containers can make application deployment easier, providing a consistent application runtime environment across all stages of development, testing, and production. Containers combine the application and its required runtime environment in a single package. This allows the application container to be created in development and then moved, unchanged, through testing and into production.

Determining the proper application runtime configuration is easier and faster as it is done by the administrator or engineer closest to the application. Additionally, because the application container brings the proper runtime components and configurations with it, no set up is required. This eliminates the additional effort per step and avoids errors from environmental differences that plague traditional approaches.

Containers also simplify the multiple application scenario by isolating each application. Each application container can have a unique runtime environment, allowing the application packagers to ignore component conflicts that exist between applications, as shown in Figure 2. This avoids the limitations of the least-common-denominator approach.

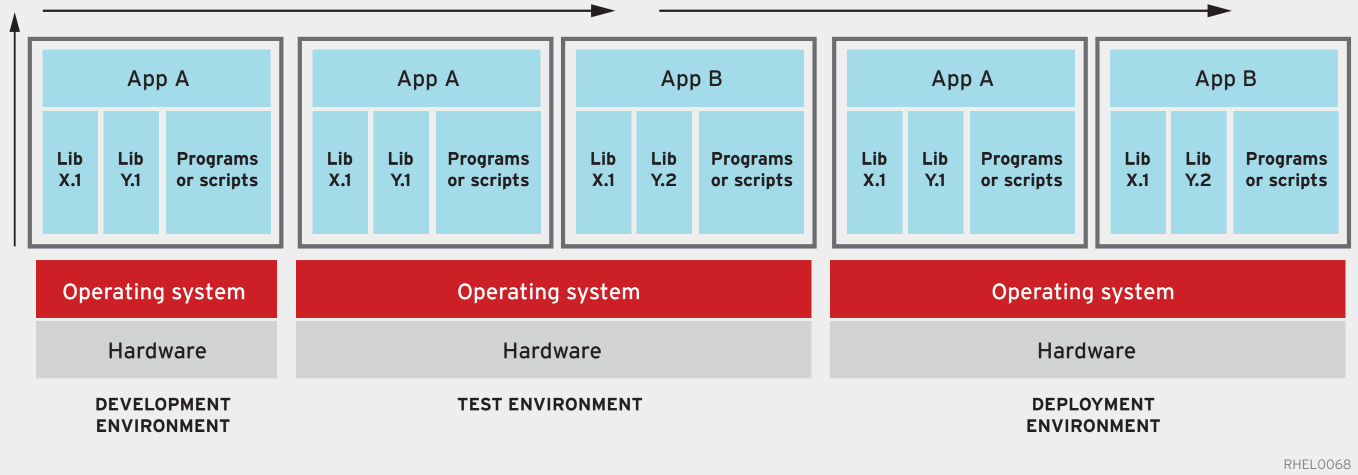


Figure 2. Containers remove complexity and increase portability. A container holds both the application and components required at runtime. Containers can then move across environments without risk of conflict, eliminating complex synchronization tasks.

Application developers using containers can choose the best runtime environment for their application. And maintenance of application containers is easier than maintaining applications grouped in an environment. Containers are managed as images, so an update means replacing the entire container with a new one – as opposed to updating individual components.

Finally, application containers are deployed on the same system, isolated from one another by the underlying operating system. This provides the same benefits as isolating deployments on physical or virtual machines, but eliminates the resulting sprawl.

CONTAINERS IN RED HAT ENTERPRISE LINUX

Red Hat Enterprise Linux 7 and Red Hat Enterprise Linux Atomic Host include the necessary technologies to securely and reliably deploy applications in containers. Red Hat Enterprise Linux 7 includes technologies that provide strong resource control, container isolation, security for containers, packaging, and orchestration capabilities.

- **Resource control** is provided by the control groups (cgroups) feature. It ensures that a container may only use a defined amount of certain system resources, such as disk I/O, memory, or CPU.
- **Container isolation** is the domain of kernel namespaces (namespaces). It means that each container has its own copy of critical system settings and cannot gain access to other processes or containers running on the same system.
- **Security** is implemented using Security-Enhanced Linux (SELinux). SELinux prevents unauthorized access by a container to both the underlying system and the other containers.
- **Standardized packaging** through the docker format combines an application and its runtime dependencies into a package that can more easily be moved around.
- **Orchestration** is delivered through Kubernetes, a framework for managing and scaling clusters of containers deployed across multiple container hosts.

The technologies that ensure isolation of containers on Red Hat Enterprise Linux 7 also insulate the container runtime from the underlying operating system. This means that the containers may have a runtime environment different from Red Hat Enterprise Linux 7, but the application in the container will still execute in the proper fashion.

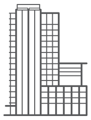
This allows organizations to deploy a variety of Linux runtime environments, as dictated by their applications, on a common Red Hat Enterprise Linux 7 infrastructure. This makes it easy to adopt new technology that can benefit application developers.

NEXT STEPS

For more detailed information on how to apply containers in your application infrastructure, see the product documentation: access.redhat.com/site/documentation/Red_Hat_Enterprise_Linux/

Download and evaluate Red Hat Enterprise Linux 7 or Red Hat Enterprise Linux Atomic Host: redhat.com/products/enterprise-linux/server/download.html

Contact Red Hat Sales to learn more or to purchase a subscription.



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