



# RED HAT ENTERPRISE LINUX ADVANCED PLATFORM

## REDUCING IT COSTS WITHOUT COMPROMISING PERFORMANCE

### OVERVIEW

Over the last 10 years, thousands of organizations have driven out millions of dollars from their IT budgets by replacing their costly proprietary UNIX systems with Red Hat® Enterprise Linux®. Deployed on industry standard x86 hardware, these systems are reducing costs without compromising performance, scalability, or security.

Cost savings delivered by Red Hat go beyond just reducing hardware acquisition costs. Red Hat Enterprise Linux Advanced Platform can drive out IT costs while providing a highly available and reliable infrastructure with low mean time to recovery.

### REAL WORLD EXAMPLE

A corporate IT infrastructure usually consists of a variety of servers, often clustered together for better performance and high availability. For example, the web service group might contain a DNS server, a mail server, and two web servers all connected to network storage (see Figure 1). To ensure a reliable infrastructure, each part—hardware, software, storage, and network—must be fault tolerant with fast recovery and automated failover.

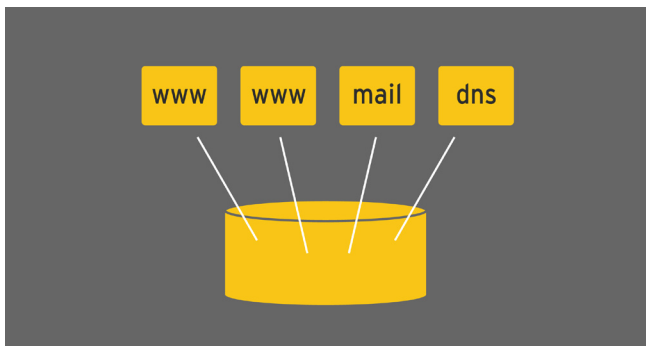


FIGURE 1. EXAMPLE WEB SERVICE CLUSTER

To achieve high availability for all these components on a standard UNIX server, there are expensive third-party add-ons that deliver:

- Load balancing and high availability for physical (and possibly virtual) servers accomplished by grouping the servers into a cluster
- Redundant physical paths between each server and the network storage with optional redundant network hardware
- A cluster-aware volume manager and clustered file system simultaneously accessible by all servers

With Red Hat Enterprise Linux, you don't need these add-ons. All of these capabilities come built-in and included with the operating system. So, with a little planning, you can do without Veritas Cluster Server, HP Service Guard, and IBM HACMP for hardware and software high availability clustering. You no longer need EMC® PowerPath® or IBM® Subsystem Device Driver (SDD) to create a reliable network with multiple physical connections from each server to the SAN. And Veritas Cluster Server and HP Polyserve are no longer needed for creating a cluster-aware file system.

## HIGH AVAILABILITY WITHOUT HIGH COST

When trying to reduce IT costs without losing performance, organizations first consider reducing their cost per server rather than reduce the number of servers. Red Hat Enterprise Linux Advanced Platform not only provides a stable and secure operating system, it can also replace all these necessary components for building a reliable, highly available infrastructure with low mean time to recovery – with no additional costs.

Just deploying Red Hat Enterprise Linux on industry standard x86 hardware instead of proprietary hardware can save significant IT budget. Using the high availability features of Advanced Platform can save an additional \$4500 per server.

## HIGH AVAILABILITY ARCHITECTURE THE RED HAT WAY

### Clustering

Service outages due to hardware and software failure can be kept to a minimum by grouping the servers in a cluster. If a server is not part of a cluster, a simple hard drive failure or an unknown software incompatibility can cause abrupt interruption of service. This affects customer experience and can possibly result in lost revenue. The length of the outage depends on how long it takes to diagnose the problem, fix it, and bring the server back to an active status. If the fault requires a software patch, it could equal many hours or even days of downtime while the software patch is written, tested, and integrated into the existing solution.

In a clustered environment, each server in the group is monitored for possible failure. If failure is detected, the automated failover process starts. The failed service on the server is immediately stopped or the server is shut down, depending on the severity of the situation. The service is then started on another server in the cluster including transferring its IP address to the failover server so clients can resume requests without any client reconfiguration. Then, the recovery process is started on the failed node. Once it is recovered, it can be added back to the cluster group, and the service can be moved back to it. Or, it can become a dedicated failover node.

Clustering also provides better performance and scalability. Without clustering, once a single server reaches capacity, it does not have the ability to increase its workload to compensate for additional requests. With clustering, two or more servers can serve the same function, such as being a web server. Web requests can be distributed across all web server nodes, allowing the solution to scale with the needs of the customers. As demand continues, more servers can be added to the cluster to increase capacity.

### Multipath I/O

Having redundant servers in a cluster prevents outages due to hardware and software, but what about the connection between the servers and the network storage? If the network cable or the FibreChannel adapter fails, so does the server's connection to the storage array. More than one physical path between each server and the storage array can be designed into the infrastructure with multiple adapters and cables to create a highly available network path with automated failover.

The multipath I/O component of Red Hat Enterprise Linux Advanced Platform monitors for connection failures and automatically re-routes paths when fault is detected, without service disruption. Multipathing can be anything from two or more physical paths between the server and storage array to multiple paths between servers with redundant network adapters and redundant SANs and storage device controllers.

If all physical paths are active, the network is optimized for performance. I/O requests are distributed over all the connections in a “round robin” fashion. In an active/passive configuration, only half the paths are active while the other half are dedicated failover paths. The redundancy in both the active/active and active/passive multipath configurations allows for automated failover to dedicated failover paths, accomplishing a very low mean time to recovery and little to no disruption of service. Multipath I/O in Advanced Platform supports multiple paths regardless of hardware. However, whether active/active or active/passive multipathing can be used is dependent on hardware support.



## Red Hat Global File System

For a high-performance clustering solution, organizations need a cluster-aware shared storage array. It needs to be able to scale easily with application growth and have the ability to store terabytes to exabytes of data.

Red Hat Global File System, included with Advanced Platform, allows storage to scale with the needs of the cluster. Up to 128 nodes can access up to 16 terabytes of data on 32-bit architectures or 8 exabytes of data on 64-bit architectures at local file system speeds with inherent high availability. If one node is removed, the other nodes may continue to function and process data.

Files stored on a Global File System volume are accessible via standard POSIX (Portable Operating System Interface) APIs. Additionally, POSIX file locks may be used to guarantee mutual exclusion across the cluster – even when the applications using them are not cluster-aware.

For enhanced performance, Red Hat Global File System implements coherent caching across the cluster nodes. Additionally, Global File System is journaled in order to maintain file system integrity in the event of a node failure.

## OPEN SOURCE VIRTUALIZATION

While not necessary for a highly available infrastructure, virtualization offers server consolidation, efficient resource utilization, and server failover with live migration and no disruption of service. Instead of one physical server per node in the cluster, each physical server can host two or more virtual servers that operate independently of the other virtual servers on the same physical machine. Current resources are used more efficiently.

When a virtual server fails, it takes only minutes to restart it on another virtual machine, either on the same physical server or a different one (see Figure 2). Once the recovery process is complete, the service can remain on the failover node or can be moved back to the original virtual server with no disruption of service. As a component of Advanced Platform, virtualization can be integrated into a clustering solution with minimal effort or compatibility issues.

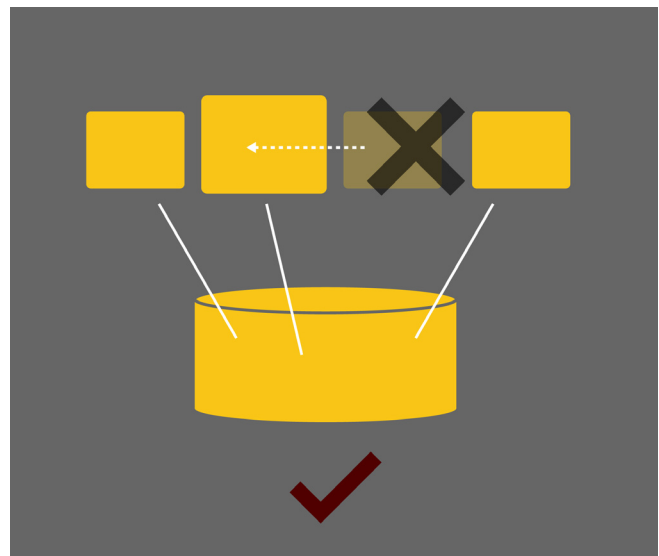


FIGURE 2. VIRTUALIZATION WITH FAILOVER

Red Hat Enterprise Linux Advanced Platform is an efficient, cost-effective, high performance solution for creating a reliable, scalable infrastructure with automated failover and minimal downtime.



## UPDATES, PATCHES, AND SUPPORT—ALL FROM ONE VENDOR

Multiple vendors mean multiple points of contact for support and updates and can result in software incompatibility issues. The multiple software layers might depend on different versions of the kernel or other conflicting components of the operating system. Or the layers might not coexist well with each other. When the software does not work in harmony, it is often difficult to determine which vendor is responsible for the software changes.

Clustering, multipath I/O, Global File System, and virtualization are all core components of Red Hat Enterprise Linux Advanced Platform. They are fully integrated into the operating system and are tested and tuned to work together as one solution set.

Patching and updating third-party, add-on software takes a significant amount of effort. Changes can have a negative impact on compatibility with the operating system and any other third-party software layers used. If incompatibilities are found, they must be resolved before deployment. Each time updates to the third-party software or the operating system are released, these compatibility tests must be redone. Time spent testing and solving these issues can quickly add up—discovering the problem, determining which software layer must be fixed, determining which vendor to call to fix it, waiting for the software changes, and then testing them all over again.

When updates are developed for Advanced Platform, compatibility with all the core components is a top priority. Core operating system and component updates are released simultaneously. Before being released, all the updates are rigorously tested as separate features and as an integrated solution. Customers must still test the updates on their hardware and software customizations, but much less time is spent testing that the separate software layers work together without conflict.

With a Red Hat subscription, it's all included. Updates and patches are automatic. Compatibility is assured. And if something does go wrong, there is only one vendor to call. Support and maintenance costs are kept low while updates to all components are easy to install and guaranteed for the life of Red Hat Enterprise Linux.

## CONCLUSION

Red Hat Enterprise Linux Advanced Platform offers a complete solution stack that enables enterprise companies to build a reliable, highly available IT infrastructure with automated failover and low mean time to recovery. All the components—clustering, multipath I/O, Global File System, and virtualization—are integrated into Advanced Platform at no additional cost. Software acquisition, support, and maintenance costs are minimized without compromising performance.