

# DxEnterprise for Linux Server

## SQL Server Use Case

### Introduction

Linux is the world's fastest growing server operating system. Responding to this growth, Microsoft is shipping a version of SQL Server for Linux.

Enterprises deploying SQL Server for Linux in production need a way to make their instances highly available.

This is because regardless of the operating system being used to host a production workload, enterprises need to meet service-level agreements (SLAs) and face increasing pressure to limit downtime to as close to zero as possible. Customers are intolerant of outages in a 24/7 world. An IT shop must have the agility to move workloads around to better balance application performance to resources available—all while mitigating the risk of downtime or disruption.

Against this backdrop, DH2i developed DxEnterprise, the industry's 1<sup>st</sup> multi-platform high availability solution for stateful Docker containers and Microsoft SQL Server. DxEnterprise provides customers with a single, unified high availability solution for Windows and Linux server operating systems. DxEnterprise manages stateful Docker containers, native Windows and Linux SQL Server instances and Windows Server application services or file shares. The software decouples them from a bare-metal server, virtual machine (VM) or cloud server. This decoupling makes stateful Docker containers and SQL Server instances highly portable and enables InstanceMobility®—a feature that lets Linux and Windows application workloads be moved from any host, to any host, anywhere, with portable persistent data. In addition to providing portability, DxEnterprise makes any Docker container, SQL Server instance, Oracle for Windows instance, Windows Server application service (NT service) or file share highly available and more easily managed. The technology puts Linux and Windows customers on a path toward near-zero application downtime—all managed from a single pane-of-glass.

The software runs on RHEL 7+, SUSE 12+, Ubuntu 16+, CentOS 7+, and Windows Server 2008R2 or newer (64-bit). It supports any edition/version of Docker, Microsoft SQL Server 2005 or newer, and Oracle Database for Windows 11gR2 or newer.

In the case of SQL Server, DxEnterprise containerizes Windows and Linux SQL Server instances and Docker containers. SQL Server instances, servers and storage are consolidated into manageable utilities for small, medium or enterprise customers—enabling seamless management from a single admin console. With DxEnterprise InstanceMobility®, users can rehost any SQL Server instance between hosts quickly and easily. An instance can be re-hosted from one server node to any other regardless of OS or SQL Server version or edition. That means any Windows SQL Server instance can quickly be re-hosted on any supported Windows Server host (e.g. a managed SQL Server 2016 instance can be re-hosted on a Windows Server 2012 host but not Windows Server 2008R2 host). For Linux SQL Server instances, InstanceMobility® means an instance can be re-hosted transparently on any RHEL, SUSE, Ubuntu or CentOS host. This rehosting capability also spans different types of infrastructure: bare-metal, virtual or cloud server.

Overall, DxEnterprise offers a unified auto-healing framework for orchestrating SQL Server management, high availability/disaster tolerance and policy-based SLA management for Linux and Windows. The software is purpose-built to manage, consolidate and ensure availability of mission-critical SQL Server instances. That said, DxEnterprise can play a range of roles—from supporting an organization’s most performance-centric instances, to managing its most critical instances.

DxEnterprise’s core capabilities for SQL Server include:

- \* Unified Windows and Linux high availability, mobility and disaster recovery for every SQL Server instance, for both onsite and geo-clustering modes.
- \* Intuitive SLA framework with instance-level quality of service (QoS) controls to ensure performance and availability.
- \* Health and performance monitoring with reactive and proactive automation/event handling and alerting.

## Preparing DxEnterprise: Portable Persistent Storage

DxEnterprise makes EXT4, XFS and NTFS disk volumes portable and persistent with Vhost technology. DxEnterprise facilitates storage virtualization and LUN portability by tapping native filesystems (e.g. EXT4, XFS, NTFS) and shared (FC or iSCSI) and/or replicated storage, to coordinate access to a pool of disk resources in the cluster.

The Storage Manager component of DxEnterprise lets administrators accomplish that task. Operations such as clean, online, offline disk, create, delete, format, expand and shrink volume sets are fully supported for DxEnterprise-managed disks, and fully cluster-coordinated.

A disk or set of disks under management can be detached at any time. In some cases, a disk may need to be cleaned. DxEnterprise lets administrators delete disk partitions, volumes and any hidden sector's information.

Here's a summary of DxEnterprise's key portable, persistent storage management features:

*SCSI Reservation:* Like other storage technologies, DxEnterprise uses SCSI reservation as the way to fence or designate the current owner of a disk. Various tools often struggle to sort out SCSI reservation information, which may lay hidden within the storage environment. DH2i, however, aims to make the task of managing any disk or storage subsystem SCSI reservation as straightforward as any other normal administrative activity. This DxEnterprise feature only applies to storage devices capable of SCSI-3 persistent reservations.

*Extend Volume:* DxEnterprise Storage Manager supports basic volumes.

*Shrink Volume:* Storage Manager supports shrinking basic volumes to reclaim unused space.

*Set Logical Drive:* DxEnterprise supports both a logical drive letter (Windows-only) and one or more mountpoints for a formatted volume. If the empty folder(s) for the mountpoint(s) do(es) not exist when the node becomes active, DxEnterprise will ensure the folder(s) is/are created on the fly and the mountpoints are

properly set. This approach prevents pilot error, ensures consistency and eases management provisioning. This feature also frees administrators from pre-creating the empty folder(s) for the mountpoints on each node participating in the cluster.

## DxEnterprise: How Does It Work?

With the storage configured, organizations can put DxEnterprise into production. Here's how it works:

DxEnterprise technology decouples new and legacy application instances -- such as SQL Server instances -- from a bare-metal server, VM or cloud server. DH2i uses a lightweight logical container called a virtual host or Vhost to accomplish this decoupling. Each Vhost consists of a network name/logical computer name, an associated IP address (or addresses), management metadata and portable persistent EXT4, XFS or NTFS disk volumes for the container. The metadata ensures a Vhost's managed application will run on the local operating system and application executable installed.

The Vhost container is a high-level abstraction of a host name and IP.

To add a SQL Server instance to a Vhost, DxEnterprise "virtualizes" the network name and IP address associated with the SQL Server instance. This process creates a Virtual SQL Server instance. Clients can then access that SQL Server instance via the Vhost name or IP address; they do not need to know which node is the currently active running node for the SQL Server instance.

Each Vhost can be associated with one native default Linux SQL Server instance. Therefore, administrators can create multiple Vhosts and distribute SQL Server instances among them depending upon the granularity of portability desired.

Administrators configuring a Vhost must specify the quorum of nodes to be made eligible to be the active node, and then who will be primary for that Vhost. The nodes in a quorum can be any number or any mix of bare-metal, virtual or cloud servers. Meanwhile, configuring SQL Server clients so they can connect to a SQL Server database requires two steps. First, the SQL clients must specify the fully qualified name or the IP address of the Virtual SQL Server instance. Second, SQL

Server clients must specify the static TCP port number of the Virtual SQL Server instance associated with the SQL Server database.

## High Availability and Failover

DxEnterprise monitors the health and availability of individual hosted applications and their dependencies to ensure SLAs are achieved. When an application fails, the software will automatically take actions to ensure application availability. As required, and as possible, DxEnterprise will restart the failed application on a different cluster node—local or remote.

DxEnterprise also enables failover in the case of planned outages, such as OS updates, or unplanned outages like the crash of a primary node. To prepare for an OS update, an administrator first moves the applications off the node. The update can then be performed and the node rebooted. Those actions will have impact on workloads. Once the node reboots, applications may be moved back to the node.

The DxEnterprise software takes the following actions during a failover:

- \* Unbinds the IP address for the Vhost from the source node and then adds it to the target node. For cloud-hosted nodes, the local IP address can be used as a virtual host IP address.
- \* Then starts SQL Server instance(s) on the target node.

When the failover executes, clients using the IP address of the Vhost will access the databases on shared/replicated storage. This all takes place via the Virtual SQL Server instance housed on the target node. But to make this failover scenario happen, the SQL instances associated with a Vhost must be installed on all the nodes of the quorum.

DH2i strongly recommends that you perform rolling updates for your managed instances—starting with the non-active servers first—to minimize downtime and provide a rollback option. Once the update is completed on the non-active node, failover the instance to let SQL Server complete inline upgrade of the databases. Confirm that the instance is satisfactorily upgraded, then update the remaining server(s).

## Orchestration, Automation and Load Balancing

High availability and failover aren't the only ways DxEnterprise provides comprehensive Vhost and virtual SQL Server instance management.

Orchestration, the ability to automate the task of dependency coordination, ranks as another important DxEnterprise Vhost management capability. Vhosts offer multiple workflow insertion points for conditional logic coordination with event handling. Thus, Vhost-managed applications with dependencies can be controlled and managed using policies.

DxEnterprise's SLA framework, meanwhile, also offers per-instance prioritization, pooling for automation, as well as individual instance-level QoS resource contention controls for CPU, Memory, Networking and I/O. The software handles resource contention issues, making sure SQL Server instances "play nice" in any given OS environment. For example, DxEnterprise can move a constrained application to alleviate resource contention. Or, if the constrained application is a higher priority, the software can make lower-priority workloads move off the node to free up resources.

As for load balancing, DxEnterprise has a policy-driven system resource monitor and load balancer designed to maintain ideal operating conditions for hosted applications. When systems fail or when load conditions change, DxEnterprise can ensure that all database instances remain within SLA requirements.

The software offers two controls for resource contention: alerting and load balancing, and performance thresholds and resource allocation. A performance threshold refers to the conditional value that reflects whether or not a policy is considered exceeded. For processor resources, this value is expressed in units of percentages. The value is stated as megabytes for memory resources and kilobytes per second for disk and network I/O. DxEnterprise's resource allocation policies, meanwhile, can define an SLA for each SQL Server instance. This helps ensure the availability of specific resources to each instance. The resource allocation policies also raise administrative alerts if the allocations cannot be met.

Administrators may set two types of policies under DxEnterprise: a system policy defined for a cluster member node, and an instance policy defined for an application, such as a SQL Server instance.

Other DxEnterprise management features include a notification manager, which sends dispatches to the appropriate personnel when a particular system event is triggered; cluster passkey, which enables secret-key encryption for secure communication; a full command-line interface; and PowerShell cmdlets for ease of integration and customization.

## Conclusion

Enterprise IT departments want to liberate a bigger chunk of their budgets for innovation as opposed to time-consuming maintenance activities. But growing companies are frequently tempted to acquire more and more servers and applications to deal with expansion. The rampant purchasing of systems, however, assures that there will be more items to maintain going forward.

SQL Server deployments contribute to the mass of systems that IT departments must monitor, patch and update. DH2i's DxEnterprise multi-platform instance and container management software offers a way off the maintenance treadmill. DxEnterprise lets administrators consolidate Linux and Windows SQL Server instances across both virtual and bare-metal server environments. In addition, the software offers a comprehensive set of management features that provide high availability, failover orchestration and load balancing among other benefits.

DxEnterprise can reduce or eliminate the proliferation of virtual machines and OSes, achieve nearest-to-zero application downtime and protect organizations from OS, application and infrastructure faults. DxEnterprise also significantly reduces lifecycle management costs, resource requirements and time required for maintenance—think no more late nights or weekends doing modernization.

DxEnterprise is the easiest, most robust high availability solution for SQL Server on Linux. Join us for a live demo to learn more. Go to [www.dh2i.com](http://www.dh2i.com) for more information.