DH2i DxE Enterprise 19.5 Software: Administration Guide
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the purpose of fulfilling the corresponding technical support request received by You or Your network
administrator. The collected information may be transferred to the DH2i group in the United States or other
countries that may have less protective data protection laws than the region in which you are situated
(including the European Union), but DH2i has taken steps so that the collected information, if transferred,
receives an adequate level of protection. Any collected information will be maintained in a secure manner,
and will not be correlated with any other personally identifiable information. DH2i may disclose the collected
information if asked to do so by a law enforcement official as required or permitted by law or in response to
a subpoena or other legal process.

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17.4.1 INDEMNITY.  DH2i will defend at its own expense any action against Customer brought by a third
party to the extent that the action is based upon a claim that the Software infringes any U.S. patents or any
copyrights or misappropriates any trade secrets of a third party or otherwise infringes on the intellectual
property rights of a third party, and DH2i will pay those costs and damages finally awarded against Customer
in any such action that are specifically attributable to such claim or those costs and damages agreed to in a
monetary settlement of such action.  The foregoing obligations are conditioned on Customer (a) notifying
DH2i promptly in writing of such action, (b) giving DH2i sole control of the defense thereof and any related
settlement negotiations, and (c) reasonably cooperating and, at DH2i’s request and expense, assisting in such
defense; provided, that any such settlement by DH2i shall not entail an admission or finding of liability or
fault on the part of Customer.  DH2i shall have the exclusive right to defend any such action, suit or
proceeding and make settlements thereof at its own discretion, and Customer may not settle or compromise
such action, suit or proceeding, except with the prior written consent of DH2i.

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continue using the Software, (b) replace or modify the Software so that it becomes non-infringing and
remains functionally equivalent, or (c) accept return of the Software, terminate this Agreement upon written
notice to Customer and refund Customer the Software and Software Support Fees paid for such Software and
related support upon such termination, computed according to a twelve (12) month straight-line
amortization schedule beginning on the Effective Date.

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otherwise with respect to any infringement claim based upon (a) any use of the Software not in accordance
with this Agreement or the Documentation, (b) any use of the Software in combination with other products,
hardware, equipment, software, or data not authorized by DH2i to be used with the Software, (c) any use of
any release of the Software other than the most current release made available to Customer, or (d) any
modification of the Software by any person other than DH2i or its authorized agents or subcontractors.
Customer shall indemnify and hold harmless DH2i from and against any action, suit or proceeding for
infringement and/or misappropriation that arises or results from any of the exclusions set forth in Section
17.4.3 above.  The foregoing obligations are conditioned on DH2i (a) notifying Customer promptly in writing
of such action, (b) giving Customer sole control of the defense thereof and any related settlement
negotiations, and (c) reasonably cooperating and, at Customer’s request and expense, assisting in such
defense; provided, that any such settlement by Customer shall not entail an admission or finding of liability
or fault on the part of DH2i.  Customer shall have the exclusive right to defend any such action, suit or
proceeding and make settlements thereof at its own discretion, and DH2i may not settle or compromise such
action, suit or proceeding, except with the prior written consent of Customer.
17.4.4 SECTION 17.4 STATES THE ENTIRE LIABILITY OF THE PARTIES, AND THEIR EXCLUSIVE REMEDIES FOR INFRINGEMENT CLAIMS AND ACTIONS.
Introduction and Configuration

DxEnterprise Software decouples Windows or GNU/Linux Server application instances from a physical server, virtual machine or cloud server. This intelligent de-coupling virtualizes the application instance connection, enabling InstanceMobility® from any host, to any host, anywhere, with a simple stop and restart.

DxEnterprise creates a framework for orchestrating SQL Server management, Docker Container management, high availability/disaster tolerance and policy-based SLA management across a heterogeneous physical and virtual infrastructure.

DxEnterprise can be used to create and manage a heterogeneous Windows/Linux cross platform Availability Group starting with the Microsoft SQL Server 2017 release.

DxEnterprise can be used to provide discreet and private micro-tunnels for distributed applications across multi-cloud environments without the cost, complexity, and security risks of VPNs.

DxEnterprise was designed specifically for virtualizing and consolidating mission-critical SQL Server instances. However, it can be used on any environment, including the most performance-centric and critical instances. DxEnterprise will function with most generic services and Docker containers.

DxEnterprise leverages native file systems (NTFS/ext4/xfs) and shared storage technology to coordinate access to a pool of disk resources in the cluster. DxEnterprise supports any vendor-supported version or edition of SQL Server or Docker, as well as any OS across physical, virtual, or hybrid infrastructure.

The following sections describe hardware and software requirements for DxEnterprise.

Minimal System Requirements

Physical/Virtual Server Requirements

DxEnterprise is hardware agnostic. Please follow operating system / application best practices to achieve performance expectations.

Supported Operating Systems

Below are the supported operating systems for DxEnterprise:

- Windows Server 2008R2, x64 *
- Windows Server 2012, x64
- Windows Server 2012 R2, x64
- Windows Server 2016, x64
- Windows Server 2019, x64
- Windows 7 * and above, x86 and x64 (DxAdmin and DxConnect Clients Only)
- CentOS Linux 7.x (No DxAdmin, No DxConnect)
- Oracle Linux 7.x (No DxAdmin, No DxConnect)
- RedHat Enterprise Linux 7.x (No DxAdmin, No DxConnect)
- Ubuntu 16.04.x (No DxAdmin, No DxConnect)
- Ubuntu 18.04.x (No DxAdmin, No DxConnect)

*No longer maintained by Microsoft

**Note:** DxEnterprise Software requires .NET Framework 4.5.2 on Windows and .Net Core 3.1 on Linux. Please ensure that these packages are installed on your servers prior to installing DxEnterprise Software.

### Network Configuration Guidelines

DxEnterprise uses a proprietary communications protocol (based on TCP and UDP) for its cluster communication. To mitigate or remove the potential for heavy network traffic adversely affecting DxEnterprise communications, DH2i allows the use of a private or stand-alone network for DxEnterprise. This dedicated network can be created using a crossover cable for a two-server cloud or an ethernet switch for clusters/clouds comprised of three or more servers.

DxEnterprise supports the following network configurations:

- IPv4
- IPv6
- Multiple subnet ranges

To ensure proper communication between the cluster member nodes, the follow guidelines should be observed.

- A static entry for each node’s private IP should exist in the hosts file (%systemroot%\system32\drivers\etc\hosts or /etc/hosts).
  
  e.g.
  
  192.168.1.101 node1 #private IP
  192.168.1.102 node2 #private IP

- “A” and “PTR” records are present in DNS for each Vhost/IP for proper forward and reverse lookup. Dynamic DNS registration is not supported.

- On Windows, ensure **Register this computer’s addresses in DNS** is unchecked for all network adapters under the properties for the interface. This prevents the virtual IP from being registered with DNS for the physical host. If this option is checked, it will cause resolution issues when the virtual IP moves between cluster member nodes.

- DxEnterprise uses the following network ports
  - Open remotely:
    - TCP: 7979 – DxLMonitor
    - TCP: 7980 – DxCMonitor
    - UDP: 7980 – DxLMonitor
Storage Configuration Guidelines

HA instances and stateful applications / containers
DxEnterprise supports management of shared volumes for managed instances and other workloads that need access to a shared disk. While cluster disks and volumes can be managed outside of DxEnterprise, DH2i strongly recommends using DxEnterprise Storage Manager to create and manage shared volumes to simplify management. Prior to DxEnterprise management for any shared disk use cases, simply present each disk to every node you want to be able to run a particular instance or workload. At least one disk per workload is recommended.

Availability Groups
DxEnterprise can also manage SQL Server Availability Groups (AGs) and make them highly available. Since AGs will replicate databases between cluster nodes automatically, shared storage and DxEnterprise Storage Manager are not required or used.

NOTE: Only storage devices with SCSI-3 persistent reservation capability are supported.

Definitions, Acronyms, Abbreviations

Table 1-1 Acronyms & Abbreviations

<table>
<thead>
<tr>
<th>Item</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGS</td>
<td>Refers to DH2i’s implementation of Microsoft’s Availability Groups. Availability Groups are a database mirroring technique for Microsoft SQL Server 2017/2019 that allows for a cross platform (Linux/Windows) group of user databases to replicate between a primary and multiple secondaries.</td>
</tr>
<tr>
<td>API</td>
<td>Application Program Interface.</td>
</tr>
<tr>
<td>DR</td>
<td>Disaster Recovery. Typically this would be multiple groups of servers that are geographically separated.</td>
</tr>
<tr>
<td>CIDR</td>
<td>Classless Inter-Domain Routing.</td>
</tr>
<tr>
<td>Context Menu</td>
<td>Right-click pop-up menu.</td>
</tr>
<tr>
<td>DxAdmin</td>
<td>Computer software component that is individually versioned and used as the graphical user interface to the DxEnterprise suite of products.</td>
</tr>
<tr>
<td>DxCli</td>
<td>DH2i Command Line interface.</td>
</tr>
<tr>
<td>DxConnect</td>
<td>DH2i Client tool used to connect to a tunnel.</td>
</tr>
<tr>
<td>Item</td>
<td>Definition</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>DxPS</td>
<td>DH2i Power Shell library (DxPS.DLL).</td>
</tr>
<tr>
<td>GUI</td>
<td>Graphical User Interface.</td>
</tr>
<tr>
<td>IP</td>
<td>Internet Protocol. A numerical label assigned to each device connected to a computer network.</td>
</tr>
<tr>
<td>IPv4</td>
<td>Internet Protocol version 4. IPv4 addresses have a size of 32 bits.</td>
</tr>
<tr>
<td>IPv6</td>
<td>Internet Protocol version 6. IPv6 addresses have a size of 128 bits.</td>
</tr>
<tr>
<td>Node</td>
<td>Nodes are devices, physical, virtual, or cloud on a larger network. A node is anything that has an IP address.</td>
</tr>
<tr>
<td>TCP</td>
<td>Transmission Control Protocol.</td>
</tr>
<tr>
<td>UDP</td>
<td>User Datagram Protocol</td>
</tr>
<tr>
<td>Vhost</td>
<td>Virtual Host</td>
</tr>
<tr>
<td>VIP</td>
<td>Virtual IP address</td>
</tr>
<tr>
<td>VPN</td>
<td>Virtual Private Network</td>
</tr>
</tbody>
</table>

Table 1-2 Definitions

<table>
<thead>
<tr>
<th>Item</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client</td>
<td>A remote client connecting to a tunnel.</td>
</tr>
<tr>
<td>Client Group</td>
<td>A group composed of one or more clients.</td>
</tr>
<tr>
<td>Cluster</td>
<td>The overall group of member servers.</td>
</tr>
<tr>
<td>Linux</td>
<td>The family of supported GNU/Linux operating systems.</td>
</tr>
<tr>
<td>Node</td>
<td>Nodes are devices, physical, virtual, or cloud on a larger network. A node is anything that has an IP address.</td>
</tr>
<tr>
<td>Process</td>
<td>A running application that resides in its own address space.</td>
</tr>
<tr>
<td>Screen</td>
<td>Refers to the display of related data.</td>
</tr>
<tr>
<td>Tunnel</td>
<td>Direct secure connection between two or more servers without the need for a VPN, expensive hardware, or data passing through a vender portal.</td>
</tr>
<tr>
<td>Tunnel Group</td>
<td>A collection of tunnels and nodes that allows for virtual tunnel configuration. Synonymous with virtual host.</td>
</tr>
<tr>
<td>Window</td>
<td>Refers to a panel with a border as defined in the Windows Operating system. Typically, a window can be opened, closed, resized and moved. A tabbed window is an example of a single window containing more than one screen.</td>
</tr>
<tr>
<td>Windows</td>
<td>The family of Microsoft Windows operating systems.</td>
</tr>
</tbody>
</table>
Table 1-3 Virtual Host Aliases

<table>
<thead>
<tr>
<th>Alias</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>.ACTIVE</td>
<td>The active node in a virtual host.</td>
</tr>
<tr>
<td>.INACTIVE</td>
<td>All inactive nodes in a virtual host.</td>
</tr>
<tr>
<td>.ALL</td>
<td>All nodes in a cluster.</td>
</tr>
<tr>
<td>.PART</td>
<td>Any node in the virtual host.</td>
</tr>
<tr>
<td>.NONPART</td>
<td>Any node in the cluster that is not in the virtual host.</td>
</tr>
<tr>
<td>.NONDEST</td>
<td>Any node that is not the destination node.</td>
</tr>
</tbody>
</table>

Installing and Configuring a New DxEnterprise Cluster

DxEnterprise leverages shared storage, as well as any supported version or edition of SQL Server and OS, anywhere.

Pre-requisite procedure for a new DxEnterprise cluster for Windows

- Install Windows operating system and apply the latest patches. Consult Microsoft documentation for further details.
- Install Microsoft .NET Framework 4.5.2.
- Install SQL Server and apply the latest patches (optional). Consult Microsoft documentation for further details. Note: SQL Server default databases and binaries should reside on any local volumes that are not used as the shared volume(s). E.g. C:\Program Files\Microsoft SQL Server\MSSQL10.Products.
- Install Docker and pull desired images on all nodes (optional). Consult Docker documentation for further details.
- Install and configure/present/map shared disks.

Pre-requisite procedure for a new DxEnterprise cluster for Linux

- Install Linux operating system and apply the latest updates. Consult Linux provider documentation for further details.
- Update the /etc/hosts file with the IPs and host names for all nodes in the cluster.
- Install .NET Core 3.1.
- Install SQL Server and apply the latest updates (optional). Consult Microsoft documentation for further details.
- Install Docker and pull desired images on all nodes (optional). Consult Docker documentation for further details.
- Install and configure/present/map shared disks.

Installing and configuring the first server for a new DxEnterprise cluster

- Install DxEnterprise software.
• Activate the server.
• Configure shared volumes.
• Create a virtual host.
• Add diskgroups.
• Attach/virtualize an instance of SQL Server.
• Add a virtual file share (optional).
• Add a generic service (optional).
• Add a Docker Container (optional).
• Add an Availability Group (optional).

Installing and configuring the additional server for a new DxEnterprise cluster
• Install DxEnterprise software.
• Join the second server to the existing cluster node.
• Join/participate in the virtual host.
• Test failover/failback (Optional).

Installing DxEnterprise software for Linux

Install DxEnterprise on RedHat
• Place a copy of the DxEnterprise RPM in a local directory
  sudo rpm -ivh dxenterprise-<version>.x86_64.rpm

Install DxEnterprise on Ubuntu
• Place a copy of the DxEnterprise DEB in a local directory
  sudo dpkg -i dxenterprise_<version>_amd64.deb

Set cluster passkey (First node installation)
• sudo dxcli cluster-set-secret

Join existing cluster (After initial node installed)
• sudo dxcli join-cluster

Installing DxEnterprise software for Windows

Double-click the DxEnterprise setup program on the first server.

A welcome screen will be displayed. Click Next to continue with the installation.
Select **I accept...** to accept the license agreement and click **Next** to continue.

In the “Destination Folder” window, select an installation folder for DxEnterprise and click **Next**.

Deselect **Add Desktop Shortcut** checkbox if a desktop shortcut is not required. This box is checked by default.
In the “Ready to install” window, click **Install**.
Click **Finish** to complete the installation.

**Login with DxAdmin Client**

Double-clicking the DxAdmin icon on the Windows desktop will display the following login dialog. Select the target server; the default name is **localhost** on port 7979. To specify a different port, append it to the target server name using a colon (:). The server name can also be written as **localhost:7979**.

On initial setup, there are three options to choose from.
1. **Configure Interface** – The following dialog displays the currently configured interface.

If the user selects **no**, the displayed settings are used for the initial interface; if the user selects **yes**, the following dialog is displayed. This dialog allows the user to select different interfaces and protocols for cluster communication.
When the user clicks the save button, the interfaces dialog will update and close. If there are multiple interfaces selected, the following dialog appears. This dialog lets the user order the interfaces from top to bottom; the interface placed at the top of the dialog will be the first interface selected for communication.

The asterisk (*) selection will cycle through the interfaces until a valid connection is established to the other cluster members. These changes are reflected in the cluster manager display but are not committed until the user submits the request.
2. DxAdmin will show the node has been added.

3. To activate the license, click on Advanced Configuration and select Cluster Membership.

4. **Activate the Product** – The following form is displayed so the user can view, activate, or reactivate any cluster nodes.
Node Name
Each node in the cluster will appear in its own row displaying the activation status of that node.

License Key
The license key used to activate the product.

Product
The DH2i product that corresponds to the license.

Clients
The number of active remote clients allowed to connect to each server.

Expiration Date
The last date the product can be used.

Support Date
The expiration of the support contract. The product may be used until the expiration date, but the ability to request customer service and receive new updates stops on the support date.

Is Valid
If the license is active, this column will be checked. If not, select the node using the checkbox on the left side and click Activate.

Activate
Click to activate the selected servers. The Accept EULA checkbox must also be selected.
5. The successful activation window will appear.

![Activation Result]

Installing DxAdmin software Stand Alone on Windows clients

Place a copy of the DxAdmin MSI in a local directory. Double-click the installer and follow the prompts to install.

A welcome screen will be displayed. Click **Next** to continue with the installation.
Select **I accept...** to accept the license agreement and click **Next** to continue.

In the “Destination Folder” window, select an installation folder for DxAdmin and click **Next**.

Deselect the **Add Desktop Shortcut** checkbox if a desktop shortcut is not required. The box is checked by default.
In the “Ready to install” window, click **Install**.

Click **Finish** to complete the installation.

A pass key is required to log in to the cluster for administration. The pass key is case-sensitive and can be any combination of alpha-numeric characters, punctuation, or symbols. If the user has not configured a
pass key or has forgotten the pass key, the user will be unable to log in remotely, or log in using unprivileged accounts. The pass key requirement can be bypassed by launching DxAdmin Client as an administrator on a cluster node.

In order to maintain the security of the cluster, DxAdmin will prompt the user to confirm that they are connecting to the correct server when they connect for the first time. It does this by checking the server’s RSA key against its list of known server keys.

![Known Server Check](image)

The public key for a server in the cluster can be viewed by selecting the server under “Cluster Nodes” and searching for the PubkeyHash. In addition, the public keys can be found in the DxCluster.xml file.

If the user accepts the server’s public key, DxAdmin will save a record of the key in its configuration and will not prompt for verification in the future. If the user is unexpectedly prompted to verify a server’s public key, the user may be the target of a man-in-the-middle attack and should immediately reject that public key and re-verify the server’s correct public key using other means.

### Overview of DxAdmin Client

The DxAdmin Client is organized into multiple sections located on the left side of the user interface and a main panel in the center that shows the details of a section. Each section is a distinct group of commands that perform a specific action.
Navigation

The Navigation section shows a global view of the connected clusters. From here, the user can manage various cluster connections and view dashboard information, status logs, and alerts.

Connected Server List

The connected server list displays each node or server DxAdmin is connected to. The overall alert status on the left is normally green, but will display a yellow icon if the cluster has a warning condition, or a red icon if the cluster has an error condition. The version is the installed version on the connected server.
The process icon is normally light grey, but displays a dark grey icon when there is new information to review, which can be viewed by clicking on the icon itself. The process icon is used to track background processes such as installations or re-hosting of Vhosts. The Chat icon on the right displays a red icon when there are unread chat messages for the cluster. Click the chat icon to show the message, who it is from, and any other message they’ve submitted.

With the exception of the Navigation section, all other sections will display the information from the currently selected node or cluster member.

**Tree View**

The tree view shows a collapsible list of Vhosts and cluster members, each of which can be selected for further details. It is displays related and child elements in a single view. For the example above, the virtual host, *VHOST1*, has three members, *DXENODE1*, *DXENODE2* and *DXENODE3*, which manage a SQL Server instance called *SQL2017*, a *SQLBROWSER* service, and the attached shared disks and volumes associated with the Vhost.

**Storage Management**

The storage management section shows the view of the state of managed and unmanaged storage on a per-node basis. Selecting a cluster node name in this view will display that node’s view of its storage details.
Advanced Configuration

The advanced configuration section has additional functions.

Cluster Membership
This section allows the user to manage cluster members and license activation.

Cluster Settings
This section allows the user to set various advanced internal settings for the cluster itself. This is not typically recommended without specific advice or explanation from DH2i Support or Engineering staff.

Contact Address Book
This section is where email aliases or addresses are stored for the notification system.

Performance Policies
This section allows the user to set Performance or Allocation policies on objects defined in the cluster.

Notification Policies
The notification policies section allows the creation or modification of global alerts, filtered by object and severity, so contacts or email addresses can be alerted when a notification policy is triggered.

DxPowerShell Utility
This launches a console with the DxPS PowerShell module loaded. This allows CLI access to the product. For more information, please refer to the DxPS Admin Guide.

Debug Commands
The debug commands section allows for the execution of commands internal to DxEnterprise. Use of this section is not recommended without a specific request from DH2i Support or Engineering staff.

Collect Logs
The collect logs utility automatically bundles selected logs and configuration, then stores them at %ProgramFiles%\DH2\support on each node for troubleshooting.
Application Installer (Windows Servers Only)

The Application Installer allows parallel installation or upgrades of SQL Server instances across the cluster.

Main Panel

The search button is located in the main panel on the right side of the window. It displays context-specific details depending on what is selected in other panes.

Configuring Shared Disks/Volumes for use with DxEnterprise

DxEnterprise leverages native file system (NTFS/ext4/xfs) and shared storage technology to coordinate access to a pool of disk resources in the cluster. Although Windows Disk Manager can be used to manage
shared disks and volumes on Windows, Windows Disk Manager is not designed to manage cluster resources.

To achieve greater levels of performance, scalability, and availability while simplifying the management of shared storage, DxEnterprise Storage Manager should be used to create and manage shared disks and volumes. DxEnterprise Storage Manager allows administrators to put any new or existing basic disks under DxEnterprise management. Operations such as clean, online, offline, create, delete, format, extend, and shrink volume sets are fully supported for DxEnterprise managed disks and are fully cluster coordinated.

**Storage Management**

To access DxEnterprise Storage Manager, from the DxAdmin main menu, select **Storage Management** and select a node.

To view all managed and unmanaged disks from the selected node perspective, refer to the main panel:
Manage Disks

Before DxEnterprise can operate and coordinate write access on the shared disks, the shared disks must be put under DxEnterprise management.

To manage disk(s), right-click on a disk and select Manage.

The Manage Disks window then appears.
Select the desired disk(s) to be managed by DxEnterprise. A custom name can be defined for each managed disk by entering the value in the Name text field. Click Submit to commit the changes. Click Close to cancel the operation without making changes.

**Unmanage Disks**

At any time, a disk or set of disks can be detached from DxEnterprise management. To unmanage disk(s), right-click on a managed disk and select Unmanage.

The Unmanage Disks window then appears.
Select desired disk(s) to be unmanaged by DxEnterprise. Click **Submit** to commit the changes. Click **Close** to cancel the operation without making changes.

**Clean a Disk**

Under some circumstances, a disk may need to be cleaned to delete all of its partitions, volumes, and any hidden sector information.

To clean a managed disk, right-click on a disk and select **Clean**.

A **Warning** dialog then appears.

Select **Yes** to commit the change or **No** to cancel the operation.
Taking a Disk Offline

Under normal operation, a managed disk is set to online on only one node (the active node). All other nodes will have the same disk set to offline. When a disk is brought online on a different node, that node is the only node allowed to write to the disk. An online disk has a shaded blue box in the Storage Manager.

To disallow writes to a managed disk, right-click on a disk and select Offline.

The Warning dialog then appears.

Select Yes to commit the change or No to cancel the operation.

Bringing a Disk Online

Under normal operation, a managed disk is set to offline on all nodes except the active node. When a disk is set to offline on a node, that node is disallowed from writing to the disk. An offline disk is marked as yellow in the Storage Manager.

To allow writes to a managed disk, right-click on a disk and select Online.
The *Warning* dialog then appears.

![Disk online warning](image)

Select *Yes* to commit the change or *No* to cancel the operation.

**SCSI Reservation**

DxEnterprise employs SCSI-3 persistent reservations as a means to fence or designate the current owner of a disk. This SCSI reservation information is often hidden or difficult to determine using other tools. It is DH2i’s intention to make managing any disk(s) or storage subsystem SCSI reservation a task like any other normal tasks.

*NOTE: Only storage devices with SCSI-3 persistent reservation capability are supported.*

To view the current SCSI reservation, right-click on a disk and select *Reservation Detail*.

![Disk Reservation window](image)

The *Disk Reservation* window then appears.
**Refresh**
Select to query the latest information about a disk.

**Clear**
This button will be enabled if a reservation is set for the disk, allowing the existing reservation to be cleared.

**Disk Info**
Disk Info will provide further details of a disk including SCSI Page 83 information.
Create Volume

DxEnterprise allows a volume to be created from any empty space available on a disk. To create a volume, right-click on an empty partition and select **Create Volume**.

The **Specify Volume Size** window then appears.
**Maximum disk space**
The current maximum free space on disk in [MB].

**Minimum disk space**
The minimum disk space for the new volume in [MB]. The default value is 8 MB.

**Selected disk space**
The chosen size for the new volume in [MB]. Either enter the desired value in the text field or use the up & down arrows or the slide bar to pick the desired value.

**Submit**
Click to commit the changes.

**Close**
Click to cancel the process without making any changes.

**Delete Volume**
When a volume is no longer needed, its disk space can be reclaimed. To delete a volume, right-click on a volume and select **Delete Volume**.

The **Warning** dialog then appears.

Select **Yes** to commit the change or **No** to cancel the operation.
**Extend Volume**

DxEnterprise Storage Manager supports extending basic volumes if additional contiguous space exists on the disk. A basic volume is a volume that occupies a single partition on the same basic disk.

To increase the volume size, right-click on a volume and select **Extend Volume**.

The **Specify Extend Size** window then appears.

- **Maximum disk space [MB]**: Maximum amount of space on the disk available for expansion.
- **Minimum disk space [MB]**: Minimum amount to extend the disk.
- **Selected disk space [MB]**: The amount in [MB] to extend the volume.
- **Submit**: Click to commit the changes.
**Close**
Click to cancel the process without making any changes.

**Shrink Volume**

DxEnterprise Storage Manager supports shrinking volumes.

To shrink the volume size, right-click on a volume and select **Shrink Volume**.

![Shrink Volume GUI](image)

The **Specify Volume Size** window then appears.

**Current disk space**
The current size of the volume in [MB].

**After reclaimed space**
The tentative final size of the volume after shrinking in [MB].

**Reclaimed disk space**
The desired disk space to reclaim in [MB].
Submit
Click to attempt to reclaim the disk space of the volume. If the reclaimed disk space exceeds the minimum volume size (determined by the operating system), an error dialog will appear. Click OK to redefine the reclaimed space and resubmit.

![Volume Management Result](image)

Close
Click to cancel the process without making any changes.

NOTE: Shrinking a volume may require the operating system to defragment the volume, which can require minutes or hours to complete, depending on the size of the volume.

Format
Before a volume is usable, it needs to be formatted with NTFS/ext4/xfs. To (re)format a volume, right-click on a volume and select Format.

![Format window](image)

The Format window then appears.
**VolumeID**
The unique volume ID. The field is read-only.

**Volume label**
The user-defined label for the volume. Default value is “New Dx Volume”.

**File system**
The file system type for which the volume should be formatted. Default value is NTFS on Windows and ext4 on Linux.

**Block size**
The user-defined block size for the volume. Default value is 4096.

**Optional**
Optional flags available to Windows format.

**Quick format**
Check to use quick format. Quick format does not fill the data on the volume with zeroes (0), but the operation takes less time to complete.

**Enable compression**
Check to enable compression support for the volume.

**OK**
Click to start the format. A warning of the operation then appears. Click Yes to format or No to cancel.
Cancel
Click to cancel the process without making any changes.

Set Logical Drive

DxEnterprise supports both a logical drive letter and one or more mountpoints for a 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. Administrators do not need to pre-create the empty folder(s) for the mountpoints on each node participating in the cluster.

To specify the logical drive letter or mountpoints, right-click on a volume and select Set Logical Drive.

The Logical Paths window then appears.
**VolumeID**

The unique volume ID. The field is read-only.

**Set drive letter or mountpoints**

Current list of drive letter and mountpoints to be set for the volume.

**Add**

Click to add a drive letter or mountpoint to the list. When clicked, the *Add new drive letter or mountpoint* window appears. Please note that there can only be one drive letter assigned per volume. If a drive letter is assigned to any other volume, the drive letter will no longer be available for assignment to additional volumes. Drive letter assignment is available and applicable on Windows only.

**Change**

Click to change the drive letter assignment. When clicked the *Change drive letter* window appears. Drive letter assignment is available and applicable on Windows only. Changing a mountpoint is not supported.
Remove
Click to remove the drive letter or mountpoint assignment for the volume.

Submit
Click to set the drive letter and mountpoints for the volume. A warning dialog for the operation then appears. Click Yes to assign the mountpoints or No to cancel.

Cancel
Click to cancel the process without making any changes.

Set Volume Label
DxEnterprise supports a custom label for a formatted volume to be set at any time. To specify the volume label, right-click on a volume and select Set Volume Label.

The Set Volume Label window then appears.
Using DxEnterprise for Applications, Availability Groups, and Docker Containers

DxEnterprise Software is a high availability solution initially created for managing and consolidating mission-critical Microsoft® SQL Server databases. DxEnterprise virtualizes SQL Server instances, Docker instances, and storage into manageable private cloud utilities for medium size businesses to large corporations. Beginning with version 19.5, DxEnterprise can now configure and manage Availability Groups for SQL Server 2017 and SQL Server 2019 on Windows and/or Ubuntu, CentOS and RedHat Linux servers.

Virtual Hosts

DxEnterprise uses Virtual Hosts (Vhosts) to provide failover support and high availability. A Vhost virtualizes the network name and IP address associated to a particular SQL Server Instance, file share, and/or service. Instead of using the network name and IP address of a physical server, a Vhost is created and assigned a unique name/IP-address pair. Clients access the databases associated with an instance via the Vhost name or IP address; they do not need to know which node is running the SQL instance. When a Vhost is configured, the user will need to specify at least one node to participate in the Vhost.

To create a Vhost, right-click on Virtual Hosts from the DxAdmin explorer tree and select Add a virtual host. The Vhost Properties window then appears.

OK
Click to set the new label for the volume.

Cancel
Click to cancel the process without making any changes.
Virtual Host Name
Use this field to specify a Vhost name. Make sure the Vhost/IP-address pair is registered in DNS. The name entered in this field cannot include spaces.

Virtual IPs
Specify the IP address(es) that will be associated with this Vhost. Prefix by an asterisk (*) for existing address. Multiple virtual IP addresses can be specified for a Vhost, delimited by a comma.

There are three types of networking topologies supported by DxEnterprise:

a. A Vhost with a virtual IP that can be bound to either side of the DR (e.g. Source: 10.1.200.100/8, Target: 10.2.200.100/8, VIP: 10.3.200.100/8). This topology is ideal for network that has VLAN stretched across both sites.

b. A Vhost with two virtual IPs that each VIP can be bound to one side of DR only (e.g. Source: 10.1.200.100/24, Target: 10.2.200.100/24, VIP: 10.1.200.111/24, 10.2.200.111/24). This topology is ideal for network without VLAN stretched across sites.

c. A Vhost with no virtual IP (e.g. Source: 10.1.200.100/24, Target: 10.2.200.100/24, VIP: *10.1.200.100/24, *10.2.200.100/24). This topology is ideal for cloud based network where the server’s public IP is the only means to connect to external services.
Note: DxEnterprise will bind the virtual IP to the adapter with the same network mask. A DNS entry must exist for each Vhost/IP address. The entry must include an A record and a [PTR] record for forward and reverse lookup. Windows authentication may fail if these records do not exist. Be sure to create a DNS entry for each Vhost/IP address that you create. Dynamic DNS registration is not supported.

**Priority**
This setting defines the importance (from 1 to 5, 5 being most important) of the Vhost relative to other Vhost(s) running on a system. When there is a system resource (processor, memory, disk I/O, network I/O) pressure or a system failure, DxEnterprise uses this value to determine the best possible cluster member to start the Vhost.

**Auto Failback**
This policy is intended to return the Vhost to its original configuration, or as close to it as possible. After the Vhost fails over to a backup node, DxEnterprise watches the health of the nodes that are higher in the list of nodes configured for that Vhost. When the health of one of these nodes is equal to or greater than the backup node where the Vhost currently resides, the Vhost will automatically attempt to fail over to that node.

*Note: By default the Vhost remains active on the backup node as long as it is healthy.*

**Available Nodes**
Move the DxEnterprise servers or nodes on which the Vhost should be configured from the Nodes Available column to the Selected Nodes column. The first node that you select is the primary node. The other nodes that you select are backups. You can use the up and down arrows to reorder the nodes in the Selected Nodes column.

**OK**
When you click OK, a confirmation dialog displays asking the user to confirm the changes.

![Confirmation Dialog](image)

When you click Yes on the Confirmation Dialog, DxEnterprise will create the Vhost.

**Close**
If you click the Close button, the virtual host will not be created and the dialog will close.
Advanced

In the Vhost details pane, there is an Advanced accordion control. When selected, the advanced scripting options are displayed. The advanced scripting is user-defined script management for the Vhost. A custom script can be set by specifying the absolute path (...) or by embedding the logic content within DxEnterprise cluster configuration. When the logic content is embedded within DxEnterprise, it is guaranteed to be available for any node when the instance fails over/back between nodes. It is the preferred choice for DxEnterprise.

- **Pre-Start** – when set, custom script is executed before the Vhost starts up on a node. Ideal event to embed business logic to switch over the replicated storage from read-only to read-write before starting up the instance.
- **Post-Start** – when set, custom script is executed after the Vhost successfully starts up on a node but before any applications start up. Ideal event to embed business logic to start 3rd party agents or dependencies for the Vhost.
- **Pre-Stop** – when set, custom script is executed before the Vhost stops on a node. Ideal event to embed business logic to stop 3rd party agents or dependencies for the Vhost.
- **Post-Stop** – when set, custom script is executed after the Vhost successfully stops on a node. Ideal event to embed business logic to clean the Vhost environment.

Add Diskgroups

A diskgroup is a logical set of disks that are added to a Vhost. When a disk is added to a Vhost diskgroup, the disk will be set online on the active node and offline on all other nodes. If there is a failure of a disk within the diskgroup, the Vhost will failover onto the next available node in the cluster.

To add a disk to a Vhost diskgroup, right-click on Diskgroups under the Vhost, select Manage virtual host diskgroup.
The *Virtual Host Diskgroup Management* window then appears. Select the desired disk(s) in the Available Disks window and click on the right arrows (or double-click the disk) to move the desired disk(s) to the Selected Disks window. To remove the Selected Disks, use the left arrows (or double-click the disk) to move the disks back to the Available Disks window.

**Submit**
Click to commit the changes.

**Close**
Click to cancel the process without making any changes.

**Plan Your SQL Server Configuration**

Before installing SQL Server, it is important to determine how the SQL Server instances should be configured in DxEnterprise. First, determine the number of SQL instances that you will need. These instances can be installed on any or all nodes in the DxEnterprise cluster.
Next, determine how you want to associate the instances with Vhosts. Here are some common configurations:

- Create a separate Vhost for each instance (Recommended).
- Assign all of the instances on a node to a single Vhost.
- Use some other organization.

**NOTE:** If you want individual InstanceMobility, you should create one Vhost per instance. Alternately, you could stack multiple instances within a given Vhost. This will create a failover group of all instances within that Vhost.

Then determine how you want to configure the Vhosts. Each Vhost needs a primary node and one or more backup nodes. The backup nodes for each Vhost must have local installations of all of the configured SQL instances.

**NOTE:** A primary SQL instance and its backup SQL instances must have the same name. For example, if you install a SQL instance called “instance1” on the primary node, you will also need to install an instance called “instance1” on every backup node.

### Add a Virtual SQL Server Instance

When a SQL Server instance is added to a Vhost, DxEnterprise virtualizes the network name and IP address associated with the SQL Server instance creating a Virtual SQL Server instance. Clients can then access the Virtual SQL Server instance via the Vhost\instance name.

Assigning a SQL Server instance to a Vhost creates a managed instance. Each Vhost can be associated with any number of SQL Server instances. You can add all of the primary SQL Server instances on a node to the same Vhost, or you can create multiple Vhosts and spread the primary SQL Server instances among them.

When assigning SQL Server instances to a Vhost, you should be aware of the following:

- If you want to use SQL Server replication on a SQL Server instance assigned to a Vhost, you will need to define the replication after you add the instance to the Vhost.
- If you assign multiple SQL Server instances to the same Vhost, keep in mind that a failure of one instance can cause the Vhost to fail over. This failover will include all instances associated with the Vhost, not just the failed instance.
- An instance of SQL Server cannot be virtualized if the physical computer name is changed after the SQL Server instance is installed and before the instance is virtualized.

To add a SQL Server instance to a Vhost, select the Vhost on the DxAdmin explorer tree, right-click, and select **Add SQL instance.**
The Virtual Host Instance Maintenance window then appears.

**Instance Name**
This field lists all of the SQL Server instances that are available for assignment to this Vhost. Select the appropriate SQL Server instance.
Description
Enter your description for the instance. It is ideal to annotate your SQL Server instances.

TCP Port
Enter the port number for TCP/IP Sockets that the SQL Server instance should listen on. A static listening port per instance is required.

Data Path
Specify the full path that will be used for the Master data files for this Virtual SQL Server instance. Ensure the path is on shared storage. For Linux, specify the mount path for the managed shared disk.

Log Path
Specify the full path that will be used for the Master log file and Error log files for this Virtual SQL Server instance. Ensure the path is on shared storage. For Linux, specify the mount path for the managed shared disk.

New virtualization
Specify whether DxEnterprise should copy the baseline data from the active node to the SAN. If this checkbox is not checked, DxEnterprise will re-use data defined from Data Path and Log Path as-is.

SQL Authentication
This section is required only if using SQL Server login credentials.

Login
The user name used to login to SQL Server.

Password
The password used to login to SQL Server.

Click OK to virtualize the SQL Server instance. The process of virtualizing an instance may take several minutes to complete depending on the system capability and the size of the databases copied to the shared storage.

Note: By default DxEnterprise executes under the LocalSystem account context on Windows. It may be necessary to add this account to SQL Admin group in order to have a successful virtualization. If it is necessary to run DxEnterprise under a different account, please ensure the account used for DxCMonitor, DxLMonitor, DxHealthMonitor, DxRegMonitor, and DxStorMonitor is part of the local Administrators group and SQL Admin group, and has full access to any SQL data folders.

Configure SQL Server Clients
To connect to a SQL database, SQL clients must specify the fully qualified name or IP address of the Virtual SQL Server instance and the instance name or static TCP port number of the Virtual SQL Server instance associated with the SQL Server database. For example, if VHOST1\Customers listens on port
50001 and has the virtual IP address 192.168.1.71, clients could specify either “VHOST1\Customers”, “192.168.1.71\Customers”, “VHOST1,50001” or “192.168.1.71,50001” (remotely connecting by instance name requires a client alias to be configured).

Note: DxEnterprise needs to know the port that SQL Server clients will use to access the SQL Server database. This means that SQL Server clients cannot use dynamic port assignment.

What happens during a failover?

Failovers can be planned (for example, upgrading the operating system) or unplanned (such as a crash of a primary node). DxEnterprise takes these actions during a failover:

- Removes the IP address for the Vhost from the original node and then adds it to the backup node. Note: DxEnterprise allows the use of the local IP address as the Vhost IP address. In this case, the Vhost IP address is not added or removed on each failover/failback.
- Updates registry keys and then starts SQL Server and SQL Agent on the backup node.

Clients using the IP address of the Vhost will now access the databases on the shared storage via the Virtual SQL Server instance on the backup node.

After a Vhost fails over, by default it remains on the backup node even after the primary node comes back online. (Optionally, you can configure the Vhost to automatically fail back to the original node.)

Note: Failover time needed for a planned outage is as long as it takes to shut the SQL Server instance down and restart it, as fast as your particular instance takes on your infrastructure. For unplanned outages, it is the time necessary for DxEnterprise to exceed user definable threshold to declare the instance offline, and SQL Server to start and do recovery, typically less than 30 seconds.

Replication of registry keys

DxEnterprise replicates the registry keys for the SQL Server instance from the local server to a location on the shared storage containing the corresponding “Master” SQL databases. The registry monitor watches the main SQL Server instance key, and if it changes, persists the key to this location.

If a Vhost fails over to a backup node, that node reads the keys from the shared storage and applies them to its local registry before starting the SQL Server services. On failback, after SQL Server services are stopped on the backup node, the registry is returned to its original state on that node.

Installing SQL Server instances with DxEnterprise for Windows

The SQL Server instances associated with a Vhost must be installed on all of the nodes. The Vhost is active on the primary node and SQL Server database requests are serviced from there. On failure, DxEnterprise will failover the Vhost to one of the designated backup servers where it will continue to provide access to the shared data under the same Vhost name/IP-address pair.
Before starting installation of SQL Server instances, be aware of the following.

**SQL Server and operating system support**
DxEnterprise Software can be used with SQL Server 2012/2014/2016/2017/2019, Express, Standard, Enterprise, and BI (2012), 64-bit. Windows Server 2012R2 64-bit, 2016 64-bit, 2019 64-bit, RedHat 7.x, CentOS 7.x, and Ubuntu 16.04/18.04 64-bit are the supported operating systems.

**General prerequisites**
Before installing SQL Server through DxEnterprise, the following prerequisites should be met:

- DxEnterprise Software must be installed on each node.
- .NET Framework 4.5.2 (Windows) or .NET Core 3.1 (Linux), or higher must be installed.
- SQL Server and the SQL Agent can be configured to use either the Local System account or a Domain account. However, certain SQL Server features are not available if you use the Local System account. Consult the Microsoft documentation for more information about these accounts and the features they support.
- Multiple instances per Windows node are supported. Consult the Microsoft documentation for supported limit.
- A primary SQL Server instance and its backup SQL Server instances must have the same name. For example, if you install a SQL 2016 instance called “instance1” on the primary node, you will also need to install a SQL 2016 instance called “instance1” on any backup nodes.

**Run the Application Installer**
Before starting the DxEnterprise Application Installer, be sure to review the prerequisites and installation considerations described above. Also be sure that the product files are in a location that can be accessed by the Installer. Mount a virtual CD/DVD for SQL media on each node unless using a network UNC path. Be sure the assigned drive letter is mapped the same for the virtual CD on all nodes unless using UNC.

To start the DxEnterprise Application Installer, select **Application Installer > Install SQL Server** in DxAdmin.
To install a new instance, provide the following information.

**SQL Version**
Select the SQL Server instance version.

**Setup file name**
Enter the name and location of the SQL Server setup files, or click the **Browse** button to locate them.

**Template file name**
Enter the name and location of a SQL Server template (INI) file, or click the **Browse** button to locate them. Sample templates are located at `C:\Program Files\DH2i\template`. Template files are a standard answer (configuration) file used by Microsoft SQL Server unattended operations. For details, please visit

**Optional parameter(s)**
Enter any optional setup parameters (e.g. `/FEATURES=SQLEngine`).

**Executing command**
Enter or edit the SQL Server instance setup command.

**Network user**
A required field if the setup media resides on a network share. Enter the user credential with proper access. This parameter is ignored if the setup media is local to the server(s).
**Network password**

A required field if the setup media resides on a network share. Enter the password for the network user credential.

Select the servers on which the instance will be installed and then click **Install** to begin the installation process.

### Updating SQL Server Instances for DxEnterprise for Windows

This section describes how to install Service Packs and Hotfixes on SQL Server instances.

**Update overview**

The DxEnterprise Application Installer should be used for all updates of SQL Server instances that have been virtualized with DxEnterprise Software on Windows. Both virtualized (Managed) and non-virtualized instances (Unmanaged) can be updated with the Installer. If the installer is not used for an update, version mismatches can occur between the virtual and original registry and the data files on the active node.

The DxEnterprise Application Installer can install any edition or version of SQL Server 2012/2014/2016/2017/2019, associated Service Packs, and most to all SQL Server hotfixes. SQL Server setup packages must support silent and unattended installations.

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

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**Note:** The DxEnterprise application installer cannot be used to apply updates to a managed SQL Server instance on the active node. This is because the application of a service pack will typically cause the instance to be temporarily shut down, which will be detected by DxEnterprise and interpreted as a failure.

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**Location of service packs and hotfixes**

The SQL Server product files must be in a location that can be reached by the DxEnterprise Application Installer. Mount a virtual CD/DVD for SQL Server media on each node. Be sure the assigned drive letter is mapped the same for the virtual CD on all nodes. If the setup media in on a network share, enter appropriate network share credential to access the media from all nodes.

**Update Considerations for SQL Server**

**Extract zip files**

Some hotfixes are provided as zip files. Be sure to extract the contacts of the file and review the README before starting the installation.

**Service pack and hotfix names**

The installation procedure expects the names of SQL Server service packs and hotfixes to follow the standardized naming schema defined in the following Microsoft Knowledge Base article.
The installation will fail if the name of a service pack or hotfix has been changed and it no longer matches the schema.

Run the DxEnterprise Application Installer

Before starting the DxEnterprise Application Installer, be sure to review the prerequisites and installation considerations described above.

To start the DxEnterprise Application Installer, select Application Installer > Update SQL Server in DxAdmin.

To dynamically push a SQL update to any desired instances, supply the following information. The update will run in parallel on all selected nodes.

**SQL Version**
Select the SQL Server instance version.

**Setup file name**
Enter the name and location of the SQL Server service packs and hotfixes files or click the Browse button to locate.

**Template file name**
Not enabled for update.
Optional parameter(s)
Enter any optional setup parameters (e.g. /FEATURES=SQLEngine).

Executing command
Enter or edit the SQL Server instance setup command.

Network user
A required field if the setup media resides on a network share. Enter the user credential with proper access. This parameter is optional if the setup media is local to the server(s).

Network password
A required field if the setup media resides on a network share. Enter the password for the network user credential.

Select the instances, virtualized (Managed) and non-virtualized instances (Unmanaged), to be updated and the servers on which the instance will be updated. Click Install to begin the update process.

SQL Server Instance Details
When a SQL Server instance is selected on the explorer tree, various instance details are displayed.
**Name**

The selected SQL Server instance name.

**Description**

User-defined description for the instance. Click the pencil icon to set or update the description for the instance.

**Port**

SQL Server instance static listening TCP port.

**Data path**

Data path on the shared storage.

**Log path**

Log path on the shared storage.
**SQL login**

The login user is displayed if connecting using server login credentials. Click the pencil icon to update the SQL login credentials.

**Advanced**

User-defined script management for the instance. This is a logical insertion point for a SQL Server application workflow. A custom script can be set by specifying the absolute path (...) or by embedding the script content within DxEnterprise cluster configuration. When the script content is embedded within DxEnterprise, it is guaranteed to be available for any node when the instance fails over/back between nodes. It is the preferred choice for DxEnterprise.

- **Pre-Start** – A custom script is executed before the instance starts up on a node. Ideal event to embed business logic to switch over the replicated storage from read-only to read-write before starting up the instance.
- **Post-Start** – A custom script is executed after the instance successfully starts up on a node. Ideal event to embed business logic to start 3rd party agents or dependencies for the instance.
- **Pre-Stop** – A custom script is executed before the instance stops on a node. Ideal event to embed business logic to stop 3rd party agents or dependencies for the instance.
- **Post-Stop** – A custom script is executed after the instance successfully stops on a node. Ideal event to embed business logic to clean the instance environment.

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*Note: Virtual SQL Server instances can be moved between Vhosts by simply dragging the Virtual SQL Server instance from one Vhost and dropping the instance onto another Vhost. However, service and disk dependencies will need to be considered when using this feature.*

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**Additional Commands**

**Virtual Host**

These additional commands can be performed from DxAdmin. In DxAdmin, select a Vhost on the explorer tree, then right-click to display a menu listing the available options.
**Refresh**

To refresh the display, select a Vhost on the DxAdmin explorer tree, right-click, and select **Refresh**.

**Remove virtual host**

To remove a Vhost, select a Vhost on the DxAdmin explorer tree, right-click, and select **Remove virtual host**.

**Update virtual host**

To change the failover order of the nodes of a Vhost, select a Vhost on the DxAdmin explorer tree, right-click, and select **Update virtual host**.
You can also update the “Auto failback” setting, or replace the Virtual IP(s) with one or more desired IPs by clicking the pencil icon to the right of the address.

**Stop virtual host**

This command administratively stops all running applications on the active node and sets the Vhost to the *administratively disabled* state.

**Restart virtual host**

Stops, then starts a virtual host on the currently active node

**Add a node**

This command allows you to add a node to a Vhost and then to reorder the failover priority of the nodes. The failover priority of the nodes starts at the top of the list down. The higher the node on the list, the higher the priority it has to host the Vhost. The new node must be running DxEnterprise, belong to the DxEnterprise cluster, and must have the same SQL Server instances installed as hosted by the Vhost.

**Freeze virtual host on node**

This command allows you to administratively put a Vhost into “frozen” state. While the Vhost is in this frozen state, applications running under the Vhost are not monitored and can be manually stopped and started without causing the cluster to initiate a failover. If the node is rebooted, all SQL Server instances running on the node would require manual restart.
**Unfreeze virtual host on node**
This command allows you administratively take a Vhost out of the “frozen” state and back into “active” state. Monitoring of applications running on the Vhost will be resumed, and the Vhost can be failed over between nodes.

**Manage virtual host diskgroup.**
This command allows you to add or remove disk(s) from the Vhost diskgroup.

**Add availability group**
This command allows the user to create a new SQL Server availability group.

**Import availability group**
This command allows you to add an existing SQL Server availability group to a Vhost.

**Add SQL instance**
This command allows you to add a SQL Server instance to a Vhost and create a Virtual SQL Server instance. To add a SQL Server instance, select a Vhost on the DxAdmin explorer tree, right-click, and select **Add an instance** (see the section Add a Virtual SQL Server Instance above for details).

**Add a file share**
This command allows you to add a fileshare to a Vhost and create a Virtual Fileshare.

**Add Docker instance**
This command allows you to add a Docker instance to a Vhost and create a Virtual Docker container instance.

**Add a service**
This command allows you to add a generic service to a Vhost and provide high availability for the service.

**Add a tunnel**
This command allows you to add a new tunnel to a Vhost. The tunnel will be displayed by a leaf under the Vhost and a leaf under tunnels.

**Nodes**

![Nodes Diagram]

DxEnterprise Software Administration Guide
These additional commands can be performed from DxAdmin. In DxAdmin, select a node under a Vhost on the explorer tree, then right-click to display a menu listing the available options.

**Refresh**

To refresh the display, select a node on the DxAdmin explorer tree, right-click, and select Refresh.

**Remove node**

This command allows you to remove a node from a Vhost.

**Start hosting on Node**

This command allows you to re-host or “move” a Vhost from one node to another. Select the node you want to Vhost to start on or “move to”, then right-click and select Start hosting on Node.

**Stop virtual host**

This command administratively stops all running applications on the active node and sets the Vhost to the administratively disabled state.

**Virtual SQL Server Instance**

These additional commands can be performed from DxAdmin. In DxAdmin, select a Virtual SQL Server instance on the explorer tree, then right-click to display a menu listing the available options.

**Refresh**

To refresh the display, select a Virtual SQL Server instance on the DxAdmin explorer tree, right-click, and select Refresh.

**Remove instance**

To remove a Virtual SQL Server Instance or de-virtualize the instance, select a Virtual SQL Server instance on the DxAdmin explorer tree, right-click, and select Remove an instance.
**Stop instance**
To administratively disable a Virtual SQL Server instance, select a Virtual SQL Server instance on the DxAdmin explorer tree, right-click, and select **Stop instance**. The instance will be shut down, and will not be included in failover actions for the Vhost.

**Relocate system databases**
When the current disk is at capacity, it may be necessary to relocate the system databases (i.e. master, msdb, model) to another disk with more free space. This operation can also be used to migrate SQL data from one system to another, for example, from DxConsole to DxEnterprise. Select a Virtual SQL Server instance on the DxAdmin explorer tree, right-click, and select **Relocate system databases**.

**Set dependencies**
To define the dependencies between SQL Server instances and/or services to prioritize which instances or services should start up first, right-click, and select **Set dependencies**.

When an instance or service depends on other instances or services, it will be started after all of the depended on instances or services finish starting. If a circular reference is set for the dependencies (i.e. instance1 depends on service1, and service1 depends on instance1), the system will break the dependency tree and revert back to default behavior as if there is no dependency set.

![Dependency Management](image-url)
**OK**

Click to commit the changes.

**Close**

Click to cancel the process without making any changes.

## Cluster Nodes

These additional commands can be performed from DxAdmin. In DxAdmin, select a Cluster Node on the explorer tree, then right-click to display a menu listing the available options.

![Diagram of DXENODE1 with options](image)

**Refresh**

To refresh the display, select a node on the DxAdmin explorer tree, right-click, and select **Refresh**.

**Freeze cluster node**

This command allows you to administratively put a node in the frozen state. While the node is in the frozen state, applications are not monitored by DxEnterprise and continue to run on the node even if the DxEnterprise software is removed from the node. If the node is rebooted, all SQL Server instances running on the node will require a manual restart. When a node is frozen, its color changes to purple.

**Unfreeze cluster node**

This command allows you to administratively take a cluster node out of the frozen state. All applications are again monitored by DxEnterprise and continue to run on the node. When a node is unfrozen, its color changes from purple to reflect the current status.

**Disable cluster node**

This command allows you to put a node in maintenance mode. It’s still a member of the Vhost, but it’s no longer an active failover target. When a node is disabled, all active
instances will failover onto other nodes in the cluster and the node is highlighted in orange.

Enable cluster node
This command allows you to take a node out of maintenance mode. The node will resume being an active failover target. When a node is enabled, it is no longer highlighted in orange. Its color might change to a different one to reflect a new status.

Set app coordinator
Administratively select a node in the cluster to be the application service coordinator. When a node is selected as the application service coordinator, it is responsible for coordinating and maintaining the application queue.

Set cluster coordinator
Administratively select a node in the cluster to be the cluster coordinator. When a node is selected as the cluster coordinator, it is responsible for coordinating cluster communication between member nodes.

Set storage coordinator
Administratively select a node in the cluster to be the storage coordinator. When a node is selected as the storage coordinator, it is responsible for coordinating and maintaining the storage queue.

Add a Virtual File Share (Windows Only)

When you add a file share to a Vhost you create a Virtual File Share. Be sure to use DxEnterprise instead of a Windows application. If Windows utilities are used to create the Virtual File Shares, they will not be made highly available.

DxEnterprise Software periodically checks whether the Virtual File Share can be accessed externally. A failure detected by DxEnterprise can cause the Vhost to fail over to a backup node. To add a Virtual File Share to a Vhost, select the Vhost on the DxAdmin explorer tree and right-click to select Add a fileshare.
The *Adding a new file share* window then appears.
**Share Name**

Type a name for the file share.

**Share Path**

Type the location of the file share (such as `O:\Share1`). This is typically the drive letter or path assigned to the filesystem that will be accessed via this share.

**Description**

If desired, enter a description of the file share.

**User limit**

This value specifies the number of users that will be allowed to access the file share simultaneously. Maximum is the system maximum, which is limited by the available memory. To specify a different number of users, select **Allow** and then type the number of users to be given access.
**Caching**

Offline caching allows users to cache files and programs from the share to their local machines. There are five options:

- Only the files and programs that users specify will be available offline. This option lets users select the files that will be available offline.
- BranchCache™ is a Microsoft feature that can reduce wide area network (WAN) utilization and enhance network application responsiveness when users access content in a central office from branch office locations. When you enable BranchCache, a copy of the content that is retrieved from the Web server or file server is cached within the branch office. If another client in the branch requests the same content, the client can download it directly from the local branch network without needing to retrieve the content by using the Wide Area Network (WAN).
- All files and programs that users open from the share will be automatically available offline.
- If you check Optimized for Performance, all programs are automatically cached and can be run locally. This feature is useful for file servers that host applications because it reduces network traffic and improves server scalability.
- Files or programs from the share will not be available offline. Files and programs are not cached offline.

**Grant**

This indicates user roles and permission granted for the new file share. The default READ for all users.

**Add**

Clicking **add** will display a new dialog box allowing you to grant permissions of **Read**, **Change**, or **Full** to the selected user name. The user name may be a single user or a group defined on the server.

**Remove**

To remove a permission, select the position in the Grant list and click the **remove** button to the right.
OK
Click to commit settings.

Close
Click to cancel the process without making any changes.

Add a Generic Service

DxEnterprise supports adding a generic service to a Vhost. When a service is added to a Vhost, it will follow the Vhost and will be brought online on the active node, similar to a SQL Server instance added to a Vhost.

This feature is ideal for various backup agents, stand-alone applications, and dependent services/applications on SQL Server. In essence, the generic service or application is made highly available because it is always available through the Vhost endpoint.

To add a generic service to a Vhost, right-click on a Vhost and select Add a service.

The Virtual Host Generic Service Maintenance window then appears.
**Service Name**
Select the dropdown list and pick the desired service to add.

**Description**
Enter a description for the service.

**Assume Vhost Name**
Optional. When the checkbox is checked, the service will assume the Vhost name when it starts up on the active node. Applicable when the service is connected via the Vhost name.

**Set**
Optional. When the checkbox is checked, the Registry key and Repository Path are available for data input.

**Registry key**
A service registry key that will follow the service during a failover. The registry key provided will be copied from the primary node for the Vhost and used as the cluster registry for the service.

**Repository Path**
A local path where the registry key will be backed up on all nodes.

**OK**
Click to commit settings. A confirmation dialog then appears. Select Yes to commit or No to cancel.
Close
Click to cancel the process without making any changes.

Virtual Generic Service
These additional commands can be performed from DxAdmin. In DxAdmin, select a virtual service on the explorer tree, then right-click to display a menu listing the available options.

Refresh
To refresh the display, select a Virtual Generic Service instance on the DxAdmin explorer tree, right-click, and select Refresh.

Remove service
To remove a service or de-virtualize the service, select a service on the DxAdmin explorer tree, right-click, and select Remove service.

Stop service
To administratively disable a service, select a service on the DxAdmin explorer tree, right-click, and select Stop service. The service will be stopped, and will not be included in failover actions for the Vhost.

Set dependencies
To define dependencies between SQL Server instances and services, right-click and select Set dependencies.
When an instance or service depends on other instances or services, it will be started after all of the dependent instances or services finish starting. If a circular reference is set for the dependencies (i.e. instance1 depends on service1, and service1 depends on instance1), the system will break the dependency tree and revert back to default behavior as if there is no dependency set.

![Dependency Management](image)

**OK**
Click to commit the changes.

**Close**
Click to cancel the process without making any changes.

**Note:** Generic services can be moved between Vhosts by simply dragging the service from one Vhost and dropping the service onto another Vhost.

### Availability Groups

DxEnterprise enables SQL Server Availability Groups to be made highly available within and between Windows and Linux nodes and across any type of infrastructure—all without relying on cumbersome and restrictive cluster orchestration technologies such as Pacemaker or Windows Server Failover Clustering (WSFC). DxEnterprise provides advanced fault detection and failover automation to minimize outages for SQL Server databases, helping customers achieve nearest-to-zero total downtime. The DxEnterprise tool is the only technology on the market that enables highly available SQL Server Availability Groups across mixed Linux and Windows nodes and mixed Linux distributions. Use this tool to make your AG deployments easier to set up and manage. This functionality requires the use of Microsoft’s SQL Server 2017 or later release. Additionally, the creation of an availability group under a Vhost simplifies common configuration criteria.

DxEnterprise for Availability Groups also integrates seamlessly with DH2i’s network security technology to make it easy to create highly available multi-server / multi-site / multi-cloud Availability Groups. Without exposing any open ports or requiring the use of a VPN, DxEnterprise automatically creates the
networking tunnels between the nodes that are required for cluster communication and Availability Group replication. These micro-tunnels then transmit TCP payloads via UDP for superior performance and security.

**Add Availability Group**

DxEnterprise allows the creation of an availability group within SQL Server and to manage it across Linux and/or Windows nodes.

*Note: To enable Availability Group management and/or tunneling features, please contact your DH2i account representative.*

The pre-requisites are as follows:
- The tunneling feature must be activated if you intend to build a cross-site or cross-subnet AGs.
- A Microsoft SQL Server 2017 or later instance on each node.
- A Vhost that does not have a Docker, Instance, or service configured.

**Steps to Add an Availability Group**

1. To add an availability group, right-click on a Vhost and select **Add availability group**.

2. The **AGS Management** window then appears.
3. Give the availability group a unique name.
4. Check the Tunnel box to create a tunnel between all of the nodes in the group if needed (cross-site mirroring or cross subnet mirroring).
5. Select the Instance name on each node.
6. Click on Authenticate for each node to supply sysadmin credentials for the instance. Once authenticated the Valid checkbox will be checked.

7. Select the Availability Mode (Synchronous, Asynchronous or Configuration Only)
8. Click OK to add or Close to exit without making changes.

**Configure a Listener Port**

After the Availability Group has been added there is an option to configure a Listener Port.

*Note: When the cluster type is set to external or none, the availability group listeners are only functional with SQL Server 2019 and later.*

1. Left click on the name of the Availability Group.
2. Click on the pencil icon to edit the Listener Port field.
3. Click on the pencil again and then click Yes to save changes or No to discard the changes.
Manage Availability Databases

To add or remove databases from an availability group, right-click on the availability group and select **Manage availability databases**.

The *AGS Database Maintenance* window then appears.

Select the database(s) and use the arrow buttons to add or remove them from the **Selected Databases**. Click **Submit** to save or **Close** to cancel.
Attach Availability Group

DxEnterprise allows the user to attach an existing availability group and manage it across Linux and/or Windows nodes.

*Note: To enable Availability Group management and/or tunneling features, please contact your DH2i account representative.*

The pre-requisites are as follows:

- All nodes in the Vhost must have Microsoft SQL Server 2017 or newer installed and are members of an availability group prior to attaching it.
- The Vhost does not have a Docker, Instance, or service configured.
- Stop any cluster software that previously managed the availability group. I.e. If using Pacemaker then stop the Corosync and Pacemaker services.
- Availability Groups with a cluster type of WSFC are not eligible for attachment.

**Steps to Attach an Availability Group**

1. To attach an availability group, right-click on a Vhost and select **Attach availability group**.

2. The **Attach Availability Group** window then opens.
3. Select the Instance name in the dropdown box.
4. Click on **Authenticate** for each node to supply sysadmin credentials for the instances. Once authenticated the **Valid** checkbox will be checked.

5. Click on **Search for Availability Group** to find any existing availability groups.

6. Select the availability group to attach.
Note: In order to attach an existing Availability Group successfully to a Vhost, check that the primary node of the Vhost is also the primary replica for the Availability Group. If an attempt is made to attach an Availability Group to the secondary replica, it may cause problems during failover due to the sequence number of the secondary replica being lower than the primary replica.

7. Click OK to attach or Close to exit without making any changes.

**Detach Availability Group**

To detach an availability group but not delete it from SQL Server, right-click on the availability group and select **Detach availability group**. This will allow the AG to be imported again later.

**Remove Availability Group**

To remove the availability group from both the cluster and delete it from SQL Server, right-click on the availability group and select **Remove availability group**. Warning: this option will completely remove the availability group configuration from SQL Server.

**Modifying AGS Credentials**

If the sysadmin credentials inside of SQL Server are modified, then the sysadmin credentials used by DxEnterprise to manage the availability group will also need to be modified. To modify the credentials used by DxEnterprise, use the following method.

1. Select the availability group under the Vhost.
2. In the availability group details pane, click on the **Advanced** bar.
3. The **Replica Credentials** section will then be visible.
4. Select **Edit** to modify the Login and/or Password for the sysadmin user(s). Click **Submit** to save the changes.

**Add a Docker Container**

DxEnterprise allows you to make a Docker container highly-available across nodes with stateful storage. Additionally, the creation of a Docker instance within a Vhost manages the container and simplifies common configuration criteria.

*Note: To enable Docker management features, please contact your DH2i account representative.*

The pre-requisites are as follows:

- Installation of Docker on each node.
- Pull the same image or set of images on each node.

To add a Docker instance to a Vhost, right-click on a Vhost and select **Add Docker instance**.
The Docker Management window then appears.
**Docker Container Type**

Contains pre-set templates for common images, as well as a Custom blank template allowing you to utilize arbitrary images.

**Docker Name**

The logical name for this container instance. This must be unique, as this is also used as the Docker container name.

**Docker Image**

This is a pull-down list of eligible images installed across nodes. The user may enter an arbitrary name instead, but it is recommended to utilize the drop-down list. If the MSSQL Container Type is selected, the user will need to check the Accept EULA checkbox in order for an mssql-server container to be started.
**Host Port**

This is the static port mapping between the host and container instance. It is in the form of `<host>:<container>`. The pre-defined templates contain the known endpoint, whereas the custom template requires you to enter the container endpoint.

**Password field**

When using pre-defined templates, this field will appear to input the MSSQL `sa`, MySQL `root`, or Postgress `postgres` user passwords.

**Data Path**

This is a pull-down list of managed and mounted volumes for stateful data. The volume selected should be one added to the Vhost diskgroup to ensure it is online where the Vhost is active. You may enter an arbitrary data path, but it is recommended to utilize the drop-down list. Custom container types require that it be entered manually. The target is pre-populated for known container types in the form of `<host path>:<container path>`. If this field is not populated, the container instance will not be stateful, but it is a valid configuration.

**Optional fields**

The optional fields allow you to specify any additional parameters to be passed in. Any option supported by the “docker run” command can be specified here.

To add an entry, click the plus sign to the right of the field. The **Docker Param Management** window will open. **Param Name** is a drop-down list of commonly-used options, and you can enter other options by typing into the field. The Value is the argument to the option, if one is necessary. If the contents of the Value are sensitive, you can click the checkbox to the right. This will store the Value encrypted and will not display in plain text in the Optional parameters list.

**OK**

Click to commit the changes.

**Close**

Click to cancel the process without making any changes.
Manage Clients and Groups

The client and group manager allows the user to add a new remote client, a remote client group, edit a client, or edit a group. This is where the configuration file is generated that allows the client to access one or more tunnels based on which tunnels the client is associated. To access the Manage Clients and Groups dialogue, right-click on **DxCluster** at the top of the treeview and select **Manage Clients and Groups**.

**Clients**
Click the radio button to display a list of current clients.

**Client Groups**
Click the radio button to display a list of current client groups.
**Grid Navigation Bar**

The navigation bar allows the user to set the number of items per page and navigate to a specific page.

From left to right the actions are:

- Move to first page.
- Move back one page.
- Set the page number manually.
- Move forward one page.
- Move to last page.
- Number of items per page.
- Refresh data.
- Display the details of the selected client (only available in client view).

**Add New Group**

Click this button to add a new remote client group. A remote client group is a unique name used to group members together. The “add new group” window is the same as the edit window, the only difference being the group name cannot be changed.

*Note: The Group Name must be unique and is not case sensitive (i.e. DEVTEAM, devteam and DevTeam are considered the same names and will be displayed in all capitals – DEVTEAM).*

**Search…**

Click this button to filter the list of clients based on the search parameters.
Add Client
Click this button to create an “add new client” dialog.

Add Arrows
After selecting one or more clients, the user can click this button to add them to the remote group. No changes are saved until the user clicks submit.

Remove Arrows
After selecting one or more client members, the user can click this button to remove them from the current group. Changes are not saved until after the user clicks the submit button.

Grid Navigation Bar
The navigation bar allows the user to set the number of items per page and navigate to a specific page. The last button is to refresh the display.

Submit
Changes are saved and the dialog closes.

Close
Changes are not saved and the dialog closes.

Add New Client
Click this button to add a new remote client user. The “add remote client” dialog is the same as the edit remote client, except the username cannot be changed in edit mode.

*Note: The username must be unique and is case-sensitive (i.e. Harry and harry are two distinct names).*
Submit
This button submits the data and closes the dialog. If apply or submit is not been selected, any information in the fields will not be saved.

Close
This button closes the dialog.

Apply
This button submits the current data and clears the form so the user can add another remote client.

Export Config File
Click this button to export the configuration file. The configuration file will be needed, along with the username and password, for a user to connect to a tunnel using the DxConnect application. For more information about DxConnect please see the DxConnect Admin Guide.

Performance Policies

DxEnterprise has a policy-driven system resource monitor and load balancer designed to maintain ideal operating conditions for hosted applications. When systems fail or load conditions change, DxEnterprise will ensure that all database instances remain responsive. DxEnterprise supports two different modes of operation: Performance Thresholds and Resource allocation. All DxEnterprise settings are configured in the Resource Manager.

Performance

DxEnterprise performance thresholds support alerting and load-balancing based on the usage of specific system resources. Performance thresholds are configured by policies in the Performance tab of the Resource Manager dialog. In this tab, all defined resource threshold policies are listed and grouped by the SQL Server instance or node for which they are defined.

Add a Policy
To add or define a new policy, click Add.
**Policy ID**
System generated policy ID.

**Enabled**
Enables or disables a policy.

**Description**
User-defined field for the policy.

**Type**
There are four types of policy supported by DxEnterprise:
- System – policy defined for a cluster member node.
- Instance – policy defined for an application, such as SQL Server instance.
- Service – policy defined for a generic service.
- Docker – policy defined for a Docker instance.

**For**
A given entity based on type selected.

**Counter**
The performance counter or type of resource to be monitored. Supported counters for instances and cluster member nodes are:
- Instance-Disk-IO
- Instance-Networking
- Instance-Processor
- Instance-Working-Set
- Process-Consumption
- System-Disk-IO
- System-Down
- System-Free-Memory
- System-Networking
- Service-Disk-Io
- Service-Networking
- Service-Processor
- Service-Working-Set
- Docker-Disk-Io
- Docker-Networking
- Docker-Processor
- Docker-Working-Set

**Threshold**
The conditional value when a policy is considered met or exceeded. For processor resources, this is specified in units of percentages. For memory resources, this is specified in units of megabytes (MB). For disk I/O and network I/O, this is specified in units of kilobytes per second (KB/s).

**Email Operator(s)**
Corrective action triggered when a threshold is met or exceeded. An email alert is sent to all the operators defined in the field. Use a comma to delimit multiple email addresses.

**Execute Script**
Corrective action triggered when a threshold is met or exceeded. Specify a full path to a custom script to be executed. The path must be accessible to all cluster nodes.

**Load Balance**
Corrective action triggered when a threshold is met or exceeded. Define whether the system should move an application instance to another cluster member node. Note that the load balance action is always taken for the System-Down condition.

**Priority**
Priority value ranges from 1 to 5 relative to other policies. When a load-balancing action is set, it is set with a priority which identifies the order of the instance relative to others for relocation. Vhosts with highest-priority instances are relocated last.
**Allocation**

Using DxEnterprise resource allocation policies, you can define a Service Level Agreement (SLA) for each SQL Server instance. This ensures the availability of specific resources for each instance and will raise administrative alerts if the allocations cannot be met.

### Mechanics of Allocation

To use allocation, a fixed amount of processor, memory, disk I/O, and network I/O resources may be specified for each instance. Resource allocation limits must also be specified for all cluster nodes. DxEnterprise will summarize the resource allocations of all instances running on a cluster node and ensure that they fit within the allocation cap for that node. DxEnterprise will also ensure that failover actions uphold allocations, if possible. If allocation limits are violated, administrative alerts are raised. Alerting actions can be configured.

**Refresh**

Requery the cluster for the latest allocation policies.

**Edit**

The DxEnterprise allocation policy editor can be accessed through the **Edit** button associated with each instance or node in the Allocation tab of the Resource Manager dialog.

**Reset**

Reset the allocation policy back to the default (none).

### Allocation Policy Editor

Allocation policies allow the allocation of each of the four system resources (processor, memory, disk I/O, and network I/O) to be specified for a given entity and the allocation limits to be specified for each cluster node.
Instance(s), Application(s) and Service(s)

When configuring policies for a given application, the allocation policy editor displays the total quantity of each resource available on the current host, the allocation size, and the actual usage of the application. The allocation size may be specified as zero; in that case, the resource will be ignored.

Actions configured for application allocations are taken when the actual resource use of the application exceeds the allocation.

Cluster Nodes

When configuring policies for a cluster node, the allocation policy editor displays the configured allocations for the node. If the node is running, the total quantity of each resource available and the actual resource usage will be displayed. The allocation size may be specified as zero; in this case, the resource will be ignored and considered to be unlimited.

Actions configured for cluster node allocations are taken when the sum of resources allocated to all instances running on the node exceed the allocation limits set for the node.

Two types of actions may be configured for allocation policies:

Email

If specified, an email alert is sent to all the operators defined in the field. Use a comma to delimit multiple email addresses.

Script

If specified, this field contains the full path to a custom script to be executed. The path must be accessible to all cluster nodes.
Notification Policies

DxEnterprise Global Alerts feature allows you to define a “catch-all” alert system that will notify the appropriate personnel when a particular system event is triggered.

<table>
<thead>
<tr>
<th>PolicyID</th>
<th>Description</th>
<th>Email</th>
<th>Enabled</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C13BFC4A-FCD8-48ED-A8F9-C103...</td>
<td>AGS Errors</td>
<td><a href="mailto:dba@dh2i.com">dba@dh2i.com</a></td>
<td></td>
<td>Edit</td>
<td>Delete</td>
</tr>
<tr>
<td>CB7377B4-AF4E-4E47-B537-14AE3...</td>
<td>CLUSTER WIDE POLICY</td>
<td><a href="mailto:admin@dh2i.com">admin@dh2i.com</a></td>
<td></td>
<td>Edit</td>
<td>Delete</td>
</tr>
</tbody>
</table>

*Add*
Add a new global alert (filter) policy.

*Edit*
Edit an existing alert (filter) policy.

*Delete*
Remove an alert (filter) policy.

Global Alerts

Adding or editing an existing alert (filter) policy.
**Enabled**
Enable or disable the global alert (filter) policy.

**Description**
User defined description for the alert (filter) policy.

**Severity level**
DxEnterprise-defined message severity level. To raise the alert for only particular severity, check the desired box. If none is checked, the system considers it as “all” severity level. The default is all severity levels.

**Includes Filters**
The filter policy based on selected entities. To select the entities to filter, click the button with the ellipsis (...).
**Virtual host(s)**
To raise the alert for particular Vhost(s), select `vhost` from the dropdown. Default is none.

**Service(s)**
To raise the alert for particular service(s), select `service` from the dropdown. Default is none.

**Availability Group(s)**
To raise the alert for particular availability group(s), select `ags` from the dropdown. Default is none.

**Docker(s)**
To raise the alert for particular Docker(s), select `docker` from the dropdown. Default is none.

**Instance(s)**
To raise the alert for particular instance(s), select `instance` from the dropdown. Default is none.

**Node(s)**
To raise the alert for particular node(s), select `node` from the dropdown. Default is none.

**Clear**
Click to clear selected filters and reset dialog to default.

**Email Operator(s)**
When the alert is triggered, the system can notify user(s) via email if one is defined. Enter the recipient’s email address here. If more than one email address is required, delimit them using a comma.
Submit
Click to save settings.

Close
Click to exit and do not save settings.

Contact Address Book
DxEnterprise Software uses Contact Address Book to store email addresses. A contact entry can be added, edited, or deleted at any time.

Add a Contact
To add or define a new contact, click Add.

Name
The name of the contact. Must be unique.

Email
Email address of the contact.

Submit
Click to save the contact info.

Close
Close the dialog.

Edit a Contact
To update a contact email address, click Edit.
**Name**
The name of the contact. Non-editable.

**Email**
Email address of the contact.

**Submit**
Click to save the contact info.

**Close**
Close the dialog.

**Delete a Contact**
To delete a contact, click **Delete**.

---

**Cluster Settings**

The DxEnterprise Cluster Settings dialog contains options to configure low-level, cluster-wide settings for DxEnterprise. This dialog can be accessed in DxAdmin by selecting **Advanced Configuration > Cluster Settings**.
**Allocation Settings**

The Allocation Settings section contains options related to DxEnterprise resource allocation.

*AllocatorAlerts*

When this setting is True, administrative alerts will be raised when allocations are exceeded, and configured actions related to allocations will be taken.
**AllocatorEnabled**
When this setting is True, allocations that are configured will be used to guide failover operations.

**Broadcast Settings**

The Broadcast Settings section specifies whether or not and how the cluster should deliver data among cluster members.

**GratuitousArp**
When this setting is True, the cluster will attempt to use WinPcap (if installed) to send a gratuitous ARP when bringing up a Vhost. The default value is False.

**PerfBroadcastEnabled**
When this setting is “True”, the performance statistic data is delivered via UDP broadcasting. If this setting is False, performance statistic data is delivered through the cluster coordinator. Default value is false.

**RelayBroadcast**
When this setting is True, performance statistic data delivered via UDP broadcasting is relayed between disjoined subnet cluster members via a selected member from each subnet. Default value is True.

**Cluster Info**

The Cluster Info section contains a user-defined cluster description and a unique system-generated cluster ID.

**ClusterDescription**
A user-defined description for the cluster.

**ClusterID**
A unique system-generated cluster ID.

**Cluster Maintenance Mode**

**MaintenanceMode**
Administratively disable automatic failovers cluster wide. Default is false.
Cluster Passkey

A pass key is required to log in to the cluster for administration. The pass key is case-sensitive and can be any combination of alpha-numeric characters, punctuation, or symbols. If the user has not configured a pass key or has forgotten the pass key, the user will be unable to log in remotely or log in using unprivileged accounts. The pass key requirement can be bypassed by launching DxAdmin as an administrator on a cluster node.

Networking

_NATEnabled_
Enable or Disable registration with MatchMaking agent.

_NatKeepAlive_
How often the nodes check in with the MatchMaking agent in seconds. The default is 30 seconds.

_NATMatchAgent_
The comma delimited list of MatchMaking agents used to resolve cluster member servers across clouds.

Sampling Intervals

When performance thresholds are configured, the usage of certain system resources are monitored, and actions are taken if a threshold is met or exceeded. In most cases, it is undesirable for a temporary spike in resource usage to cause such actions to be taken. To protect against this, DxEnterprise computes a moving average for all resources that it monitors. The sampling interval setting can be used to set the size of the moving average, and is specified in seconds. When the sampling interval for the processor is set at 120 seconds, the processor usage for the previous 120 seconds is averaged together and reported as the resource usage for the purpose of thresholds. Reducing the length of the interval causes thresholds to be triggered faster, but also makes it easier for the threshold to be triggered by a short spike.

_IntervalDisk_
The moving average size for disk I/O. Default value is 120 seconds.
**IntervalMemory**

The moving average size for memory. Default value is 1 second.

**IntervalNetwork**

The moving average size for network I/O. Default value is 120 seconds.

**IntervalProcessor**

The moving average size for processor. Default value is 120 seconds.

**IntervalReservationCheck**

The sampling duration in seconds in which the system rechecks the storage reservation. Default value is 5 seconds.

**SMTP Configuration**

DxEnterprise Software uses the settings in SMTP Configuration to send email alerts when a system event has been triggered.

![SMTP Configuration](image)

**Server**

The name or IP address of the SMTP server.

**Port**

The listening or connecting port of the SMTP server. Default is 25.

**Protocol**

The security protocol used to connect to SMTP server. Supported protocol are “None”, “TLS”, and “SSL”.

**Name**

The user name used to connect to SMTP server.

**Email**

The email used to test connection to SMTP server and to send email from.

**Password**

The password for user credential used to connect to SMTP server.
Set
Click to persist the SMTP info.

Delete
Click to delete the SMTP info.

Close
Close the dialog.

Storage Management

The Storage Management section defines how the cluster will handle and manage cluster storage resources.

PathWatcher
When this setting is True, the cluster regularly checks and monitors cluster storage availability. If storage is not available or lost, the cluster will indicate the current cluster member is ineligible to host applications and will failover as necessary. This setting is only set to False if the cluster is using replicated storage subsystems. Default value is true.

System Settings

The System Settings section defines internal cluster processing logic that affects system overall performance. This setting should be changed only at the direction of DH2i support staff.

MaxProcesses
The number of processes the system allows to work on in parallel. Default value is 10.

Timeouts

These options are used to specify the timeout period before a fault is reported.

Note: Timeout settings should be changed only at the direction of DH2i support staff.

AgsTimeout
The timeout in seconds that the system waits for an availability group to initialize on add-ags. Default value is 30 seconds.

DelayStartNode
The short delay in seconds to wait for the Preferred state after add-ip operation. Default value is 4 seconds.

DelayStopNode
The short delay in seconds after stop-node operation to avoid subsequent false-positive duplicate address. Default value is 2 seconds.
**DismountTimeout**
The timeout in seconds that the system waits for the file handles to be closed on a volume before performing a forced dismount. Default value is 15 seconds.

**DockerTimeout**
The timeout in seconds that the system waits for a Docker container to return the running state on add-docker to a Vhost. Default value is 5 seconds.

**Filesystem**
The file system timeout specifies the number of seconds to wait for file systems to become available when starting SQL Server instances. Default value is 120 seconds.

**IoTimeout**
The timeout in seconds that the system waits for I/O API call to complete. Default value is 15 seconds.

**PathRecheck**
The path recheck timeout specifies the number of seconds to wait before rechecking the data path for managed SQL instances. Default value is 120 seconds.

**Ping**
The ping timeout specifies the number of seconds of non-communication before a node is considered inaccessible and is removed from the cluster. Default value is 9 seconds.

**ScriptTimeout**
The time in seconds that the system waits for a pre/post script to complete before taking corrective actions. Default value is 300 seconds.

**VdsWait**
The timeout in seconds the system waits for a PnP-enumerated disk or volume to be noticed by VDS and reported. Default value is 15 seconds.

**VhostRetry**
The Vhost retry timeout specifies the number of seconds to wait before the system retries to start the Vhost from the last failed start-node. Default value is 120 seconds.

**VolumeTimeout**
The timeout in seconds that the system waits for a volume PnP device to appear after setting a disk to online state. Default value is 15 seconds.

**Witness**
This section defines the network share(s) used as the cluster witness. In order to prevent a split-brain scenario when the cluster members are unable to communicate with one another, the witness is used to decide which set of members should own the cluster resources (i.e. storage, configurations, etc.). The rule for deciding the winning side is as follow, from highest to lowest ranking:
• Majority witness quorum
• First-come first-lock/win

To achieve the best tie-breaking/witness system, DH2i recommends that you employ an odd number of witness system(s). A maximum of 3 unique file shares can be specified for DxEnterprise cluster.

**WitnessProperties**
The witness properties.

**Shares**
The read-only witness share(s). Delimited by comma.

**User**
The read-only user credential used to access witness share(s).

**Password**
The read-only password used to access witness share(s).

Click on the eclipse (...) button to edit the properties.

**Witness share1**
The first file share path used as a cluster witness. For example, \server1\share1.

**Witness share2**
The second file share path used as a cluster witness. For example, \server2\share2.
**Witness share3**
The third file share path used as a cluster witness. For example, `\server3\share3`.

**User**
The user credential used to access the witness share(s). For example, `<domain>\<user>`.

**Password**
The password used to access the witness share(s).

**Test**
Test the validity of the witness share(s) with user credentials. The test must pass before the witness properties can be committed.

**OK**
Accept the witness settings.

**Close**
Cancel witness properties modification.

## Cluster Membership

The DxEnterprise Cluster Membership section allows you to define or join DxEnterprise cluster members.

### Join New Cluster

The Join Cluster option allows administrative re-assignment of the local server to another existing DxEnterprise cluster.
Advanced
Toggles the visibility of the NatMatchAgent checkbox.

NatMatchAgent Checkbox
If the NatMatchAgent checkbox is selected, the default value of the target cluster server is `match.DH2i.com`. This allows servers to join the cluster from remote locations using the DH2i matchmaking service.

Target Cluster Server
Enter the hostname or IP address of a server from an existing DxEnterprise cluster.

Pass Key
Enter the passkey for the existing DxEnterprise cluster.

Activate after joining
This only needs to be selected if local server activation is still required.

Accept EULA
Confirm acceptance of the software EULA. An option to view the EULA is provided by a link below the checkbox. Acceptance is required to continue.

OK
Click to process the request.

Close
Click to cancel and exit without saving change(s).
Manage License

The Manage License section allows you to view and (re)activate any cluster node.

<table>
<thead>
<tr>
<th>Node Name</th>
<th>Each node in the cluster will appear in its own row displaying the activation status of that node.</th>
</tr>
</thead>
<tbody>
<tr>
<td>License Key</td>
<td>The license key used to activate the product.</td>
</tr>
<tr>
<td>Product</td>
<td>The DH2i product that corresponds to the license.</td>
</tr>
<tr>
<td>Clients</td>
<td>The number of active remote clients allowed to connect to each server.</td>
</tr>
<tr>
<td>Expiration Date</td>
<td>The last date the product can be used.</td>
</tr>
<tr>
<td>Support Date</td>
<td>The expiration of the support contract. The product may be used until the expiration date, but the ability to request customer service and receive new updates stops on the support date.</td>
</tr>
<tr>
<td>Is Valid</td>
<td>If the license is active, this column will be checked. If not, select the node using the checkbox on the left side and click Activate.</td>
</tr>
</tbody>
</table>

Activate
Click to activate the selected servers. The Accept EULA checkbox must also be selected.
Automatic over the internet
Activation using the server’s internet connection.

Manual activation
Activation when the server is not connected to the internet. The license request is generated for the given license code and must be activated through DH2i customer service center or from a workstation with internet access. The DH2i activation website is at http://clients.dh2i.com.

Activate
Click to activate the server with the license key.

Close
Click to cancel the process without making any changes.

Refresh
Click to refresh the cluster list.

Close
Click to exit.
High Availability Features

DxEnterprise Software includes components that monitor the health and availability of individual hosted applications, and the ability of each node to host applications. When an application fails, DxEnterprise will automatically take actions to ensure application availability. As required, and as possible, DxEnterprise will restart failing applications on a different cluster node.

Failure Scenarios

Node Unresponsive
DxEnterprise monitors the availability of each node participating in a cluster. If a node becomes unresponsive in the cluster (ex. sudden power loss or a system crash), any applications that were hosted on that node will be failed over to another node. Nodes that are unresponsive are shown in orange in the user interface, and administrative alerts are raised for this condition.

Instance Failure
DxEnterprise monitors the service process of each managed instance of Microsoft SQL Server, application, or container. If any process terminates unexpectedly, DxEnterprise will attempt to restart the entire Vhost of that instance on a different cluster node.

Administratively Disabled
When a node is administratively disabled, any applications hosted on the node will be failed over to another node. Administratively disabled nodes are shown with a yellow background in the user interface.

File System/Disk Access
DxEnterprise monitors the availability of shared disks on each node participating in a cluster. If it detects that disk access is lost (ex. by unplugging a fiber channel host adapter or external fencing), the node will be considered ineligible to host applications. Any applications currently hosted on the node will fail over to another node. Nodes that have lost file system access are shown in orange in the user interface, and administrative alerts are raised for this condition.
Load Balancing
DxEnterprise monitors the resource utilization of each node and each hosted application and will enforce certain limits set by policies. If a policy is set for memory usage and one of the hosted applications starts leaking memory, actions may be taken to move that application to a different cluster node that satisfies the resource allocation policy.

Auto-Failback
Normally, failover actions are only taken when the availability of an application is compromised. Vhosts are configured with a prioritized list of nodes that are able to host them. If a Vhost is being hosted on a lower-priority node, and a higher priority node that was down becomes available, it may be desirable to start hosting the application on the higher priority node. If the Vhost is marked as “auto-failback” then this action will be taken.

Cascading Failures
When DxEnterprise attempts to fail over an application to a specific cluster node, it is possible that the application may fail to start on that node. In this case, DxEnterprise will remember that it was unable to start the application on that node, and will attempt to start the application on the next eligible node. If the list of eligible nodes is exhausted, DxEnterprise will raise an administrative alert and wait until the VhostRetry lapses before re-attempting to start the application from beginning of the node list.

Configuration Affecting High Availability
It is possible to control high availability behavior using certain configuration options.

Node Priority
Each Vhost has a list of cluster nodes that are eligible to host it. The list is in priority order, and nodes closer to the top will be chosen as failover targets first. The ordering of the list may be changed with the “Update Vhost” command in the user interface.
**Auto-Failback**
Each Vhost can be marked as “auto-failback.” While fail-over actions are only taken when the availability of an application is compromised, fail-back actions are taken when a higher priority node becomes available.

**Administrative Disablement**
A node may be marked as administratively disabled, in which case it becomes ineligible to host applications. Disabled nodes are never chosen as failover targets.

**Using Cluster View**

The Cluster View on DxEnterprise shows all SQL Server instance resources, Services, Fileshares and Coordinator resources configured in the cluster, and enables you to manage and monitor them from a single screen. To access the cluster view, select *DxCluster* at the top of the tree view. Each of the different views are located in tabs across the top of the detail pane.

- The SQL Server resources are grouped under the Instance View tab of the Cluster View. The SQL Server resources appear in the rows of the table.
- The service resources are grouped under the Service View tab of the Cluster View. The Service resources also appear in the rows of the table.
- The File Share resources are grouped under the Fileshare View tab of the Cluster View. The File Share resources also appear in the rows of the table.
- The Coordinator resources are grouped under the Coordinator View tab of the Cluster View. The coordinator resources also appear in the rows of the table.

Using the Cluster View, you can quickly determine whether clients are able to access SQL Server, Service, File Share and/or Docker resources. If a problem occurs, you can locate the resource experiencing the problem.

**Instance View**

The Instance View shows all of the Vhosts and Virtual SQL Server instances configured in the cluster. Each row shows the Virtual SQL Server instance’s name, version, Vhost, and primary and backup nodes.

The columns show the configuration of each Virtual SQL Server Instance. A “1” indicates the primary server; the other numbers indicate the failover order of the other servers. The green box specifies the server on which the Vhost/Virtual SQL Server instance is currently active. The red box specifies the current server is down or offline.

In the Instance View, you can drag and drop the SQL Server instances from the currently active node to any available node that is also a member of the Vhost. This will cause the Vhost to failover.
Service View

The Service View shows all of the Vhosts and Virtual Services configured in the cluster. Each row shows the Virtual Service’s name, version, Vhost and primary and backup nodes.

The columns show the configuration of each Virtual Services. A “1” indicates the primary server; the other numbers indicate the failover order of the other servers. The green box specifies the server on which the Vhost/Virtual Service is currently active. The red box specifies the current server is down or offline.

In the Service View, you can drag and drop the services from the currently active node to any available node that is also a member of the Vhost. This will cause the Vhost to failover.

Fileshare View

The Fileshare View shows the configuration of the Vhost and Virtual File Shares. Each row shows the Virtual File Share’s share name, share path, Vhost, and primary and backup nodes.

The columns show the configuration of each Virtual File Share. A “1” indicates the primary server; the other numbers indicate the failover order of the other servers. The dark blue box specifies the server on which the Vhost/Virtual File Share is currently active.

In the Fileshare View, you can drag and drop the fileshare from the currently active node to any available node that is also a member of the Vhost. This will cause the Vhost to failover.

Coordinator View

The Coordinator View shows all of the Coordinators in the Cluster. The Cluster Coordinator controls cluster messages and priorities. The Storage Coordinator manages the storage priorities and issues the storage commands. The Application Coordinator is in charge of maintaining the application states and reporting on them as they change.

The columns show the configuration of each coordinator. The green box specifies the server on which the coordinator is currently active. To change coordinators, you can drag the green box to a new desired node.

In the Coordinator View, you can drag and drop the Cluster Coordinator, Storage Coordinator, or Application Coordinator to move each coordinator role to another node.

AGS View

The AGS View shows all of the availability groups in the Cluster. Each row shows the availability group’s name, Vhost, and status.
The columns show the configuration of each availability group. The green box specifies the primary server for the availability group. The numbers in the boxes indicate the failover order of the availability group Vhost. To change the primary, you can drag the green box to a new desired node.

In the AGS View, you can drag and drop the primary server from the currently active node to any available node that is also a member of the Vhost. This will cause the Vhost to failover.

**Docker View**

The Docker View provides information about Docker instances managed by DxEnterprise. Each row shows the Docker name, virtual host, image name, port mapping, status, and primary and backup nodes.

The columns show the configuration of each managed Docker container. A “1” indicates the primary server; the other numbers indicate the failover order of the other servers. The green box specifies the server on which the Vhost/Container is currently active.

In the Docker View, you can drag and drop the container from the currently active node to any available node that is also a member of the Vhost. This will cause the Vhost to failover.

**Navigation**

DxEnterprise Software uses a subset of standalone dialogs to provide additional information about the cluster states and operations.

**Search**

The Search dialog allows the user to search for and select any entity within any connected server connection from a single pane.

<table>
<thead>
<tr>
<th>Name</th>
<th>Server</th>
<th>Entity</th>
<th>vHost</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQL 2012 Instance 1 Disk</td>
<td>localhost</td>
<td>vDiskgroup</td>
<td>V1</td>
</tr>
<tr>
<td>e27cb75b-e5f3-4c9e-9ee2-5...</td>
<td>localhost</td>
<td>cVolumes</td>
<td>V1</td>
</tr>
<tr>
<td>SQL2012_INST1</td>
<td>localhost</td>
<td>vInstances</td>
<td>V1</td>
</tr>
</tbody>
</table>

Selecting the Search bar expands the pane and provides a text box to search for arbitrary entities. The user may optionally choose to make the search case-sensitive, clear the search, or exit the search by clicking the red X at the top right. Clicking **Hide Results** will leave the search open but collapse the result.
view, clearing space without clearing the Search pane. Clicking any result will show the user details of that result as if they had selected the entity within the tree view.

**Connection Manager**

To connect to additional servers or to disconnect from a server, go to **Connection Manager**.

This will bring up the connection manager dialog. The user can enter the name or IP address of the target server and click **Connect Server** or disconnect by clicking on the “X” in the Delete column.

**Dashboard Manager**

The Dashboard Manager allows the user to create a custom dashboard environment for viewing data from one or more clusters in a single view.

Selecting **Dashboard Manager** from the Navigation Pane, the user can view active Dashboard controls. To add items to the view, select **Design** from the bottom of the pane. There is the ability to drill down from a single server or all servers and select the entity to view, the specific value of that entity, and the information to be viewed.

The following table lists the available options for each selection:

<table>
<thead>
<tr>
<th>Server</th>
<th>Entity</th>
<th>Name</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Servers</td>
<td>N/A</td>
<td>Alerts</td>
<td>Regular (2x1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Large (3x1)</td>
</tr>
</tbody>
</table>
### Status Logs

<table>
<thead>
<tr>
<th>Entity</th>
<th>Status</th>
<th>Logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server Nodes</td>
<td>Processor %</td>
<td>Regular (2x1)</td>
</tr>
<tr>
<td></td>
<td>Memory Usage</td>
<td>Large (3x1)</td>
</tr>
<tr>
<td></td>
<td>Disk I/O</td>
<td>XLarge (4x1)</td>
</tr>
<tr>
<td>SQL Instances</td>
<td>Processor %</td>
<td>Regular (2x1)</td>
</tr>
<tr>
<td></td>
<td>Memory Usage</td>
<td>Large (3x1)</td>
</tr>
<tr>
<td></td>
<td>Disk I/O</td>
<td>XLarge (4x1)</td>
</tr>
<tr>
<td>Services</td>
<td>Processor %</td>
<td>Regular (2x1)</td>
</tr>
<tr>
<td></td>
<td>Memory Usage</td>
<td>Large (3x1)</td>
</tr>
<tr>
<td></td>
<td>Disk I/O</td>
<td>XLarge (4x1)</td>
</tr>
<tr>
<td>Docker Containers</td>
<td>Processor %</td>
<td>Regular (2x1)</td>
</tr>
<tr>
<td></td>
<td>Memory Usage</td>
<td>Large (3x1)</td>
</tr>
<tr>
<td></td>
<td>Disk I/O</td>
<td>XLarge (4x1)</td>
</tr>
<tr>
<td>Disk Volumes</td>
<td>Volume</td>
<td>Regular (2x1)</td>
</tr>
<tr>
<td>Virtual Hosts</td>
<td>Status</td>
<td>Regular (2x1)</td>
</tr>
<tr>
<td>Witnesses</td>
<td>Witness</td>
<td>Regular (2x1)</td>
</tr>
</tbody>
</table>

### Server

A specific connection as defined in Connection Manager

### Entity

This includes the following entities to monitor if a specific server is selected:

- Server Nodes
- SQL Instances
- Services
- Docker
- Disk Volumes
- Virtual Hosts
- Witnesses

If All Servers is selected, the Entity field is not available.

### Name

The field displays a context-specific list of objects to display depending on the Entity specified above. For example, a list of Nodes, SQL Instances, or Volumes.
**Info**

The specific information to be displayed from the Entity and Name selected above.

Once each field is selected, the Design section will allow the selection of the Info View. This is the preferred way of viewing information. The user may from a visual Graph view or a textual Data view.

Once complete, click **Add to Dashboard** and the control will be added to the pane above. An arbitrary number of controls can be added as desired. Once the controls are added, they can be re-ordered by dragging and dropping the title bar of each control. To remove a control, simply click the X in the top-right corner of each control.

Clicking the **Design** bar will collapse it again, providing more space in the display pane.
Status Log Manager

The Status Log dialog provides a short collection of system health and status information for the connected servers since the UI started. To display the dialog, select the Status Log Manager option from the Navigation panel. There is a drop down filter to limit the status messages to only the non-selected servers and a live update checkbox to enable or disable the live-scrolling of new messages. Right-click in the status log to either copy or clear the log.

Status messages are in black and white unless there is a warning (yellow) or severe (red) alert.

Alert Manager

When a system event is triggered due to a system down or over-utilization of system resources, an alert is raised and registered with the Alert Manager. The alert continues to remain in the Alert Manager until the system is stabilized or the over-utilization has subsided.

To display the dialog, select the Alert Manager option from the menu.

Historical alerts are available from the time DxAdmin was launched or until the user clears the old alerts.
Debug Commands

Under some special circumstances, DH2i support staff may request to use the Debug Window to diagnose the system.

To display the dialog, select the Debug Commands option from the Advanced Configuration menu.
TCP Tunnels

DH2i TCP Tunneling is a new way for accessing specific applications without the cost, complexity, and security risks of VPNs. DH2i TCP Tunneling is designed for scaling across environments to build a secure hybrid/multi-cloud distributed application infrastructure from any platform to any platform, any host to any host, anywhere. DH2i TCP Tunneling features:

**Configuration and Management Simplicity**
- Lightweight Windows or Linux install
- Simply install and connect
- No dedicated VPN routers
- No ACLs, no firewall rules
- No expensive cloud VPN services

**Highest Level of Security and Performance**
- Application-level micro-tunneling
- Discreetly transports TCP payloads via UDP
- Eliminates lateral network attack surface
- Highly available, auto self-healing tunnels
- Invisible to port scanners
To enable the tunneling features within DxEnterprise, please contact your account representative.

**Add a Tunnel**

Right-click on **DxCluster** in the tree view and select **Add a tunnel**. The following dialog is displayed to allow the user to configure the new tunnel.

---

**Tunnel Name**

The logical name for the tunnel. This must be unique.

**Gateway Name**

The node name or .ACTIVE alias if the tunnel is assigned to a Vhost.

**Target Host/IP**

The desired host name or IP address of the target server.
**Target Port**
The destination port of the target server.

**Origin Node Name Origin Network Address**
The node name or alias for an origin server to create a listener.

**Origin Listening Port**
Origin port to create a listener on the origin side of the tunnel.

**Origin Source Filter**
Predefined source filter rules defined in Source Filter Manager.

**Enabled**
If this is checked the tunnel is enabled. Unchecking this will keep the tunnel defined but will not allow data to pass through the tunnel.

**Add Row**
Add a row to the origin listener set.

**Delete Row**
Deletes the selected row from the tunnel definition.

---

*Note: DxEnterprise allows the tunnel to be configured using aliases if the tunnel is a member of a virtual host and the NATEnabled setting is true. The aliases are defined in the alias table in Definitions, Acronyms, Abbreviations section.*

**Tunnel Detail View**
The main panel displays the details of the selected tunnel from the tree view.
The **edit** button allows the user to edit the data that is set up in the Add Tunnel screen with the exception of the tunnel name. After clicking edit, the same button changes to save. The user is required to click save to save any changes made to the tunnel details. However, as stated above, the tunnel name is the unique identifier in the cluster and can only be changed by deleting the tunnel and adding a new one with the same parameters but a different tunnel name.

**Cancel**

This will undo any changes made in the edit screen and will return to the tunnel detail view in read-only mode.
**Adding Tunnels to a Vhost**

DxEnterprise Software allows adding tunnels to Vhosts to provide failover support and high availability. A Vhost virtualizes the network name and IP address associated with a particular gateway. Rather than using the network name and IP address of a physical server, a Vhost is created and assigned a unique name/IP-address pair to be used as a tunnel gateway.

To add a tunnel to a Vhost, right-click on the Vhost and select **Add a tunnel**.

![VHOST1 menu](image)

The Tunnel Management window is then displayed to allow the user to configure the tunnel.
**Vhost Tunnel Detail View**

The add button on the right in the tunnel section will allow the user to add a new tunnel.

**Delete**

The delete button on the right in the tunnel section will allow the user to delete the tunnel from the cluster. To remove the tunnel from the Vhost, click the Assign button.

**Assign**

To assign or remove a tunnel from the Vhost, click the Assign button. The following dialog is displayed.
To remove a tunnel, move it from the selected tunnels to the available tunnels. To add a tunnel, move it from the available tunnels to the selected tunnels. To move a tunnel, you can double-click on the tunnel or select the tunnel and use the appropriate arrow.

**OK**

All changes are committed when the user clicks **OK**.

**Close**

This will close the Assign dialog with making any changes.

**Source Filter Manager**

The Source Filter Manager dialog allows the user to configure specific rules for allowing or denying one or many IP addresses, subnets, ports or ranges. To add a source filter, right-click on **DxCluster** at the top of the treeview and select **Add a source filter**.
The *Configure Address Filter rules* dialogue is then displayed.

**Filter Name**

The name of the rule to create.

**Address**

The first column is a text entry that allows input in the following formats:

1. IPAddress – 10.0.0.10
2. IPAddress:Port – 10.0.0.10:2345
3. IPAddress/CIDR – 10.0.0.0/24
4. IPAddress/Mask – 10.0.0.0/255.255.255.0

**Action**

In this column is a drop down with the following selections:

- **Allow**
  Allows the configured address access to the tunnel.

- **Deny**
  Denies the configured address access to the tunnel.
**Delete**
When the user clicks on the ✗ in the delete column, the selected IP definition is removed from the rule.

**Default**
Select DENY ALL or ACCEPT ALL for the default rule, depending on the user’s intent to deny all connections but allow a specific IP or allow all connections and deny a specific IP.

**Up Arrows Button**
Moves the selected IP definition up in the sorting order of the rule.

**Down Arrows Button**
Moves the selected IP definition down in the sorting order of the rule.

**Delete Button**
Removes the selected IP definition from the rule.

**New Row**
Add a new IP definition for the rule.

**Submit**
Close the form and commit changes.

**Close**
Close the form without making changes.

To manage existing source filters, select **Source Filters** at the bottom of the treeview. Any existing filters will then be displayed in the center detail pane.
**Add**

Click add to create a new rule. The following form is displayed.

**Edit**

Highlight a selection and click Edit to modify the rule.

**Delete**

Highlight a selection and click Delete to remove the rule.

**Automatic Tunneling with AGS**

Tunneling with AGS can be performed automatically during the initial configuration of an AGS Vhost. To perform this function, right-click on a Vhost and select Add availability group. The following dialog is presented.
The Tunnel checkbox under the AGS Name will automatically create a tunnel between the nodes in the Vhost for AGS replication.

For additional information on setting up AGS, please see the “Add an Availability Group” section of this guide.

Support and Other Resources

Troubleshooting

This section includes several steps that can be performed if issues arise when using shared storage.

1. First, make sure that your storage hardware is working properly. Check the system and application event log for error messages. If there are timeouts, controller or device errors, or anything else, resolve them according to your storage manufacturer’s guidelines.

2. Confirm network connectivity between all the DxEnterprise machines in the cluster. This is especially important on multi-homed systems (systems with several IP addresses). Make sure DxEnterprise uses the correct IP addresses on the machines so DxEnterprise instances can communicate across the network. Also ensure that all DxEnterprise instances are set to the same port number (this applies to both TCP and UDP).
3. Check the Event log for messages generated by NTFS. The file system reports information, warning and error messages in the System event log that can offer insight regarding how to proceed with troubleshooting (i.e., pointing to a network connectivity issue, disk array problem, etc.).

4. If you experience any anomalies, you can freeze the node and uninstall DxEnterprise software. This will rule out DxEnterprise interference with the system operations.

5. For further information please visit the Knowledge Base on our Support Portal.
   o http://support.dh2i.com/

How to request technical support

For technical assistance, contact DH2i Technical Support through one of the following methods:

   Email: support@dh2i.com
   Web: support.dh2i.com
   Phone: U.S.: (800) 380-5405 ext 2

Before you submit a support request, please collect the following information:

1. Technical support registration number
2. Information on your hardware and software
3. DxEnterprise version.
4. Describe the steps to reproduce the problem.
5. Supply event logs from all nodes.
6. Exact error message(s).
7. Specify how many times the problem has occurred.
8. State the actual results.
9. Describe the expected results.

1. **Technical support registration number**
   This number given with a valid support contract

2. **Supply information on your hardware and software**
   Use the All programs > Accessories > System tools > System information or other product that will give details about the software and hardware being run on the system.

   Please describe the configuration of your central storage. Specify the type and speed of the connection to the hosts, the type of the disk array - JBOD or RAID, the model of the hard disks. Also describe the RAID controller, the RAID level, type of RAID (hardware/software), what software achieves the RAID functionality (Windows or third-party). Describe the topology of your storage network (how many hosts, how many disk arrays, how many loops, etc.).

3. **Supply DxEnterprise version**
   The version of DxEnterprise can be obtained by using DxAdmin. From the DxAdmin explorer tree, select the node under Cluster Nodes and write down the DxVersion from the details pane.
Please make sure that you run the same version of DxEnterprise on all your machines. If for some reason this is not the case, please state the version of DxEnterprise on each of the nodes.

4. **Describe the steps to reproduce the problem**
   Please write down the exact steps that led to the problem. If DH2i Technical Support is unable to reproduce the problem, it may be difficult to identify, investigate and fix the problem.

   Due to the distributed nature of DxEnterprise, you will have to include some additional information as well. Take notes of the order in which machines were started - this directly corresponds to the order they enter the cluster and also affects some other aspects of DxEnterprise operation.

5. **Supply System event logs**
   A. Please send system and application event logs from all your systems forming a cluster.
      DxEnterprise writes its information in the DH2i event log, but other software (e.g. MS SQL) enters important information in the Application event log. To collect all the needed logs, from the DxAdmin Advanced Configuration, select **Collect Logs**.
   B. Open Windows Explorer and browse to DH2i support folder (e.g. C:\Program Files\DH2i\Support) on each node.
   C. Upload the zipped file to support@dh2i.com.

   To help DH2i Technical Support get as much information as possible out of log files, please provide the approximate time the issue occurred.

6. **Supply the error message(s)**
   If an error message is displayed in a message box, write down the exact text of the message. Please translate the text into English, if the message is in some other language. Also you may perform a screen capture of the error message as follows:
   A. Make sure that the error message is the active window. Press Alt+PrtScn to place a bitmap copy of the window in the Clipboard.
   B. Open the built-in MS Paint bitmap editor, and paste the image.
   C. Go to "File->Save as" and choose a filename.

   In case a STOP error occurs that leads to a "blue screen of death", it is important to obtain the kernel memory dump that should be created at %SystemDrive%:\Windows\Memory.dmp. If you review the memory dump and suspect the STOP error may be DxEnterprise related, compress and upload the memory dump via the file manager in your account at http://clients.dh2i.com. Then contact support@dh2i.com with a problem description according to the steps provided in this section. A DH2i Technical Support engineer will analyze the memory dump and offer suggestions to resolve the error based on his/her findings.

7. **Specify how many times the problem has occurred**
   The best property a problem may have is to be reproducible every time a particular test is run. Unfortunately this is not always the case, if a something shows up only once chances are it won't be discovered.
Please specify the frequency with which a particular bug is occurring - every time you use the same steps, intermittent (how many times in how many tests), just once.

8. **State the actual results**
   Describe the exact results achieved during the test using quantitative values, when possible. For example, avoid saying just "the machine hangs". Instead say something along the lines of "Windows Explorer stopped responding (hanged), we waited for X minutes, nothing changed, we had to kill the explorer process".

9. **Describe the expected results**
   Please describe in detail the expected test results.

**References**

- DH2i Support Portal
- DxEnterprise v19.5 DxCli Guide
- Microsoft SQL Server 2017
- Microsoft SQL Server 2019
- Docker Documentation
- Docker Enterprise Edition for RedHat Enterprise Linux
- Docker Enterprise Edition for CentOS
- Docker Community Edition for CentOS
- Docker Enterprise Edition for Ubuntu Linux
- Docker Community Edition for Ubuntu Linux

**Contacting DH2i**

DH2i Company
Technical support:
   Email: support@dh2i.com
   Web: support.dh2i.com
   Phone: U.S.: (800) 380-5405 ext 2
Information requests: info@dh2i.com
Sales inquiries: sales@dh2i.com
Website: www.dh2i.com

Mailing address:
DH2i Company
320 East Vine Drive, Ste 321
Appendix A

Overview

This appendix defines the entities used in DxAdmin, and the various states they may maintain. The header defines the entity, and the table defines the various states. The foreground refers to the color of the text in the treeview and the background is the highlighted color. The description is of the entity state and what that may mean to the system. The image is the look in DxAdmin of the tree leaf in the described state.

Virtual Host

A Virtual Host (Vhost) “virtualizes” the network name and IP address associated to a particular SQL Server Instance, file share, and/or service monitor. That is, rather than using the network name and IP address of an actual server, a Vhost is created and assigned a unique name/IP-address pair. Clients access the databases associated with an instance via the Vhost name or IP address; they do not need to know which node is running the SQL instance. When you configure a Vhost, you will need to specify at least one node to participate in the Vhost.

The images in the table are of the tree leaves directly below the Virtual Hosts tree leaf.

<table>
<thead>
<tr>
<th>STATUS</th>
<th>FOREGROUND</th>
<th>BACKGROUND</th>
<th>DESCRIPTION</th>
<th>IMAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIVE</td>
<td>🟢</td>
<td>🟠</td>
<td>The virtual host is running on an active node.</td>
<td>📈 VSQL1</td>
</tr>
<tr>
<td>DISABLED</td>
<td>🟠</td>
<td>🟢</td>
<td>The virtual host is not running on purpose based on user action.</td>
<td>📈 VSQL1</td>
</tr>
<tr>
<td>DOWN</td>
<td>🟠</td>
<td>🟠</td>
<td>The virtual host is not running because there is no available node able to host.</td>
<td>📈 VSQL1</td>
</tr>
<tr>
<td>FREEZE</td>
<td>🟨</td>
<td>🟠</td>
<td>The virtual host is assumed up and running, but is not monitored for failover by DxEnterprise.</td>
<td>📈 VSQL1</td>
</tr>
</tbody>
</table>
**SQL Instance, Docker or Availability Group Instance**

When a SQL Server or Docker instance is added to a Vhost, DxEnterprise “containerizes” the network name and IP address associated with the SQL Server or Docker instance creating a Virtual SQL Server or Docker Container instance. Clients can then access the Virtual SQL Server or Docker instance via the Vhost name. In addition to the Vhost, the instance can have a status that is reflected in the tree view color of the instance.

The images in the table are of the tree leaves directly below the **Instances** tree leaf.

<table>
<thead>
<tr>
<th>STATUS</th>
<th>FOREGROUND</th>
<th>BACKGROUND</th>
<th>DESCRIPTION</th>
<th>IMAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACTIVE</strong></td>
<td></td>
<td></td>
<td>The SQL instance is running on an active node.</td>
<td>CUSTOMERS</td>
</tr>
<tr>
<td><strong>DISABLED</strong></td>
<td></td>
<td></td>
<td>The SQL instance is not running.</td>
<td>CUSTOMERS</td>
</tr>
<tr>
<td><strong>FREEZE</strong></td>
<td></td>
<td></td>
<td>The SQL instance is assumed up and running, but is not monitored for failover by DxEnterprise.</td>
<td>CUSTOMERS</td>
</tr>
</tbody>
</table>

**Services**

A service can also be added to a Vhost, DxEnterprise “containerizes” the network name and IP address associated with the service creating a virtual service. Clients can then access the Virtual service via the Vhost. Similar to a SQL Instance, a service can have a status that is reflected in the tree view color of the service.

The images in the table are of the tree leaves directly below the **Services** tree leaf.
**Vhost Nodes**

A Node is a server device, that is physical, virtual, or cloud based selected on the current cluster. A node is any server that has an IP address, and is able to host the defined instances, diskgroups, services, and fileshares of the selected Vhost.

The images in the table are of the tree leaves directly below the **Nodes** tree leaf.

<table>
<thead>
<tr>
<th>STATUS</th>
<th>FOREGROUND</th>
<th>BACKGROUND</th>
<th>DESCRIPTION</th>
<th>IMAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIVE</td>
<td></td>
<td></td>
<td>The Service is running on an active node.</td>
<td>SQLBROWSER</td>
</tr>
<tr>
<td>DISABLED</td>
<td></td>
<td></td>
<td>The Service is not running.</td>
<td>SQLBROWSER</td>
</tr>
<tr>
<td>FREEZE</td>
<td></td>
<td></td>
<td>The Service is assumed up and running, but is not monitored for failover by DxEnterprise.</td>
<td>SQLBROWSER</td>
</tr>
</tbody>
</table>

**Cluster Nodes**

A Cluster Node is a server device, that is physical, virtual, or cloud based. A Cluster node is any server that has an IP address, and is available to be added to a virtual host cluster.

<table>
<thead>
<tr>
<th>STATUS</th>
<th>FOREGROUND</th>
<th>BACKGROUND</th>
<th>DESCRIPTION</th>
<th>IMAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIVE</td>
<td></td>
<td></td>
<td>The node is the active node hosting the virtual host.</td>
<td>DEMO1</td>
</tr>
<tr>
<td>AVAILABLE</td>
<td></td>
<td></td>
<td>The node is available to host the virtual host.</td>
<td>DEMO1</td>
</tr>
<tr>
<td>DISABLED</td>
<td></td>
<td></td>
<td>The node is unavailable to host the virtual host because it has been disabled by the user.</td>
<td>DEMO1</td>
</tr>
<tr>
<td>DOWN</td>
<td></td>
<td></td>
<td>The node is unavailable to host the virtual host because it cannot be reached, or has no available storage.</td>
<td>DEMO3</td>
</tr>
<tr>
<td>FREEZE</td>
<td></td>
<td></td>
<td>The node is assumed up and running, but is not monitored for failover by DxEnterprise.</td>
<td>DEMO1</td>
</tr>
<tr>
<td>UNLICENSED</td>
<td></td>
<td></td>
<td>The node is unavailable to host the virtual host because it has not been activated.</td>
<td>DEMO1</td>
</tr>
</tbody>
</table>
The images in the table are of the tree leaves directly below the **Cluster Nodes** tree leaf.

<table>
<thead>
<tr>
<th>STATUS</th>
<th>FOREGROUND</th>
<th>BACKGROUND</th>
<th>DESCRIPTION</th>
<th>IMAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIVE</td>
<td></td>
<td></td>
<td>The node is active, running and available to host a virtual host.</td>
<td>![DEMO1]</td>
</tr>
<tr>
<td>NO STORAGE</td>
<td></td>
<td></td>
<td>The node is running and but is unavailable to host a virtual host because there is no available storage.</td>
<td>![DEMO2]</td>
</tr>
<tr>
<td>DISABLED</td>
<td></td>
<td></td>
<td>The node is unavailable to host the virtual host because it has been disabled by the user.</td>
<td>![DEMO1]</td>
</tr>
<tr>
<td>UNAVAILABLE</td>
<td></td>
<td></td>
<td>The node is unavailable to host the virtual host because it cannot be reached on the network. Unavailable is the same color scheme as no storage but the icon has an x to indicate no communication.</td>
<td>![DEMO3]</td>
</tr>
<tr>
<td>UNLICENSED</td>
<td></td>
<td></td>
<td>The node is unavailable to host any virtual host because it has not been activated.</td>
<td>![DEMO1]</td>
</tr>
</tbody>
</table>

**Entity Types**

An entity type is an individual element type in a defined cluster. A cluster is an entity type that comprises all individual elements and treats them as a single group of those units. The entity type abbreviation is used in the search to clarify which item is to be displayed in the main detail pane when you select it from the results. An example would be a vNode versus a cNode. A vNode is a node specific to a virtual host and its status reflects the status in the virtual host i.e. active, available, frozen, no storage...if a cNode is selected the status refers to the status in relation to the cluster, i.e. available, disabled, unlicensed... the table below shows all entity types in the DxEnterprise system.
<table>
<thead>
<tr>
<th>ENTITY ABBREVIATION</th>
<th>UNIQUE IDENTIFIER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invalid</td>
<td>None</td>
<td>This is an unidentified Entity. It is the default type when an object is created and should only be visible if there is an error</td>
</tr>
<tr>
<td>Cluster</td>
<td>Cluster ID</td>
<td>The overall single cluster that defines all individual entities</td>
</tr>
<tr>
<td>Vhost</td>
<td>Virtual Host Name</td>
<td>The virtual host.</td>
</tr>
<tr>
<td>vNodes</td>
<td>Node Name</td>
<td>The nodes that have been added to a specific vhost.</td>
</tr>
<tr>
<td>vInstances</td>
<td>Instance Name</td>
<td>The instances that have been added to a specific vhost.</td>
</tr>
<tr>
<td>vFileShare</td>
<td>File share name</td>
<td>A file share that is a member of a vhost</td>
</tr>
<tr>
<td>vService</td>
<td>Service Name</td>
<td>A generic service that has been assigned to be managed by a vhost</td>
</tr>
<tr>
<td>vDiskgroup</td>
<td>Disk ID</td>
<td>A disk group that has been added to a vhost</td>
</tr>
<tr>
<td>vDocker</td>
<td>Container Name</td>
<td>A named Docker container that has been assigned to be managed by a vhost</td>
</tr>
<tr>
<td>cNodes</td>
<td>Node Name</td>
<td>All nodes available to the cluster</td>
</tr>
<tr>
<td>cDiskgroup</td>
<td>Disk ID</td>
<td>All disk groups available to the cluster</td>
</tr>
<tr>
<td>cVolumes</td>
<td>Volume ID</td>
<td>All defined volumes that have been assigned to the cluster</td>
</tr>
</tbody>
</table>