

Horizon 7 Integration

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Horizon 7 Integration

The *Horizon 7 Integration* document describes how to integrate Horizon 7™ software with third-party software such as Windows PowerShell and business intelligence reporting engines.

Intended Audience

This document is intended for anyone who wants to customize or integrate software to work with Horizon 7. The information in this document is written for experienced Windows or Linux system administrators who are familiar with virtual machine technology and datacenter operations.

Introduction to Horizon 7 Integration

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With Horizon 7, system administrators can provision desktops and control user access to these desktops. Client software connects users to virtual machines running in VMware vSphere™, or to physical systems running within your network environment. In addition, Horizon 7 administrators can configure Remote Desktop Services (RDS) hosts to provide Horizon 7 desktop and application sessions to client devices.

This chapter includes the following topics:

- [Horizon 7 Components](#)
- [Integration Interfaces to Horizon 7](#)

Horizon 7 Components

You can use Horizon 7 with VMware vCenter Server to create desktops from virtual machines that are running on VMware ESX® or VMware ESXi™ hosts and deploy these desktops to end users. You can also install Horizon 7 on RDS hosts to deploy desktops and applications to end users. Horizon 7 uses your existing Active Directory infrastructure for user authentication and management.

After you create a desktop or application, authorized end users can use Web-based or locally installed client software to securely connect to centralized virtual machines, back-end physical systems, or RDS hosts.

Horizon 7 consists of the following major components.

Horizon Connection Server	A software service that acts as a broker for client connections by authenticating and then directing incoming user requests to the appropriate virtual machine, physical system, or RDS host.
Horizon Agent	A software service that is installed on all guest virtual machines, physical systems, or RDS hosts to allow them to be managed by Horizon 7. Horizon Agent provides features such as connection monitoring, virtual printing, USB support, and single sign-on.
Horizon Client	A software application that communicates with Connection Server to enable users to connect to their desktops.

Horizon Administrator	A Web application that enables Horizon 7 administrators to configure Connection Server, deploy desktop and application pools, manage machines, control user authentication, initiate and examine system events, and perform analytical activities.
vCenter Server	A server that acts as a central administrator for ESX/ESXi hosts that are connected on a network. A vCenter Server instance provides the central point for configuring, provisioning, and managing virtual machines in the datacenter.
View Composer	A software service that is installed on a vCenter Server instance to enable Horizon 7 to rapidly deploy multiple linked-clone desktops from a single centralized base image.

Integration Interfaces to Horizon 7

You can use several interfaces to integrate Horizon 7 with external applications.

Event database	You can configure Horizon 7 to record events to a Microsoft SQL Server or Oracle database. You can then use business intelligence reporting engines to access and analyze this database.
Lightweight Directory Access Protocol (LDAP)	You can export and import LDAP configuration data from and into Horizon 7. You can create scripts that update this configuration data without accessing Horizon Administrator directly.
Windows Management Instrumentation (WMI)	You can examine performance statistics for a PCoIP session.

Integrating Horizon 7 with the Event Database

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You can configure Horizon 7 to record events to a Microsoft SQL Server or Oracle database. Horizon 7 records events such as end-user actions, administrator actions, alerts that report system failures and errors, and statistical sampling.

End-user actions include logging and starting desktop and application sessions. Administrator actions include adding entitlements and creating desktop and application pools. An example of statistical sampling is recording the maximum number of users over a 24-hour period.

You can use business intelligence reporting engines such as Crystal Reports, IBM Cognos, MicroStrategy 9, and Oracle Enterprise Performance Management System to access and analyze the event database.

This chapter includes the following topics:

- [Event Database Tables and Schemas](#)
- [Horizon Connection Server Events](#)
- [Horizon Agent Events](#)
- [Horizon Administrator Events](#)
- [Event Message Attributes](#)
- [Sample Database Queries and Views](#)

Event Database Tables and Schemas

Horizon 7 uses database tables to implement the event database. The event database prepends the names of these tables with a prefix that you define when you set up the database.

Event Database Tables

The following table shows the database tables that implement the event database in Horizon 7.

Table 2-1. Event Database Tables

Table Name	Description
event	Metadata and search optimization data for recent events.
event_data	Data values for recent events.

Table 2-1. Event Database Tables (Continued)

Table Name	Description
event_data_historical	Data values for all events.
event_historical	Metadata and search optimization data for all events.

Horizon 7 records details about events to all the database tables. After a certain period of time has elapsed since writing an event record, Horizon 7 deletes the record from the event and event_data tables. You can use Horizon Administrator to configure the time period for which the database keeps a record in the event and event_data tables.

Important Horizon 7 does not restrict the growth of the event_historical and event_data_historical tables. You must implement a space management policy for these tables.

A unique primary key, EventID, identifies each event that Horizon 7 records in the event and event_historical tables. Horizon 7 records data values for each event in the event_data and event_data_historical tables. You can obtain the complete set of information for an event by joining the event and event_data tables or the event_historical and event_data_historical tables on the EventID column.

The EventType, Severity, and Time columns in the event and event_historical tables identify the type and severity of an event and the time at which it occurred.

For information about setting up the event database, see the *Horizon 7 Installation* document.

Note To purge data from the historical tables, see <http://kb.vmware.com/kb/2150309>.

Event Database Schemas

The following table shows the schema for the event and event_historical database tables.

Table 2-2. Schema for the event and event_historical Tables

Column Name	Oracle Data Type	SQL Server Data Type	Description
Acknowledged	SMALLINT	tinyint	Whether Horizon 7 acknowledged the event. ■ 0 = false ■ 1 = true
DesktopId	NVARCHAR2(512)	nvarchar(512)	Desktop ID of the associated pool.
EventID	INTEGER	int	Unique primary key for the event.
EventType	NVARCHAR2(512)	nvarchar(512)	Event name that corresponds to an item in the message catalog. For example, BROKER_USERLOGGEDIN.
FolderPath	NVARCHAR2(512)	nvarchar(512)	Full path of the folder that contains the associated object.
GroupId	NVARCHAR2(512)	nvarchar(512)	SID of the associated group in Active Directory.

Table 2-2. Schema for the event and event_historical Tables (Continued)

Column Name	Oracle Data Type	SQL Server Data Type	Description
LUNId	NVARCHAR2(512)	nvarchar(512)	ID of the LUN that stores the associated object.
MachineId	NVARCHAR2(512)	nvarchar(512)	ID of the associated physical or virtual machine.
Module	NVARCHAR2(512)	nvarchar(512)	Horizon 7 component that raised the event. For example, Admin, Broker, Tunnel, Framework, Client, or Agent.
ModuleAndEventText	NVARCHAR2(512)	nvarchar(512)	Event message with values substituted for attribute parameters.
Node	NVARCHAR2(512)	nvarchar(512)	Name of the virtual device node.
Severity	NVARCHAR2(512)	nvarchar(512)	Severity level. For example, INFO, WARNING, ERROR, AUDIT_SUCCESS, AUDIT_FAIL.
Source	NVARCHAR2(512)	nvarchar(512)	Identifier for the source of the event.
ThinAppId	NVARCHAR2(512)	nvarchar(512)	ID of the associated ThinApp™ object.
Time	TIMESTAMP	datetime	Time at which the event occurred, measured from the epoch (January 1, 1970).
UserDiskPathId	NVARCHAR2(512)	nvarchar(512)	ID of the user disk.
UserSID	NVARCHAR2(512)	nvarchar(512)	SID of the associated user in Active Directory.

The following table shows the schema for the event_data and event_data_historical database tables.

Table 2-3. Schema for the event_data and event_data_historical Tables

Column Name	Oracle Data Type	SQL Server Data Type	Description
BooleanValue	SMALLINT	tinyint	Value of a Boolean attribute. <ul style="list-style-type: none"> ■ 0 = false ■ 1 = true
EventID	INTEGER	int	Unique primary key for the event.
IntValue	INTEGER	int	Value of an integer attribute.
Name	NVARCHAR2(512)	nvarchar(512)	Attribute name (for example, UserDisplayName).
StrValue	NVARCHAR2(512)	nvarchar(512)	Value of a string attribute. For other types of attributes, this column contains an interpretation of the data type as a string.

Table 2-3. Schema for the event_data and event_data_historical Tables (Continued)

Column Name	Oracle Data Type	SQL Server Data Type	Description
TimeValue	TIMESTAMP	datetime	Value of a date and time attribute.
Type	SMALLINT	tinyint	The data type of the attribute. <ul style="list-style-type: none"> 0 = StrValue 1 = IntValue 2 = TimeValue 3 = BooleanValue

Horizon Connection Server Events

Horizon Connection Server events report Connection Server-related information, such as desktop and application sessions, user authentication failures, and provisioning errors.

The BROKER_DAILY_MAX_DESKTOP_SESSIONS event reports the maximum number of concurrent desktop sessions over a 24-hour period. If a user runs multiple desktop sessions concurrently, each desktop session is counted separately.

The BROKER_DAILY_MAX_APP_USERS event reports the maximum number of concurrent application users over a 24-hour period. If a user runs multiple applications concurrently, the user is counted only once. Short-lived sessions might not be included in the count because the sampling is performed every five minutes.

The BROKER_VC_DISABLED and BROKER_VC_ENABLED events report the state of the vCenter driver that Horizon 7 uses to track a vCenter Server instance.

The BROKER_VC_STATUS_* events report the state of a vCenter Server instance.

The following table lists all the event types for Connection Server.

Table 2-4. Connection Server Events

Event Type	Severity	ModuleAndEventText
BROKER_AGENT_OFFLINE	WARNING	The agent running on machine \${MachineName} has not responded to queries, marking it as offline
BROKER_AGENT_ONLINE	WARNING	The agent running on machine \${MachineName} is responding again, but did not send a startup message
BROKER_APPLICATION_LAUNCH_FAILURE	ERROR	Unable to launch from Pool \${PoolId} for user \${UserDisplayName}: The broker encountered an error while processing the request, please contact support for assistance
BROKER_APPLICATION_MISSING	WARNING	At least \${ApplicationMissingCount} applications, including \${ApplicationExecutable}, are not installed on \${MachineName} in Pool \${PoolId}
BROKER_APPLICATION_NOT_ENTITLED	AUDIT_FAIL	Unable to launch from Pool \${PoolId} for user \${UserDisplayName}: User is not entitled to this Pool

Table 2-4. Connection Server Events (Continued)

Event Type	Severity	ModuleAndEventText
BROKER_APPLICATION_PROTOCOL_NOT_SUPPORTED	AUDIT_FAIL	Unable to launch from Pool \${PoolId} for user \${UserDisplayName}: Requested protocol \${ProtocolId} is not supported
BROKER_APPLICATION_REQUEST	INFO	User \${UserDisplayName} requested Application \${ApplicationId}
BROKER_APPLICATION_SESSION_REQUEST	INFO	User \${UserDisplayName} requested an application session from Pool \${PoolId}
BROKER_DAILY_MAX_DESKTOP_SESSIONS	INFO	\$(Time): Over the past 24 hours, the maximum number of concurrent desktop sessions was \${UserCount}
BROKER_DAILY_MAX_APP_USERS	INFO	\$(Time): Over the past 24 hours, the maximum number of users with concurrent application sessions was \${UserCount}
BROKER_DESKTOP_LAUNCH_FAILURE	ERROR	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: The broker encountered an error while processing the request, please contact support for assistance
BROKER_DESKTOP_NOT_ENTITLED	AUDIT_FAIL	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: User is not entitled to this Pool
BROKER_DESKTOP_PROTOCOL_NOT_SUPPORTED	AUDIT_FAIL	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: Requested protocol \${ProtocolId} is not supported
BROKER_DESKTOP_REQUEST	INFO	User \${UserDisplayName} requested Pool \${DesktopId}
BROKER_EVENT_HANDLING_STARTED	INFO	Broker \${BrokerName} has started handling events
BROKER_EVENT_HANDLING_STOPPED	INFO	\$(BrokerName) has stopped handling events
BROKER_MACHINE_ALLOCATED	INFO	User \${UserDisplayName} requested Pool \${DesktopId}, allocated machine \${MachineName}
BROKER_MACHINE_ASSIGNED_UNAVAILABLE	AUDIT_FAIL	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: Assigned machine \${MachineName} is unavailable
BROKER_MACHINE_CANNOT_CONNECT	AUDIT_FAIL	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: Failed to connect to Machine \${MachineName} using \${ProtocolId}
BROKER_MACHINE_CONFIGURED_VIDEO_SETTINGS	INFO	Successfully configured video settings for Machine VM \${MachineName} in Pool \${DesktopId}
BROKER_MACHINE_NOT_READY	WARNING	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: Machine \${MachineName} is not ready to accept connections
BROKER_MACHINE_OPERATION_DELETED	INFO	machine \${MachineName} has been deleted
BROKER_MACHINE_PROTOCOL_NOT_SUPPORTED	AUDIT_FAIL	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: Machine \${MachineName} does not support protocol \${ProtocolId}

Table 2-4. Connection Server Events (Continued)

Event Type	Severity	ModuleAndEventText
BROKER_MACHINE_PROTOCOL_UNAVAILABLE	AUDIT_FAIL	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: Machine \${MachineName} did not report protocol \${ProtocolId} as ready
BROKER_MACHINE_REJECTED_SESSION	WARNING	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: Machine \${MachineName} rejected the start session request
BROKER_MACHINE_SESSION_TIMEDOUT	WARNING	Session for user \${UserDisplayName} timed out
BROKER_MULTIPLE_DESKTOPS_FOR_KIOSK_USER	WARNING	User \${UserDisplayName} is entitled to multiple desktop pools
BROKER_POOL_CANNOT_ASSIGN	AUDIT_FAIL	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: There are no machines available to assign the user to
BROKER_POOL_COMANAGER_REQUIRED	AUDIT_FAIL	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: No co-management availability for protocol \${ProtocolId}
BROKER_POOL_EMPTY	AUDIT_FAIL	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: The Desktop Pool is empty
BROKER_POOL_NO_MACHINE_ASSIGNED	AUDIT_FAIL	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: No machine assigned to this user
BROKER_POOL_NO_RESPONSES	AUDIT_FAIL	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: No machines in the Desktop Pool are responsive
BROKER_POOL_OVERLOADED	AUDIT_FAIL	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: All responding machines are currently in use
BROKER_POOL_POLICY_VIOLATION	AUDIT_FAIL	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: This Desktop Pool does not allow online sessions
BROKER_POOL_PROTOCOL_NOT_SUPPORTED	AUDIT_FAIL	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: There were no machines available that support protocol \${ProtocolId}
BROKER_POOL_PROTOCOL_UNAVAILABLE	AUDIT_FAIL	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: There were no machines available that reported protocol \${ProtocolId} as ready
BROKER_POOL_TUNNEL_NOT_SUPPORTED	AUDIT_FAIL	Unable to launch from Pool \${DesktopId} for user \${UserDisplayName}: Tunneling is not supported for protocol \${ProtocolId}
BROKER_PROVISIONING_ERROR_CONFIG_CLEARED	INFO	The previously reported configuration problem is no longer present on Pool \${DesktopId}
BROKER_PROVISIONING_ERROR_CONFIG_SET	ERROR	Provisioning error occurred on Pool \${DesktopId} because of a configuration problem

Table 2-4. Connection Server Events (Continued)

Event Type	Severity	ModuleAndEventText
BROKER_PROVISIONING_ERROR_DISK_C LEARED	INFO	The previously reported disk problem is no longer present on Pool \${DesktopId}
BROKER_PROVISIONING_ERROR_DISK_L C_RESERVATION_CLEARED	INFO	The previously reported error due to available free disk space reserved for linked clones is no longer present on Pool \${DesktopId}
BROKER_PROVISIONING_ERROR_DISK_L C_RESERVATION_SET	ERROR	Provisioning error occurred on Pool \${DesktopId} because available free disk space is reserved for linked clones
BROKER_PROVISIONING_ERROR_DISK_S ET	WARNING	Provisioning error occurred on Pool \${DesktopId} because of a disk problem
BROKER_PROVISIONING_ERROR_LICENC E_CLEARED	INFO	The previously reported licensing problem is no longer present on Pool \${DesktopId}
BROKER_PROVISIONING_ERROR_LICENC E_SET	ERROR	Provisioning error occurred on Pool \${DesktopId} because of a licensing problem
BROKER_PROVISIONING_ERROR_NETWO RKING_CLEARED	INFO	The previously reported networking problems with Horizon Agent are no longer present on Pool \${DesktopId}
BROKER_PROVISIONING_ERROR_NETWO RKING_SET	ERROR	Provisioning error occurred on Pool \${DesktopId} because of a networking problem with Horizon Agent
BROKER_PROVISIONING_ERROR_RESOU RCE_CLEARED	INFO	The previously reported resource problem is no longer present on Pool \${DesktopId}
BROKER_PROVISIONING_ERROR_RESOU RCE_SET	ERROR	Provisioning error occurred on Pool \${DesktopId} because of a resource problem
BROKER_PROVISIONING_ERROR_TIMEOU T_CUSTOMIZATION_CLEARED	INFO	The previously reported timeout while customizing is no longer present on Pool \${DesktopId}
BROKER_PROVISIONING_ERROR_TIMEOU T_CUSTOMIZATION_SET	ERROR	Provisioning error occurred on Pool \${DesktopId} because of a timeout while customizing
BROKER_PROVISIONING_ERROR_VM_CLO NING	ERROR	Provisioning error occurred for Machine \${MachineName}: Cloning failed for Machine
BROKER_PROVISIONING_ERROR_VM_CU STOMIZATION_ERROR	ERROR	Provisioning error occurred for Machine \${MachineName}: Customization failed for Machine
BROKER_PROVISIONING_ERROR_VM_CU STOMIZATION_NETWORKING	ERROR	Provisioning error occurred for Machine \${MachineName}: Customization error due to no network communication between Horizon Agent and Connection Server
BROKER_PROVISIONING_ERROR_VM_CU STOMIZATION_TIMEOUT	ERROR	Provisioning error occurred for Machine \${MachineName}: Customization operation timed out
BROKER_PROVISIONING_SVI_ERROR_CO MPOSER_AGENT_INIT_FAILED	ERROR	Provisioning error occurred for Machine \${MachineName}: View Composer agent initialization failed
BROKER_PROVISIONING_SVI_ERROR_RE CONFIG_FAILED	ERROR	Provisioning error occurred for Machine \${MachineName}: Reconfigure operation failed

Table 2-4. Connection Server Events (Continued)

Event Type	Severity	ModuleAndEventText
BROKER_PROVISIONING_SVI_ERROR_REFIT_FAILED	ERROR	Provisioning error occurred for Machine \${MachineName}: Refit operation \${SVIOperation} failed
BROKER_PROVISIONING_SVI_ERROR_REMOVING_VM	ERROR	Provisioning error occurred for Machine \${MachineName}: Unable to remove Machine from inventory
BROKER_PROVISIONING_VERIFICATION_FAILED_USER_ASSIGNED	WARNING	Provisioning verification failed for Machine \${MachineName}: User is already assigned to a machine in Pool \${DesktopId}
BROKER_PROVISIONING_VERIFICATION_FAILED_USER_CANNOT_BE_ASSIGNED	WARNING	Provisioning verification failed for Machine \${MachineName}: A user cannot be assigned because Pool \${DesktopId} is not persistent
BROKER_PROVISIONING_VERIFICATION_FAILED_VMNAME_IN_USE	WARNING	Provisioning verification failed for Machine \${MachineName}: A machine already exists in Pool \${DesktopId} with name \${MachineName}
BROKER_SECURITY_SERVER_ADD_FAILED	AUDIT_FAIL	Failed to add security server \${SecurityServerId}
BROKER_SECURITY_SERVER_ADD_FAILED_PASSWORD_EXPIRED	AUDIT_FAIL	Failed to add security server \${SecurityServerId}, pairing password expired
BROKER_SECURITY_SERVER_ADD_FAILED_PASSWORD_INCORRECT	AUDIT_FAIL	Failed to add security server \${SecurityServerId}, pairing password incorrect
BROKER_SECURITY_SERVER_ADD_FAILED_PASSWORD_NOT_SET	AUDIT_FAIL	Failed to add security server \${SecurityServerId}, pairing password not set
BROKER_SECURITY_SERVER_ADDED	AUDIT_SUCCESS	Security server \${SecurityServerId} added
BROKER_SVI_ARCHIVE_UDD_FAILED	AUDIT_FAIL	Failed to archive user data disk \${UserDiskName} to location \${SVIPath}
BROKER_SVI_ARCHIVE_UDD_SUCCEEDED	AUDIT_SUCCESS	Archived user data disk \${UserDiskName} to location \${SVIPath}
BROKER_SVI_ATTACH_UDD_FAILED	AUDIT_FAIL	Failed to attach user data disk \${UserDiskName} to VM \${SVIVMID}
BROKER_SVI_ATTACH_UDD_SUCCEEDED	AUDIT_SUCCESS	Attached user data disk \${UserDiskName} to VM \${SVIVMID}
BROKER_SVI_DETACH_UDD_FAILED	AUDIT_FAIL	Failed to detach user data disk \${UserDiskName} from VM \${SVIVMID}
BROKER_SVI_DETACH_UDD_SUCCEEDED	AUDIT_SUCCESS	Detached user data disk \${UserDiskName} from VM \${SVIVMID}
BROKER_USER_AUTHFAILED_ACCOUNT_DISABLED	AUDIT_FAIL	User \${UserDisplayName} failed to authenticate because the account is disabled
BROKER_USER_AUTHFAILED_ACCOUNT_EXPIRED	AUDIT_FAIL	User \${UserDisplayName} failed to authenticate because the account has expired
BROKER_USER_AUTHFAILED_ACCOUNT_LOCKED_OUT	AUDIT_FAIL	User \${UserDisplayName} failed to authenticate because the account is locked out

Table 2-4. Connection Server Events (Continued)

Event Type	Severity	ModuleAndEventText
BROKER_USER_AUTHFAILED_ACCOUNT_RESTRICTION	AUDIT_FAIL	User \${UserDisplayName} failed to authenticate because of an account restriction
BROKER_USER_AUTHFAILED_BAD_USER_PASSWORD	AUDIT_FAIL	User \${UserDisplayName} failed to authenticate because of a bad username or password
BROKER_USER_AUTHFAILED_GENERAL	AUDIT_FAIL	User \${UserDisplayName} failed to authenticate
BROKER_USER_AUTHFAILED_NO_LOGON_SERVERS	AUDIT_FAIL	User \${UserDisplayName} failed to authenticate because there are no logon servers
BROKER_USER_AUTHFAILED_PASSWORD_EXPIRED	AUDIT_FAIL	User \${UserDisplayName} failed to authenticate because the password has expired
BROKER_USER_AUTHFAILED_PASSWORD_MUST_CHANGE	AUDIT_FAIL	User \${UserDisplayName} failed to authenticate because the password must change
BROKER_USER_AUTHFAILED_SECUREID_ACCESS_DENIED	AUDIT_FAIL	SecurID access denied for user \${UserDisplayName}
BROKER_USER_AUTHFAILED_SECUREID_NEWPIN_REJECTED	AUDIT_FAIL	SecurID access denied for user \${UserDisplayName} because new pin was rejected
BROKER_USER_AUTHFAILED_SECUREID_WRONG_NEXTTOKEN	AUDIT_FAIL	SecurID access denied for user \${UserDisplayName} because wrong next token entered
BROKER_USER_AUTHFAILED_SECUREID_WRONG_STATE	AUDIT_FAIL	SecurID access denied for user \${UserDisplayName} because of incorrect state
BROKER_USER_AUTHFAILED_TIME_RESTRICTION	AUDIT_FAIL	User \${UserDisplayName} failed to authenticate because of a time restriction
BROKER_USER_NOT_AUTHORIZED	AUDIT_FAIL	User \${UserDisplayName} has authenticated, but is not authorized to perform the operation
BROKER_USER_NOT_ENTITLED	AUDIT_FAIL	User \${UserDisplayName} has authenticated, but is not entitled to any Pools
BROKER_USERCHANGEDPASSWORD	AUDIT_SUCCESS	Password for \${UserDisplayName} has been changed by the user
BROKER_USERLOGGEDIN	AUDIT_SUCCESS	User \${UserDisplayName} has logged in
BROKER_USERLOGGEDOUT	AUDIT_SUCCESS	User \${UserDisplayName} has logged out
BROKER_VC_DISABLED	INFO	vCenter at address \${VCAddress} has been temporarily disabled
BROKER_VC_ENABLED	INFO	vCenter at address \${VCAddress} has been enabled
BROKER_VC_STATUS_CHANGED_CANNOT_LOGIN	WARNING	Cannot log in to vCenter at address \${VCAddress}
BROKER_VC_STATUS_CHANGED_DOWN	INFO	vCenter at address \${VCAddress} is down
BROKER_VC_STATUS_CHANGED_INVALID_CREDENTIALS	WARNING	vCenter at address \${VCAddress} has invalid credentials
BROKER_VC_STATUS_CHANGED_NOT_YET_CONNECTED	INFO	Not yet connected to vCenter at address \${VCAddress}

Table 2-4. Connection Server Events (Continued)

Event Type	Severity	ModuleAndEventText
BROKER_VC_STATUS_CHANGED_RECONNECTING	INFO	Reconnecting to vCenter at address \${VCAddress}
BROKER_VC_STATUS_CHANGED_UNKNO WN	WARNING	The status of vCenter at address \${VCAddress} is unknown
BROKER_VC_STATUS_CHANGED_UP	INFO	vCenter at address \${VCAddress} is up

Horizon Agent Events

Horizon Agent events report Horizon Agent-related information, such as the users who have logged in to or disconnected from a specific machine, whether Horizon Agent has shut down on a specific machine, and whether Horizon Agent has sent a start up message from a specific machine to Horizon Connection Server.

Table 2-5. Horizon Agent Events

Event Type	Severity	ModuleAndEventText
AGENT_CONNECTED	INFO	User \${UserDisplayName} has logged in to a new session on machine \${MachineName}
AGENT_DISCONNECTED	INFO	User \${UserDisplayName} has disconnected from machine \${MachineName}
AGENT_ENDED	INFO	User \${UserDisplayName} has logged off machine \${MachineName}
AGENT_PENDING	INFO	The agent running on machine \${MachineName} has accepted an allocated session for user \${UserDisplayName}
AGENT_PENDING_EXPIRED	WARNING	The pending session on machine \${MachineName} for user \${UserDisplayName} has expired
AGENT_RECONFIGURED	INFO	Machine \${MachineName} has been successfully reconfigured
AGENT_RECONNECTED	INFO	User \${UserDisplayName} has reconnected to machine \${MachineName}
AGENT_RESUME	INFO	The agent on machine \${MachineName} sent a resume message
AGENT_SHUTDOWN	INFO	The agent running on machine \${MachineName} has shut down, this machine will be unavailable
AGENT_STARTUP	INFO	The agent running on machine \${MachineName} has contacted the connection server and sent a startup message
AGENT_SUSPEND	INFO	The agent on machine \${MachineName} sent a suspend message

Horizon Administrator Events

Horizon Administrator events report information about actions that users initiate in Horizon Administrator.

Table 2-6. Horizon Administrator Events

EventType	Severity	ModuleAndEventText
ADMIN_ADD_DESKTOP_ENTITLEMENT	AUDIT_SUCCESS	\${EntitlementDisplay} was entitled to Pool \${DesktopId} by \${UserDisplayName}
ADMIN_ADD_LICENSE	AUDIT_SUCCESS	\${UserDisplayName} added license
ADMIN_ADD_LICENSE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to add license
ADMIN_ADD_PM	AUDIT_SUCCESS	\${UserDisplayName} added physical machine \${MachineName} to Pool \${DesktopId}
ADMIN_ADD_PM_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to add physical machine \${MachineName} to Pool \${DesktopId}
ADMIN_ADD_THINAPP_ENTITLEMENT	AUDIT_SUCCESS	Application \${ThinAppDisplayName} was assigned to Desktop \${MachineName} by \${UserDisplayName}
ADMIN_ADD_THINAPP_ENTITLEMENT_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to add Application entitlement
ADMIN_ADD_THINAPP_POOL_ENTITLEMENT	AUDIT_SUCCESS	Application \${ThinAppDisplayName} was assigned to Pool \${DesktopId} by \${UserDisplayName}
ADMIN_ADMINISTRATOR_REMOVE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to remove all permissions for Administrator \${AdminPermissionEntity}
ADMIN_ADMINISTRATOR_REMOVED	AUDIT_SUCCESS	\${UserDisplayName} removed all permissions for Administrator \${AdminPermissionEntity}
ADMIN_CONNECTION_BROKER_UPDATE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to update connection broker \${BrokerId}
ADMIN_CONNECTION_BROKER_UPDATED	AUDIT_SUCCESS	\${UserDisplayName} updated connection broker \${BrokerId}: (\${AttrChangeType}: \${AttrName} = \${AttrValue})
ADMIN_CONNECTION_SERVER_BACKUP_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to initiate a backup of connection broker \${BrokerId}
ADMIN_CONNECTION_SERVER_BACKUP_INITIATED	AUDIT_SUCCESS	\${UserDisplayName} initiated a backup of connection broker \${BrokerId}
ADMIN_CONNECTION_SERVER_DISABLE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to disable connection broker \${BrokerId}
ADMIN_CONNECTION_SERVER_DISABLED	AUDIT_SUCCESS	\${UserDisplayName} is disabling connection broker \${BrokerId}
ADMIN_CONNECTION_SERVER_ENABLE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to enable connection broker \${BrokerId}

Table 2-6. Horizon Administrator Events (Continued)

EventType	Severity	ModuleAndEventText
ADMIN_CONNECTION_SERVER_ENABLED	AUDIT_SUCCESS	\${UserDisplayName} is enabling connection broker \${BrokerId}
ADMIN_DATABASE_CONFIGURATION_ADD_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to add database configuration
ADMIN_DATABASE_CONFIGURATION_ADDED	AUDIT_SUCCESS	\${UserDisplayName} has added database configuration
ADMIN_DATABASE_CONFIGURATION_DELETE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to delete database configuration
ADMIN_DATABASE_CONFIGURATION_DELETE_FAILED	AUDIT_SUCCESS	\${UserDisplayName} has deleted database configuration
ADMIN_DATABASE_CONFIGURATION_UPDATE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to update database configuration
ADMIN_DATABASE_CONFIGURATION_UPDATED	AUDIT_SUCCESS	\${UserDisplayName} has updated database configuration
ADMIN_DEFAULT_DESKTOPPOOL_ASSIGN	AUDIT_SUCCESS	\${UserDisplayName} assigned Pool \${DesktopId} for default desktop to \${UserName}
ADMIN_DEFAULT_DESKTOPPOOL_ASSIGN_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to assign Pool \${DesktopId} for default desktop to \${UserName}
ADMIN_DEFAULT_DESKTOPPOOL_UNASSIGN	AUDIT_SUCCESS	\${UserDisplayName} removed pool assignment for default desktop to \${UserName}
ADMIN_DEFAULT_DESKTOPPOOL_UNASSIGN_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to remove Pool assignment for default desktop to \${UserName}
ADMIN_DESKTOP_ADDED	AUDIT_SUCCESS	\${UserDisplayName} added Pool \${DesktopId}
ADMIN_DESKTOP_ASSIGN	AUDIT_SUCCESS	\${UserDisplayName} assigned Desktop \${MachineName} to \${UserName}
ADMIN_DESKTOP_ASSIGN_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to assign Desktop \${MachineName} to \${UserName}
ADMIN_DESKTOP_EDITED	AUDIT_SUCCESS	\${UserDisplayName} edited Pool \${DesktopId} (\${AttrChangeType}): \${AttrName} = \${AttrValue}
ADMIN_DESKTOP_MAINTENANCE_MODE_UPDATE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to update desktop \${MachineName} to \${MaintenanceMode} maintenance mode
ADMIN_DESKTOP_MAINTENANCE_MODE_UPDATED	AUDIT_SUCCESS	\${UserDisplayName} updated desktop \${MachineName} to \${MaintenanceMode} maintenance mode

Table 2-6. Horizon Administrator Events (Continued)

EventType	Severity	ModuleAndEventText
ADMIN_DESKTOP_UNASSIGN	AUDIT_SUCCESS	\${UserDisplayName} removed assignment for Desktop \${MachineName}
ADMIN_DESKTOP_UNASSIGN_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to remove assignment for Desktop \${MachineName}
ADMIN_ENABLE_DESKTOP_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to set Pool \${DesktopId} to \${EnableStatus}
ADMIN_ENABLE_DESKTOP_SUCCEEDED	AUDIT_SUCCESS	\${UserDisplayName} set Pool \${DesktopId} to \${EnableStatus}
ADMIN_ENABLED_DESKTOP_PROVISION_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to set provisioning for Pool \${DesktopId} to \${EnableStatus}
ADMIN_ENABLED_DESKTOP_PROVISION_SUCCEEDED	AUDIT_SUCCESS	\${UserDisplayName} set provisioning for Pool \${DesktopId} to \${EnableStatus}
ADMIN_EVENT_CONFIGURATION_UPDATE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to update event configuration
ADMIN_EVENT_CONFIGURATION_UPDATED	AUDIT_SUCCESS	\${UserDisplayName} has updated global configuration
ADMIN_FOLDER_ADD_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to add folder \${AdminFolderName}
ADMIN_FOLDER_ADDED	AUDIT_SUCCESS	\${UserDisplayName} added folder \${AdminFolderName}
ADMIN_FOLDER_CHANGE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to change object \${ObjectID}(type=\${ObjectType}) to folder \${AdminFolderName}
ADMIN_FOLDER_CHANGED	AUDIT_SUCCESS	\${UserDisplayName} changed object \${ObjectID}(type=\${ObjectType}) to folder \${AdminFolderName}
ADMIN_FOLDER_DELETE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to delete folder \${AdminFolderName}
ADMIN_FOLDER_DELETED	AUDIT_SUCCESS	\${UserDisplayName} deleted folder \${AdminFolderName}
ADMIN_GLOBAL_CONFIGURATION_UPDATE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to update global configuration
ADMIN_GLOBAL_CONFIGURATION_UPDATED	AUDIT_SUCCESS	\${UserDisplayName} updated global configuration (\${AttrChangeType}: \${AttrName} = \${AttrValue})
ADMIN_GLOBAL_POLICY_UPDATE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to update global policies
ADMIN_GLOBAL_POLICY_UPDATED	AUDIT_SUCCESS	\${UserDisplayName} updated global policy (\${AttrChangeType}: \${AttrName} = \${AttrValue})

Table 2-6. Horizon Administrator Events (Continued)

EventType	Severity	ModuleAndEventText
ADMIN_PERFMON_CONFIGURATION_UPDATE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to update performance monitoring configuration
ADMIN_PERFMON_CONFIGURATION_UPDATED	AUDIT_SUCCESS	\${UserDisplayName} has updated performance monitoring configuration
ADMIN_PERMISSION_ADD_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to add Permission to \${AdminPermissionEntity} with Role \${AdminRoleName} on Folder \${AdminFolderName}
ADMIN_PERMISSION_ADDED	AUDIT_SUCCESS	\${UserDisplayName} added Permission to \${AdminPermissionEntity} with Role \${AdminRoleName} on Folder \${AdminFolderName}
ADMIN_PERMISSION_REMOVE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to remove Permission to \${AdminPermissionEntity} with Role \${AdminRoleName} on Folder \${AdminFolderName}
ADMIN_PERMISSION_REMOVED	AUDIT_SUCCESS	\${UserDisplayName} removed Permission to \${AdminPermissionEntity} with Role \${AdminRoleName} on Folder \${AdminFolderName}
ADMIN_POOL_POLICY_UPDATE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to update Pool \${DesktopId} policies
ADMIN_POOL_POLICY_UPDATED	AUDIT_SUCCESS	\${UserDisplayName} updated Pool \${DesktopId} policy (\${AttrChangeType}): \${AttrName} = \${AttrValue}
ADMIN_REMOVE_DESKTOP_ENTITLEMENT	AUDIT_SUCCESS	\${EntitlementDisplay} was unentitled from Pool \${DesktopId} by \${UserDisplayName}
ADMIN_REMOVE_DESKTOP_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to removed Pool \${DesktopId}
ADMIN_REMOVE_DESKTOP_SUCCEEDED	AUDIT_SUCCESS	\${UserDisplayName} removed Pool \${DesktopId}
ADMIN_REMOVE_THINAPP_ENTITLEMENT	AUDIT_SUCCESS	Application \${ThinAppDisplayName} was unassigned from Desktop \${MachineName} by \${UserDisplayName}
ADMIN_REMOVE_THINAPP_ENTITLEMENT_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to remove Application entitlement
ADMIN_REMOVE_THINAPP_POOL_ENTITLEMENT	AUDIT_SUCCESS	Application \${ThinAppDisplayName} was unassigned from Pool \${DesktopId} by \${UserDisplayName}
ADMIN_RESET_THINAPP_STATE	AUDIT_SUCCESS	Application \${ThinAppDisplayName} state are reset for Desktop \${DesktopDisplayName} by \${UserDisplayName}

Table 2-6. Horizon Administrator Events (Continued)

EventType	Severity	ModuleAndEventText
ADMIN_RESET_THINAPP_STATE_FAILED	AUDIT_FAIL	<p> \${UserDisplayName} failed to reset Application state for \$ {ThinAppDisplayName} </p>
ADMIN_ROLE_ADD_FAILED	AUDIT_FAIL	<p> \${UserDisplayName} failed to add Role \$ {AdminRoleName} with privileges \$ {AdminPrivilegeName} </p>
ADMIN_ROLE_ADDED	AUDIT_SUCCESS	<p> \${UserDisplayName} added Role \$ {AdminRoleName} with privileges \$ {AdminPrivilegeName} </p>
ADMIN_ROLE_PRIV_UPDATE_FAILED	AUDIT_FAIL	<p> \${UserDisplayName} failed to update Role \${AdminRoleName} to privileges \$ {AdminPrivilegeName} </p>
ADMIN_ROLE_PRIV_UPDATED	AUDIT_SUCCESS	<p> \${UserDisplayName} updated Role \$ {AdminRoleName} to privileges \$ {AdminPrivilegeName} </p>
ADMIN_ROLE_REMOVE_FAILED	AUDIT_FAIL	<p> \${UserDisplayName} failed to remove Role \${AdminRoleName} </p>
ADMIN_ROLE_REMOVED	AUDIT_SUCCESS	<p> \${UserDisplayName} removed Role \$ {AdminRoleName} </p>
ADMIN_ROLE_RENAME_FAILED	AUDIT_FAIL	<p> \${UserDisplayName} failed to rename Role \${AdminRoleName} to \$ {AdminRoleNewName} </p>
ADMIN_ROLE_RENAMED	AUDIT_SUCCESS	<p> \${UserDisplayName} renamed Role \$ {AdminRoleName} to \$ {AdminRoleNewName} </p>
ADMIN_SECURITY_SERVER_ADD_FAILED	AUDIT_FAIL	<p> \${UserDisplayName} failed to add security server \${SecurityServerId} </p>
ADMIN_SECURITY_SERVER_ADDED	AUDIT_SUCCESS	<p> \${UserDisplayName} added security server \${SecurityServerId} </p>
ADMIN_SECURITY_SERVER_EDIT_FAILED	AUDIT_FAIL	<p> \${UserDisplayName} failed to edit security server \${SecurityServerId} </p>
ADMIN_SECURITY_SERVER_EDITED	AUDIT_SUCCESS	<p> \${UserDisplayName} edited security server \${SecurityServerId} (\$ {AttrChangeType}: \${AttrName} = \$ {AttrValue}) </p>
ADMIN_SECURITY_SERVER_REMOVE_FAILED	AUDIT_FAIL	<p> \${UserDisplayName} failed to remove security server \${SecurityServerId} </p>
ADMIN_SECURITY_SERVER_REMOVED	AUDIT_SUCCESS	<p> \${UserDisplayName} removed security server \${SecurityServerId} </p>
ADMIN_SESSION_SENDMSG	AUDIT_SUCCESS	<p> \${UserDisplayName} sent message (\$ {SessionMessage}) to session (User \$ {UserName}, Desktop \${MachineName}) </p>

Table 2-6. Horizon Administrator Events (Continued)

EventType	Severity	ModuleAndEventText
ADMIN_SESSION_SENDMSG_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to send message (\${SessionMessage}) to session \${ObjectId}
ADMIN_SVI_ADD_DEPLOYMENT_GROUP_FAILED	AUDIT_FAIL	Failed to add deployment group for \${SVIParentVM} : \${SVISnapshot}
ADMIN_SVI_ADD_DEPLOYMENT_GROUP_SUCCEEDED	AUDIT_SUCCESS	Added deployment group \${SVIDeploymentGroupId} for \${SVIParentVM} : \${SVISnapshot}
ADMIN_SVI_ADD_UDD_FAILED	AUDIT_FAIL	Failed to add user data disk \${UserDiskName}
ADMIN_SVI_ADD_UDD_SUCCEEDED	AUDIT_SUCCESS	Added user data disk \${UserDiskName}
ADMIN_SVI_ADMIN_ADDED	AUDIT_SUCCESS	\${UserDisplayName} added SVI QuickPrep domain \${SVIAdminFqdn}(\${SVIAdminName})
ADMIN_SVI_ADMIN_REMOVED	AUDIT_SUCCESS	\${UserDisplayName} removed SVI QuickPrep domain (id=\${SVIAdminID})
ADMIN_SVI_ADMIN_UPDATED	AUDIT_SUCCESS	\${UserDisplayName} updated SVI QuickPrep domain \${SVIAdminFqdn}(\${SVIAdminName})
ADMIN_SVI_ATTACH_UDD_FAILED	AUDIT_FAIL	Failed to request attach user data disk \${UserDiskName} to VM \${SVIVMID}
ADMIN_SVI_ATTACH_UDD_SUCCEEDED	AUDIT_SUCCESS	Requested attach user data disk \${UserDiskName} to VM \${SVIVMID}
ADMIN_SVI_DELETE_UDD_FAILED	AUDIT_FAIL	Failed to delete user data disk \${UserDiskName}
ADMIN_SVI_DELETE_UDD_SUCCEEDED	AUDIT_SUCCESS	Deleted user data disk \${UserDiskName}
ADMIN_SVI_DETACH_UDD_FAILED	AUDIT_FAIL	Failed to request detach user data disk \${UserDiskName} from VM \${SVIVMID}
ADMIN_SVI_DETACH_UDD_SUCCEEDED	AUDIT_SUCCESS	Requested detach user data disk \${UserDiskName} from VM \${SVIVMID}
ADMIN_SVI_REBALANCE_VM_FAILED	AUDIT_FAIL	Failed to rebalance VM \${SVIVMID}
ADMIN_SVI_REBALANCE_VM_SUCCEEDED	AUDIT_SUCCESS	Rebalanced VM \${SVIVMID}
ADMIN_SVI_REFRESH_VM_FAILED	AUDIT_FAIL	Failed to refresh VM \${SVIVMID}
ADMIN_SVI_REFRESH_VM_SUCCEEDED	AUDIT_SUCCESS	Refreshed VM \${SVIVMID}
ADMIN_SVI_RESYNC_VM_FAILED	AUDIT_FAIL	Failed to resync VM \${SVIVMID} to deployment group \${SVIDeploymentGroupId}
ADMIN_SVI_RESYNC_VM_SUCCEEDED	AUDIT_SUCCESS	Resyncd VM \${SVIVMID} to deployment group \${SVIDeploymentGroupId}

Table 2-6. Horizon Administrator Events (Continued)

EventType	Severity	ModuleAndEventText
ADMIN_SVI_UPDATE_POOL_DEPLOYMENT_GROUP_FAILED	AUDIT_FAIL	Failed to update pool \${DesktopId} to deployment group \$ {SVIDeploymentGroupId}
ADMIN_SVI_UPDATE_POOL_DEPLOYMENT_GROUP_SUCCEEDED	AUDIT_SUCCESS	Updated pool \${DesktopId} to deployment group \$ {SVIDeploymentGroupId}
ADMIN_SVI_UPDATE_UDD_FAILED	AUDIT_FAIL	Failed to update user data disk \$ {UserDiskName}
ADMIN_SVI_UPDATE_UDD_SUCCEEDED	AUDIT_SUCCESS	Set user data disk \$ {UserDiskName} pool to \${DesktopId} and user to \$ {UserName}
ADMIN_THINAPP_ADD_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to add Application \$ {ThinAppDisplayName}
ADMIN_THINAPP_ADDED	AUDIT_SUCCESS	\${UserDisplayName} added Application \$ {ThinAppDisplayName}
ADMIN_THINAPP_DESKTOP_AVAILABLE	AUDIT_SUCCESS	Application \$ {ThinAppDisplayName} is now available on Desktop \$ {DesktopDisplayName}
ADMIN_THINAPP_DESKTOP_REMOVED	AUDIT_SUCCESS	Application \$ {ThinAppDisplayName} has been removed from Desktop \$ {DesktopDisplayName}
ADMIN_THINAPP_EDITED	AUDIT_SUCCESS	\${UserDisplayName} edited Application \$ {ThinAppDisplayName}
ADMIN_THINAPP_FAILED_DESKTOP_DELIVERY	AUDIT_FAIL	Failed to deliver Application \$ {ThinAppDisplayName} to Desktop \$ {DesktopDisplayName}
ADMIN_THINAPP_FAILED_DESKTOP_REMOVAL	AUDIT_FAIL	Failed to remove Application \$ {ThinAppDisplayName} from Desktop \$ {DesktopDisplayName}
ADMIN_THINAPP_GROUP_ADD_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to add Application Template \$ {ThinAppGroupName}
ADMIN_THINAPP_GROUP_ADDED	AUDIT_SUCCESS	\${UserDisplayName} added Application Template \$ {ThinAppGroupName} with Applications \$ {ThinAppGroupApplications}
ADMIN_THINAPP_GROUP_EDIT_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to edit Application Template \$ {ThinAppGroupName}
ADMIN_THINAPP_GROUP_EDITED	AUDIT_SUCCESS	\${UserDisplayName} edited Application Template \$ {ThinAppGroupName} with Applications \$ {ThinAppGroupApplications}

Table 2-6. Horizon Administrator Events (Continued)

EventType	Severity	ModuleAndEventText
ADMIN_THINAPP_GROUP_REMOVE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to remove Application Template \$ {ThinAppGroupName}
ADMIN_THINAPP_GROUP_REMOVED	AUDIT_SUCCESS	\${UserDisplayName} removed Application Template \$ {ThinAppGroupName}
ADMIN_THINAPP_REMOVE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to remove Application \${ThinAppDisplayName}
ADMIN_THINAPP_REMOVED	AUDIT_SUCCESS	\${UserDisplayName} removed Application \${ThinAppDisplayName}
ADMIN_THINAPP_REPO_ADD_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to add Repository \${ThinAppRepositoryName}, path \${ThinAppRepositoryPath}
ADMIN_THINAPP_REPO_ADDED	AUDIT_SUCCESS	\${UserDisplayName} added Repository \${ThinAppRepositoryName}, path \$ {ThinAppRepositoryPath}
ADMIN_THINAPP_REPO_EDIT_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to edit Repository \${ThinAppRepositoryName}, path \${ThinAppRepositoryPath}
ADMIN_THINAPP_REPO_EDITED	AUDIT_SUCCESS	\${UserDisplayName} edited Repository \$ {ThinAppRepositoryName}, path \$ {ThinAppRepositoryPath}
ADMIN_THINAPP_REPO_REMOVED	AUDIT_SUCCESS	\${UserDisplayName} removed Repository \${ThinAppRepositoryName}
ADMIN_UNREGISTER_PM	AUDIT_SUCCESS	\${UserDisplayName} unregistered physical machine \${MachineName})
ADMIN_UNREGISTER_PM_FAILED	AUDIT_FAIL	\${UserDisplayName} fails to unregister physical machine \${MachineName})
ADMIN_USER_INFO_UPDATE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to update user info with AD server for \$ {UserName}
ADMIN_USER_INFO_UPDATED	AUDIT_SUCCESS	\${UserDisplayName} updated user info with AD server for \${UserName}
ADMIN_USER_POLICY_DELETE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to delete Pool \${DesktopId} override policies for user \${UserName}
ADMIN_USER_POLICY_DELETED	AUDIT_SUCCESS	\${UserDisplayName} deleted Pool \$ {DesktopId} override policy for user \$ {UserName} (\${AttrChangeType}: \$ {AttrName} = \${AttrValue})
ADMIN_USER_POLICY_UPDATE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to update Pool \${DesktopId} policies for user \$ {UserName}

Table 2-6. Horizon Administrator Events (Continued)

EventType	Severity	ModuleAndEventText
ADMIN_USER_POLICY_UPDATED	AUDIT_SUCCESS	\${UserDisplayName} updated Pool \${DesktopId} policy for user \${UserName} (\${AttrChangeType}: \${AttrName} = \${AttrValue})
ADMIN_USERLOGGEDIN	AUDIT_SUCCESS	User \${UserDisplayName} has logged in to View Administrator
ADMIN_USERLOGGEDOUT	AUDIT_SUCCESS	User \${UserDisplayName} has logged out from View Administrator
ADMIN_VC_ADD_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to add VC server \${VCAddress}
ADMIN_VC_ADDED	AUDIT_SUCCESS	\${UserDisplayName} added VC server \${VCAddress}
ADMIN_VC_EDITED	AUDIT_SUCCESS	\${UserDisplayName} edited VC server \${VCAddress} (\${AttrChangeType}: \${AttrName} = \${AttrValue})
ADMIN_VC_LICINV_ALARM_DISABLED	AUDIT_SUCCESS	Alarm on VC server \${VCAddress} for License Inventory monitoring was disabled as all Hosts have desktop licenses
ADMIN_VC_REMOVE_FAILED	AUDIT_FAIL	\${UserDisplayName} failed to remove VC server \${VCAddress}
ADMIN_VC_REMOVED	AUDIT_SUCCESS	\${UserDisplayName} removed VC server \${VCAddress}

Event Message Attributes

ModuleAndEventText messages use certain attributes. To determine the data type for an attribute, you can examine its value in the type column in the event_data or event_data_historical table.

Table 2-7. Attributes that ModuleAndEventText Messages Use

Attribute Name	Description
AdminFolderName	Name of a folder that requires privileged access.
AdminPermissionEntity	Name of an object that requires privileged access.
AdminPrivilegeName	Name of an administrative privilege.
AdminRoleName	Name of an administrative role.
AdminRoleNewName	New name of an administrative role.
AttrChangeType	Type of change that was applied to a generic attribute.
AttrName	Name of a generic attribute.
AttrValue	Value of a generic attribute.
BrokerId	Identifier of a Connection Server instance.
BrokerName	Name of a Connection Server instance.

Table 2-7. Attributes that ModuleAndEventText Messages Use (Continued)

Attribute Name	Description
DesktopDisplayName	Display name of a desktop pool.
DesktopId	Identifier of a desktop pool.
EntitlementDisplay	Display name of a desktop entitlement.
MachinelId	Name of a physical or virtual machine.
MachineName	Name of a physical or virtual machine.
MaintenanceMode	Maintenance mode state.
ObjectID	Identifier of an inventory object.
ObjectType	Type of an inventory object.
PolicyDisplayName	Display name of a policy.
PolicyObject	Identifier of a policy object.
PolicyValue	Value of a policy object.
ProtocolId	Identifier of a display protocol.
SecurityServerId	Identifier of a security server.
SVIAdminFqdn	FQDN of a QuickPrep domain.
SVIAdminID	Identifier of a QuickPrep domain.
SVIAdminName	Name of a QuickPrep domain.
SVIDeploymentGroupID	Identifier of a View Composer deployment group.
SVIOperation	Name of a View Composer operation.
SVIParentVM	Parent virtual machine in View Composer.
SVIPath	Path of an object in View Composer.
SVISnapshot	Snapshot in View Composer.
SVIVMID	Identifier of a virtual machine in View Composer.
ThinAppDisplayName	Display name of a ThinApp object.
ThinAppId	Identifier of a ThinApp object.
ThinAppRepositoryName	Name of a ThinApp repository
ThinAppRepositoryPath	Path of a ThinApp repository.
Time	Date and time value.
UserCount	Maximum number of desktop users over a 24-hour period.
UserDiskName	Name of a user data disk.
UserDisplayName	User name in the form DOMAIN\username.
UserName	Name of a user in Active Directory.
VCAddress	URL of a vCenter Server.

Sample Database Queries and Views

You can query the event_historical database to display error events, warning events, and specific recent events.

Note Replace the dbo.VE_ prefix in the following examples with the appropriate prefix for your event database.

List Error Events

The following query displays all error events from the event_historical table.

```
CREATE VIEW error_events AS
(
    SELECT ev.EventID, ev.Time, ev.Module, ev.EventType, ev.ModuleAndEventText
    FROM dbo.VE_event_historical AS ev
    WHERE ev.Severity = 'ERROR'
);
```

List Warning Events

The following query displays all warning events from the event_historical table.

```
CREATE VIEW warning_events AS
(
    SELECT ev.EventID, ev.Time, ev.Module, ev.EventType, ev.ModuleAndEventText
    FROM dbo.VE_event_historical AS ev
    WHERE ev.Severity = 'WARNING'
);
```

List Recent Events

The following query lists all recent events that are associated with the user fred in the domain MYDOM.

```
CREATE VIEW user_fred_events AS
(
    SELECT ev.EventID, ev.Time, ev.Module, ev.EventType, ev.Severity, ev.Acknowledged
    FROM dbo.VE_event_historical AS ev,
    dbo.VE_event_data_historical AS ed
    WHERE ev.EventID = ed.EventID AND ed.Name = 'UserDisplayName' AND ed.StrValue =
    'MYDOM\fred'
);
```

The following query lists all recent events where the agent on a machine shut down.

```
CREATE VIEW agent_shutdown_events AS
(
  SELECT ev.EventID, ev.Time, ed.StrValue
    FROM dbo.VE_event_historical AS ev,
         dbo.VE_event_data_historical AS ed
   WHERE ev.EventID = ed.EventID AND ev.EventType = 'AGENT_SHUTDOWN' AND
         ed.Name = 'MachineName'
);
```

The following query lists all recent events where a desktop failed to launch because the desktop pool was empty.

```
CREATE VIEW desktop_launch_failure_events AS
(
  SELECT ev.EventID, ev.Time, ed1.StrValue, ed2.StrValue
    FROM dbo.VE_event_historical AS ev,
         dbo.VE_event_data_historical AS ed1,
         dbo.VE_event_data_historical AS ed2
   WHERE ev.EventID = ed1.EventID AND ev.EventID = ed2.EventID AND
         ev.EventType = 'BROKER_POOL_EMPTY' AND
         ed1.Name = 'UserDisplayName' AND ed2.Name = 'DesktopId'
);
```

The following query lists all recent events where an administrator removed a desktop pool.

```
CREATE VIEW desktop_pool_removed_events AS
(
  SELECT ev.EventID, ev.Time, ed1.StrValue, ed2.StrValue
    FROM dbo.VE_event_historical AS ev,
         dbo.VE_event_data_historical AS ed1,
         dbo.VE_event_data_historical AS ed2
   WHERE ev.EventID = ed1.EventID AND ev.EventID = ed2.EventID AND
         ev.EventType = 'ADMIN_DESKTOP_REMOVED' AND
         ed1.Name = 'UserDisplayName' AND ed2.Name = 'DesktopId'
);
```

The following query lists all recent events where an administrator added a ThinApp repository.

```
CREATE VIEW thinapp_repository_added_events AS
(
  SELECT ev.EventID, ev.Time, ed1.StrValue, ed2.StrValue, ed3.StrValue
    FROM dbo.VE_event_historical AS ev,
         dbo.VE_event_data_historical AS ed1,
         dbo.VE_event_data_historical AS ed2,
         dbo.VE_event_data_historical AS ed3
   WHERE ev.EventID = ed1.EventID AND ev.EventID = ed2.EventID AND ev.EventID = ed3.EventID
  AND
```

```
ev.EventType = 'ADMIN_THINAPP_REPO_ADDED' AND  
ed1.Name = 'UserDisplayName' AND ed2.Name = 'ThinAppRepositoryName' AND  
ed3.Name = 'ThinAppRepositoryPath'  
);
```

Deploying Horizon 7 on VMware Cloud on AWS

3

VMware Cloud on AWS is a cloud service where you can deploy Horizon 7 desktops and applications.

For more information about deploying Horizon 7 on VMware Cloud on AWS, see the *"Horizon 7 on VMware Cloud on AWS Deployment Guide"* at

<https://www.vmware.com/content/dam/digitalmarketing/vmware/en/pdf/products/vmw-deploy-horizon-seven-on-vmware-cloud-on-aws.pdf>.

For a list of Horizon 7 features supported on VMware Cloud on AWS, see the VMware Knowledge Base article <https://kb.vmware.com/s/article/58539>.

For more information about VMware Cloud on AWS, see the VMware Cloud on AWS documentation at <https://docs.vmware.com/en/VMware-Cloud-on-AWS/index.html>.

Customizing LDAP Data

You can use VMware and Microsoft command-line tools to import and export LDAP configuration data to and from Horizon 7. These command-line tools import and export LDAP configuration data in LDAP Data Interchange Format (LDIF) configuration files.

This feature is intended for use by advanced administrators who want to perform automatic bulk configuration operations. To create scripts to update the Horizon 7 configuration, use Horizon 7 PowerCLI.

This chapter includes the following topics:

- [Introduction to LDAP Configuration Data](#)
- [Modifying LDAP Configuration Data](#)

Introduction to LDAP Configuration Data

All Horizon 7 configuration data is stored in an LDAP directory. Each Horizon Connection Server standard or replica instance contains a local LDAP configuration repository and a replication agreement between each of the Connection Server instances. This arrangement ensures that changes to one repository are automatically replicated to all other repositories.

When you use Horizon Administrator to modify the Horizon 7 configuration, the appropriate LDAP data is updated in the repository. For example, if you add a desktop pool, Horizon 7 stores information about users, user groups, and entitlements in LDAP. Connection Server instances manage other LDAP configuration data automatically, and they use the information in the repository to control Horizon 7 operations.

You can use LDIF configuration files to perform a number of tasks, including transferring configuration data between Connection Server instances and backing up your Horizon 7 configuration so that you can restore the state of a Connection Server instance.

You can also use LDIF configuration files to define a large number of Horizon 7 objects, such as desktop pools, and add those objects to your Connection Server instances without having to use Horizon Administrator to perform the task manually.

In Horizon 7 3.1 and later releases, Horizon 7 performs regular backups of the LDAP repository.

LDAP configuration data is transferred as plain ASCII text and conforms to the Internet Engineering Task Force (IETF) RFC 2849 standard.

Modifying LDAP Configuration Data

You can export LDAP configuration data on a Horizon Connection Server instance to an LDIF configuration file, modify the LDIF configuration file, and import the modified LDIF configuration file into other Connection Server instances to perform automatic bulk configuration operations.

You can obtain examples of LDIF syntax for any item of LDAP configuration data in Horizon by examining the contents of an exported LDIF configuration file. For example, you can extract the data for a desktop pool and use that data as a template to create a large number of desktop pools.

Export LDAP Configuration Data

You can use the `vdmexport` command-line utility to export configuration data from a standard or replica Horizon Connection Server instance to an LDIF configuration file.

By default, the `vdmexport` command-line utility is installed in the `C:\Program Files\VMware\VMware View\Server\tools\bin` directory.

Procedure

- 1 Log in to a standard or replica Connection server instance.

Option	Action
View 3.1 and earlier	Log in as an administrator and be a member of the Local Administrators user group.
View 4.5 and later	Log in as a user in the Administrators or Administrators (Read only) role. Note You must be logged in as a user in the Administrators or Administrators (Read only) role to export configuration data from the View configuration repository.

- 2 At the command prompt, type the `vdmexport` command and use the `-f` option to specify the name of the LDIF configuration file to export.

For example: `vdmexport -f myexport.LDF`

Alternatively, you can redirect the output instead of using the `-f` option.

For example: `vdmexport > myexport.LDF`

The `vdmexport` command writes the configuration of your Connection Server instance to the file that you specify. The command displays errors if your role has insufficient privileges to view the data in the configuration repository.

Defining a Desktop Pool in an LDIF Configuration File

You can define a desktop pool in an LDIF configuration file and import the customized LDIF configuration file to create a large number of desktop pools.

Note You can also create customized LDIF configuration files for other objects that are defined in the LDAP repository, including global configuration settings, configuration settings for a specific Horizon Connection Server instance or security server, and configuration settings for a specific user.

To define a desktop pool in an LDIF configuration file, you must add the following entries to the file.

- A Virtual Desktop VM entry for each virtual desktop in the desktop pool
- A VM Pool entry for each desktop pool
- A Desktop Application entry that defines the entitlement of the desktop pool

You associate each VM Pool entry with one Desktop Application entry in a one-to-one relationship. A Desktop Application entry cannot be shared between VM Pool entries, and a VM Pool entry can only be associated with one Desktop Application entry.

The following table describes the attributes you must specify when you modify a desktop pool definition in an LDIF configuration file.

Table 4-1. Important Attributes for Defining a Desktop Pool

Entry	Attribute	Description
Virtual Desktop VM VM Pool Desktop Application	cn	Common name of an entry. If you require names to be generated automatically, specify globally unique identifier (GUID) strings. You can use any reliable GUID generator, such as the mechanism provided by .NET (for example, by calling <code>System.Guid.NewGuid().ToString()</code> in Visual Basic).
Desktop Application	member	<p>A list of Active Directory (AD) users and groups who are entitled to access the desktop pool. The attribute is specified in the form of a Windows Security Identifier (SID) reference. A member value of <code><SID=S-1-2-3-4></code> represents an AD user or group with the SID value S-1-2-3-4.</p> <p>In LDIF format, the left angle (<) character is reserved, so you must place two colons (::) after the attribute name and specify the SID value in base 64 format (for example, <code>PFNJRD1TLTEtMi0zLTQ+IA==</code>). Because this attribute is multivalued, you can use it on multiple lines to represent each entry in a list of SIDs.</p>

Sample LDIF Configuration File Desktop Pool Entries

The following example is an excerpt from an LDIF configuration file. It shows sample entries for a desktop pool named Pool1, which contains two virtual desktops named VM1 and VM2. The desktop pool entry is paired with the Desktop Application entry, which is also named Pool1.

```
#
# Virtual Desktop VM entry VM1
#
DN: CN=vm1,OU=Servers,DC=vdi,DC=vmware,DC=int
```

```

changetype: add
objectClass: top
objectClass: pae-Server
objectClass: pae-WinServer
objectClass: pae-ThinWinServer
objectClass: pae-VM
cn: vm1
description: sample virtual desktop entry
pae-VmSuspended:: IA==
pae-OptIgnoreProcessList: 0
pae-MOID: vm-1
pae-VmState: READY
pae-ServerManaged: 1
pae-SSOEnabled: 1
pae-DisplayName: virtual desktop 1
pae-TunneledConnection: 1
pae-pwdEncryption: KERB5
ipHostNumber: vm1
pae-ClientProtVersion: 1
pae-WinDomain: NULL
pae-thinProto: XP_RDP
pae-Services: SESSION |, HEARTBEAT |, EVENTS |, USED |
pae-VmPath: /New Datacenter/vm/vm-1
pae-OptSuspendTimeout: 0
pae-OptDisconnectLimitTimeout: 0
pae-OptMaximumSessions: 0
pae-Disabled: 0

#
# Virtual Desktop VM entry VM2
#
DN: CN=vm2,OU=Servers,DC=vdi,DC=vmware,DC=int
changetype: add
objectClass: top
objectClass: pae-Server
objectClass: pae-WinServer
objectClass: pae-ThinWinServer
objectClass: pae-VM
cn: vm2
description: sample virtual desktop entry
pae-VmSuspended:: IA==
pae-OptIgnoreProcessList: 0
pae-MOID: vm-2
pae-VmState: READY
pae-ServerManaged: 1
pae-SSOEnabled: 1
pae-DisplayName: virtual desktop 2
pae-TunneledConnection: 1
pae-pwdEncryption: KERB5
ipHostNumber: vm2
pae-ClientProtVersion: 1
pae-WinDomain: NULL
pae-thinProto: XP_RDP
pae-Services: SESSION |, HEARTBEAT |, EVENTS |, USED |
pae-VmPath: /New Datacenter/vm/vm-2

```

```

pae-OptSuspendTimeout: 0
pae-OptDisconnectLimitTimeout: 0
pae-OptMaximumSessions: 0
pae-Disabled: 0
#
# Further Virtual Desktop VM entries as required
#
#
# VM Pool entry Pool1
#
DN: CN=Pool1,OU=Server Groups,DC=vdi,DC=vmware,DC=int
changetype: add
objectClass: top
objectClass: pae-ServerPool
cn: Pool1
pae-VC DN: CN=b180b93b-2dd3-4b58-8a81-b8534a4b7565,OU=VirtualCenter,OU=Properties,DC=vdi,
DC=vmware,DC=int
pae-MemberDN: CN=vm1,OU=Servers,DC=vdi,DC=vmware,DC=int
pae-MemberDN: CN=vm2,OU=Servers,DC=vdi,DC=vmware,DC=int
pae-VmPowerPolicy: remainon
pae-VmProvEnabled: 1
pae-VmProvSuspendOnError: 1
pae-VmStartClone: 1
pae-VmPoolCalculatedValues: 1
pae-ServerPoolType: 0
pae-VmMinimumCount: 0
pae-VmHeadroomCount: 0
pae-VmMaximumCount: 0
pae-Disabled: 0

#
# Desktop Application entry Pool1 -- one entry is required for each VM Pool
#
DN: CN=Pool1,OU=Applications,DC=vdi,DC=vmware,DC=int
changetype: add
objectClass: top
objectClass: pae-Entity
objectClass: pae-App
objectClass: pae-WinApp
objectClass: pae-ThinWinApp
objectClass: pae-DesktopApplication
cn: Pool1
member:: PFNJRD1LTETMi0zLTQ+IA==
pae-Icon: /thinapp/icons/desktop.gif
pae-URL: \
pae-Servers: CN=Pool1,OU=Server Groups,DC=vdi,DC=vmware,DC=int
pae-ServerProtocolLevel: OSX_NETOP
pae-ServerProtocolLevel: OS2_NETOP
pae-ServerProtocolLevel: NT4_NETOP
pae-ServerProtocolLevel: WIN2K_NETOP
pae-ServerProtocolLevel: NT4_RDP
pae-ServerProtocolLevel: WIN2K_RDP
pae-ServerProtocolLevel: XP_RDP
pae-Disabled: 0

```

Use the vdmimport Command to Import LDAP Configuration Data

In View 4.5 and later releases, you can use the `vdmimport` command to import configuration data from an LDIF configuration file into a standard or replica Horizon Connection Server instance.

By default, the `vdmimport` command-line utility is installed in the `C:\Program Files\VMware\VMware View\Server\tools\bin` directory.

Prerequisites

- Verify that you have View 4.5 or later. If you have an earlier release, see [Use the LDIFDE Command to Import LDAP Configuration Data](#).
- Export LDAP configuration data to an LDIF configuration file. See [Export LDAP Configuration Data](#).

Procedure

- 1 Log in to a Connection Server instance as a user in the Administrators role.

You must be logged in as a user in the Administrators role to import configuration data into the View configuration repository.

- 2 At the command prompt, type the `vdmimport` command and use the `-f` option to specify the LDIF configuration file to import.

For example: `vdmimport -f myexport.LDF`

After the `vdmimport` command runs, the configuration of your Connection Server instance is updated with the data from the file, and the number of records that have been successfully updated is displayed. Errors are displayed if some records could not be updated because your role has insufficient privileges.

Use the LDIFDE Command to Import LDAP Configuration Data

You can use the Microsoft LDIFDE command to import configuration data from an LDIF configuration file into a standard or replica Horizon Connection Server instance.

In releases earlier than View 4.5, you must use the Microsoft LDIFDE command to import configuration data from an LDIF configuration file. The `vdmimport` command is not supported in releases earlier than View 4.5.

If you have View 4.5 or later, use the `vdmimport` command rather than the LDIFDE command. The `vdmimport` command does not display the large number of error messages that are produced by running the LDIFDE command. For more information, see [Use the vdmimport Command to Import LDAP Configuration Data](#).

Because the LDIFDE command does not update, create, or delete any LDAP records that are not defined in the LDIF configuration file, it enables you to customize an LDIF configuration file so that only selected records are affected when you import the file. For complete information about using the LDIFDE command, go to <http://support.microsoft.com/kb/237677>.

Prerequisites

Export LDAP configuration data to an LDIF configuration file. See [Export LDAP Configuration Data](#).

Procedure

- 1 Log in to a Connection server instance.

Option	Action
View 3.1 or earlier	Log in as an administrator and be a member of the Local Administrators user group.
View 4.5 or later	Log in as a user in the Administrators role. Note You must be logged in as a user in the Administrators role to import configuration data into the Horizon configuration repository.

- 2 At the command prompt, type the LDIFDE command and use the `-f` option to specify an existing LDIF configuration file.

For example: `LDIFDE -i -f myexport.LDF -s 127.0.0.1 -z`

After the LDIFDE command runs, the configuration of your Connection Server instance is updated with the data from the file, and the number of records that are successfully updated is displayed.

Error messages appear whenever an existing entry in the repository is overwritten. You can ignore these error messages. Error messages also appear if a record cannot be updated because your role has insufficient privileges.

Examining PCoIP Session Statistics with WMI

5

You can use Windows Management Instrumentation (WMI) to examine performance statistics for a PCoIP session by using any of the supported programming interfaces, including C#, C++, PowerShell, VBScript, VB .NET, and Windows Management Instrumentation Command-line (WMIC).

You can also use the Microsoft WMI Code Creator tool to generate VBScript, C#, and VB .NET code that accesses the PCoIP performance counters. For more information about WMI, WMIC, and the WMI Code Creator tool, go to <http://technet.microsoft.com/en-us/library/bb742610.aspx> and [http://www.microsoft.com/downloads/en/details.aspx?familyid=2cc30a64-ea15-4661-8da4-55bbc145c30e&dis](http://www.microsoft.com/downloads/en/details.aspx?familyid=2cc30a64-ea15-4661-8da4-55bbc145c30e&displaylang=en) playlang=en.

This chapter includes the following topics:

- [Using PCoIP Session Statistics](#)
- [General PCoIP Session Statistics](#)
- [PCoIP Audio Statistics](#)
- [PCoIP Imaging Statistics](#)
- [PCoIP Network Statistics](#)
- [PCoIP USB Statistics](#)
- [Examples of Using PowerShell cmdlets to Examine PCoIP Statistics](#)

Using PCoIP Session Statistics

The WMI namespace for the PCoIP session statistics is `root\CIMV2`. The names of the statistics are suffixed with (Server) or (Client), according to whether the statistic is recorded on the PCoIP server or PCoIP client.

You can use Windows Performance Monitor (PerfMon) with the counters to calculate averages over a specified sampling period. You must have administrator privileges to access the performance counters remotely.

All statistics are reset to 0 when a PCoIP session is closed. If the WMI `SessionDurationSeconds` property is a non-zero value and stays constant, the PCoIP server was forcefully ended or crashed. If the `SessionDurationSeconds` property changes from a non-zero value to 0, the PCoIP session is closed.

To avoid a division-by-zero error, verify that the denominator in the expressions for calculating bandwidth or packet-loss percentage does not evaluate to zero.

USB statistics are recorded for zero clients, but not for thin clients or software clients.

General PCoIP Session Statistics

The WMI class name for PCoIP general session statistics is `Win32_PerfRawData_TeradiciPerf_PCoIPSessionGeneralStatistics`.

Table 5-1. General Session Statistics

WMI Property Name	Description
BytesReceived	Total number of bytes of PCoIP data that have been received since the PCoIP session started.
BytesSent	Total number of bytes of PCoIP data that have been transmitted since the PCoIP session started.
PacketsReceived	Total number of packets that have been received successfully since the PCoIP session started. Not all packets are the same size.
PacketsSent	Total number of packets that have been transmitted since the PCoIP session started. Not all packets are the same size.
RXPacketsLost	Total number of received packets that have been lost since the PCoIP session started.
SessionDurationSeconds	Total number of seconds that the PCoIP Session has been open.
TXPacketsLost	Total number of transmitted packets that have been lost since the PCoIP session started.

Calculating Bandwidth for Received PCoIP Data

To calculate the bandwidth in kilobits per second for received PCoIP data over the time interval from time t_1 to time t_2 , use the following formula.

$$(\text{BytesReceived}[t_2] - \text{BytesReceived}[t_1]) * 8 / (1024 * (t_2 - t_1))$$

Calculating Bandwidth for Transmitted PCoIP Data

To calculate the bandwidth in kilobits per second for transmitted PCoIP data over the time interval from time t_1 to time t_2 , use the following formula.

$$(\text{BytesSent}[t_2] - \text{BytesSent}[t_1]) * 8 / (1024 * (t_2 - t_1))$$

Calculating Packet Loss for Received PCoIP Data

To calculate the percentage of received packets that are lost, use the following formula.

$$100 / (1 + ((\text{PacketsReceived}[t_2] - \text{PacketsReceived}[t_1]) / (\text{RXPacketsLost}[t_2] - \text{RXPacketsLost}[t_1])))$$

Calculating Packet Loss for Transmitted PCoIP Data

To calculate the percentage of transmitted packets that are lost, use the following formula.

$$100 * (TXPacketsLost[t2] - TXPacketsLost[t1]) / (PacketsSent[t2] - PacketsSent[t1])$$

PCoIP Audio Statistics

The WMI class name for PCoIP audio statistics is
Win32_PerfRawData_TeradiciPerf_PCoIPSessionAudioStatistics.

Note Audio statistics do not include audio data that is carried within USB data.

Table 5-2. PCoIP Audio Statistics

WMI Property Name	Description
AudioBytesReceived	Total number of bytes of audio data that have been received since the PCoIP session started.
AudioBytesSent	Total number of bytes of audio data that have been sent since the PCoIP session started.
AudioRXBkbitPersec	Bandwidth for ingoing audio packets averaged over the sampling period, in seconds.
AudioTXBkbitPersec	Bandwidth for outgoing audio packets averaged over the sampling period, in seconds.
AudioTXBWLimitkbitPersec	Transmission bandwidth limit in kilobits per second for outgoing audio packets. The limit is defined by a GPO setting.

Calculating Bandwidth for Received Audio Data

To calculate the bandwidth in kilobits per second for received audio data over the time interval from time t1 to time t2, use the following formula.

$$(\text{AudioBytesReceived}[t2] - \text{AudioBytesReceived}[t1]) * 8 / (1024 * (t2 - t1))$$

Do not use AudioRXBkbitPersec for this calculation.

Calculating Bandwidth for Transmitted Audio Data

To calculate the bandwidth in kilobits per second for transmitted audio data over the time interval from time t1 to time t2, use the following formula.

$$(\text{AudioBytesSent}[t2] - \text{AudioBytesSent}[t1]) * 8 / (1024 * (t2 - t1))$$

Do not use AudioTXBkbitPersec for this calculation.

PCoIP Imaging Statistics

The WMI class name for PCoIP imaging statistics is
Win32_PerfRawData_TeradiciPerf_PCoIPSessionImagingStatistics.

Table 5-3. PCoIP Imaging Statistics

WMI Property Name	Description
ImagingBytesReceived	Total number of bytes of imaging data that have been received since the PCoIP session started.
ImagingBytesSent	Total number of bytes of imaging data that have been transmitted since the PCoIP session started.
ImagingDecoderCapabilitykbitPersec	Estimated processing capability of the imaging decoder in kilobits per second. This statistic is updated once per second.
ImagingEncodedFramesPersec	Number of imaging frames that were encoded over a one-second sampling period.
ImagingActiveMinimumQuality	Lowest encoded quality value on a scale from 0 to 100. This statistic is updated once per second. This counter does not correspond to the GPO setting for minimum quality.
ImagingRXBkbitPersec	Bandwidth for incoming imaging packets averaged over the sampling period, in seconds.
ImagingTXBkbitPersec	Bandwidth for outgoing imaging packets averaged over the sampling period, in seconds.

Calculating Bandwidth for Received Imaging Data

To calculate the bandwidth in kilobits per second for received imaging data over the time interval from time t_1 to time t_2 , use the following formula.

$$(\text{ImagingBytesReceived}[t_2] - \text{ImagingBytesReceived}[t_1]) * 8 / (1024 * (t_2 - t_1))$$

Do not use ImagingRXBkbitPersec for the calculation.

Calculating Bandwidth for Transmitted Imaging Data

To calculate the bandwidth in kilobits per second for transmitted imaging data over the time interval from time t_1 to time t_2 , use the following formula.

$$(\text{ImagingBytesSent}[t_2] - \text{ImagingBytesSent}[t_1]) * 8 / (1024 * (t_2 - t_1))$$

Do not use ImagingTXBkbitPersec for the calculation.

PCoIP Network Statistics

The WMI class name for PCoIP network statistics is
Win32_PerfRawData_TeradiciPerf_PCoIPSessionNetworkStatistics.

Table 5-4. PCoIP Network Statistics

WMI Property Name	Description
RoundTripLatencys	Round trip latency in milliseconds between the PCoIP server and the PCoIP client.
RXBWkbitPersec	Overall bandwidth for incoming PCoIP packets averaged over the sampling period, in seconds.
RXBWPeakkbitPersec	Peak bandwidth in kilobits per second for incoming PCoIP packets over a one-second sampling period.
RXPacketLossPercent	Percentage of received packets lost during a sampling period.
TXBWkbitPersec	Overall bandwidth for outgoing PCoIP packets averaged over the sampling period, in seconds.
TXBWActiveLimitkbitPersec	Estimated available network bandwidth in kilobits per second. This statistic is updated once per second.
TXBWLimitkbitPersec	<p>Transmission bandwidth limit in kilobits per second for outgoing packets. The limit is the minimum of the following values.</p> <ul style="list-style-type: none"> ■ GPO bandwidth limit for the PCoIP client ■ GPO bandwidth limit for the PCoIP server ■ Bandwidth limit for the local network connection ■ Negotiated bandwidth limit for the Zero Client firmware based on encryption limits
TXPacketLossPercent	Percentage of transmitted packets lost during a sampling period.

Calculating Bandwidth for Received Network Data

To calculate the bandwidth in kilobits per second for received data over the time interval from time t_1 to time t_2 , use the following formula.

$$(\text{BytesReceived}[t_2] - \text{BytesReceived}[t_1]) * 8 / (1024 * (t_2 - t_1))$$

Do not use RXBWkbitPersec for the calculation.

Calculating Bandwidth for Transmitted Network Data

To calculate the bandwidth in kilobits per second for transmitted data over the time interval from time t_1 to time t_2 , use the following formula.

$$(\text{BytesSent}[t_2] - \text{BytesSent}[t_1]) * 8 / (1024 * (t_2 - t_1))$$

Do not use TXBWkbitPersec for the calculation.

Calculating Packet Loss for Received Network Data

To calculate the packet loss in percentage for received data over the time interval from time t_1 to time t_2 , use the following formula.

```
PacketsReceived during interval = (PacketsReceived[t2]-PacketsReceived[t1])

RXPacketsLost during interval = (RXPacketsLost[t2]-RXPacketsLost[t1])

RXPacketsLost % = RXPacketsLost during interval /
(RXPacketsLost during interval + PacketsReceived during interval) * 100
```

Do not use RXPacketsLostPercent or RXPacketsLostPercent_Base for the calculation.

Calculating Packet Loss for Transmitted Network Data

To calculate the packet loss in percentage for transmitted data over the time interval from time t_1 to time t_2 , use the following formula.

```
PacketsSent during interval = (PacketsSent[t2]-PacketsSent[t1])

TXPacketsLost during interval = (TXPacketsLost[t2]-TXPacketsLost[t1])

TXPacketsLost % = TXPacketsLost during interval /
(TXPacketsLost during interval + PacketsSent during interval) * 100
```

Do not use TXPacketsLostPercent or TXPacketsLostPercent_Base for the calculation.

Use this formula to prevent the packet loss percent from becoming greater than 100 percent. This calculation is required because PacketsLost and PacketsSent are asynchronous.

PCoIP USB Statistics

The WMI class name for PCoIP USB statistics is Win32_PerfRawData_TeradiciPerf_PCoIPSessionUSBStatistics.

Table 5-5. PCoIP USB Statistics

WMI Property Name	Description
USBBytesReceived	Total number of bytes of USB data that have been received since the PCoIP session started.
USBBytesSent	Total number of bytes of USB data that have been transmitted since the PCoIP session started.
USBRXBWkbitPersec	Bandwidth for incoming USB packets averaged over the sampling period, in seconds.
USBTXBWkbitPersec	Bandwidth for outgoing USB packets averaged over the sampling period, in seconds.

Calculating Bandwidth for Received USB Data

To calculate the bandwidth in kilobits per second for received USB data over the time interval from time t_1 to time t_2 , use the following formula.

$$(\text{USBBytesReceived}[t_2] - \text{USBBytesReceived}[t_1]) * 8 / (1024 * (t_2 - t_1))$$

Do not use `USBRXBWkbitPersec` for the calculation.

Calculating Bandwidth for Transmitted USB Data

To calculate the bandwidth in kilobits per second for transmitted USB data over the time interval from time t_1 to time t_2 , use the following formula.

$$(\text{USBBytesSent}[t_2] - \text{USBBytesSent}[t_1]) * 8 / (1024 * (t_2 - t_1))$$

Do not use `USBTXBWkbitPersec` for the calculation.

Examples of Using PowerShell cmdlets to Examine PCoIP Statistics

You can use PowerShell cmdlets to examine PCoIP statistics.

In the following example, the `Get-WmiObject` cmdlet retrieves the PCoIP network statistics for the client `cm-02`.

```
Get-WmiObject -namespace "root\cimv2" -computername cm-02 -class
Win32_PerfRawData_TeradiciPerf_PCoIPSessionNetworkStatistics
```

In the following example, the `Get-WmiObject` cmdlet retrieves the PCoIP general session statistics for desktop `dt-03` if any transmitted packets have been lost.

```
Get-WmiObject -namespace "root\cimv2" -computername desktop-03 -query "select * from
Win32_PerfRawData_TeradiciPerf_PCoIPSessionGeneralStatistics where TXPacketsLost > 0"
```

Setting Desktop Policies with Start Session Scripts

6

With start session scripts, you can configure specific Horizon 7 desktop settings before a desktop session starts based on information received from Horizon Client and Horizon Connection Server.

For example, you can use a start session script to configure desktop policies based on client device and user location instead of setting up multiple desktop pools that have different desktop policies. A start session script can enable mapped drives, clipboard redirection, and other desktop features for a user who has an IP address in your organization's internal domain, but disallow these features for a user who has an IP address in an external domain.

This chapter includes the following topics:

- [Obtaining Input Data for a Start Session Script](#)
- [Best Practices for Using Start Session Scripts](#)
- [Preparing a Horizon 7 Desktop to Use a Start Session Script](#)
- [Sample Start Session Scripts](#)

Obtaining Input Data for a Start Session Script

Start session scripts cannot run interactively. A start session script runs in an environment created by Horizon 7 and must obtain its input data from that environment.

Start session scripts gather input data from environment variables on the client computer. Start session environment variables have the prefix `VDM_StartSession_`. For example, the start session environment variable that contains the client system's IP address is `VDM_StartSession_IP_Address`. You must ensure that a start session script validates the existence of any environment variable that it uses.

For a list of variables similar to start session environment variables, see "Client System Information Sent to Remote Desktops" in the *Configuring Remote Desktop Features in Horizon 7* document.

Best Practices for Using Start Session Scripts

Follow these best practices when using start session scripts.

When to Use Start Session Scripts

Use start session scripts only if you need to configure desktop policies before a session starts.

As a best practice, use the Horizon Agent `CommandsToRunOnConnect` and `CommandsToRunOnReconnect` group policy settings to run command scripts after a desktop session is connected or reconnected. Running scripts within a desktop session, rather than using start session scripts, satisfies most use cases.

For more information, see “Running Commands on Horizon Desktops” in the *Configuring Remote Desktop Features in Horizon 7* document.

Managing Start Session Timeouts

Make sure your start session scripts run quickly.

If you set the `WaitScriptsOnStartSession` value in the Windows registry, your start session script must finish running before Horizon Agent can respond to the `StartSession` message that Horizon Connection Server sends. A long-running script is likely to cause the `StartSession` request to time out.

If a timeout occurs and the pool uses floating assignments, Connection Server tries to connect the user to another virtual machine. If a timeout occurs and no virtual machine is available, Connection Server rejects the user's connection request.

As a best practice, set a hard timeout for the script host operation so that a specific error can be returned if a script runs too long.

Making Start Session Scripts Accessible

The path where you configure your start session scripts must be accessible only to the SYSTEM account and to local administrators. Set the ACL for the base key to be accessible to these accounts only.

As a best practice, place start session scripts in the `View_Agent_install_path\scripts` directory, for example:

```
%ProgramFiles%\VMware\VMware View\Agent\scripts\sample.vbs
```

By default, this directory is accessible only by the SYSTEM and administrator accounts.

Preparing a Horizon 7 Desktop to Use a Start Session Script

To prepare a Horizon 7 desktop to use a start session script, you must enable the VMware View Script Host service and add entries in the Windows registry.

You must configure all Horizon 7 desktops that need to run start session scripts. Horizon 7 does not provide a mechanism to propagate registry changes, VMware View Script Host service configuration changes, and start session scripts to multiple Horizon 7 desktop virtual machines.

Enable the VMware View Script Host Service

You must enable the VMware View Script Host service on each Horizon 7 desktop virtual machine where you want Horizon 7 to run a start session script. The VMware View Script Host service is disabled by default.

When you configure the VMware View Script Host service, you can optionally specify the user account under which the start session script runs. Start session scripts run in the context of the VMware View Script Host service. By default, the VMware View Host Script service is configured to run as the SYSTEM user.

Important Start session scripts are run outside a desktop user session and not by the desktop user account. Information is sent directly from the client computer within a script running as the SYSTEM user.

Procedure

- 1 Log in to the Horizon 7 desktop virtual machine.
- 2 At the command prompt, type `services.msc` to start the Windows Services tool.
- 3 In the details pane, right-click the VMware View Script Host service entry and select **Properties**.
- 4 On the **General** tab, select **Automatic** from the **Startup type** drop-down menu.
- 5 (Optional) If you do not want the local System account to run the start session script, select the **Log On** tab, select **This account**, and type the user name and password of the account to run the start session script.
- 6 Click **OK** and exit the Windows Services tool.

Add Windows Registry Entries for a Start Session Script

You must add Windows registry entries on each Horizon desktop virtual machine where you want Horizon to run a start session script.

Prerequisites

- Verify that the path where you configured your start session scripts is accessible only to the SYSTEM account and local administrators. For more information, see [Making Start Session Scripts Accessible](#).
- Make sure your start session scripts run quickly. If you set the `WaitScriptsOnStartSession` value in the Windows registry, your start session script must finish running before Horizon Agent can respond to the `StartSession` message that Horizon Connection Server sends. For more information, see [Managing Start Session Timeouts](#).

Procedure

- 1 Log in to the Horizon desktop virtual machine.
- 2 At the command prompt, type `regedit` to start the Windows Registry Editor.
- 3 In the registry, navigate to `HKLM\SOFTWARE\VMware, Inc.\VMware VDM\ScriptEvents`.

4 Add the path to the start session script to the registry.

- a In the navigation area, right-click ScriptEvents, select **New > Key**, and create a key named StartSession.
- b In the navigation area, right-click StartSession, select **New > String Value**, and create a string value that identifies the start session script to run, for example, SampleScript.

To run more than one start session script, create a string value entry for each script under the StartSession key. You cannot specify the order in which these scripts run. If the scripts must run in a particular order, invoke them from a single control script.

- c In the topic area, right-click the entry for the new string value and select **Modify**.
- d In the **Value data** text box, type the command line that invokes the start session script and click **OK**.

Type the full path of the start session script and any files that it requires.

5 Add and enable a start session value in the registry.

- a Navigate to HKLM\SOFTWARE\VMware, Inc.\VMware VDM\Agent\Configuration.
- b (Optional) If the Configuration key does not exist, right-click **Agent**, select **New > Key**, and create the key.
- c In the navigation area, right-click Configuration, select **New > DWORD (32 bit) Value**, and type RunScriptsOnStartSession.
- d In the topic area, right-click the entry for the new DWORD value and select **Modify**.
- e In the **Value data** text box, type 1 to enable start session scripting and click **OK**.

You can type 0 to disable this feature. The default value is 0.

- f (Optional) To delay the StartSession response by Horizon Agent, add a second DWORD value to the Configuration key called WaitScriptsOnStartSession.

A WaitScriptsOnStartSession data value of 1 causes Horizon Agent to delay sending a StartSession response and fail if the scripts do not complete. A value of 0 means that Horizon Agent does not wait for the scripts to complete or check script exit codes before sending the StartSession response. The default value is 0.

6 Set a registry value to specify timeout values in seconds rather than minutes to prevent scripts from timing out.

Setting this timeout value in seconds enables you to configure the VMware View Script Host service timeout value in seconds. For example, if you set the VMware View Script Host service timeout to 30 seconds, you can ensure that a start session script either finishes running or times out before a Connection Server timeout occurs.

- a Navigate to HKLM\SOFTWARE\VMware, Inc.\VMware VDM\ScriptEvents.
- b Add a DWORD value called TimeoutsInMinutes.
- c Set a data value of 0.

7 (Optional) To enable the VMware View Script Host service to time out the start session script, set a timeout value.

- a Navigate to HKLM\SOFTWARE\VMware, Inc.\VMware VDM\ScriptEvents\StartSession.
- b In the topic area, right-click the Default (@) key and select **Modify**.
- c In the **Value data** text box, type the timeout value and click **OK**.

A value of 0 means that no timeout is set.

8 Exit the Registry Editor and restart the system.

Sample Start Session Scripts

These sample start session scripts illustrate how to write environment variables to a file, test the timeout functionality, and test a non-zero exit code.

The following sample Visual Basic script writes all the environment variables provided to the script into a file. You can use this sample script to see example data in your own environment. You might save this script as C:\sample.vbs.

```
Option Explicit
Dim WshShell, FSO, outFile, strOutputFile, objUserEnv, strEnv

strOutputFile = "c:\setvars.txt"

Set FSO = CreateObject("Scripting.FileSystemObject")
Set outFile = FSO.CreateTextFile(strOutputFile, TRUE)
outFile.WriteLine("Script was called at (" & Now & ")")

Set WshShell = CreateObject("WScript.Shell")
Set objUserEnv = WshShell.Environment("PROCESS")
For Each strEnv In objUserEnv
    outFile.WriteLine(strEnv)
Next

outFile.Close
```

The following sample script tests the timeout functionality.

```
Option Explicit
WScript.Sleep 60000
```

The following sample script tests a non-zero exit code.

```
Option Explicit
WScript.Quit 2
```

Using the Horizon PowerCLI Module

7

The Horizon PowerCLI Module includes Horizon PowerCLI cmdlets that you can use to perform various administration tasks on Horizon components. You can use Horizon PowerCLI with API specifications to create community-based open-source scripts.

You can install the Horizon PowerCLI module when you install VMware PowerCLI.

For more information about Horizon PowerCLI cmdlets, read the *VMware PowerCLI Cmdlets Reference* document available at <https://code.vmware.com/docs/6978/cmdlet-reference>.

For information on the API specifications to create advanced functions and scripts to use with Horizon PowerCLI, see the View API Reference at <https://code.vmware.com/apis/405/view>.

For more information on sample scripts that you can use to create your own Horizon PowerCLI scripts, visit the PowerCLI community at <https://github.com/vmware/PowerCLI-Example-Scripts>.

This chapter includes the following topics:

- [Set Up the Horizon PowerCLI Module](#)
- [Run Example Horizon PowerCLI Scripts](#)

Set Up the Horizon PowerCLI Module

You can setup the Horizon PowerCLI module with VMware PowerCLI and use the Horizon PowerCLI cmdlets to connect or disconnect from Connection Server. After you connect to the Connection Server, you can write PowerShell scripts that invoke the Horizon APIs.

Procedure

- 1 Install VMware PowerCLI.

Install VMware PowerCLI from the PowerShell Gallery. To install VMware PowerCLI, run the following command in the Windows PowerShell prompt:

```
Install-Module -Name VMware.PowerCLI
```

This command installs all the VMware PowerCLI modules into Windows PowerShell. The `VMware.VimAutomation.HorizonView` module is the Horizon PowerCLI module.

You can also download and install VMware PowerCLI from <https://code.vmware.com/web/dp/tool/vmware-powercli>.

For more information on how to install VMware PowerCLI, see the *VMware PowerCLI User's Guide* available at <https://code.vmware.com/web/dp/tool/vmware-powercli>.

- 2 Import the Horizon PowerCLI module named `VMware.VimAutomation.HorizonView` in the Windows PowerShell session.

Use the following command to import `VMware.VimAutomation.HorizonView` into the Windows PowerShell session:

```
Import-Module -Name VMware.VimAutomation.HorizonView
```

`VMware.VimAutomation.HorizonView` contains the `Connect-HVServer` and `Disconnect-HVServer` cmdlets that you can use to connect to a Connection Server or disconnect from a Connection Server.

- 3 Pull sample scripts from the github repository.

After you use the `Connect-HVServer` cmdlet to connect to the Horizon API service of the Connection Server, you can run PowerShell scripts that invoke the Horizon APIs. For more information about Horizon APIs, see the *View API Reference* documentation available at <https://code.vmware.com/apis/405/view>.

Example scripts for the Horizon PowerCLI module are available as the `VMware.Hv.Helper` module in the Modules section at <https://github.com/vmware/PowerCLI-Example-Scripts>.

What to do next

Use the example scripts directly or modify the scripts to suit your automation needs. Apart from example scripts, you can also develop new scripts that invoke Horizon APIs based on your needs. See, [Run Example Horizon PowerCLI Scripts](#).

Run Example Horizon PowerCLI Scripts

You can use example scripts that invoke Horizon APIs and use these scripts to perform Horizon 7 administrator tasks. You can also modify these scripts to perform administrative tasks based on your requirements.

Prerequisites

- Complete the steps to install VMware PowerCLI and set up the Horizon PowerCLI module. See, [Set Up the Horizon PowerCLI Module](#).

Procedure

- 1 Download the `VMware.Hv.Helper` module from the Modules section at <https://github.com/vmware/PowerCLI-Example-Scripts>.

- 2 Use the `$env:PSModulePath` command to find out the modules path in your Windows PowerShell session and copy the `VMware.Hv.Helper` module to that location.
- 3 Use the following command to load the `VMware.Hv.Helper` module into your Windows PowerShell session and start using the scripts.

```
Get-Module -ListAvailable 'VMware.Hv.Helper' | Import-Module Get-Command -Module  
'VMware.Hv.Helper'
```