HP Vertica Installation Guide

HP HP Vertica

Software Version: 7.00

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Contents

Installation Overview and Checklist

This page provides an overview of installation tasks.

Important Notes

- HP Vertica supports only one running database per cluster.

- HP Vertica supports installation on one, two, or multiple nodes. The steps in Installing HP Vertica are the same, no matter how many nodes are in the cluster.

- Prerequisites listed in Before You Install HP Vertica are required for all HP Vertica configurations.

- Only one instance of HP Vertica can be running on a host at any time.

- To run the `install_vertica` script, you must be logged in as root, or sudo as a user with all privileges. You must run the script for all installations, including upgrades and single-node installations.

Carefully review and follow the instructions in all sections in this topic.

Installation Scenarios

The four main scenarios for installing HP Vertica on hosts are:

- A single node install, where HP Vertica is installed on a single host as a *localhost* process. This form of install cannot be expanded to more hosts later on and is typically used for development or evaluation purposes.

- Installing to a cluster of physical host hardware. This is the most common scenario when deploying HP Vertica in a testing or production environment.

- Installing on Amazon Web Services (AWS). When you choose the recommended Amazon Machine Image (AMI), Vertica is installed when you create your instances. For more information, see the guide, *Using HP Vertica on Amazon Web Services*.

> **Note:** Follow the instructions and steps in *Using HP Vertica on Amazon Web Services* for an AWS configuration rather than the steps for installation and upgrade that appear in this guide.

- Installing to a local cluster of virtual host hardware. Also similar to installing on physical hosts, but with network configuration differences.

Before You Install

Before You Install HP Vertica describes how to construct a hardware platform and prepare Linux for HP Vertica installation. These preliminary steps are broken into two categories: Configuring Hardware and Installing Linux and Configuring the Network.

Install or Upgrade HP Vertica

Once you have completed the steps in the Before You Install HP Vertica section, you are ready to run the install script.

Installing HP Vertica describes how to:

- Back up any existing databases.

- Download and install the HP Vertica **RPM** package.

- Install a **cluster** using the `install_vertica` script.

- [Optional] Create a properties file that lets you install HP Vertica silently.

> **Note:** This guide provides additional manual procedures in case you encounter installation problems.

Upgrading HP Vertica to a New Version describes the steps for upgrading to a more recent version of the software.

Upgrading HP Vertica from Community Edition to Enterprise Edition describes the steps for upgrading HP Vertica to an evaluation or Enterprise Edition version of the software.

Post-Installation Tasks

After You Install HP Vertica describes subsequent steps to take after you've run the installation script. Some of the steps can be skipped based on your needs:

- Install the license key

- Verify that kernel and user parameters are correctly set

- Install the vsql client application on non-cluster hosts

- Resolve any SUSE10 issues during spread configuration.

- Use the HP Vertica documentation online, or download and install HP Vertica documentation. Find the online documentation and documentation packages to download at http://www.vertica.com/documentation.

- Install client drivers.

- Extend your installation with HP Vertica packages.

- Install or upgrade the Management Console.

Get started!

- Read the Concepts Guide for a high-level overview of the HP Vertica Analytics Platform.

- Proceed to the Tutorial: Setting up an Example Database in the Getting Started Guide, where you will be guided through setting up a database, loading sample data, and running sample queries.

About HP Vertica-created Linux Users and Their Privileges

When you install HP Vertica, the installation script optionally creates the following Linux user and group:

- dbadmin—Administrative user

- verticadba—Group for DBA users

dbadmin and verticadba are the default names. If you want to change what these Linux accounts are called, you can do so using the installation script. See Installing HP Vertica with the install_ vertica Script for details.

This topic describes the Linux accounts that the installer creates and configures so HP Vertica can run.

Before You Install HP Vertica

The user who runs the HP Vertica installer must have sudo privileges on all cluster nodes. See the following topics for more information:

- Installation Overview and Checklist

- General Hardware and OS Requirements and Recommendations

When You Install HP Vertica

The dbadmin user. The Linux dbadmin user owns the database catalog and data storage on disk. When you run the install script, HP Vertica creates this user on each node in the database cluster, adds dbadmin to the Linux dbadmin and verticadba groups, and configures the account as follows:

- Configures and authorizes dbadmin for passwordless SSH between all cluster nodes. SSH must be installed and configured to allow passwordless logins. See Enable Secure Shell (SSH) Logins.

- Sets the dbadmin user's BASH shell to `/bin/bash`, required to run scripts, such as install_ vertica and the **Administration Tools**.

- Provides read-write-execute permissions on the following directories:

  - `/opt/vertica/*`

  - `/home/dbadmin`, the default directory for database data and catalog files (configurable through the install script)

> **Note:** The HP Vertica installation script also creates an HP Vertica database superuser named dbadmin. They share the same name, but they are not the same; one is a Linux user and the other is an HP Vertica user. See DBADMIN User in the Administrator's Guide for information about the database superuser

After You Install HP Vertica

Root or sudo privileges are not required to start or run HP Vertica after the installation process completes.

The dbadmin user can log in and perform HP Vertica tasks, such as creating a database, installing/changing the license key, or installing drivers. If dbadmin wants database directories in a location that differs from the default, the root user (or a user with sudo privileges) must create the requested directories and change ownership to the dbadmin user.

HP Vertica prevents administration from users other than the dbadmin user (or the user name you specified during the installation process if not dbadmin). Only this user can run the Administration Tools.

See Also

- Installation Overview and Checklist

- Before You Install HP Vertica

- Platform Requirements and Recommendations

- Enable Secure Shell (SSH) Logins

Before You Install HP Vertica

Complete all of the tasks in this section before you install HP Vertica. When you have completed this section, proceed to Installing HP Vertica.

Platform Requirements and Recommendations

You must verify that your servers meet the platform requirements described in Supported Platforms. The Supported Platforms topis detail supported versions for the following:

- OS for Server and Management Console (MC)

- Supported Browsers for MC

- HP Vertica driver compatibility

- R

- Hadoop

- Various plug-ins

BASH Shell

All shell scripts included in HP Vertica must run under the BASH shell. If you are on a Debian system, then the default shell can be DASH. DASH is not supported. Change the shell for root and for the dbadmin user to BASH with the chsh command. Validation Scripts For example:

```
# getent passwd | grep root
root:x:0:0:root:/root:/bin/dash

# chsh
Changing shell for root.
New shell [/bin/dash]: /bin/bash
Shell changed.
```

Then, as root, change the symbolic link for /bin/sh from /bin/dash to /bin/bash:

```
# rm /bin/sh
# ls -l /bin/bash /bin/sh
```

Log out and back in for the change to take effect.

Install the Latest Vendor Specific System Software

Install the latest vendor drivers for your hardware. For HP Servers, update to the latest versions for:

- HP ProLiant Smart Array Controller Driver (cciss)

- Smart Array Controller Firmware

- HP Array Configuration Utility (HP ACU CLI)

Data Storage Recommendations

- All internal drives connect to a single RAID controller.

- The RAID array should form one hardware RAID device as a contiguous /data volume.

Validation Utilities

HP Vertica provides several validation utilities that validate the performance on prospective hosts. The utilities are installed when you install the HP Vertica RPM, but you can use them before you run the `install_vertica` script. See Validation Scripts for more details on running the utilities and verifying that your hosts meet the recommended requirements.

General Hardware and OS Requirements and Recommendations

Hardware Recommendations

The HP Vertica Analytic Database is based on a massively parallel processing (MPP), shared-nothing architecture, in which the query processing workload is divided among all nodes of the Vertica database. HP highly recommends using a homogeneous hardware configuration for your HP Vertica cluster; that is, each node of the cluster should be similar in CPU, clock speed, number of cores, memory, and operating system version.

Note that HP has not tested HP Vertica on clusters made up of nodes with disparate hardware specifications. While it is expected that an HP Vertica database would functionally work in a mixed hardware configuration, performance will most certainly be limited to that of the slowest node in the cluster.

Detailed hardware recommendations are available in the HP Vertica Hardware Planning Guide.

Platform OS Requirements

Important! Deploy HP Vertica as the only active process on each host—other than Linux processes or software explicitly approved by HP Vertica. HP Vertica cannot be collocated with other software. Remove or disable all non-essential applications from cluster hosts.

You must verify that your servers meet the platform requirements described in **Supported Platforms: Server and Management Console**.

Verify Sudo

HP Vertica uses the sudo command during installation and some administrative tasks. Ensure that sudo is available on all hosts with the following command:

```
# which sudo
```

```
/usr/bin/sudo
```

If sudo is not installed, browse to the Sudo Main Page and install sudo on all hosts.

When you use sudo to install HP Vertica, the user that performs the installation must have privileges on all nodes in the cluster.

Configuring sudo with privileges for the individual commands can be a tedious and error-prone process; thus, the HP Vertica documentation does not include every possible sudo command that you can include in the sudoers file. Instead, HP recommends that you temporarily elevate the sudo user to have all privileges for the duration of the install.

Note: See the sudoers and visudo man pages for the details on how to write/modify a sudoers file.

To allow root sudo access on all commands as any user on any machine, use visudo as root to edit the /etc/sudoers file and add this line:

```
## Allow root to run any commands anywhere
root    ALL=(ALL) ALL
```

After the installation completes, remove (or reset) sudo privileges to the pre-installation settings.

Prepare Disk Storage Locations

You must create and specify directories in which to store your catalog and data files (**physical schema**). You can specify these locations when you install or configure the database, or later during database operations.

The directory you specify for your catalog files (the catalog path) is used across all nodes. That is, if you specify /home/catalog for your catalog files, HP Vertica will use /home/catalog as the catalog path on all nodes. The catalog directory should always be separate from any data files.

> **Note:** : Do not use a shared directory for more than one node. Data and catalog directories must be distinct for each node. Multiple nodes must not be allowed to write to the same data or catalog directory.

The same is true for your data path. If you specify that your data should be stored in /home/data, HP Vertica ensures this is the data path used on all database nodes.

Do not use a single directory to contain both catalog and data files. You can store the catalog and data directories on different drives, which can be either on drives local to the host (recommended for the catalog directory) or on a shared storage location, such as an external disk enclosure or a **SAN**.

Both the catalog and data directories must be owned by the **database administrator**.

Before you specify a catalog or data path, be sure the parent directory exists on all nodes of your database. The database creation process in admintools creates the actual directories, but the parent directory must exist on all nodes.

You do not need to specify a disk storage location during installation. However, you can by using the `--data-dir` parameter to the `install_vertica` script. See Specifying Disk Storage Location During Installation

See Also

- Specifying Disk Storage Location on MC

- Specifying Disk Storage Location During Database Creation

- Configuring Disk Usage to Optimize Performance

- Using Shared Storage With

Disk Space Requirements for HP Vertica

In addition to actual data stored in the database, HP Vertica requires disk space for several data reorganization operations, such as **mergeout** and managing nodes in the cluster. For best results, HP recommends that disk utilization per node be no more than sixty percent (60%) for a **K-Safe=1** database to allow such operations to proceed.

In addition, disk space is temporarily required by certain query execution operators, such as hash joins and sorts, in the case when theycannot be completed in memory (RAM). Such operators might be encountered during queries, recovery, refreshing projections, and so on. The amount of disk space needed (known as **temp space**) depends on the nature of the queries, amount of data on the node and number of concurrent users on the system. By default, any unused disk space on the data disk can be used as temp space. However, HP recommends provisioning temp space separate from data disk space. See Configuring Disk Usage to Optimize Performance.

Configuring the Network

This group of steps involve configuring the network. These steps differ depending on your installation scenario. A single node installation requires little network configuration, since the single instance of the HP Vertica server does not need to communication with other nodes in a cluster. For cluster and cloud install scenarios, you must make several decisions regarding your configuration.

HP Vertica supports server configuration with multiple network interfaces. For example, you might want to use one as a private network interface for internal communication among cluster hosts (the ones supplied via the `--hosts` option to `install_vertica`) and a separate one for client connections.

> **Important:** HP Vertica performs best when all nodes are on the same subnet and have the same broadcast address for one or more interfaces. A cluster that has nodes on more than one subnet can experience lower performance due to the network latency associated with a multi-subnet system at high network utilization levels.

Important Notes

- Network configuration is exactly the same for single nodes as for multi-node clusters, with one special exception. If you install HP Vertica on a single host machine that is to remain a permanent single-node configuration (such as for development or Proof of Concept), you can install HP Vertica using `localhost` or the loopback IP (typically 127.0.0.1) as the value for `--hosts`. Do not use the hostname `localhost` in a node definition if you are likely to add nodes to the configuration later.

- If you are using a host with multiple network interfaces, configure HP Vertica to use the address which is assigned to the NIC that is connected to the other cluster hosts.

- Use a dedicated gigabit switch. If you do not performance could be severely affected.

- Do not use DHCP dynamically-assigned IP addresses for the private network. Use only static addresses or permanently-leased DHCP addresses.

Optionally Run Spread on Separate Control Network

If your query workloads are network intensive, you can use the `--control-network` parameter with the `install_vertica` script (see Installing HP Vertica with the install_vertica Script) to allow spread communications to be configured on a subnet that is different from other HP Vertica data communications.

The `--control-network` parameter accepts either the `default` value or a broadcast network IP address (for example, `192.168.10.255`).

Configure SSH

- Verify that root can use Secure Shell (SSH) to log in (ssh) to all hosts that are included in the cluster. SSH (SSH client) is a program for logging into a remote machine and for running commands on a remote machine.

- If you do not already have SSH installed on all hosts, log in as root on each host and install it before install HP Vertica. You can download a free version of the SSH connectivity tools from OpenSSH.

- Make sure that `/dev/pts` is mounted. Installing HP Vertica on a host that is missing the mount point `/dev/pts` could result in the following error when you create a database:

```
TIMEOUT ERROR: Could not login with SSH. Here is what SSH said:Last login: Sat Dec 15 18:
05:35 2007 from node01
```

Allow Passwordless SSH Access for the Dbadmin User

The dbadmin user must be authorized for passwordless ssh. In typical installs, you won't need to change anything; however, if you set up your system to disallow passwordless login, you'll need to enable it for the dbadmin user. See Enable Secure Shell (SSH) Logins.

Ensure Ports Are Available

Verify that ports required by HP Vertica are not in use by running the following command as the root user and comparing it with the ports required in **Firewall Considerations** below:

```
netstat -atupn
```

Firewall Considerations

HP Vertica requires several ports to be open on the local network. HP Vertica does not recommend placing a firewall between nodes (all nodes should be behind a firewall), but if you must use a firewall between nodes, ensure the following ports are available:

Port	Protocol	Service	Notes
22	TCP	sshd	Required by **Administration Tools** and the Management Console Cluster Installation wizard.
5433	TCP	HP Vertica	HP Vertica client (vsql, ODBC, JDBC, etc) port.

Port	Protocol	Service	Notes
5434	TCP	HP Vertica	Intra-cluster communication. HP Vertica opens the HP Vertica client port +1 (5434 by default) for intra-cluster communication, such as during a plan. If the port +1 from the default client port is not available, then HP Vertica opens a random port for intra-cluster communication.
5433	UDP	HP Vertica	HP Vertica spread monitoring.
5444	TCP	HP Vertica Management Console	MC-to-node and node-to-node (agent) communications port. See Changing MC or Agent Ports.
5450	TCP	HP Vertica Management Console	Port used to connect to MC from a web browser and allows communication from nodes to the MC application/web server. See Connecting to Management Console.
4803	TCP	**Spread**	Client connections.
4803	UDP	Spread	Daemon to Daemon connections.
4804	UDP	Spread	Daemon to Daemon connections.
6543	UDP	Spread	Monitor to Daemon connection.

Operating System Configuration Task Overview

This topic provides a high-level overview of the OS settings required for HP Vertica. Each item provides a link to additional details about the setting and detailed steps on making the configuration change. The installer tests for all of these settings and provides hints, warnings, and failures if the current configuration does not meet HP Vertica requirements.

Before you Install the Operating System

Configuration	Description
Supported Platforms	Verify that your servers meet the platform requirements described in HP Vertica 7.0 Supported Platforms . Unsupported operating systems are detected by the installer.
LVM	Linux Logical Volume Manager (LVM) is not supported on partitions that contain HP Vertica files.
Filesystem	The filesystem for the HP Vertica data and catalog directories must be formatted as ext3 or ext4.
Swap Space	A 2GB swap partition is required. Partition the remaining disk space in a single partition under "/".
Disk Block Size	The disk block size for the HP Vertica data and catalog directories should be 4096 bytes (the default for ext3 and ext4 filesystems).
Memory	See the **HP Vertica Hardware Planning Guide** in the http://my.vertica.com/ Docs tab for more information on sizing your hardware.

Firewall Considerations

Configuration	Description
Firewall/Ports	Firewalls, if present, must be configured so as not to interfere HP Vertica.

General Operating System Configuration - Automatically Configured by Installer

These general OS settings are automatically made by the installer if they do not meet HP Vertica requirements. You can prevent the installer from automatically making these configuration changes by using the `--no-system-configuration` parameter for the `install_vertica` script.

Configuration	Description
Nice Limits	The database administration user must be able to *nice* processes back to the default level of 0.
min_free_kbytes	The `vm.min_free_kbytes` setting in `/etc/sysctl.conf` must be configured sufficiently high. The specific value depends on your hardware configuration.
User Open Files Limit	The open file limit for the dbadmin user should be at least 1 file open per MB of RAM, 65536, or the amount of RAM in MB; whichever is greater.
System Open File Limits	The maximum number of files open on the system must not be less than at least the amount of memory in MB, but not less than 65536.
Pam Limits	/etc/pam.d/su must contain the line: `session required pam_limits.so` This allows for the conveying of limits to commands run with the `su -` command.
Address Space Limits	The address space limits (`as` setting) defined in /etc/security/limits.conf must be **unlimited** for the database administrator.
File Size Limits	The file sizelimits (`fsize` setting) defined in /etc/security/limits.conf must be **unlimited** for the database administrator.
User Process Limits	The `nproc` setting defined in /etc/security/limits.conf must be 1024 or the amount of memory in MB, whichever is greater.
Maximum Memory Maps	The vm.max_map_count in /etc/sysctl.conf must be **65536** or the amount of memory in KB / 16, whichever is greater.

General Operating System Configuration - Manual Configuration

The following general OS settings must be done manually.

Configuration	Description
Disk Readahead	This disk readahead must be at least 2048. The specific value depends on your hardware configuration.
NTP Services	The NTP daemon must be enabled and running.
SELinux	SElinux must be disabled or run in permissive mode.
CPU Frequency Scaling	HP Vertica recommends that you disable CPU Frequency Scaling. **Important:** Your systems may use significantly more energy when CPU frequency scaling is disabled.

Configuration	Description
Transparent Hugepages	Transparent Hugepages should be disabled or set to *madvise*.
I/O Scheduler	The I/O Scheduler for disks used by HP Vertica must be set to *deadline* or *noop*.
Support Tools	Several optional packages can be installed to assist HP Vertica support when troubleshooting your system.

System User Requirements

The following tasks pertain to the configuration of the system user required by HP Vertica.

Configuration	Required Setting(s)
System User Requirements	The installer automatically creates a user with the correct settings. If you specify a user with `--dba-user`, then the user must conform to the requirements for the HP Vertica system user.
LANG Environment Settings	The LANG environment variable must be set and valid for the database administration user.
TZ Environment Settings	The TZ environment variable must be set and valid for the database administration user.

Before You Install The Operating System

The topics in this section detail system settings that must be configured when you install the operating system. These settings cannot be easily changed after the operating system is installed.

Supported Platforms

the HP Vertica installer checks the type of operating system that is installed. If the operating system does not meet one of the supported operating systems (See **Supported Platforms: Server and Management Console**), or the operating system cannot be determined, then the installer halts.

The installer generates one of the following issue identifiers if it detects an unsupported operating system:

- [**S0320**] - Fedora OS is not supported.

- [**S0321**] - The version of RedHat is not supported.

- [**S0322**] - The version of Ubuntu/Debian is not supported.

- **[S0323]** - The operating system could not be determined. The unkonw operating system is not supported because it does not match the list of supported operating systems.

LVM Warning

HP Vertica does not support LVM (Logical Volume Manager) on any drive where database (catalog and data) files are stored. The installer reports this issue with the identifier: **S0170**.

Filesystem Requirement

HP Vertica requires that your Linux filesystem be either ext3 or ext4. All other filesystem types are unsupported. The installer reports this issue with the identifier **S0160**.

Swap Space Requirements

HP Vertica requires at least 2 GB swap partition regardless of the amount of RAM installed on your system. The installer reports this issue with identifier **S0180**.

For typical installations HP Vertica recommends that you partition your system with a 2GB primary partition for swap regardless of the amount of installed RAM. Larger swap space is acceptable, but unnecessary.

Note: Do not place a swap file on a disk containing the HP Vertica data files. If a host has only two disks (boot and data), put the swap file on the boot disk.

If you do not have at least a 2 GB swap partition then you may experience performance issues when running HP Vertica.

You typically define the swap partition when you install Linux. See your platform's documentation for details on configuring the swap partition.

Disk Block Size Requirements

HP Vertica recommends that the disk block size be 4096 bytes, which is generally the default on ext3 and ext4 filesystems. The installer reports this issue with the identifier **S0165**.

The disk block size is set when you format your filesystem. Changing the block size requires a re-format.

Memory Requirements

HP Vertica requires, at a minimum, 1GB of RAM per logical processor. The installer reports this issue with the identifier **S0190**.

However, for performance reasons, you typically require more RAM than the minimum. See the **HP Vertica Hardware Planning Guide** in the http://my.vertica.com/ Docs tab for more information on sizing your hardware.

Firewall Considerations

HP Vertica requires multiple ports be open between nodes. You may use a firewall (IP Tables) on Redhat and Ubuntu/Debian based systems. Note that firewall use is not supported on SuSE systems and that SuSE systems must disable the firewall. The installer reports issues found with your IP tables configuration with the identifiers **N0010** for (systems that use IP Tables) and **N011** (for SuSE systems).

RedHat, Ubuntu, and Debian Based Systems

The installer checks the IP tables configuration and issues a warning if there are any configured rules or chains. The installer does not detect if the configuration may conflict with HP Vertica. It is your responsibility to verify that your firewall allows traffic for HP Vertica as described in Ensure Ports Are Available.

SuSE Systems

The firewall must be disabled on SUSE systems. To disable the firewall on SuSE systems, run the following command:

```
/sbin/SuSEfirewall2 off
```

Port Availability

The install_vertica script checks that required ports are open and available to HP Vertica. The installer reports any issues with the identifier: **N0020**.

Port Requirements

the following table lists the ports required by HP Vertica.

Port	Protocol	Service	Notes
22	TCP	sshd	Required by **Administration Tools** and the Management Console Cluster Installation wizard.
5433	TCP	HP Vertica	HP Vertica client (vsql, ODBC, JDBC, etc) port.

Port	Protocol	Service	Notes
5434	TCP	HP Vertica	Intra-cluster communication. HP Vertica opens the HP Vertica client port +1 (5434 by default) for intra-cluster communication, such as during a plan. If the port +1 from the default client port is not available, then HP Vertica opens a random port for intra-cluster communication.
5433	UDP	HP Vertica	HP Vertica spread monitoring.
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4803	UDP	Spread	Daemon to Daemon connections.
4804	UDP	Spread	Daemon to Daemon connections.
6543	UDP	Spread	Monitor to Daemon connection.

General Operating System Configuration - Automatically Configured by the Installer

These general Operating System settings are automatically made by the installer if they do not meet HP Vertica requirements. You can prevent the installer from automatically making these configuration changes by using the `--no-system-configuration` parameter for the `install_vertica` script.

Nice Limits Configuration

The HP Vertica system user (dbadmin by default) must be able to raise and lower the priority of HP Vertica processes. To do this, the nice option in the `/etc/security/limits.conf` file must include an entry for the dbadmin user. The installer reports this issue with the identifier: **S0010**.

The installer automatically configures the correct setting if the default value does not meet system requirements. If there is an issue setting this value, or you have used the `--no-system-configuration` argument to the installer and the current setting is incorrect, then the installer reports this as an issue.

> **Note:** HP Vertica never raises priority above the default level of 0. However, HP Vertica does lower the priority of certain HP Vertica threads and needs to able to raise the priority of these threads back up to the default level. This setting allows HP Vertica to raise the priorities back to the default level.

All Systems

To set the Nice Limit configuration for the dbadmin user, edit /etc/security/limits.conf and add the following line. Replace *dbadmin* with the name of your system user.

```
dbadmin -      nice    0
```

min_free_kbytes Setting

This topic details how to update the min_free_kbytes setting so that it is within the range supported by HP Vertica. The installer reports this issue with the identifier: **S0050** if the setting is too low, or **S0051** if the setting is too high.

The vm.min_free_kbytes setting configures the page reclaim thresholds. When this number is increased the system starts reclaiming memory earlier, when its lowered it starts reclaiming memory later. The default min_free_kbytes is calculated at boot time based on the number of pages of physical RAM available on the system.

The installer automatically configures the correct setting if the default value does not meet system requirements. If there is an issue setting this value, or you have used the `--no-system-configuration` argument to the installer and the current setting is incorrect, then the installer reports this as an issue.

All Systems

Determine the current/default setting with the following command:

```
sysctl vm.min_free_kbytes
```

The setting must be the greater of:

- the default value configured by the system, or

- **4096**, or

- the value of the following command:

```
memtot=`grep MemTotal /proc/meminfo | awk '{printf "%.0f",$2}'`
echo "scale=0;sqrt ($memtot*16)" | bc
```

You update the setting by editing the value of `vm.min_free_kbytes` in `/etc/sysctl.conf`. If the setting does not exist in the file, and the default value is less than 4096 or the output from the command above, then add the following line. Replace the number with the number for your system as determined from the command above.

```
vm.min_free_kbytes 5572
```

Then, load the setting into the currently running kernel with the sysctl command:

```
sysctl vm.min_free_kbytes=5572
```

User Max Open Files Limit

This topic details how to change the user max open-files limit setting to meet HP Vertica requirements The installer reports this issue with the identifier: **S0060**.

The installer automatically configures the correct setting if the default value does not meet system requirements. If there is an issue setting this value, or you have used the `--no-system-configuration` argument to the installer and the current setting is incorrect, then the installer reports this as an issue.

HP Vertica requires that the dbadmin user not be limited when opening files. The open file limit should be at least 1 file open per MB of RAM, 65536, or the amount of RAM in MB; whichever is greater. HP Vertica sets this to the minimum recommended value of 65536 or the amount of RAM in MB.

All Systems

The open file limit can be determined by running `ulimit -n` as the dbadmin user. For example:

```
dbadmin@localhost:$ ulimit -n
65536
```

To manually set the limit, edit `/etc/security/limits.conf` and edit/add the line for the `nofile` setting for the user you configured as the database admin (default dbadmin). The setting must be at least 65536.

```
dbadmin -      nofile  65536
```

Note: There is also an open file limit on the system. See System Max Open Files Limit.

System Max Open Files Limit

This topic details how to modify the limit for the number of open files on your system so that it meets HP Vertica requirements. The installer reports this issue with the identifier: **S0120**.

The installer automatically configures the correct setting if the default value does not meet system requirements. If there is an issue setting this value, or you have used the `--no-system-configuration` argument to the installer and the current setting is incorrect, then the installer reports this as an issue.

HP Vertica opens many files. Some platforms have global limits on the number of open files. The open file limit must be set sufficiently high so as not to interfere with database operations.

The recommended value is at least the amount of memory in MB, but not less than 65536.

All Systems

To manually set the open file limit:

1. Run `cat /proc/sys/fs/file-max` to determine the current limit.

2. If the limit is not **65536** or the amount of system memory in MB (whichever is higher), then edit/add the following line to `/etc/sysctl.conf`. Replace *65536* with the value for your system.

```
fs.file-max=65536
```

Note: There is also an open file limit on the user. See User Max Open Files Limit.

Pam Limits

This topic details how to enable the "su" pam_limits.so module required by HP Vertica. The installer reports issues with the setting with the identifier: **S0070**.

On some systems the pam module called `pam_limits.so` is not set in the file `/etc/pam.d/su`. When it is not set, it prevents the conveying of limits (such as open file descriptors) to any command started with `su -`

In particular, the HP Vertica init script would fail to start HP Vertica because it calls the Administration Tools to start a database with the `su -` command. This problem was first noticed on Debian systems, but the configuration could be missing on other Linux distributions. See the pam_limits man page for more details.

The installer automatically configures the correct setting if the default value does not meet system requirements. If there is an issue setting this value, or you have used the `--no-system-configuration` argument to the installer and the current setting is incorrect, then the installer reports this as an issue.

All Systems

To manually configure this setting, append the following line to the `/etc/pam.d/su` file:

```
session required pam_limits.so
```

See the pam_limits man page for more details: `man pam_limits`.

User Address Space Limits

This topic details how to modify the Linux address space limit for the dbadmin user so that it meets HP Vertica requirements. The address space setting controls the maximum number of threads and processes for each user. If this setting does not meet the requirements then the installer reports this issue with the identifier: **S0090**.

The installer automatically configures the correct setting if the default value does not meet system requirements. If there is an issue setting this value, or you have used the `--no-system-configuration` argument to the installer and the current setting is incorrect, then the installer reports this as an issue.

The address space available to the dbadmin user must not be reduced via user limits and must be set to **unlimited**.

All Systems

To manually set the address space limit:

1. Run `ulimit -v` as the dbadmin user to determine the current limit.

2. If the limit is not **unlimited**, then add the following line to `/etc/security/limits.conf`. Replace *dbadmin* with your database admin user

```
dbadmin -       as      unlimited
```

User File Size Limit

This topic details how to modify the file size limit for files on your system so that it meets HP Vertica requirements. The installer reports this issue with the identifier: **S0100**.

The installer automatically configures the correct setting if the default value does not meet system requirements. If there is an issue setting this value, or you have used the `--no-system-configuration` argument to the installer and the current setting is incorrect, then the installer reports this as an issue.

The file size limit for the dbadmin user must not be reduced via user limits and must be set to **unlimited**.

All Systems

To manually set the file size limit:

1. Run `ulimit -f` as the dbadmin user to determine the current limit.

2. If the limit is not **unlimited**, then edit/add the following line to `/etc/security/limits.conf`. Replace *dbadmin* with your database admin user.

```
dbadmin -       fsize      unlimited
```

User Process Limit

This topic details how to change the user process limit so that it meets HP Vertica requirements. The installer reports this issue with the identifier: **S0110**.

The installer automatically configures the correct setting if the default value does not meet system requirements. If there is an issue setting this value, or you have used the `--no-system-configuration` argument to the installer and the current setting is incorrect, then the installer reports this as an issue.

The user process limit must be high enough to allow for the many threads opened by HP Vertica. The recommended limit is the amount of RAM in MB and must be at least 1024.

All Systems

To manually set the user process limit:

1. Run `ulimit -u` as the dbadmin user to determine the current limit.

2. If the limit is not the amount of memory in MB on the server, then edit/add the following line to `/etc/security/limits.conf`. Replace *4096* with the amount of system memory, in MB, on the server.

```
dbadmin -       nproc    4096
```

Maximum Memory Maps Configuration

This topic details how to modify the limit for the number memory maps a process can have on your system so that it meets HP Vertica requirements. The installer reports this issue with the identifier: **S0130**.

The installer automatically configures the correct setting if the default value does not meet system requirements. If there is an issue setting this value, or you have used the `--no-system-configuration` argument to the installer and the current setting is incorrect, then the installer reports this as an issue.

HP Vertica uses a lot of memory while processing and can approach the default limit for memory maps per process.

The recommended value is at least the amount of memory on the system in KB / 16, but not less than 65536.

All Systems

To manually set the memory map limit:

1. Run `sysctl vm.max_map_count` to determine the current limit.

2. If the limit is not **65536** or the amount of system memory in KB / 16 (whichever is higher), then edit/add the following line to `/etc/sysctl.conf`. Replace *65536* with the value for your system.

```
vm.max_map_count=65536
```

General Operating System Configuration - Manual Configuration

The following general Operating System settings must be done manually.

Disk Readahead

This topic details how to change Disk Readahead to a supported value. HP Vertica requires that Disk readahead by set to at least 2048. The installer reports this issue with the identifier: **S0020**.

RedHat and SuSE Based Systems

For each drive in the HP Vertica system, HP Vertica recommends that you set the readahead value to 2048 for most deployments. The command immediately changes the readahead value for the specified disk. The second line adds the command to `/etc/rc.local` so that the setting is applied each time the system is booted. Note that some deployments may require a higher value and the setting can be set as high as 8192, under guidance of support.

> **Note:** These commands must be executed with root privileges and assumes the blockdev program is in `/sbin`.

> **Note:** For systems that do not support `/etc/rc.local`, use the equivalent startup script that is run after the destination runlevel has been reached. For example SuSE uses `/etc/init.d/after.local`.

```
/sbin/blockdev --setra 2048 /dev/sda1
echo '/sbin/blockdev --setra 2048 /dev/sda1' >> /etc/rc.local
```

Ubuntu and Debian Systems

For each drive in the HP Vertica system, set the readahead value to 2048. Run the command once in your shell, then add the command to `/etc/rc.local` so that the setting is applied each time the system is booted. Note that on Ubuntu systems, the last line in rc.local must be "`exit 0`". So you must manually add the following line to `etc/rc.local` before the last line with `exit 0`.

> **Note:** For systems that do not support `/etc/rc.local`, use the equivalent startup script that is run after the destination runlevel has been reached. For example SuSE uses `/etc/init.d/after.local`.

```
/sbin/blockdev --setra 2048 /dev/sda1
```

NTP

This topic details how to enable NTP (Network Time Protocol) for your system. HP Vertica requires that NTP be enabled and active. The installer reports this issue with the identifier: **S0030**.

Verify NTP

The network time protocol (NTP) daemon needs to be running on all of the hosts in the cluster to ensure their clocks are synchronized. The spread daemon relies on all of the nodes in the having their clocks synchronized for timing purposes. If your nodes do not have NTP running, the installation can fail with a spread configuration error as well as other potential errors.

> **Note:** Different Linux distributions refer to the NTP daemon in different ways. For example, SUSE and Debian/Ubuntu refer to it as `ntp`, while CentOS and Red Hat refer to it as `ntpd`. If the following commands produce an error, try using `ntp` in place of `ntpd`.

To check if your hosts are configured to run the NTP daemon on startup, run the following command:

$ `chkconfig --list ntpd`

> **Note:** Debian and Ubuntu do not install `chkconfig` by default, but do offer it as an optional package. You can install it with the command `sudo apt-get install chkconfig`.

If `chkconfig` command produces an error similar to `ntpd: unknown service`, check to ensure your Linux distribution does not refer to the NTP daemon as `ntp` rather than `ntpd`. If it does not, you need to install the NTP daemon package before you can configure it. Consult your Linux documentation for instructions on how to locate and install packages.

If the NTP daemon is installed, output should resemble the following:

```
ntp 0:off 1:off 2:on 3:on 4:off 5:on 6:off
```

The output indicates the runlevels where the daemon runs. Verify that the current runlevel of the system (usually 3 or 5) has the NTP daemon set to on. If you do not know the current runlevel, you can find it using the `runlevel` command:

```
$ runlevel
N 3
```

To configure NTP for your OS, see the steps below:

RedHat and SuSE Based Systems

For RedHat and SuSE based systems, simply use the `service` and `chkconfig` utilities to start NTP and have it start at boot time.

```
/sbin/service ntpd restart
/sbin/chkconfig ntpd on
```

Note: For RedHat based systems, NTP uses the default time servers at ntp.org. You can change the default NTP servers by editing `/etc/ntpd.conf`.
For SuSE based systems, there are no time servers configured by default. You must edit `/etc/ntpd.conf` after the install completes and add time servers.

Ubuntu and Debian Systems

The NTP daemon is not installed by default on some Ubuntu and Debian Systems. First, install NTP, then start the NTP process. You can change the default NTP servers by editing `/etc/ntpd.conf`.

```
sudo apt-get install ntp

sudo /etc/init.d/ntp reload
```

Verify NTP is Operating Correctly

To verify that the Network Time Protocol Daemon (NTPD) is operating correctly, issue the following command on all nodes in the cluster:

/usr/sbin/ntpq -c rv | grep stratum

A stratum level of 16 indicates that NTP is not synchronizing correctly.

See Also

- http://kbase.redhat.com/faq/docs/DOC-6731

- http://kbase.redhat.com/faq/docs/DOC-6902

- http://kbase.redhat.com/faq/docs/DOC-6991

> **Note:** The above links were current as of the last publication of the HP Vertica documentation and could change between releases.

SELinux Configuration

HP Vertica does not support SELinux except when SELinux is running in permissive mode. The installer reports this issue with the identifier **S0080** if it detects that SELinux is installed and the mode cannot be determined. If the mode can be determined, and the mode is not permissive, then the issue is reported with the identifier **S0081**.

RedHat and SuSE Based Systems

You can either disable SELinux or change it to use permissive mode.

To disable SELinux:

1. Edit `/etc/selinux/config` and change setting for SELINUX to disabled (`SELINUX=disabled`). This disables SELinux at boot time.

2. As root/sudo, type `setenforce 0` to disable SELinux immediately.

To change SELinux to use permissive mode:

1. Edit `/etc/selinux/config` and change setting for SELINUX to permissive (`SELINUX=Permissive`).

2. As root/sudo, type `setenforce Permissive` to switch to permissive mode immediately.

Ubuntu and Debian Systems

You can either disable SELinux or change it to use permissive mode.

To disable SELinux:

1. Edit `/selinux/config` and change setting for SELINUX to disabled (`SELINUX=disabled`). This disables SELinux at boot time.

2. As root/sudo, type `setenforce 0` to disable SELinux immediately.

To change SELinux to use permissive mode:

1. Edit `/selinux/config` and change setting for SELINUX to permissive
   (`SELINUX=Permissive`).

2. As root/sudo, type `setenforce Permissive` to switch to permissive mode immediately.

CPU Frequency Scaling

This topic details the various CPU frequency scaling methods support by HP Vertica In general, if you do not require CPU frequency scaling, then disable it so as not to impact system performance.

> **Important:** Your systems may use significantly more energy when frequency scaling is disabled.

The installer allows CPU frequency scaling to be enabled when the cpufreq scaling governor set to `performance`. If cpu scaling governor is set to *ondemand*, and `ignore_nice_load` is 1 (true), then the installer **fails** with the error **S0140**. If the cpu scaling governor is set to *ondemand* and `ignore_nice_load` is 0 (false), then the installer **warns** with the identifier **S0141**.

CPU frequency scaling is a hardware and software feature that helps computers conserve energy by slowing the processor when the system load is low, and speeding it up again when the system load increases. This feature can impact system performance, since raising the CPU frequency in response to higher system load does not occur instantly. Always disable this feature on the database hosts to prevent it from interfering with HP Vertica's performance.

You disable CPU scaling in your host's system BIOS. There may be multiple settings in your host's BIOS that you need to adjust in order to completely disable CPU frequency scaling. Consult your host hardware's documentation for details of entering the system BIOS and disabling CPU frequency scaling.

If you cannot disable CPU scaling through the system BIOS, you can limit the impact of CPU scaling by disabling the scaling through the Linux kernel or setting the CPU frequency governor to always run the CPU at full speed.

> **Caution:** This method is not reliable, as some hardware platforms may ignore the kernel settings. **The only reliable method is to disable CPU scaling in BIOS**.

The method you use to disable frequency depends on the CPU scaling method being used in the Linux kernel. See your Linux distribution's documentation for instructions on disabling scaling in the kernel or changing the CPU governor.

Transparent Hugepages

This topic details how to modify transparent hugepages so that the configuration meets HP Vertica requirements. HP Vertica requires that transparent hugepages be disabled or set to *madvise*. The installer reports this issue with the identifier: **S0310**.

If you are not using madvise as your transparent hugepage setting, then you can disable it with the following steps:

RedHat Systems

To determine if transparent hugepages is enabled, run the following command. The setting returned in brackets is your current setting.

```
cat /sys/kernel/mm/redhat_transparent_hugepage/enabled
[always] madvise never
```

You can disable transparent hugepages one of two ways:

1. Edit your boot loader (for example /etc/grub.conf), typically you add the following to the end of the kernel line. However, consult the documentation for your system before editing your boot loader configuration.

   ```
   transparent_hugepage=never
   ```

2. Or, edit /etc/rc.local and add the following script.

   Note: For systems that do not support /etc/rc.local, use the equivalent startup script that is run after the destination runlevel has been reached. For example SuSE uses /etc/init.d/after.local.

   ```
   if test -f /sys/kernel/mm/redhat_transparent_hugepage/enabled; then
      echo never > /sys/kernel/mm/redhat_transparent_hugepage/enabled
   fi
   ```

You must reboot your system for the setting to take effect, or run the following two echo lines to proceed with the install without rebooting:

```
echo never > /sys/kernel/mm/redhat_transparent_hugepage/enabled
```

Other Systems

Note: SuSE did not offer transparent hugepage support in the initial 11.0 release. Subsequent SuSE service packs do include support for transparent hugepages.

To determine if transparent hugepages is enabled, run the following command. The setting returned in brackets is your current setting. Depending on your platform OS, the madvise setting may not be displayed.

```
cat /sys/kernel/mm/transparent_hugepage/enabled
```

```
[always] madvise never
```

You can disable transparent hugepages one of two ways:

1. Edit your boot loader (for example `/etc/grub.conf`), typically you add the following to the end of the kernel line. However, consult the documentation for your system before editing your bootloader configuration.

   ```
   transparent_hugepage=never
   ```

2. Or, edit `/etc/rc.local` (on systems that support rc.local) and add the following script.

   > **Note:** For systems that do not support `/etc/rc.local`, use the equivalent startup script that is run after the destination runlevel has been reached. For example SuSE uses `/etc/init.d/after.local`.

   ```
   if test -f /sys/kernel/mm/transparent_hugepage/enabled; then
      echo never > /sys/kernel/mm/transparent_hugepage/enabled
   fi
   ```

You must reboot your system for the setting to take effect, or run the following two echo lines to proceed with the install without rebooting:

```
echo never > /sys/kernel/mm/transparent_hugepage/enabled
```

I/O Scheduling

This topic details how to change I/O Scheduling to a supported scheduler. HP Vertica requires that I/O Scheduling be set to deadline or noop. If the installer detects that the system is using an unsupported scheduler, then it reports this issue with the identifier: **S0150**. If the installer cannot detect the type of scheduler that the system uses (typically if your system is using a RAID array) then it reports the issue with identifier: **S0151**.

If your system is not using a RAID array, then complete the steps below to change your IO Scheduler to a supported scheduler. If you are using a RAID array then consult the documentation from your RAID vendor for the best performing scheduler for your hardware.

Configure the I/O Scheduler

The Linux kernel can use several different I/O schedulers to prioritize disk input and output. Most Linux distributions use the Completely Fair Queuing (CFQ) scheme by default, which gives input and output requests equal priority. This scheduler is efficient on systems running multiple tasks that need equal access to I/O resources. However, it can create a bottleneck when used on the drives containing HP Vertica's catalog and data directories, since it gives write requests equal priority to

read requests, and its per-process I/O queues can penalize processes making more requests than other processes.

Instead of the CFQ scheduler, configure your hosts to use either the Deadline or NOOP I/O scheduler for the drives containing the catalog and data directories:

- The Deadline scheduler gives priority to read requests over write requests. It also imposes a deadline on all requests. After reaching the deadline, such requests gain priority over all other requests. This scheduling methods helps prevent processes from becoming starved for I/O access. The Deadline scheduler is best used on physical media drives (disks using spinning platters), since it attempts to group requests for adjacent sectors on a disk, lowering the time the drive spends seeking.

- The NOOP scheduler uses a simple FIFO approach, placing all input and output requests into a single queue. This scheduler is best used on solid state drives (SSDs). Since SSDs do not have a physical read head, no performance penalty exists when accessing non-adjacent sectors.

Failure to use one of these schedulers for the drives containing HP Vertica's catalog and data directories can result in slower database performance. Other drives on the system (such as the drive containing swap space, log files, or the Linux system files) can still use the default CFQ scheduler (although you should always use the NOOP scheduler for SSDs).

There are two ways for you to set the scheduler used by your disk devices:

1. Write the name of the scheduler to a file in the `/sys` directory

    --or--

2. Use a kernel boot parameter

Configure the I/O Scheduler - Changing the Scheduler Through the /sys Directory

You can view and change the scheduler Linux uses for I/O requests to a single drive using a virtual file under the `/sys` directory. The name of the file that controls the scheduler a block device uses is:

```
/sys/block/deviceName/queue/scheduler
```

Where *deviceName* is the name of the disk device, such as `sda` or `cciss\!c0d1` (the first disk on an HP RAID array). Viewing the contents of this file shows you all of the possible settings for the scheduler, with the currently-selected scheduler surrounded by square brackets:

```
# cat /sys/block/sda/queue/scheduler
noop deadline [cfq]
```

To change the scheduler, write the name of the scheduler you want the device to use to its scheduler file. You must have root privileges to write to this file. For example, to set the sda drive to use the deadline scheduler, run the following command as root:

```
# echo deadline > /sys/block/sda/queue/scheduler
# cat /sys/block/sda/queue/scheduler
noop [deadline] cfq
```

Changing the scheduler immediately affects the I/O requests for the device. The Linux kernel starts using the new scheduler for all of the drive's input and output requests.

> **Note:** While tests have shown no problems caused by changing the scheduler settings while HP Vertica is running, you should strongly consider shutting down any running HP Vertica database before changing the I/O scheduler or making any other changes to the system configuration.

Changes to the I/O scheduler made through the `/sys` directory only last until the system is rebooted, so you need to add commands that change the I/O scheduler to a startup script (such as those stored in `/etc/init.d`, or though a command in `/etc/rc.local`). You also need to use a separate command for each drive on the system whose scheduler you want to change.

For example, to make the configuration take effect immediately and add it to rc.local so it is used on subsequent reboots.

> **Note:** For systems that do not support `/etc/rc.local`, use the equivalent startup script that is run after the destination runlevel has been reached. For example SuSE uses `/etc/init.d/after.local`.

```
echo deadline > /sys/block/sda/queue/scheduler
echo 'echo deadline > /sys/block/sda/queue/scheduler' >> /etc/rc.local
```

> **Note:** On some Ubuntu/Debian systems, the last line in rc.local must be "`exit 0`". So you must manually add the following line to `etc/rc.local` before the last line with `exit 0`.

You may prefer to use this method of setting the I/O scheduler over using a boot parameter if your system has a mix of solid-state and physical media drives, or has many drives that do not store HP Vertica catalog and data directories.

Configure the I/O Scheduler - Changing the Scheduler with a Boot Parameter

Use the `elevator` kernel boot parameter to change the default scheduler used by all disks on your system. This is the best method to use if most or all of the drives on your hosts are of the same type (physical media or SSD) and will contain catalog or data files. You can also use the boot parameter to change the default to the scheduler the majority of the drives on the system need, then use the `/sys` files to change individual drives to another I/O scheduler. The format of the elevator boot parameter is:

```
elevator=schedulerName
```

Where *schedulerName* is `deadline`, `noop`, or `cfq`. You set the boot parameter using your bootloader (grub or grub2 on most recent Linux distributions). See your distribution's documentation for details on how to add a kernel boot parameter.

Support Tools

HP Vertica suggests that the following tools are installed so support can assist in troubleshooting your system if any issues arise:

- pstack (or gstack) package. Identified by issue **S0040** when not installed.

- mcelog package. Identified by issue **S0041** when not installed.

- sysstat package. Identified by issue **S0045** when not installed.

RedHat Based Systems

To install the required tools on RedHat based systems, run the following commands as sudo or root:

```
yum install pstack
yum install mcelog
yum install sysstat
```

Ubuntu and Debian Systems

To install the required tools on Ubuntu and Debian systems, run the following commands as sudo or root:

```
apt-get install pstack
apt-get install mcelog
apt-get install sysstat
```

SuSE Systems

To install the required too on SuSE systems, run the following command as sudo or root.

```
zypper install sysstat
zypper install mcelog
```

There is no individual SuSE package for pstack/gstack. However, the gdb package contains gstack, so you could optionally install gdb instead, or build pstack/gstack from source. To install the gdb package:

```
zypper install gdb
```

System User Configuration

The following tasks pertain to the configuration of the system user required by HP Vertica.

System User Requirements

HP Vertica has specific requirements for the system user that runs and manages HP Vertica. If you specify a user during install, but the user does not exist, then the installer reports this issue with the identifier **S0200**.

System User Requirement Details

HP Vertica requires a system user to own database files and run database processes and administration scripts. By default, the install script automatically configures and creates this user for you with the username *dbadmin*. See About HP Vertica-created Linux Users and Their Privileges for details on the default user created by the install script. If you decide to manually create your own system user, then you must create the user **before** you run the install script. If you manually create the user:

> **Note:** Instances of `dbadmin` and `verticadba` are placeholders for the names you choose if you do not use the default values.

- the user must have the same username and password on all nodes

- the user must use the BASH shell as the user's default shell. If not, then the installer reports this issue with identifier **[S0240]**.

- the user must be in the *verticadba* group (for example: `usermod -a -G verticadba` *userNameHere*). If not, the installer reports this issue with identifier **[S0220]**.

  > **Note:** You must create a verticadba group on all nodes. If you do not, then the installer reports the issue with identifier **[S0210]**.

- the user's login group must be either *verticadba* or a greoup with the same name as the user (for example, the home group for dbadmin is dbadmin). You can check the groups for a user with the id command. For example: `id dbadmin`. The "gid" group is the user's primary group. If this is not configured correctly then the installer reports this issue with the identifier [**S0230**]. HP Vertica recommends that you use *verticadba* as the user's primary login group. For example: `usermod -g verticadba` *userNameHere*. If the user's primary group is not *verticadba* as suggested, then the installer reports this with HINT [**S0231**].

- the user must have a home directory. If not, then the installer reports this issue with identifier **[S0260]**.

- the user's home directory must be owned by the user. If not, then the installer reports the issue with identifier **[S0270]**.

- the system must be aware of the user's home directory (you can set it with the usermod command: `usermod -m -d /path/to/new/home/dir userNameHere`). If this is not configured correctly then the installer reports the issue with **[S0250]**.

- the user's home directory must be owned by the user (use the `chown`and `chgrp`commands if necessary). If this is not configured correctly, then the installer reports the issue with identifier **[S0280]**.

- the user's home directory *should* have secure permissions. Specifically, it should not be writable by anyone or by the group. Ideally the permissions should be, when viewing with *ls*, "`---`" (nothing), or "`r-x`" (read and execute). If this is not configured as suggested then the installer reports this with HINT **[S0290]**.

TZ Environment Variable

This topic details how to set or change the TZ environment variable and update yourTzdata package. If this variable is not set, then the installer reports this issue with the identifier: **S0305**.

Before installing HP Vertica Update the Tzdata Package for your system and set the default time zone for your database administrator account by specifying the `TZ` environmental variable. If your database administrator is being created by the `install_vertica` script, then set the `TZ` variable after you have installed HP Vertica.

Update Tzdata Package

The tzdata package is a public-domain time zone database that is pre-installed on most linux systems. The tzdata package is updated periodically for time-zone changes across the world. HP recommends that you update to the latest tzdata package before installing or updating HP Vertica.

Update your tzdata package with the following command:

- For RedHat based systems: `yum update tzdata`

- For Debian and Ubuntu systems: `apt-get install tzdata`

Setting the Default Time Zone

When a client receives the result set of a SQL query, all rows contain data adjusted, if necessary, to the same time zone. That time zone is the default time zone of the initiator node unless the client explicitly overrides it using the SQL SET TIME ZONE command described in the SQL Reference Manual. The default time zone of any node is controlled by the `TZ` environment variable. If `TZ` is undefined, the operating system time zone.

If your operating system timezone is not set to the desired timezone of the database then make sure that the Linux environment variable TZ is set to the desired value on all cluster hosts. Typically, the TZ variable is the same on all cluster hosts but this is not required; you can configure a cluster to provide convenient client connections from multiple time zones as explained below.

The installer returns a warning if the TZ variable is not set. If your operating system timezone is appropriate for your database, then the operating system timezone is used and the warning can be safely ignored.

Setting the Time Zone on a Host

> **Important:** If you explicitly set the TZ environment variable at a command line before you start the **Administration Tools**, the current setting will not take effect. The Administration Tools uses SSH to start copies on the other nodes, so each time SSH is used, the TZ variable for the startup command is reset. TZ must be set in the .profile or .bashrc files on all nodes in the cluster to take affect properly.

You can set the time zone several different ways, depending on the Linux distribution or the system administrator's preferences.

- To set the system time zone on Red Hat and SUSE Linux systems, edit:

```
/etc/sysconfig/clock
```

- To set the TZ variable, edit, /etc/profile, or /dbadmin/.bashrc or /home/dbadmin/.bash_ profile and add the following line (for example, for the US Eastern Time Zone):

```
export TZ="America/New_York"
```

For details on which timezone names are recognzied by HP Vertica, see the appendix: Using Time Zones With HP Vertica.

LANG Environment Variable Settings

This topic details how to set or change the LANG environment variable. The LANG environment variable controls the locale of the host. If this variable is not set, then the installer reports this issue with the identifier: **S0300**. If this variable is not set to a valid value, then the installer reports this issue with the identifier: **S0301**.

Set the Host Locale

Each host has a system setting for the Linux environment variable LANG. LANG determines the locale category for native language, local customs, and coded character set in the absence of the LC_ALL and other LC_ environment variables. LANG can be used by applications to determine which language to use for error messages and instructions, collating sequences, date formats, and so forth.

To change the LANG setting for the database administrator, edit, `/etc/profile`, or `/dbadmin/.bashrc` or `/home/dbadmin/.bash_profile` on all cluster hosts and set the environment variable; for example:

```
export LANG=en_US.UTF-8
```

The LANG setting controls the following in HP Vertica:

- OS-level errors and warnings, for example, "file not found" during COPY operations.

- Some formatting functions, such as TO_CHAR and TO_NUMBER. See also Template Patterns for Numeric Formatting.

The LANG setting does not control the following:

- HP Vertica-specific error and warning messages. These are always in English at this time.

- Collation of results returned by SQL issued to HP Vertica. This must be done using a database parameter instead. See Implement Locales for International Data Sets section in the Administrator's Guide for details.

> **Note:** If the LC_ALL environment variable is set, it supersedes the setting of LANG.

Installing HP Vertica

There are different paths you can take when installing HP Vertica. You can:

- Install HP Vertica on one or more hosts using the command line, and not use the Management Console.

- Install the Management Console, and from the Management Console install HP Vertica on one or more hosts by using the Management Console cluster creation wizard.

- Install HP Vertica on one or more hosts using the command line, then install the Management Console and import the cluster to be managed.

Installing Using the Command Line

Although HP supports installation on one node, two nodes, and multiple nodes, this section describes how to install the HP Vertica software on a cluster of nodes. It assumes that you have already performed the tasks in Before You Install HP Vertica, and that you have an HP Vertica license key.

To install HP Vertica, complete the following tasks:

1. Download and install the HP Vertica server package

2. Installing HP Vertica with the install_vertica Script

Special notes

- Downgrade installations are not supported.

- Be sure that you download the RPM for the correct operating system and architecture.

- HP Vertica supports two-node clusters with zero fault tolerance (K=0 safety). This means that you can add a node to a single-node cluster, as long as the installation node (the node upon which you build) is not the loopback node (`localhost/127.0.0.1`).

- The Version 7.0 installer introduces new platform verification tests that prevent the install from continuing if the platform requirements are not met by your system. Manually verify that your system meets the requirements in Before You Install HP Verticaon your systems. These tests ensure that your platform meets the hardware and software requirements for HP Vertica. Previous versions documented these requirements, but the installer did not verify all of the settings. If this is a fresh install, then you can simply run the installer and view a list of the failures and warnings to determine which configuration changes you must make.

Back Up Existing Databases

If you are doing an upgrade installation, back up the following for all existing databases:

- The Catalog and Data directories, using the HP Vertica backup utility. See Backing Up and Restoring the Database in the Administrator's Guide.

- /opt/vertica/, using manual methods. For example:

  a. Enter the command:

     ```
     tar -czvf /tmp/vertica.tgz /opt/vertica
     ```

  b. Copy the tar file to a backup location.

Backing up MC

Before you upgrade MC, HP recommends that you back up your MC metadata (configuration and user settings) on a storage location external to the server on which you installed MC.

1. On the target server (where you want to store MC metadata), log on as root or a user with sudo privileges.

2. Create a backup directory; for example:

```
# mkdir /backups/mc/mc-backup-20130425
```

3. Copy the /opt/vconsole directory to the new backup folder:

```
# cp –r /opt/vconsole /backups/mc/mc-backup-20130425
```

After you have completed the backup tasks, proceed to Upgrading HP Vertica to a New Version.

Download and Install the HP Vertica Server Package

To Download and Install the HP Vertica Server Package:

1. Use a Web browser to log in to myVertica portal.

2. Click the Download tab and download the HP Vertica server package to the **Administration Host**.

   Be sure the package you download matches the operating system and the machine architecture on which you intend to install it. In the event of a node failure, you can use any other node to run the Administration Tools later.

3. If you installed a previous version of HP Vertica on any of the hosts in the cluster, use the **Administration Tools** to shut down any running database.

   The database must stop normally; you cannot upgrade a database that requires recovery.

4. If you are using sudo, skip to the next step. If you are root, log in to the Administration Host as root (or log in as another user and switch to root).

```
$ su - root
password: root-password
#
```

> **Caution:** When installing HP Vertica using an existing user as the dba, you must exit all UNIX terminal sessions for that user after setup completes and log in again to ensure that group privileges are applied correctly.

After HP Vertica is installed, you no longer need root privileges. See also Verify sudo.

5. Use one of the following commands to run the RPM package installer:

   ▪ If you are root and installing an RPM:

   ```
   # rpm -Uvh pathname
   ```

   ▪ If you are using sudo and installing an RPM:

   ```
   $ sudo rpm -Uvh pathname
   ```

   ▪ If you are using Debian, replace `rpm -Uvh` with `dpkg -i`

   where *pathname* is the HP Vertica package file you downloaded.

> **Note:** If the package installer reports multiple dependency problems, or you receive the error *"ERROR: You're attempting to install the wrong RPM for this operating system"*, then you are trying to install the wrong HP Vertica server package. Make sure that the machine architecture (32-bit or 64-bit) of the package you downloaded matches the operating system.

Installing HP Vertica with the install_vertica Script

About the Installation Script

You run the install script after you have installed the HP Vertica package. The install script is run on a single node, using a Bash shell, and it copies the HP Vertica package to all other hosts (identified by the `--hosts` argument) in your planned cluster.

The install script runs several tests on each of the target hosts to verify that the hosts meet the system and performance requirements for a HP Vertica node. The install script modifies some operating system configuration settings to meet these requirements. Other settings cannot be modified by the install script and must be manually re-configured.

The installation script takes the following basic parameters:

- A list of hosts on which to install.

- Optionally, the HP Vertica RPM/DEB path and package file name if you have not pre-installed the server package on other potential hosts in the cluster.

- Optionally, a system user name. If you do not provide a user name, then the install script creates a new system user named dbadmin. If you do provide a username and the username does not exist on the system, then the install script creates that user.

For example:

```
# /opt/vertica/sbin/install_vertica --hosts node01,node02,node03
--rpm /tmp/vertica_7.0.x.x86_64.RHEL5.rpm --dba-user mydba
```

Note: The install script sets up passwordless ssh for the administrator user across all the hosts. If passwordless ssh is already setup, the install script verifies that it is functioning correctly.

To Perform a Basic Install of HP Vertica:

1. As root (or sudo) run the install script. The script must be run in a BASH shell as root or as a user with sudo privileges. There are many options you can configure when running the install script. See install_vertica Options below for the complete list of options.

   If the installer fails due to any requirements not being met, you can correct the issue and then **simply re-run the installer** with the same command line options.

   To perform a basic install:

   - As root:

     ```
     # /opt/vertica/sbin/install_vertica --hosts host_list --rpm rpm_package --dba-user
     dba_username
     ```

   - Using sudo:

     ```
     $ sudo /opt/vertica/sbin/install_vertica --hosts host_list -rpm rpm_package --dba-
     user dba_username
     ```

   Basic Installation Parameters

`--hosts host_list`	A comma-separated list of IP addresses to include in the cluster; do not include space characters in the list. Examples: ```\n--hosts 127.0.0.1\n--hosts 192.168.233.101,192.168.233.102,192.168.233.103\n``` **Note:** HP Vertica stores only IP addresses in its configuration files. You can provide a hostname to the `--hosts` parameter, but it is immediately converted to an IP address when the script is run.

`--rpm  (or --deb)`
`package`
	The path and name of the HP Vertica RPM package. Example:
	
	```\n--rpm /tmp/vertica_7.0.x.x86_64.RHEL5.rpm\n```
	
	For Debian and Ubuntu installs, provide the name of the Debian package, for example:
	
	```\n--deb /tmp/vertica_7.0.x86\n```

`--dba-user dba_username`	The name of the **Database Administrator** system account to create. Only this account can run the Administration Tools. If you omit the `--dba-user` parameter, then the default database administrator account name is `dbadmin`. This parameter is optional for new installations done as root but must be specified when upgrading or when installing using sudo. If upgrading, use the `-u` parameter to specify the same DBA account name that you used previously. If installing using sudo, the user must already exist. **Note:** If you manually create the user, modify the user's .bashrc file to include the line: `PATH=/opt/vertica/bin:$PATH` so that the HP Vertica tools such as *vsql* and *admintools* can be easily started by the dbadmin user.

2. When prompted for a password to log into the other nodes, provide the requested password. This allows the installation of the package and system configuration on the other cluster nodes. If you are root, this is the root password. If you are using sudo, this is the sudo user password. The password does not echo on the command line. For example:

```
HP Vertica Database 7.0. Installation Tool
Please enter password for root@host01:password
```

3. If the dbadmin user, or the user specified in the argument `--dba-user`, does not exist, then the install script prompts for the password for the user. Provide the password. For example:

```
Enter password for new UNIX user dbadmin:password
Retype new UNIX password for user dbadmin:password
```

4. Carefully examine any warnings or failures returned by `install_vertica` and correct the problems.

   For example, insufficient RAM, insufficient network throughput, and too high readahead settings on the filesystem could cause performance problems later on. Additionally, LANG warnings, if not resolved, can cause database startup to fail and issues with VSQL. The system LANG attributes must be UTF-8 compatible. **Once you fix the problems, re-run the install script**.

5. Once installation is successful, disconnect from the **Administration Host**, as instructed by the script; then complete the required post-installation steps.

   At this point, root privileges are no longer needed and the database administrator can perform any remaining steps.

To Complete Required Post-install Steps:

1. Log in to the **Database Administrator** account on the administration host.

2. Install the License Key

3. Accept the EULA.

4. If you have not already done so, proceed to the Getting Started Guide. Otherwise, proceed to Configuring the Database in the Administrator's Guide.

install_vertica Options

The table below details all of the options available to the install_vertica script. Most options have a long and short form. For example `--hosts` is interchangeable with `-s`. the only required options are `--hosts/-s` and `--rpm/--deb/-r`.

Option (long form, short form)	Description
`--help`	Display help for this script.

Option (long form, short form)	Description

`--hosts host_list,`
`-s host_list`
	A comma-separated list of host names or IP addresses to include in the cluster. Do not include spaces in the list.
	
	Examples:
	
	```--hosts host01,host02,host03```
	```-s 192.168.233.101,192.168.233.102,192.168.233.103```
	
	Note: If you are upgrading an existing installation of HP Vertica, be sure to use the same host names that you used previously.

`--rpm package_name,`
`--deb package_name,`
`-r package_name`
	The name of the RPM or Debian package. The install package must be provided if you are installing or upgrading multiple nodes and the nodes do not have the latest server package installed, or if you are adding a new node. The `install_vertica` and `upgrade_vertica` scripts serially copy the server package to the other nodes and install the package. If you are installing or upgrading a large number of nodes, then consider manually installing the package on all nodes before running the upgrade script, as the script runs faster if it does not need to serially upload and install the package on each node.
	
	Example:
	
	```--rpm vertica_7.0.x.x86_64.RHEL5.rpm```

`--data-dir data_directory,` `-d data_directory`	The default directory for database data and catalog files. The default is `/home/dbadmin` **Note**: Do not use a shared directory over more than one host for this setting. Data and catalog directories must be distinct for each node. Multiple nodes must not be allowed to write to the same data or catalog directory.

Option (long form, short form)	Description
`--dba-user` *dba_username*	The name of the **Database Administrator** system account to create. Only this account can run the Administration Tools. If you omit the `--dba-user` parameter, then the default database administrator account name is `dbadmin`. This parameter is optional for new installations done as root but must be specified when upgrading or when installing using sudo. If upgrading, use the `-u` parameter to specify the same DBA account name that you used previously. If installing using sudo, the user must already exist. **Note:** If you manually create the user, modify the user's .bashrc file to include the line: `PATH=/opt/vertica/bin:$PATH` so that the HP Vertica tools such as *vsql* and *admintools* can be easily started by the dbadmin user.
`--dba-group` *GROUP*, `-g` *GROUP*	The UNIX group for DBA users. The default is `verticadba`.
`--dba-user-home` *dba_home_directory*, `-l` *dba_home_directory*	The home directory for the database administrator. The default is `/home/dbadmin`
`--dba-user-password` *dba_password*, `-p` *dba_password*	The password for the database administrator account. If not supplied, the script prompts for a password and does not echo the input.
`--dba-user-password-disabled`	Disable the password for the `--dba-user`. This argument stops the installer from prompting for a password for the `--dba-user`. You can assign a password later using standard user management tools such as `passwd`.
`--spread-logging`, `-w`	Configures spread to output logging output to `/opt/vertica/log/spread_<hostname>.log`. Does not apply to upgrades. **Note:** Do not enable this logging unless directed to by HP Vertica Technical Support.

Option (long form, short form)	Description

`--ssh-password` *`password,`*
`-P` *`password`*
	The password to use by default for each cluster host. If not supplied, and the -i option is not used, then the script prompts for the password if and when necessary and does not echo the input. Do not use with the -i option.
	
	Special note about password:
	
	If you run the `install_vertica` script as root, specify the root password with the `-P` parameter:
	
	`# /opt/vertica/sbin/install_vertica -P <root_pass wd>`
	
	If, however, you run the `install_vertica` script with the `sudo` command, the password for the `-P` parameter should be the password of the user who runs `install_vertica`, not the root password. For example if user dbadmin runs `install_vertica` with sudo and has a password with the value `dbapasswd`, then the value for -P should be `dbapasswd`:
	
	`$ sudo /opt/vertica/sbin/install_vertica -P dbapa sswd`

Option (long form, short form)	Description
`--ssh-identity` *file,* `-i` *file*	The root private-key *file* to use if passwordless ssh has already been configured between the hosts. Verify that normal SSH works without a password before using this option. The file can be private key file (for example, id_rsa), or PEM file. Do not use with the `--ssh-password`/`-P` option. HP Vertica accepts the following: ● By providing an SSH private key which is not password protected. You cannot run the `install_vertica`script with the sudo command when using this method. ● By providing a password-protected private key and using an SSH-Agent. Note that sudo typically resets environment variables when it is invoked. Specifically, the SSH_AUTHSOCK variable required by the SSH-Agent may be reset. Therefore, configure your system to maintain SSH_AUTHSOCK or invoke the install_vertica command using a method similar to the following: `sudo SSH_AUTHSOCK=$SSH_ AUTHSOCK /opt/vertica/sbin/install_ vertica ...`
`--dba-user` *dba_username,* `-u` *dba_username*	The name of the **database administrator** account to create. Only this account can run the **Administration Tools**. If you omit the `--dba-user` parameter, then the install script creates a new system account named `dbadmin`. If dbadmin exists, it verifies the user can be used as the database administrator. **Note:** This parameter is optional for new installations done as root but must be specified when using sudo. If upgrading HP Vertica, use the `--dba-user` parameter to specify the same DBA account name that you used previously. If installing using sudo, the user must already exist.
`--config-file` *file,* `-z` *file*	Accepts an existing properties file created by `--record-config file_name`. This properties file contains key/value parameters that map to values in the `install_vertica` script, many with Boolean arguments that default to false.

Option (long form, short form)	Description
`--add-hosts host_list,` `-A host_list`	A comma-separated list of hosts to add to an existing HP Vertica cluster. `--add-hosts` modifies an existing installation of HP Vertica by adding a host to the database cluster and then reconfiguring the spread. This is useful for increasing system performance or setting **K-safety** to one (1) or two (2). **Notes:** • If you have used the `-T` parameter to configure spread to use direct point-to-point communication within the existing cluster, you must use the `-T` parameter when you add a new host; otherwise, the new host automatically uses UDP broadcast traffic, resulting in cluster communication problems that prevent HP Vertica from running properly. Examples: <code>--add-hosts host01 --add-hosts 192.168.233.101</code> • The `update_vertica` script described in Adding Nodes calls the `install_vertica` script to update the installation. You can use either the `install_vertica` or `update_vertica` script with the `--add-hosts` parameter.
`--record-config file_name,` `-B file_name`	Accepts a file name, which when used in conjunction with command line options, creates a properties file that can be used with the `--config-file` parameter. This parameter creates the properties file and exits; it has no impact on installation.
`--clean`	Forcibly cleans previously stored configuration files. Use this parameter if you need to change the hosts that are included in your cluster. Only use this parameter when no database is defined. Cannot be used with `update_vertica`.

| Option
(long form, short form)	Description
`--license { license_file	CE }`,
`-L { license_file	CE }`	Silently and automatically deploys the license key to `/opt/vertica/config/share`. On multi-node installations, the `--license` option also applies the license to all nodes declared in the `--hosts host_ list`.

If specified with **CE**, automatically deploys the Community Edition license key, which is included in your download. You do not need to specify a license file.

Examples:

```
--license CE
--license /tmp/vlicense.dat
``` |
| `--remove-hosts host_list`,
`-R host_list` | A comma-separated list of hosts to remove from an existing HP Vertica cluster.

`--remove-hosts` modifies an existing installation of HP Vertica by removing a host from the database cluster and then reconfiguring the spread. This is useful for removing an obsolete or over-provisioned system. For example:

```
---remove-hosts host01
-R 192.168.233.101
```

Notes:

- If you used the `-T` parameter to configure spread to use direct point-to-point communication within the existing cluster, you must use `-T` when you remove a host; otherwise, the hosts automatically use UDP broadcast traffic, resulting in cluster communication problems that prevents HP Vertica from running properly.

- The `update_vertica` script described in Removing Nodes in the Administrator's Guide calls the install_vertica script to perform the update to the installation. You can use either the `install_vertica` or `update_vertica` script with the `-R` parameter. |

Option (long form, short form)	Description

`--control-network { BCAST_ADDR | default },`
`-S { BCAST_ADDR | default }`
	Takes either the value 'default' or a broadcast network IP address (*BCAST_ADDR*) to allow spread communications to be configured on a subnet that is different from other HP Vertica data communications. `--control-network` is also used to force a cluster-wide spread reconfiguration when changing spread related options.
	
	Examples:
	
	`--control-network default`
	`--control-network 10.20.100.255`

`--point-to-point,` `-T`	Configures **spread** to use direct point-to-point communication between all HP Vertica nodes. You should use this option if your nodes aren't located on the same subnet. You should also use this option for all virtual environment installations, regardless of whether the virtual servers are on the same subnet or not. Cannot be used with `--broadcast`, as the setting must be either `--broadcast` or `--point-to-point` **Important**: When changing the configuration from `--broadcast` (the default) to `--point-to-point` or from `--point-to-point` to `--broadcast`, the `--control-network` parameter must also be used. **Note:** Spread always runs on UDP. `-T` does not denote TCP.
`--broadcast,` `-U`	Specifies that HP Vertica use UDP broadcast traffic by spread between nodes on the subnet. This parameter is automatically used by default. Cannot be used with `--point-to-point`, as the setting must be either `--broadcast` or `--point-to-point` **Important**: When changing the configuration from `--broadcast` (the default) to `--point-to-point` or from `--point-to-point` to `--broadcast`, the `--control-network` parameter must also be used. **Note:** Spread always runs on UDP. `-U` does not mean use UDP instead of TCP.

Option (long form, short form)	Description
`--accept-eula,` `-Y`	Silently accepts the EULA agreement. On multi-node installations, the `--accept-eula` value is propagated throughout the cluster at the end of the installation, at the same time as the Administration Tools metadata.
`--no-system-configuration`	By default, the installer makes system configuration changes to meet server requirements. If you do not want the installer to change any system properties, then use the `--no-system-configuration`. The installer presents warnings or failures for configuration settings that do not meet requirements that it normally would have automatically configured. **Note:** The system user account is still created/updated when using this parameter.

Option (long form, short form)	Description
`--failure-threshold`	Stops the installation when the specified failure threshold is encountered. Options can be one of: ● HINT - Stop the install if a HINT or greater issue is encountered during the installation tests. HINT configurations are settings you should make, but the database runs with no significant negative consequences if you omit the setting. ● WARN (default) - Stop the installation if a WARN or greater issue is encountered. WARN issues may affect the performance of the database. However, for basic testing purposes or Community Edition users, WARN issues can be ignored if extreme performance is not required. ● FAIL - Stop the installation if a FAIL or greater issue is encountered. FAIL issues can have severely negative performance consequences and possible later processing issues if not addressed. However, HP Vertica can start even if FAIL issues are ignored. ● HALT - Stop the installation if a HALT or greater issue is encountered. The database may not be able to be started if you choose his option. Not supported in production environments. ● NONE - Do not stop the installation. The database may not start. Not supported in production environments.

Option (long form, short form)	Description

`--large-cluster,`
`-2`
`[ <integer> | DEFAULT ]`
	Enables a large cluster layout, in which control message responsibilities are delegated to a subset of HP Vertica nodes (called control nodes) to improve control message performance in large clusters. Options can be one of:
	
	• `<integer>`—The number of control nodes you want in the cluster. Valid values are 1 to 120 for all new databases.
	
	• `DEFAULT`—HP Vertica chooses the number of control nodes using calculations based on the total number of cluster nodes in the `--hosts` argument.
	
	For more information, see Large Cluster in the Administrator's Guide.

Installing HP Vertica Silently

This section describes how to create a properties file that lets you install and deploy HP Vertica-based applications quickly and without much manual intervention.

> **Note:** The procedure assumes that you have already performed the tasks in Before you Install HP Vertica.

Installing HP Vertica Silently

1. Download and install the HP Vertica install package, as described in Installing HP Vertica.

2. Create the properties file that enables non-interactive setup by supplying the parameters you want HP Vertica to use. For example:

   The following command assumes a multi-node setup:

   ```
   # /opt/vertica/sbin/install_vertica --record-config file_name --license /tmp/license.
   txt --accept-eula --dba-user-password password --ssh-password password --hosts host_l
   ist --rpm package_name
   ```

   The following command assumes a single-node setup:

   ```
   # /opt/vertica/sbin/install_vertica --record-config file_name --license
   /tmp/license.txt --accept-eula --dba-user-password password
   ```

`--record-fil e `*`file_name`*	[Required] Accepts a file name, which when used in conjunction with command line option s, creates a properties file that can be used with the --config-file option during setup. This fl ag creates the properties file and exits; it has no impact on installation.
`--license-fi le { `*`licens e_file`*`	CE }`	Silently and automatically deploys the license key to /opt/vertica/config/share. On multi-nod e installations, the —license option also applies the license to all nodes declared in the --hos ts host_list. If specified with CE, automatically deploys the Community Edition license key, which is inclu ded in your download. You do not need to specify a license file.
`--accept-eul a`	Silently accepts the EULA agreement during setup.
`--dba-user-p assword pass word`	The password for the Database Administrator account; if not supplied, the script prompts f or the password and does not echo the input.
`--ssh-passwo rd password`	The root password to use by default for each cluster host; if not supplied, the script prompts for the password if and when necessary and does not echo the input.

`--hosts hos t_list`	A comma-separated list of hostnames or IP addresses to include in the cluster; do not inclu de space characters in the list. Examples:
	
	`--hosts host01,host02,host03`
	`--hosts 192.168.233.101,192.168.233.102,192.168.233.103`

`--rpm packag e_name`	The name of the RPM or Debian package that contained this script. Example: `--rpm vertica_7.0.x.x86_64.RHEL5.rpm` This parameter is required on multi-node installations if the RPM or DEB package is not alr eady installed on the other hosts.

See Installing HP Vertica with the install_vertica Script for the complete set of installation parameters.

> **Tip:** Supply the parameters to the properties file once only. You can then install HP Vertica using just the `--config-file` parameter, as described below.

3. Use one of the following commands to run the installation script.

   ■ If you are root:

   ```
   # /opt/vertica/sbin/install_vertica --config-file file_name
   ```

   ■ If you are using sudo:

   ```
   $ sudo /opt/vertica/sbin/install_vertica --config-file file_name
   ```

--config-file *file_name* Accepts an existing properties file created by --record-config *file_name*. This properties file contains key/value parameters that map to values in the install_vertica script, many with boolean arguments that default to false

The command for a single-node install might look like this:

```
# /opt/vertica/sbin/install_vertica --config-file /tmp/vertica-inst.prp
```

4. If you did not supply a --ssh-password password parameter to the properties file, you are prompted to provide the requested password to allow installation of the RPM/DEB and system configuration of the other cluster nodes. If you are root, this is the root password. If you are using sudo, this is the sudo user password. The password does not echo on the command line.

> **Note:** If you are root on a single-node installation, you are not prompted for a password.

5. If you did not supply a --dba-user-password password parameter to the properties file, you are prompted to provide the database administrator account password.

The installation script creates a new Linux user account (dbadmin by default) with the password that you provide.

6. Carefully examine any warnings produced by install_vertica and correct the problems if possible. For example, insufficient RAM, insufficient Network throughput and too high readahead settings on filesystem could cause performance problems later on.

> **Note:** You can redirect any warning outputs to a separate file, instead of having them display on the system. Use your platforms standard redirected machanisms. For example: install_vertica *[options]* > /tmp/file 1>&2.

7. **Optionally** perform the following steps:

   - Install the ODBC and JDBC driver.

   - Install the vsql client application on non-cluster hosts.

8. Disconnect from the Administration Host as instructed by the script. This is required to:

   - Set certain system parameters correctly.

   - Function as the HP Vertica database administrator.

At this point, Linux root privileges are no longer needed. The database administrator can perform the remaining steps.

> **Note:** when creating a new database, the database administrator might want to use

> different data or catalog locations than those created by the installation script. In that case, a Linux administrator might need to create those directories and change their ownership to the database administrator.

- If you supplied the --license and --accept-eula parameters to the properties file, then proceed to the Getting Started Guideand then see Configuring the Database in the Administrator's Guide. Otherwise:

1. Log in to the **Database Administrator** account on the administration host.

2. Accept the End User License Agreement and install the license key you downloaded previously as described in Install the License Key.

3. Proceed to the Getting Started Guideand then see Configuring the Database in the Administrator's Guide.

Notes

- Downgrade installations are not supported.

- The following is an example of the contents of the configuration properties file:

```
accept_eula = Truelicense_file = /tmp/license.txt
record_to = file_name
root_password = password
vertica_dba_group = verticadba
vertica_dba_user = dbadmin
vertica_dba_user_password = password
```

Installing HP Vertica on Amazon Web Services (AWS)

Beginning with Vertica 6.1.x, you can use Vertica on AWS by utilizing a pre-configured Amazon Machine Image (AMI). For details on installing and configuring a cluster on AWS, refer to About Using on Amazon Web Services (AWS).

Creating a Cluster Using MC

You can use Management Console to install an HP Vertica cluster on hosts where HP Vertica software has not been installed. The Cluster Installation wizard lets you specify the hosts you want to include in your HP Vertica cluster, loads the HP Vertica software onto the hosts, validates the hosts, and assembles the nodes into a cluster.

Management Console must be installed and configured before you can create a cluster on targeted hosts. See Installing and Configuring the MC for details.

Steps Required to Install an HP Vertica Cluster Using MC:

- Install and configure MC

- Prepare the Hosts

- Create the private key file and copy it to your local machine

- Run the Cluster Installation Wizard

- Validate the hosts and create the cluster

- Create a new database on the cluster

Prepare the Hosts

Before you can install an HP Vertica cluster using the MC, you must prepare each host that will become a node in the cluster. The cluster creation process runs validation tests against each host before it attempts to install the HP Vertica software. These tests ensure that the host is correctly configured to run HP Vertica.

The validation tests provide:

- Warnings and error messages when they detect a configuration setting that conflicts with HP Vertica's requirements or any performance issue

- Suggestions for configuration changes when they detect an issue

> **Note:** The validation tests do not automatically fix all problems they encounter.

All hosts must pass validation before the cluster can be created.

If you accepted the default configuration options when installing the OS on your host, then the validation tests will likely return errors, since some of the default options used on Linux systems conflict with HP Vertica requirements. See the Installation Guide for details on OS settings. To speed up the validation process you can perform the following steps on the prospective hosts

before you attempt to validate the hosts. These steps are based on Red Hat Enterprise Linux and CentOS systems, but other supported platforms have similar settings.

On each host you want to include in the HP Vertica cluster, you must stage the host according to Before You Install HP Vertica.

Create a Private Key File

Before you can install a cluster, Management Console must be able to access the hosts on which you plan to install HP Vertica. MC uses password-less SSH to connect to the hosts and install HP Vertica software using a private key file.

If you already have a private key file that allows access to all hosts in the potential cluster, you can use it in the cluster creation wizard.

> **Note:** The private key file is required to complete the MC cluster installation wizard.

Create a Private Key File

1. Log in on the server as root or as a user with sudo privileges.

2. Change to your home directory.

   ```
   $ cd ~
   ```

3. If an .ssh directory does not exist, create one.

   ```
   $ mkdir .ssh
   ```

4. Generate a passwordless private key/public key pair.

   ```
   $ ssh-keygen -q -t rsa -f ~/.ssh/vid_rsa -N ''
   ```

   This command creates two files: *vid_rsa* and *vid_rsa.pub*. The vid_rsa file is the private key file that you upload to the MC so that it can access nodes on the cluster and install HP vertica. The vid_rsa.pub file is copied to all other hosts so that they can be accessed by clients using the vid_rsa file.

5. Make your .ssh directory readable and writable only by yourself.

   ```
   $ chmod 700 /root/.ssh
   ```

6. Change to the .ssh directory.

```
$ cd ~/.ssh
```

7. Concatenate the public key into to the file vauthorized_keys2.

```
$ cat vid_rsa.pub >> vauthorized_keys2
```

8. If the host from which you are creating the public key will also be in the cluster, then copy the public key into the local-hosts authorized key file:

```
cat vid_rsa.pub >> authorized_keys2
```

9. Make the files in your .ssh directory readable and writable only by yourself.

```
$ chmod 600 ~/.ssh/*
```

10. Create the .ssh directory on the other nodes.

```
$ ssh <host> "mkdir /root/.ssh"
```

11. Copy the vauthorized key file to the other nodes.

```
$ scp -r /root/.ssh/vauthorized_keys2 <host>:/root/.ssh/.
```

12. On each node, concatenate the vauthorized_keys2 public key to the authorized_keys2 file and make the file readable and writable only by the owner.

```
$ ssh <host> "cd /root/.ssh/;cat vauthorized_keys2 >> authorized_keys2; chmod 600 /ro
ot/.ssh/authorized_keys2"
```

13. On each node, remove the vauthorized_keys2 file.

```
$ ssh -i /root/.ssh/vid_rsa <host> "rm /root/.ssh/vauthorized_keys2"
```

14. Copy the *vid_rsa* file to the workstation from which you will access the MC cluster installation wizard. This file is required to install a cluster from the MC.

A complete example of the commands for creating the public key and allowing access to three hosts from the key is below. The commands are being initiated from the docg01 host, and all hosts will be included in the cluster (docg01 - docg03):

```
ssh docg01
cd ~/.ssh
ssh-keygen -q -t rsa -f ~/.ssh/vid_rsa -N ''
cat vid_rsa.pub > vauthorized_keys2
cat vid_rsa.pub >> authorized_keys2
chmod 600 ~/.ssh/*
scp -r /root/.ssh/vauthorized_keys2 docg02:/root/.ssh/.
scp -r /root/.ssh/vauthorized_keys2 docg03:/root/.ssh/.
ssh docg02 "cd /root/.ssh/;cat vauthorized_keys2 >> authorized_keys2; chmod 600 /root/.ss
h/authorized_keys2"
ssh docg03 "cd /root/.ssh/;cat vauthorized_keys2 >> authorized_keys2; chmod 600 /root/.ss
h/authorized_keys2"
ssh -i /root/.ssh/vid_rsa docg02 "rm /root/.ssh/vauthorized_keys2"
ssh -i /root/.ssh/vid_rsa docg03 "rm /root/.ssh/vauthorized_keys2"
rm ~/.ssh/vauthorized_keys2
```

Use MC's Cluster Installation Wizard

MC's Cluster Installation Wizard guides you through the steps required to install an HP Vertica cluster on hosts that do not already have HP Vertica software installed.

Note: If you are using MC with the HP Vertica AMI on Amazon Web Services, note that the Create Cluster and Import Cluster options are not supported.

Prerequisites

Before you proceed, make sure you:

- Installed and configured MC.

- Prepared the hosts that you will include in the HP Vertica database cluster.

- Created the private key (pem) file and copied it to your local machine

- Obtained a copy of your HP Vertica license if you are installing the Enterprise Edition. If you are using the Community Edition, a license key is not required.

- Downloaded the HP Vertica server RPM (or DEB file).

- Have read/copy permissions on files stored on the local browser host that you will transfer to the host on which MC is installed.

Permissions on Files you'll Transfer to MC

On your local workstation, you must have at least read/write privileges on files you'll upload to MC through the Cluster Installation Wizard. These files include the HP Vertica server package, the license key (if needed), the private key file, and an optional CSV file of IP addresses.

Create a New HP Vertica Cluster Using MC

1. Connect to Management Console and log in as an MC administrator.

2. On MC's Home page, click the **Databases and Clusters** task.

3. Click the plus sign and select **Create Cluster**.

4. The Create Cluster wizard opens. Provide the following information:

   a. Cluster name—A label for the cluster

5. Vertica Admin User—The user that is created on each of the nodes when they are installed, typically 'dbadmin'. This user has access to HP Vertica and is also an OS user on the host.

6. Password for the HP Vertica Admin User—The password you enter (required) is set for each node when MC installs HP Vertica.

   Note: MC does not support an empty password for the administrative user.

7. HP Vertica Admin Path—Storage location for catalog files, which defaults to /home/dbadmin unless you specified a different path during MC configuration (or later on MC's Settings page).

   IMPORTANT: The Vertica Admin Path must be the same as the Linux database administrator's home directory. If you specify a path that is not the Linux dbadmin's home directory, MC returns an error.

8. Click **Next** and specify the private key file and host information:

   a. Click **Browse** and navigate to the private key file (vid_rsa) that you created earlier.

   Note: You can change the private key file at the beginning of the validation stage by clicking the name of the private key file in the bottom-left corner of the page. However, you cannot change the private key file after validation has begun unless the first host fails validation due to an SSH login error.

   b. Include the host IP addresses. Here you have three options:

   Specify later (but include number of nodes). This option allows you to specify the number of nodes, but not the specific IPs. You can specify the specific IPs before you validate hosts.

   Import IP addresses from local file. You can specify the hosts in a CSV file using either IP addresses or host names.

   Enter a range of IP addresses. You can specify a range of IPs to use for new nodes. For example 192.168.1.10 to 192.168.1.30. The range of IPs must be on the same or contiguous subnets.

9. Click **Next** and select the software and license:

a. Vertica Software. If one or more HP Vertica packages have been uploaded, you can select one from the list; otherwise select **Upload a new local vertica binary file** and browse to an HP Vertica server file on your local system.

b. Vertica License. Click **Browse** and navigate to a local copy of your HP Vertica license if you are installing the <ENT)>. Community Edition versions require no license key

10. Click **Next**. The Create cluster page opens. If you did not specify the IP addresses, select each host icon and provide an IP address by entering the IP in the box and clicking **Apply** for each host you add.

The hosts are now ready for **Host Validation and Cluster Creation**.

Validate Hosts and Create the Cluster

Host validation is the process where the MC runs tests against each host in a proposed cluster.

You can validate hosts only after you have completed the cluster installation wizard. You must validate hosts before the MC can install HP Vertica on each host.

At any time during the validation process, but before you create the cluster, you can add and remove hosts by clicking the appropriate button in the upper left corner of the page on MC. A Create Cluster button appears when all hosts that appear in the node list are validated.

How to Validate Hosts

To validate one or more hosts:

1. Connect to Management Console and log in as an MC administrator.

2. On the MC Home page, click the **Databases and Clusters** task.

3. In the list of databases and clusters, select the cluster on which you have recently run the cluster installation wizard (**Creating...** appears under the cluster) and click **View**.

4. Validate one or several hosts:

    ▪ To validate a single host, click the host icon, then click **Validate Host**.

    ▪ To validate all hosts at the same time, click **All** in the Node List, then click **Validate Host**.

    ▪ To validate more than one host, but not all of them, Ctrl+click the host numbers in the node list, then click **Validate Host**.

5. Wait while validation proceeds.

    The validation step takes several minutes to complete. The tests run in parallel for each host, so the number of hosts does not necessarily increase the amount of time it takes to validate all the hosts if you validate them at the same time. Hosts validation results in one of three possible states:

- Green check mark—The host is valid and can be included in the cluster.

- Orange triangle—The host can be added to the cluster, but warnings were generated. Click the tests in the host validation window to see details about the warnings.

- Red X—The host is not valid. Click the tests in the host validation window that have red X's to see details about the errors. You must correct the errors re-validate or remove the host before MC can create the cluster.

  To remove an invalid host: Highlight the host icon or the IP address in the Node List and click **Remove Host**.

All hosts must be valid before you can create the cluster. Once all hosts are valid, a **Create Cluster** button appears near the top right corner of the page.

How to Create the Cluster

1. Click **Create Cluster** to install HP Vertica on each host and assemble the nodes into a cluster.

   The process, done in parallel, takes a few minutes as the software is copied to each host and installed.

2. Wait for the process to complete. When the **Success** dialog opens, you can do one of the following:

   - Optionally create a database on the new cluster at this time by clicking **Create Database**

   - Click **Done** to create the database at a later time

   See Creating a Database on a Cluster for details on creating a database on the new cluster.

Create a Database on a Cluster

After you use the MC Cluster Installation Wizard to create an HP Vertica cluster, you can create a database on that cluster through the MC interface. You can create the database on all cluster nodes or on a subset of nodes.

If a database had been created using the Administration Tools on any of the nodes, MC detects (autodiscovers) that database and displays it on the Manage (Cluster Administration) page so you can import it into the MC interface and begin monitoring it.

MC allows only one database running on a cluster at a time, so you might need to stop a running database before you can create a new one.

The following procedure describes how to create a database on a cluster that you created using the MC Cluster Installation Wizard. To create a database on a cluster that you created by running the install_vertica script, see Creating an Empty Database.

Create a Database on a Cluster

To create a new empty database on a new cluster:

1. If you are already on the **Databases and Clusters** page, skip to the next step; otherwise:

   a. Connect to MC and sign in as an MC administrator.

   b. On the Home page, click the **Databases and Clusters** task.

2. If no databases exist on the cluster, continue to the next step; otherwise:

   a. If a database is running on the cluster on which you want to add a new database, select the database and click **Stop**.

   b. Wait for the running database to have a status of *Stopped*.

3. Click the cluster on which you want to create the new database and click **Create Database**.

4. The Create Database wizard opens. Provide the following information:

   ▪ Database name and password. See Creating a Database Name and Password for rules.

   ▪ Optionally click **Advanced** to open the advanced settings and change the port and catalog, data, and temporary data paths. By default the MC application/web server port is 5450 and paths are `/home/dbadmin`, or whatever you defined for the paths when you ran the cluster creation wizard. Do not use the default agent port 5444 as a new setting for the MC application/web server port. See **MC Settings > Configuration** for port values.

5. Click **Continue**.

6. Select nodes to include in the database.

   The Database Configuration window opens with the options you provided and a graphical representation of the nodes appears on the page. By default, all nodes are selected to be part of this database (denoted by a green check mark). You can optionally click each node and clear **Include host in new database** to exclude that node from the database. Excluded nodes are gray. If you change your mind, click the node and select the **Include** check box.

7. Click **Create** in the Database Configuration window to create the database on the nodes.

   The creation process takes a few moments and then the database is started and a **Success** message appears.

8. Click **OK** to close the success message.

   The Database Manager page opens and displays the database nodes. Nodes not included in the database are gray.

Installing and Configuring Management Console

This section describes how to install, configure, and upgrade Management Console (MC). If you need to back up your instance of MC, see Backing Up MC in the Administrator's Guide.

You can install MC before or after you install HP Vertica; however, consider installing HP Vertica and creating a database before you install MC. After you finish configuring MC, it automatically discovers your running database cluster, saving you the task of importing it manually.

Before You Install MC

Each version of HP Vertica Management Console (MC) is compatible only with the matching version of the HP Vertica server. For example, HP Vertica 6.1.2 server is supported with HP Vertica 6.1.2 MC only. Read the following documents for more information:

- Supported Platforms document, at http://www.vertica.com/documentation. The Supported Platforms document also lists supported browsers for MC.

- Installation Overview and Checklist. Make sure you have everything ready for your HP Vertica configuration.

- Before you Install HP Vertica. Read for required prerequisites for *all* HP Vertica configurations, including Management Console.

Driver Requirements for Linux SuSe Distributions

The MC (`vertica-console`) package contains the Oracle Implementation of Java 6 JRE and requires that you install the unixODBC driver manager on SuSe Linux platforms. unixODBC provides needed libraries libodbc and lidodbcinst.

Port Requirements

When you use MC to create a HP Vertica cluster, the Create Cluster Wizard uses SSH on its default port (22).

Port 5444 is the default agent port and must be available for MC-to-node and node-to-node communications.

Port 5450 is the default MC port and must be available for node-to-MC communications.

See Ensure Ports Are Available for more information about port and firewall considerations.

Firewall Considerations

Make sure that a firewall or iptables are not blocking communications between the cluster's database, Management Console, and MC's agents on each cluster node.

IP Address Requirements

If you install MC on a server outside the HP Vertica cluster it will be monitoring, that server must be accessible to at least the public network interfaces on the cluster.

Disk Space Requirements

You can install MC on any node in the cluster, so there are no special disk requirements for MC—other than disk space you would normally allocate for your database cluster. See Disk Space Requirements for HP Vertica.

Time Synchronization and MC's Self-Signed Certificate

When you connect to MC through a client browser, HP Vertica assigns each HTTPS request a self-signed certificate, which includes a timestamp. To increase security and protect against password replay attacks, the timestamp is valid for several seconds only, after which it expires.

To avoid being blocked out of MC, synchronize time on the hosts in your HP Vertica cluster, as well as on the MC host if it resides on a dedicated server. To recover from loss or lack of synchronization, resync system time and the Network Time Protocol. See Set Up Time Synchronization in the Installation Guide. If you want to generate your own certificates and keys for MC, see Generating Certifications and Keys for MC.

SSL Requirements

The openssl package must be installed on your Linux environment so SSL can be set up during the MC configuration process. See SSL Prerequisites in the Administrator's Guide.

File Permission Requirements

On your local workstation, you must have at least read/write privileges on any files you plan to upload to MC through the Cluster Installation Wizard. These files include the HP Vertica server package, the license key (if needed), the private key file, and an optional CSV file of IP addresses.

Monitor Resolution

Management Console requires a minimum resolution of 1024 x 768, but HP recommends higher resolutions for optimal viewing.

Installing Management Console

This procedure describes how to install the Management Console package on a dedicated MC server.

Before You Start

Before you install MC, it is assumed that you already:

- Read Before You Install Management Console

- Downloaded the HP Vertica rpm for your Linux distribution from the myVertica portal and saved it to a location on one of your cluster nodes, such as to /tmp

- Downloaded the `vertica-console` package for your Linux distribution from the myVertica portal and saved it to a location on the MC server, such as to /tmp

---

Notes

- HP Vertica requires a dedicated host for Management Console outside the database cluster. You cannot install MC on the same host on which you installed the HP Vertica server.

- Supported combinations of the HP Vertica server and Management Console appear in the Supported Platforms document, available at http://www.vertica.com/documentation.

- The MC user interface is intended to be installed near the cluster that it will be monitoring, in order that it have access to at least the public network interfaces on the cluster.

- If you need to upgrade MC, see Upgrading Management Console.

- The default port for MC is 5450, and the default port for agents is 5444. If you need to specify another port for the agents, see Changing MC or Agent Ports.

- For a list of supported browsers, see the documentation at http://www.vertica.com/documentation.

Install Management Console on the MC Server

1. Download the MC package (`vertica-console-<current-version>.<Linux-distro>`) from myVertica portal and save it to a location on the target server, such as `/tmp`.

2. On the target server, log in as root or a user with sudo privileges.

3. Change directory to the location where you saved the MC package.

4. Install MC using your local Linux distribution package management system (for example, rpm, yum, zipper, apt, dpkg).

   The following command is a generic example for Red Hat 5:

```
# rpm -Uvh vertica-console-<current-version>.x86_64.RHEL5.rpm
```

The following command is a generic example for Debian 5 and Debian 6:

```
# dpkg -i vertica-console-<current-version>.deb
```

For Ubuntu systems, use sudo:

```
$ sudo dpkg -i vertica-console-<current-version>.deb
```

5. Open a browser and enter the IP address or host name of the server on which you installed MC, as well as the default MC port 5450.

   For example, you'll enter one of:

```
https://xx.xx.xx.xx:5450/ https://hostname:5450/
```

6. When the Configuration Wizard dialog box appears, proceed to Configuring MC.

See Also

- Upgrading MC

Configuring MC

After you install MC, you need to configure it through a client browser connection. An MC configuration wizard walks you through creating the Linux **MC super** administrator account, storage locations, and other settings that MC needs to run. Information you provide during the configuration process is stored in the /opt/vconsole/config/console.properties file.

If you need to change settings after the configuration wizard ends, such as port assignments, you can do so later through Home > MC Settings page.

How to Configure MC

1. Open a browser session.

2. Enter the IP address or host name of the server on which you installed MC (or any cluster node's IP/host name if you already installed HP Vertica), and include the default MC port 5450. For example, you'll enter one of:

```
https://xx.xx.xx.xx:5450/ https://hostname:5450/
```

3. Follow the configuration wizard.

About Authentication for the MC Super Administrator

In the final step of the configuration process, you choose an authentication method for the MC super administrator. You can decide to have MC authenticate the MC super (in which case the process is complete), or you can choose LDAP.

If you choose LDAP, provide the following information for the newly-created MC super administrator:

- Corporate LDAP service host (IP address or host name)

- LDAP server running port (default 389)

- LDAP **DN** (distinguished name) for base search/lookup/authentication criteria

  At a minimum, specify the dc (domain component) field. For example: `dc=vertica, dc=com` generates a unique identifier of the organization, like the corporate Web URL vertica.com

- Default search path for the organization unit (ou)

  For example: `ou=sales, ou=engineering`

- Search attribute for the user name (uid), common name (cn), and so on

  For example, `uid=jdoe, cn=Jane Doe`

- Binding DN and password for the MC super administrator.

  In most cases, you provide the "Bind as administrator" fields, information used to establish the LDAP service connection for all LDAP operations, like search. Instead of using the administrator user name and password, the MC administrator could use his or her own LDAP credentials, as long as that user has search privileges.

If You Choose Bind Anonymously

Unless you specifically configure the LDAP server to deny anonymous binds, the underlying LDAP protocol will not cause MC's Configure Authentication process to fail if you choose "Bind anonymously" for the MC administrator. Before you use anonymous bindings for LDAP authentication on MC, be sure that your LDAP server is configured to explicitly disable/enable this option. For more information, see the article on Infusion Technology Solutions and the OpenLDAP documentation on access control.

What Happens Next

Shortly after you click Finish, you should see a status in the browser; however, for several seconds you might see only an empty page. During this brief period, MC runs as the local user 'root' long enough to bind to port number 5450. Then MC switches to the **MC super** administrator account that you just created, restarts MC, and displays the MC login page.

Where to Go Next

If you are a new MC user and this is your first MC installation, you might want to familiarize yourself with MC design. See Management Console in the Concepts Guide.

If you'd rather use MC now, the following following topics in the Administrator's Guide should help get you started:

If you want to ...	See ...
Use the MC interface to install HP Vertica on a cluster of hosts	Creating a Cluster Using MC
Create a new, empty HP Vertica database or import an existing HP Vertica database cluster into the MC interface	Managing Database Clusters on MC
Create new MC users and map them to one or more HP Vertica databases that you manage through the MC interface	Managing Users and Privileges (About MC Users and About MC privileges and roles)
Monitor MC and one or more MC-managed HP Vertica databases	Monitoring HP Vertica Using Management Console
Change default port assignments or upload a new HP Vertica license or SSL certificate	Managing MC Settings
Compare MC functionality to functionality that the Administration Tools provides	Administration Tools and Management Console

After You Install HP Vertica

The tasks described in this section are optional and are provided for your convenience. When you have completed this section, proceed to one of the following:

- The Getting Started Guide

- Configuring the Database in the Administrator's Guide

Install the License Key

If you did not supply the `-L` parameter during setup, or if you did not bypass the `-L` parameter for a silent install, the first time you log in as the **Database Administrator** and run the HP Vertica **Administration Tools** or Management Console, HP Vertica requires you to install a license key.

Follow the instructions in Managing licenses in Administrator's Guide.

Optionally Install vsql Client Application on Non-Cluster Hosts

You can use the HP Vertica vsql executable image on a non-cluster Linux host to connect to an HP Vertica database.

- On Red Hat 5.0 64-bit and SUSE 10/11 64-bit, you can install the client driver RPM, which includes the vsql executable. See Installing the Client RPM on Red Hat and SUSE for details.

- If the non-cluster host is running the same version of Linux as the cluster, copy the image file to the remote system. For example:

```
$ scp host01:/opt/vertica/bin/vsql .$ ./vsql
```

- If the non-cluster host is running a different version of Linux than your cluster hosts, and that operating system is not Red Hat version 5 64-bit or SUSE 10/11 64-bit, you must install the HP Vertica server RPM in order to get vsql. Download the appropriate rpm package from the Download tab of the myVertica portal then log into the non-cluster host as root and install the rpm package using the command:

```
# rpm -Uvh filename
```

In the above command, *filename* is package you downloaded. Note that you do not have to run the `install_HP Vertica` script on the non-cluster host in order to use vsql.

Notes

- Use the same command line options that you would on a cluster host.

- You cannot run vsql on a Cygwin bash shell (Windows). Use ssh to connect to a cluster host, then run vsql.

In release 5.1.5 vsql is also available for additional platforms. See Installing the vsql client.

Changing the IP Addresses of an HP Vertica Cluster

This section describes how to change the IP addresses of the nodes in an HP Vertica cluster.

> **Note:** This process requires that you stop the database on all nodes, then subsequently stop the database on individual nodes as you update IP addresses.

These instructions assume you will make the standard OS changes to change the IPs (for example, updating `/etc/hosts`) in Step 4 of this procedure. These instructions detail only the HP Vertica-specific IP changes. Consult the documentation for your particular OS platform for details on changing the IP address of the host.

To change the IP address of one or more nodes in a cluster:

1. Before changing the IP address on the Host, back up the following three files on all nodes:

   - `/opt/vertica/config/admintools.conf`

   - `/opt/vertica/config/vspread.conf`

   - `/etc/sysconfig/spreadd`

2. Stop HP Vertica on all nodes.

3. As root, on each node, stop spread by using the following command:

   `/etc/init.d/spreadd stop`

4. Change the IP addresses of the hosts as required by your operating system platform.

5. On each node edit `/opt/vertica/config/admintools.conf` and change the IPs as required.

   You can use sed to change each IP in the file, for example to change `10.10.81.8` to `192.168.150.108` issue the command:

   `sed -i 's/10.10.81.8/192.168.150.108/g' /opt/vertica/config/admintools.conf`

6. On each node edit `/opt/vertica/config/vspread.conf`:

   a. Change the old IPs to the new IPs as required.

   b. Locate the N number for each IP and change it to match the new IP. For example, if the old IP is `10.10.81.8`, then the corresponding N number is `N010010081008`. N numbers consist of 3 digits for each IP number segment, padded with zeros when appropriate (10 becomes 010, 8 become 008, etc.). If the new IP address is `192.168.150.255`, then the new corresponding N number is `N192168250255`.

7. On each node edit `/etc/sysconfig/spreadd` and change the N number to that node's new N number as you specified in `vspread.conf`.

8. As root, on each node start spread by using the following command:

   `/etc/init.d/spreadd start`

9. Start the database.

10. Run vsql.

11. In vsql, issue the following query to verify the new IP has been updated:

   `select host_name from host_resources;`

   You can also verify IPs with the following shell commands:

   ▪ cat /var/log/spreadd.log

   ▪ admintools -t list_host

   ▪ cat /etc/hosts

12. Update the database to use the new IPs for reporting node status:

   a. In vsql, issue the command `select node_name, node_address from v_catalog.nodes;` to show you the current node names configured.

   b. For each node in the result, change the hostname to the new IP address. **Note**: the node must be down to change the IP using the alter node command. You must bring the node down before altering the *NODE_NAME* property for that node:

      ○ Bring the node down that you are going to update (don't bring down the node from which you are using vsql!). You can bring down the node from the initiator node using admintools. For example:
      `admintools -t stop_node -s 192.168.150.255`

      ○ Update the IP address by issuing the command: `alter node` *NODE_NAME* `is hostname '`*new.ip.address*`';` where NODE_NAME is the node_name and new.ip.address is the new IP address of that node.

- Bring the node back up, check it's status in the nodes table (`select node_name,` `node_state from nodes;`), and wait for that node's status to be *UP*. You can use admintools from the initiator node to restart the node. You must provide the database name. For example:
  `admintools -t restart_node -s 192.168.150.255 -d VMart`

- Repeat the process for the next node in the result. After all nodes have been updated except the node from which you are using vsql, log out of vsql, then log into vsql from another node and update the IP address for the node from which you were previously using vsql.

Install HP Vertica Documentation

The latest documentation for your HP Vertica release is available at
http://www.vertica.com/documentation. After you install HP Vertica, you can optionally install the
documentation on your database server and client systems.

Installing the HP Vertica Documentation

To install a local copy of the documentation:

1. Open a Web browser and go to http://www.vertica.com/documentation.

2. Scroll down to **Install documentation locally** and save the HP Vertica documentation
   package (`.tar.gz` or `.zip`) to your system; for example, to `/tmp`.

3. Extract the contents using your preferred unzipping application.

4. The home page for the HTML documentation is located at `/HTML/index.htm` in the extracted
   folder.

Get Started!

HP Vertica lets you choose between instant gratification and a more detailed path in setting up your
example database. Both processes, described in the Getting Started Guide, are simple, and both let
you start using your database immediately—literally within minutes.

- If you can't wait to get started, read about one-step installation script in Installing the Example
  Database.

- If you prefer a more thorough, but equally-simple example, see the Tutorial.

Installing Client Drivers

After you install HP Vertica, install drivers on the client systems from which you plan to access your databases. HP supplies drivers for ADO.NET, JDBC, ODBC Perl, and Python. For instructions on installing these drivers, see Client driver install procedures in the Programmer's Guide.

Extend Your Installation Using HP Vertica Packages

You can extend the functionality of your HP Vertica installation in a number of different ways. You can create your own SQL functions, which allow you to execute complex queries and combine HP Vertica built-in functions. You can also create your own user-defined functions (UDFs), which are libraries of functions that you develop in C++ to perform analytic operations that are difficult to perform with SQL. And, you can take advantage of HP Vertica *packages* to install additional SQL functions to your system. An example of a package is the HP Vertica Geospatial package, which allows you to query and analyze geographic/spatial data.

Installing Packages

HP Vertica packages are optional; you can decide whether or not you want to install and use them. After you install HP Vertica, you'll find all of the directories and files necessary for package installation within the `/opt/vertica/packages/<package-name>` directory.

Keep in mind that, if you decide to make any changes to the SQL functions in any package, you should be sure to save a backup of your changes in another directory, so that your changes will be preserved in the event of an upgrade. HP Vertica is not responsible for migrating any changes you make to package functions to newer versions.

Directory Structure for HP Vertica Packages

At the top level of each package directory, you'll find these files:

- `readme.txt`—contains information on how to install the package

- `install.sh`—use this script to install the package

Each package directory might also contain a number of subdirectories. Note that each of these subdirectories is created only when the package requires the specified files.

- `/bin`—contains procedures needed for the package.

- `/lib`—contains shared libraries (.so files) needed for the package.

- `/src`—contains .sql or other source files needed for the package.

- `/examples`—contains example files (.demo.sql files) that illustrate common use cases.

To Install an HP Vertica package:

Run the install.sh script that appears in the `/opt/vertica/packages/` directory for the specific package.

Note: If you choose to install an HP Vertica package in a directory other than the default, be sure to set the appropriate environment variable to reflect the correct directory.

Upgrading HP Vertica

Upgrading HP Vertica to a New Version

Important: The Version 7.0 installer introduces new platform verification tests that prevent the install from continuing if the platform requirements are not met by your system. Manually verify that your system meets the requirements in Before You Install HP Vertica **before you update the server package** on your systems. These tests ensure that your platform meets the hardware and software requirements for HP Vertica. Previous versions documented these requirements, but the installer did not verify all of the settings.

Version 7.0 introduces the new installation parameter `--failure-threshold` that allows you to change the level at which the installer stops the installation process based on the severity of the failed test. By default, the installer stops on all warnings. You can change the failure threshold to FAIL to bypass all warnings and only stop on failures. However, your platform is unsupported until you correct all warnings generated by the installer. By changing the failure threshold you are able to immediately upgrade and bring up your HP Vertica database, but performance can not be guaranteed until you correct the warnings.

Important: When upgrading from 5.x to a later version of HP Vertica, due to a change in how transaction catalog storage works in HP Vertica 6.0 and later, the amount of space that the transaction catalog takes up can increase significantly during and after the upgrade. Verify that you have a at least 4x the size of the Catalog folder in the catalog free (in addition to normal free space requirements) on your nodes prior to upgrading.

To determine the amount of space the Catalog folder is using, run `du -h` on the Catalog folder. **Note:** do not run `du -h` on the entire catalog. Run it specifically on the Catalog folder in the catalog.

For example:

```
[dbadmin@localhost ~]$ du -h /home/dbadmin/db/v_db_node0001_catalog/Catalog/
```

Upgrading HP Vertica

Follow these steps to upgrade your database. Note that upgrades are an incremental and must follow one of the following upgrade paths:

- HP Vertica 3.5 to 4.0

- HP Vertica 4.0 to 4.1

- HP Vertica 4.1 to 5.0

- HP Vertica 4.1 to 5.1

- HP Vertica 5.0 to 5.1

- HP Vertica 5.0 to 6.0

- HP Vertica 5.1 to 6.0

- HP Vertica 6.0 to 6.1

- HP Vertica 6.1 to 7.0. If you have enabled LDAP over SSL/TLS, read Configuring LDAP Over SSL/TLS When Upgrading HP Vertica before upgrading.

IMPORTANT NOTE: HP strongly recommends that you follow the upgrade paths. Be sure to read the New Features and New Features for each version you skip. The HP Vertica documentation is available in the rpm, as well as at http://www.vertica.com/documentation (which also provides access to previous versions of the documentation).

1. Back up your existing database. This is a precautionary measure so that you can restore from the backup if the upgrade is unsuccessful.

   Note: Release 5.1 introduced a new backup utility, `vbr.py`. This utility replaced both the `backup.sh` and `restore.sh` scripts, making both obsolete. Any backups created with `backup.sh` are incompatible with backups created with `vbr.py`. HP Vertica recommends that you use the current utility `vbr.py` as soon as possible after successfully upgrading from a version prior to Release 5.1 to Release 5.1 or later. Documentation for the 5.0 scripts remained in the 5.1 documentation. However, the topics were marked Obsolete in that version and were removed from later versions of the documentation.

2. Stop the database using admintools if it is not already stopped. See Stopping a Database.

3. On each host that you have an additional package installed, such as the R Language Pack, uninstall the package. For example: `rpm -e vertica-R-lang`.

   Note: If you fail to uninstall HP Vertica packages prior to upgrading the server package, then the server package fails to install due to dependencies on the earlier version of the package. The error that appears is similar to the following:

   ```
   error: Failed dependencies:
   vertica-base = 6.1.3 is needed by (installed) vertica-R-lang-6.1.3-3.x86_64
   ```

4. On any host in the cluster, install the new HP Vertica Server RPM or DEB. See Download and Install the HP Vertica Server Package.

   For example:

   ```
   rpm syntax:
   ```

```
# rpm -Uvh /home/dbadmin/vertica-x86_64.RHEL5.rpm
```

```
deb syntax:
# dpkg -i /home/dbadmin/vertica-x86_64.RHEL5.rpm
```

Note: If you fail to install the rpm or deb prior to running the next step, then `update_vertica` fails with an error due to the conflict between the version of the `update_vertica` script and the version of the rpm argument.

5. As root or sudo, run `update_vertica`. **Use the same options that you used when you last installed or upgraded the database**, except for the `--hosts/-s` *host_list* parameter, as the upgrade script automatically determines the hosts in the cluster.

    If you forgot the options that were last used, open `/opt/vertica/config/admintools.conf` in a text editor and find the line that starts with `install_opts`. This line details each option. It is important to use the same options that were used previously as omitting any options used previously causes them to revert to their default setting when the upgrade script runs. Also, if you use different options than originally used, then the update script reconfigures the cluster to use the new options, which can cause issues with your existing database.

    Note: Installing HP Vertica with the install_vertica Script - provides details on all options available to the `update_vertica` script. `update_vertica` uses the same options as `install_vertica`.

    For example:

    ```
    # /opt/vertica/sbin/update_vertica  --rpm /home/dbadmin/vertica-x86_64.RHEL5.rpm
    ```

    Note: the rpm/deb file must be readable by the dbadmin user when upgrading. Some upgrade scripts are run as the dbadmin user, and that user must be able to read the rpm/deb file.

6. Start the database. The startup scripts analyze the database and perform any necessary data and catalog updates for the new version.

7. Perform another backup. When moving from Version 5.0 and earlier to Version 5.1 and later, the backup process changes from using `backup.sh` to using `vbr.py`. You cannot use an incremental backup between these different versions of backup scripts. Create a full backup the first time you move to using `vbr.py`, and optionally use incremental backups as you continue to upgrade. However, HP Vertica recommends doing full backups each time if disk space and time allows.

8. Continue along the upgrade path and perform these same steps for each version in your upgrade path.

9. After you have upgraded to the latest version of the server, install any additional packs you previously removed. See the pack install/upgrade instructions for details on upgrading the packs. For R, see Installing/Upgrading the R Language Pack for HP Vertica.

Notes

- Downgrade installations are not supported.

Configuring LDAP Over SSL/TLS When Upgrading HP Vertica

If you have LDAP enabled over SSL/TLS, in HP Vertica 7.0, the certificate authentication is more secure than in previous releases. Before you upgrade to HP Vertica 7.0, you must perform several tasks to connect to the LDAP server after the upgrade.

This section describes the steps you should follow when setting up secure LDAP authentication on a new installation of HP Vertica 7.0. The section also includes the procedure you should follow should you choose to revert to the more permissive behavior used in HP Vertica6.1.

- Using HP Vertica 7.0 Secure LDAP Authentication

- Using HP Vertica 6.1 Secure LDAP Authentication

Using HP Vertica 7.0 Secure LDAP Authentication

If you are a new customer installing HP Vertica7.0 and you want to use LDAP over SSL/TLS, take the following steps on all cluster nodes. You must perform these steps to configure LDAP authentication:

1. If necessary, modify the LDAP authentication record in your `vertica.conf` file to point to the correct server.

2. As the root user, if necessary, create an `ldap.conf` file and add the following settings. The `TLS_REQCERT` option is required. You must include either the `TLS_CACERT` or `TLS_CACERTDIR` option.

```
TLS_REQCERT hard
```

```
TLS_CACERT = /<certificate_path>/CA-cert-bundle.crt
or
TLS_CACERTDIR = <certificate_path>
```

The options for `TLS_REQCERT` are:

- `hard`: If you do not provide a certificate or you provide an invalid certificate, you cannot connect. This is the default behavior.

- `never`: The client will not request or check a certificate.

- `allow`: If you do not provide a certificate, or you provide an invalid certification, you can connect anyway.

- `try`: If you do not provide a certificate, you can connect. If you provide an invalid certificate is provided, you cannot connect.

  `TLS_CACERT` specifies the path to the file that contains the certificates.

  `TLS_CACERTDIR` specifies the path to the directory that contains the certificates.

3. Store the `ldap.conf` file in a location that is readable by DBADMIN. The DBADMIN must be able to access the `ldap.conf` file and all path names specified in the `ldap.conf` file on all cluster nodes.

4. Set the Linux LDAPCONF environment variable to point to this `ldap.conf` file.

   Make sure this environment variable is set before you start the HP Vertica software or you create a database. To ensure that this happens, add a command to the DBADMIN's profile to set LDAPCONF to point to the `ldap.conf` file every time you start the database.

   If you start the database using a script like a startup or init file, add steps to the script that set the LDAPCONF variable to point to the ldap.conf file.

5. Test that LDAP authentication works with and without SSL/TLS. You can use the `ldapsearch` tool for this.

6. Repeat steps 1–5 for all cluster nodes.

Using HP Vertica 6.1 Secure LDAP Authentication

If you have LDAP enabled over SSL/TLS and you want to use the more permissive LDAP settings used in HP Vertica 6.1, perform the following tasks on all cluster nodes. These settings allow HP Vertica to connect to the LDAP server, even if authentication fails. You must perform these tasks before you upgrade to HP Vertica 7.0 and you must perform them on all cluster nodes:

1. If necessary, modify the LDAP authentication record in your `vertica.conf` file to point to the correct server.

2. As the root user, create or modify the `ldap.conf` file and make the following changes to `ldap.conf`:

```
TLS_REQCERT allow
```

- `hard`: If you do not provide a certificate or you provide an invalid certificate, you cannot connect. This is the default.

- `never`: The client will not request or check a certificate..

- `allow`: If you do not provide a certificate, or you provide an invalid certification, you can connect anyway. This is consistent with the behavior in HP Vertica 6.1.

- `try`: If you do not provide a certificate, you can connect. If you provide an invalid certificate is provided, you cannot connect.

3. Store the `ldap.conf` file in a location that is readable by DBADMIN. The DBADMIN must be able to access the `ldap.conf` file and all path names specified in the `ldap.conf` file on all cluster nodes.

4. Set the Linux LDAPCONF environment variable to point to this `ldap.conf`file.

   Make sure this environment variable is set before you start the HP Vertica software or you create a database. To ensure that this happens, add a command to the DBADMIN's Linux profile to set LDAPCONF to point to the ldap.conf file every time you log in.

5. If you start the database using a script like a startup or init file, add steps to the script that set the LDAPCONF variable to point to the `ldap.conf` file.

6. Test that LDAP authentication works with and without SSL/TLS. You can use the ldapsearch tool for this.

7. Repeat steps 1–5 for all cluster nodes.

Upgrading Your HP Vertica License

To upgrade from the Community Edition license, obtain an evaluation or Enterprise Edition license from HP. For information on applying your new license, see Installing or Upgrading a License Key in the Administrator's Guide.

Upgrading MC

If you are moving from MC 6.1.1 to MC 6.1.2, you can install MC on any HP Vertica cluster node. This scenario requires a fresh install because HP does not provide scripts to migrate metadata (MC users and settings) established in earlier releases from your existing server to the cluster node. See Installing and Configuring Management Console.

After you install and configure MC, you will need to recreate MC users you'd created for your 6.1.1 MC instance, if any, and apply previous MC settings to the new MC version.

> **Tip:** You can export MC-managed database messages and user activity to a location on the existing server. While you can't import this data, using the exported files as a reference could help make metadata recreation easier. See Exporting MC-managed Database Messages and Exporting the Audit Log.

If You Want to Keep MC on the Existing Server

If you want to keep MC on the same server (such as on the dedicated server that had been required in previous MC releases), your MC metadata is retained when you run the `vertica-console` installation script.

Before You Upgrade MC on the Same Server

1. Log in as root or a user with sudo privileges on the server where MC is already installed.

2. Back up MC to preserve configuration metadata. See Backing Up MC .

3. Open a terminal window and shut down the MC process using the following command:

```
# /etc/init.d/vertica-consoled stop
```

Upgrade MC on the Same Server

1. Download the MC package (`vertica-console-<current-version>.<Linux-distro>`) from myVertica portal and save it to a location on the target server, such as `/tmp`.

2. On the target server, log in as root or a user with sudo privileges.

3. Change directory to the location where you saved the MC package.

4. Install MC using your local Linux distribution package management system (for example, rpm, yum, zipper, apt, dpkg).

    The following command is a generic example for Red Hat 5:

    ```
    # rpm -Uvh vertica-console-<current-version>.x86_64.RHEL5.rpm
    ```

    The following command is a generic example for Debian 5 and Debian 6:

    ```
    # dpkg -i vertica-console-<current-version>.deb
    ```

    For Ubuntu systems, use sudo:

    ```
    $ sudo dpkg -i vertica-console-<current-version>.deb
    ```

5. Open a browser and enter the IP address or host name of the server on which you installed MC, as well as the default MC port 5450.

    For example, you'll enter one of:

    ```
    https://xx.xx.xx.xx:5450/ https://hostname:5450/
    ```

6. When the Configuration Wizard dialog box appears, proceed to Configuring MC.

Uninstalling HP Vertica

Uninstalling HP Vertica

To uninstall HP Vertica:

1. For each host in the cluster, do the following:

   a. Choose a host machine and log in as root (or log in as another user and switch to root).

   ```
   $ su - root
   password: <root-password>
   ```

   b. Find the name of the package that is installed:

   ```
   # rpm -qa | grep vertica
   ```

   c. Remove the package:

   ```
   # rpm -e package
   ```

   Note: If you want to delete the configuration file used with your installation, you can choose to delete the /opt/vertica/ directory and all subdirectories using this command:
   # rm -rf /opt/vertica/

2. For each client system, do the following:

   a. Delete the JDBC driver jar file.

   b. Delete ODBC driver data source names.

   c. Delete the ODBC driver software by doing the following:

      i. In Windows, go to **Start > Control Panel > Add or Remove Programs**.

      ii. Locate HP Vertica.

      iii. Click **Remove**.

Uninstalling MC

The uninstall command shuts down Management Console and removes most of the files that MC installation script installed.

Uninstall MC

1. Log in to the target server as root:

2. Look for previously-installed versions of MC and note the version:

   ```
   # rpm -qa | grep vert
   ```

   For example, the following is similar to output you will see:

   ```
   vertica-console-6.1.2-0.x86_64
   ```

3. Run the erase command:

   ```
   # rpm -e <vertica-console>
   ```

4. Check for running processes and shut them down, including spread.

   a. Check for running processes:

      ```
      # ps ax | grep opt
      ```

   b. If you see nothing running, proceed to step 5. If output similar to the following appears, proceed to step 4c:

      ```
      3170 ? S<s 0:00 /opt/vertica/spread/sbin/spread -n N127000000001 -c
       /opt/vertica/config/vspread.conf
      3292 ? S<s 0:00 /bin/sh /opt/vertica/agent/agent.sh
                     /opt/vertica/config/users/mcadmin/agent.conf
      3334 ? S<l 0:33 /opt/vertica/oss/python/bin/python ./simply_fast.py
      ```

   c. Stop spread:

      ```
      # /etc/init.d/spreadd stop
      ```

   d. Issue the kill command on the remaining running processes, using their process ID (PID); for example, based on the sample output in step 4a:

      ```
      # kill -9 3292# kill -9 3334
      ```

5. Manually delete the `/opt/vconsole` directory:

```
# rm -rf /opt/vconsole
```

If You Want to Reinstall MC

To re-install MC, see Installing and Configuring Management Console.

Troubleshooting the HP Vertica Install

The topics described in this section are performed automatically by the `install_vertica` script and are described in Installing HP Vertica. If you did not encounter any installation problems, proceed to the Administrator's Guide for instructions on how to configure and operate a database.

Validation Scripts

HP Vertica provides several validation utilities that can be used prior to deploying HP Vertica to help determine if your hosts and network can properly handle the processing and network traffic required by HP Vertica. These utilities can also be used if you are encountering performance issues and need to troubleshoot the issue.

After you install the HP Vertica RPM, you have access to the following scripts in `/opt/vertica/bin`:

- Vcpuperf - a CPU performance test used to verify your CPU performance.

- Vioperf - an Input/Output test used to verify the speed and consistency of your hard drives.

- Vnetperf - a Network test used to test the latency and throughput of your network between hosts.

These utilities can be run at any time, but are well suited to use before running the install_vertica script.

Vcpuperf

The vcpuperf utility measures your server's CPU processing speed and compares it against benchmarks for common server CPUs. The utility performs a CPU test and measures the time it takes to complete the test. The lower the number scored on the test, the better the performance of the CPU.

The vcpuperf utility also checks the high and low load times to determine if CPU throttling is enabled. If a server's low-load computation time is significantly longer than the high-load computation time, CPU throttling may be enabled. CPU throttling is a power-saving feature. However, CPU throttling can reduce the performance of your server. HP Vertica recommends disabling CPU throttling to enhance server performance.

Syntax

```
vcpuperf [-q]
```

Options

-q: run in quiet mode. Quiet mode displays only the CPU Time, Real Time, and high and low load times.

Returns

- CPU Time: the amount of time it took the CPU to run the test.

- Real Time: the total time for the test to execute.

- High load time: The amount of time to run the load test while simulating a high CPU load.

- Low load time: The amount of time to run the load test while simulating a low CPU load.

Example

The following example shows a CPU that is running slightly slower than the expected time on a Xeon 5670 CPU that has CPU throttling enabled.

```
[root@docb04 bin]# /opt/vertica/bin/vcpuperfCompiled with: 4.1.2 20080704 (Red Hat 4.1.2-
52)Expected time on Core 2, 2.53GHz: ~9.5sExpected time on Nehalem, 2.67GHz: ~9.0sExpecte
d time on Xeon 5670, 2.93GHz: ~8.0sThis machine's time:  CPU Time: 8.540000s  Real Time:8
.710000sSome machines automatically throttle the CPU to save power.  This test can be don
e in <100 microseconds (60-70 on Xeon 5670, 2.93GHz).  Low load times much larger than 10
0-200us or much larger than the corresponding high load time indicate low-load throttlin
g, which can adversely affect small query / concurrent performance.This machine's high lo
ad time: 67 microseconds.This machine's low load time: 208 microseconds.
```

Vioperf

The `vioperf` utility quickly tests the performance of your host's input and output subsystem. The utility performs the following tests:

- sequential write

- sequential rewrite

- sequential read

- skip read (read non-contiguous data blocks)

The utility verifies that the host reads the same bytes that it wrote and prints its output to STDOUT. The utility also logs the output to a JSON formatted file.

Minimum and Recommended IO Performance

- The minimum required I/O is 20 MB/s read/write per physical processor core on each node, in full duplex (reading and writing) simultaneously, concurrently on all nodes of the cluster.

- The recommended I/O is 40 MB/s per physical core on each node.

For example, the I/O rate for a node with 2 hyper-threaded six-core CPUs (12 physical cores) is 240 MB/s required minimum, 480 MB/s recommended.

Syntax

```
vioperf [--help] [--duration=<INTERVAL>] [--log-interval=<INTERVAL>] [--log-
file=<FILE>] [--condense-log] [<DIR>*]
```

Options

`--help`	Prints a help message and exits.
`--duration`	The length of time `vioprobe` runs performance tests. The default is 5 minutes. Specify the interval in seconds, minutes, or hours with any of these suffixes: - Seconds: `s`, `sec`, `secs`, `second`, `seconds`. Example: `--duration=60sec` - Minutes: `m`, `min`, `mins`, `minute`, `minutes`. Example: `--duration=10min` - Hours: `h`, `hr`, `hrs`, `hour`, `hours`. Example: `--duration=1hrs`
`--log-interval`	The interval at which the log file reports summary information. The default interval is 10 seconds. This option uses the same interval notation as `--duration`.
`--log-file`	The path and name where log file contents are written, in JSON. If not specified, then `vioperf` creates a file named `results`*date-time*`.JSON` in the current directory.
`--condense-log`	Directs `vioperf` to write the log file contents in condensed format, one JSON entry per line, rather than as indented JSON syntax.
`<DIR>`	Zero or more directories to test. If you do not specify a directory, `vioperf` tests the current directory. To test the performance of each disk, specify different directories mounted on different disks.

Returns

The utility returns the following information:

test	The test being run (Write, ReWrite, Read, or Skip Read)
directory	The directory in which the test is being run.
counter name	The counter type of the test being run. Can be either MB/s or Seeks per second.
counter value	The value of the counter in MB/s or Seeks per second across all threads. This measurement represents the bandwidth at the exact time of measurement. Contrast with counter value (avg).
counter value (avg)	The average amount of data in MB/s, or the average number of Seeks per second, for the test being run in the duration specified with `--log-interval`. The default interval is 10 seconds. The `counter value (avg)` is the average bandwidth since the last log message, across all threads.
thread count	The number of threads used to run the test.

%CPU	The available CPU percentage used during this test.
%IO Wait	The CPU percentage in I/O Wait state during this test. I/O wait state is the time working processes are blocked while waiting for I/O operations to complete.
elapsed time	The amount of time taken for a particular test. If you run the test multiple times, elapsed time increases the next time the test is run.
remaining time	The time remaining until the next test. Based on the `--duration` option, each of the tests is run at least once. If the test set is run multiple times, then `remaining time` is how much longer the test will run. The `remaining time` value is cumulative. Its total is added to elapsed time each time the same test is run again.

Example

Invoking `vioperf` from a terminal outputs the following message and sample results:

```
[dbadmin@node01 ~]$ /opt/vertica/bin/vioperf --duration=60s
```

```
The minimum required I/O is 20 MB/s read and write per physical processor core on each no
de, in full duplex i.e. reading and writing at this rate simultaneously, concurrently on
all nodes of the cluster. The recommended I/O is 40 MB/s per physical core on each node.
For example, the I/O rate for a server node with 2 hyper-threaded six-core CPUs is 240 MB
/s required minimum, 480 MB/s recommended.Using direct io (buffer size=1048576, alignment
=512) for directory "/home/dbadmin/VMart/v_vmart_node0001_catalog"
test      | directory                                      | counter name    | counter v
alue      | counter value (10 sec avg)     | thread count  | %CPU  | %IO Wait | elapse
d time (s)| remaing time (s)
----------------------------------------------------------------------------------------
----------------------------------------------------------------------------------------
--------------------------
Write     | /home/dbadmin/VMart/v_vmart_node0001_catalog   | MB/s            | 27
          | 27                             | 1             | 2     | 97       | 10
       | 5
Write     | /home/dbadmin/VMart/v_vmart_node0001_catalog   | MB/s            | 24
          | 16                             | 1             | 3     | 96       | 15
       | 0
ReWrite   | /home/dbadmin/VMart/v_vmart_node0001_catalog   | MB/s            | 8
          | 8                              | 1             | 2     | 96       | 10
       | 5
ReWrite   | /home/dbadmin/VMart/v_vmart_node0001_catalog   | MB/s            | 9
          | 12                             | 1             | 3     | 95       | 15
       | 0
Read      | /home/dbadmin/VMart/v_vmart_node0001_catalog   | MB/s            | 22
          | 22                             | 1             | 4     | 94       | 10
       | 5
Read      | /home/dbadmin/VMart/v_vmart_node0001_catalog   | MB/s            | 23
          | 27                             | 1             | 6     | 91       | 15
       | 0
SkipRead  | /home/dbadmin/VMart/v_vmart_node0001_catalog   | seeks/s         | 300
          | 300                            | 1             | 0     | 99       | 10
       | 5
SkipRead  | /home/dbadmin/VMart/v_vmart_node0001_catalog   | seeks/s         | 308
```

| | 324 | | 1 | | 0 | | 99 | | 15 |
| | 0 | | | | | | | | |

Vnetperf

The vnetperf utility allows you to measure the network performance of your hosts. It can measure network latency and the throughput for both the TCP and UDP protocols.

Important: This utility introduces a high network load and must not be used on a running HP Vertica cluster or database performance is degraded.

Using this utility you can detect:

● if throughput is low for all hosts or a particular host,

● if latency is high for all hosts or a particular host,

● bottlenecks between one or more hosts or subnets,

● too low a limit in the number of TCP connections that can be established simultaneously,

● and if there is a high rate of packet loss on the network.

The latency test measures the latency from the host running the script to the other hosts. Any host that has a particularly high latency should be investigated further.

The throughput tests measure both UDP and TCP throughput. You can specify a rate limit in MB/s to use for these tests, or allow the utility to use a range of throughputs to be used.

Recommended Network Performance

● The maximum recommended RTT (round-trip time) latency is 1000 microseconds. The ideal RTT latency is 200 microseconds or less. HP Vertica recommends that clock skew be kept to under 1 second.

● The minimum recommended throughput is 100MB/s. Ideal throughput is 800 MB/s or more.
  Note: UDP numbers may be lower, multiple network switches may reduce performance results.

Syntax

```
vnetperf [options] [tests]
```

Options

`--condense`	Condense the log into one JSON entry per line, instead of indented JSON syntax.
`--collect-logs`	Collect the test log files from each host.
`--datarate` *rate*	Limit the throughput to this rate in MB/s. A rate of 0 loops the tests through several different rates. The default is 0.
`--duration` *seconds*	The time limit for each test to run in seconds. The default is 1.
`--hosts` *host1,host2,...*	A comma-separated list of hosts on which to run the tests. Do not use spaces between the comma's and the host names.
`--hosts` *file*	A hosts file that specifies the hosts on which to run the tests. If the --hosts argument is not used, then the utility attempts to access admintools and determine the hosts in the cluster.
`--identity-file` *file*	If using passwordless SSH/SCP access between the hosts, then specify the key file used to gain access to the hosts.
`--ignore-bad-hosts`	If set, run the tests on the reachable hosts even if some hosts are not reachable. If not set, and a host is unreachable, then no tests are run on any hosts.
`--log-dir` *directory*	If --collect-logs is set, the directory in which to place the collected logs. The default directory is named logs.netperf.*<timestamp>*
`--log-level` *LEVEL*	The log level to use. Possible values are: INFO, ERROR, DEBUG, and WARN. The default is WARN.
`--list-tests`	Lists the tests that can be run by this utility.
`--output-file` *file*	The file that JSON results are written to. The default is results.*<timestamp>*.json.
`--ports` *port1,port2,port3*	The port numbers to use. If only one is specified then the next two numbers in sequence are also used. The default ports are 14159,14160, 14161.
`--scp-options` *'options'*	Using this argument, you can specify one or more standard SCP command line arguments enclosed in single quotes. SCP is used to copy test binaries over to the target hosts.
`--ssh-options` *'options'*	Using this argument, you can specify one or more standard SSH command line arguments enclose in single quotes. SSH is used to issue test commands on the target hosts.
`--vertica-install` *directory*	If specified, then the utility assumes HP Vertica is installed on each of the hosts and to use the test binaries on the target system rather than copying them over using SCP.

Tests

> **Note:** : If the tests argument is omitted then all tests are run.

`latency`	Test the latency to each of the hosts.
`tcp-throughput`	Test the TCP throughput amongst the hosts.
`udp-throughput`	Test the UDP throughput amongst the hosts.

Returns

For each host it returns the following:

Latency test returns:

- The Round Trip Time (rtt) latency for each host in milliseconds.

- Clock Skew = the difference in time shown by the clock on the target host relative to the host running the utility.

UDP and TCP throughput tests return:

- The date/time and test name.

- The rate limit in MB/s.

- The node being tested.

- Sent and Received data in MB/s and bytes.

- The duration of the test in seconds.

Example

```
/opt/vertica/bin/vnetperf --condense -hosts 10.20.100.66,10.20.100.67 --identity-file '/r
oot/.ssh/vid_rsa'
```

Enable Secure Shell (SSH) Logins

The administrative account must be able to use Secure Shell (SSH) to log in (ssh) to all hosts without specifying a password. The shell script install_vertica does this automatically. This section describes how to do it manually if necessary.

1. If you do not already have SSH installed on all hosts, log in as root on each host and install it now. You can download a free version of the SSH connectivity tools from OpenSSH.

2. Log in to the HP Vertica administrator account (dbadmin in this example).

3. Make your home directory (~) writable only by yourself. Choose one of:

   ```
   $ chmod 700 ~
   ```

   or

   ```
   $ chmod 755 ~
   ```

   where:

700 includes	755 includes
400 read by owner	400 read by owner
200 write by owner	200 write by owner
100 execute by owner	100 execute by owner
	040 read by group
	010 execute by group
	004 read by anybody (other)
	001 execute by anybody

4. Change to your home directory:

   ```
   $ cd ~
   ```

5. Generate a private key/ public key pair:

   ```
   $ ssh-keygen -t rsaGenerating public/private rsa key pair.
   Enter file in which to save the key (/home/dbadmin/.ssh/id_rsa):
   Created directory '/home/dbadmin/.ssh'.
   Enter passphrase (empty for no passphrase):
   Enter same passphrase again:
   Your identification has been saved in /home/dbadmin/.ssh/id_rsa.
   Your public key has been saved in /home/dbadmin/.ssh/id_rsa.pub.
   ```

6. Make your .ssh directory readable and writable only by yourself:

```
$ chmod 700 ~/.ssh
```

7. Change to the .ssh directory:

```
$ cd ~/.ssh
```

8. Copy the file id_rsa.pub onto the file authorized_keys2.

```
$ cp id_rsa.pub authorized_keys2
```

9. Make the files in your .ssh directory readable and writable only by yourself:

```
$ chmod 600 ~/.ssh/*
```

10. For each cluster host:

```
$ scp -r ~/.ssh <host>:.
```

11. Connect to each cluster host. The first time you ssh to a new remote machine, you could get a message similar to the following:

```
$ ssh dev0Warning: Permanently added 'dev0,192.168.1.92' (RSA) to the list of known h
osts.
```

This message appears only the first time you ssh to a particular remote host.

See Also

- OpenSSH

Appendix: Time Zones

Using Time Zones With HP Vertica

HP Vertica uses the `TZ` environment variable on each node, if it has been set, for the default current time zone. Otherwise, HP Vertica uses the operating system time zone.

The `TZ` variable can be set by the operating system during login (see `/etc/profile`, `/etc/profile.d`, or `/etc/bashrc`) or by the user in `.profile`, `.bashrc` or `.bash-profile`.

`TZ` must be set to the same value on each node when you start HP Vertica.

The following command returns the current time zone for your database:

```
=> SHOW TIMEZONE;   name   |      setting
----------+------------------
 timezone | America/New_York
(1 row)
```

You can also use the SET TIMEZONE TO { *value* | *'value'* } command to set the time zone for a single session.

There is no database default time zone; instead, TIMESTAMP WITH TIMEZONE (TIMESTAMPTZ) data is stored in GMT (**UTC**) by converting data from the current local time zone to GMT.

When TIMESTAMPTZ data is used, data is converted back to use the current local time zone, which might be different from the local time zone where the data was stored. This conversion takes into account Daylight Saving Time (Summer Time), if applicable, depending on the year and date, to know when the Daylight Saving Time change occurred.

TIMESTAMP WITHOUT TIMEZONE data stores the timestamp, as given, and retrieves it exactly as given. The current time zone is ignored. The same is true for TIME WITHOUT TIMEZONE. For TIME WITH TIMEZONE (TIMETZ), however, the current time zone setting is stored along with the given time, and that time zone is used on retrieval.

> **Note:** HP recommends that you use TIMESTAMPTZ, not TIMETZ.

TIMESTAMPTZ uses the current time zone on both input and output, such as in the following example:

```
=> CREATE TEMP TABLE s (tstz TIMESTAMPTZ);=> SET TIMEZONE TO 'America/New_York';
=> INSERT INTO s VALUES ('2009-02-01 00:00:00');
=> INSERT INTO s VALUES ('2009-05-12 12:00:00');
=> SELECT tstz AS 'Local timezone', tstz AT TIMEZONE 'America/New_York' AS 'America/New_Y
ork',
   tstz AT TIMEZONE 'GMT' AS 'GMT' FROM s;
    Local timezone     |   America/New_York   |        GMT
-----------------------+----------------------+---------------------
```

```
  2009-02-01 00:00:00-05 | 2009-02-01 00:00:00 | 2009-02-01 05:00:00
  2009-05-12 12:00:00-04 | 2009-05-12 12:00:00 | 2009-05-12 16:00:00
(2 rows)
```

The -05 in the Local time zone column above shows that the data is displayed in EST, while -04 indicates EDT. The other two columns show the TIMESTAMP WITHOUT TIMEZONE at the specified time zone.

The next example illustrates what occurs if the current time zone is changed to, for example, Greenwich Mean Time:

```
=> SET TIMEZONE TO 'GMT';=> SELECT tstz AS 'Local timezone', tstz AT TIMEZONE 'America/Ne
w_York' AS
   'America/New_York', tstz AT TIMEZONE 'GMT' as 'GMT' FROM s;
    Local timezone     |   America/New_York  |         GMT
-----------------------+---------------------+---------------------
 2009-02-01 05:00:00+00 | 2009-02-01 00:00:00 | 2009-02-01 05:00:00
 2009-05-12 16:00:00+00 | 2009-05-12 12:00:00 | 2009-05-12 16:00:00
(2 rows)
```

The +00 in the Local time zone column above indicates that TIMESTAMPTZ is displayed in 'GMT'.

The approach of using TIMESTAMPTZ fields to record events captures the GMT of the event, as expressed in terms of the local time zone. Later, it allows for easy conversion to any other time zone, either by setting the local time zone or by specifying an explicit AT TIMEZONE clause.

The following example shows how TIMESTAMP WITHOUT TIMEZONE fields work in HP Vertica.

```
=> CREATE TEMP TABLE tnoz (ts TIMESTAMP);=> INSERT INTO tnoz VALUES('2009-02-01 00:00:0
0');
=> INSERT INTO tnoz VALUES('2009-05-12 12:00:00');
=> SET TIMEZONE TO 'GMT';
=> SELECT ts AS 'No timezone', ts AT TIMEZONE 'America/New_York' AS
   'America/New_York', ts AT TIMEZONE 'GMT' AS 'GMT' FROM tnoz;
     No timezone     |    America/New_York    |         GMT
---------------------+------------------------+------------------------
 2009-02-01 00:00:00 | 2009-02-01 05:00:00+00 | 2009-02-01 00:00:00+00
 2009-05-12 12:00:00 | 2009-05-12 16:00:00+00 | 2009-05-12 12:00:00+00
(2 rows)
```

The +00 at the end of a timestamp indicates that the setting is TIMESTAMP WITH TIMEZONE in GMT (the current time zone). The 'America/New_York' column shows what the 'GMT' setting was when you recorded the time, assuming you read a normal clock in the time zone 'America/New_York'. What this shows is that if it is midnight in the 'America/New_York' time zone, then it is 5 am GMT.

Note: 00:00:00 Sunday February 1, 2009 in America/New_York converts to 05:00:00 Sunday February 1, 2009 in GMT.

The 'GMT' column displays the GMT time, assuming the input data was captured in GMT.

If you don't set the time zone to GMT, and you use another time zone, for example 'America/New_York', then the results display in 'America/New_York' with a -05 and -04, showing the difference between that time zone and GMT.

```
=> SET TIMEZONE TO 'America/New_York';=> SHOW TIMEZONE;
   name   |     setting
----------+------------------
 timezone | America/New_York
 (1 row)
=> SELECT ts AS 'No timezone', ts AT TIMEZONE 'America/New_York' AS
   'America/New_York', ts AT TIMEZONE 'GMT' AS 'GMT' FROM tnoz;
    No timezone     |    America/New_York     |          GMT
--------------------+-----------------------+-----------------------
 2009-02-01 00:00:00 | 2009-02-01 00:00:00-05 | 2009-01-31 19:00:00-05
 2009-05-12 12:00:00 | 2009-05-12 12:00:00-04 | 2009-05-12 08:00:00-04
 (2 rows)
```

In this case, the last column is interesting in that it returns the time in New York, given that the data was captured in 'GMT'.

See Also

- TZ Environment Variable

- SET TIME ZONE

- Date/Time Data Types

Africa

Africa/Abidjan
Africa/Accra
Africa/Addis_Ababa
Africa/Algiers
Africa/Asmera
Africa/Bamako
Africa/Bangui
Africa/Banjul
Africa/Bissau
Africa/Blantyre
Africa/Brazzaville

Africa/Bujumbura
Africa/Cairo Egypt
Africa/Casablanca
Africa/Ceuta
Africa/Conakry
Africa/Dakar
Africa/Dar_es_Salaam
Africa/Djibouti
Africa/Douala
Africa/El_Aaiun
Africa/Freetown
Africa/Gaborone
Africa/Harare
Africa/Johannesburg
Africa/Kampala
Africa/Khartoum
Africa/Kigali
Africa/Kinshasa
Africa/Lagos
Africa/Libreville
Africa/Lome
Africa/Luanda
Africa/Lubumbashi
Africa/Lusaka
Africa/Malabo
Africa/Maputo
Africa/Maseru
Africa/Mbabane

Africa/Mogadishu
Africa/Monrovia
Africa/Nairobi
Africa/Ndjamena
Africa/Niamey
Africa/Nouakchott
Africa/Ouagadougou
Africa/Porto-Novo
Africa/Sao_Tome
Africa/Timbuktu
Africa/Tripoli Libya
Africa/Tunis
Africa/Windhoek

America

America/Adak America/Atka US/Aleutian
America/Anchorage SystemV/YST9YDT US/Alaska
America/Anguilla
America/Antigua
America/Araguaina
America/Aruba
America/Asuncion
America/Bahia
America/Barbados
America/Belem
America/Belize
America/Boa_Vista
America/Bogota

America/Boise
America/Buenos_Aires
America/Cambridge_Bay
America/Campo_Grande
America/Cancun
America/Caracas
America/Catamarca
America/Cayenne
America/Cayman
America/Chicago CST6CDT SystemV/CST6CDT US/Central
America/Chihuahua
America/Cordoba America/Rosario
America/Costa_Rica
America/Cuiaba
America/Curacao
America/Danmarkshavn
America/Dawson
America/Dawson_Creek
America/Denver MST7MDT SystemV/MST7MDT US/Mountain America/Shiprock Navajo
America/Detroit US/Michigan
America/Dominica
America/Edmonton Canada/Mountain
America/Eirunepe
America/El_Salvador
America/Ensenada America/Tijuana Mexico/BajaNorte
America/Fortaleza
America/Glace_Bay
America/Godthab

America/Goose_Bay
America/Grand_Turk
America/Grenada
America/Guadeloupe
America/Guatemala
America/Guayaquil
America/Guyana
America/Halifax Canada/Atlantic SystemV/AST4ADT
America/Havana Cuba
America/Hermosillo
America/Indiana/Indianapolis
America/Indianapolis
America/Fort_Wayne EST SystemV/EST5 US/East-Indiana
America/Indiana/Knox America/Knox_IN US/Indiana-Starke
America/Indiana/Marengo
America/Indiana/Vevay
America/Inuvik
America/Iqaluit
America/Jamaica Jamaica
America/Jujuy
America/Juneau
America/Kentucky/Louisville America/Louisville
America/Kentucky/Monticello
America/La_Paz
America/Lima
America/Los_Angeles PST8PDT SystemV/PST8PDT US/Pacific US/Pacific- New
America/Maceio
America/Managua

America/Manaus Brazil/West
America/Martinique
America/Mazatlan Mexico/BajaSur
America/Mendoza
America/Menominee
America/Merida
America/Mexico_City Mexico/General
America/Miquelon
America/Monterrey
America/Montevideo
America/Montreal
America/Montserrat
America/Nassau
America/New_York EST5EDT SystemV/EST5EDT US/Eastern
America/Nipigon
America/Nome
America/Noronha Brazil/DeNoronha
America/North_Dakota/Center
America/Panama
America/Pangnirtung
America/Paramaribo
America/Phoenix MST SystemV/MST7 US/Arizona
America/Port-au-Prince
America/Port_of_Spain
America/Porto_Acre America/Rio_Branco Brazil/Acre
America/Porto_Velho
America/Puerto_Rico SystemV/AST4
America/Rainy_River

America/Rankin_Inlet
America/Recife
America/Regina Canada/East-Saskatchewan Canada/Saskatchewan SystemV/CST6
America/Santiago Chile/Continental
America/Santo_Domingo
America/Sao_Paulo Brazil/East
America/Scoresbysund
America/St_Johns Canada/Newfoundland
America/St_Kitts
America/St_Lucia
America/St_Thomas America/Virgin
America/St_Vincent
America/Swift_Current
America/Tegucigalpa
America/Thule
America/Thunder_Bay
America/Toronto Canada/Eastern
America/Tortola
America/Vancouver Canada/Pacific
America/Whitehorse Canada/Yukon
America/Winnipeg Canada/Central
America/Yakutat
America/Yellowknife

Antarctica

Antarctica/Casey
Antarctica/Davis
Antarctica/DumontDUrville

Antarctica/Mawson
Antarctica/McMurdo
Antarctica/South_Pole
Antarctica/Palmer
Antarctica/Rothera
Antarctica/Syowa
Antarctica/Vostok

Asia

Asia/Aden
Asia/Almaty
Asia/Amman
Asia/Anadyr
Asia/Aqtau
Asia/Aqtobe
Asia/Ashgabat Asia/Ashkhabad
Asia/Baghdad
Asia/Bahrain
Asia/Baku
Asia/Bangkok
Asia/Beirut
Asia/Bishkek
Asia/Brunei
Asia/Calcutta
Asia/Choibalsan
Asia/Chongqing Asia/Chungking
Asia/Colombo
Asia/Dacca Asia/Dhaka

Asia/Damascus
Asia/Dili
Asia/Dubai
Asia/Dushanbe
Asia/Gaza
Asia/Harbin
Asia/Hong_Kong Hongkong
Asia/Hovd
Asia/Irkutsk
Asia/Jakarta
Asia/Jayapura
Asia/Jerusalem Asia/Tel_Aviv Israel
Asia/Kabul
Asia/Kamchatka
Asia/Karachi
Asia/Kashgar
Asia/Katmandu
Asia/Krasnoyarsk
Asia/Kuala_Lumpur
Asia/Kuching
Asia/Kuwait
Asia/Macao Asia/Macau
Asia/Magadan
Asia/Makassar Asia/Ujung_Pandang
Asia/Manila
Asia/Muscat
Asia/Nicosia Europe/Nicosia
Asia/Novosibirsk

Asia/Omsk
Asia/Oral
Asia/Phnom_Penh
Asia/Pontianak
Asia/Pyongyang
Asia/Qatar
Asia/Qyzylorda
Asia/Rangoon
Asia/Riyadh
Asia/Riyadh87 Mideast/Riyadh87
Asia/Riyadh88 Mideast/Riyadh88
Asia/Riyadh89 Mideast/Riyadh89
Asia/Saigon
Asia/Sakhalin
Asia/Samarkand
Asia/Seoul ROK
Asia/Shanghai PRC
Asia/Singapore Singapore
Asia/Taipei ROC
Asia/Tashkent
Asia/Tbilisi
Asia/Tehran Iran
Asia/Thimbu Asia/Thimphu
Asia/Tokyo Japan
Asia/Ulaanbaatar Asia/Ulan_Bator
Asia/Urumqi
Asia/Vientiane
Asia/Vladivostok

| Asia/Yakutsk |
| Asia/Yekaterinburg |
| Asia/Yerevan |

Atlantic

| Atlantic/Azores |
| Atlantic/Bermuda |
| Atlantic/Canary |
| Atlantic/Cape_Verde |
| Atlantic/Faeroe |
| Atlantic/Madeira |
| Atlantic/Reykjavik Iceland |
| Atlantic/South_Georgia |
| Atlantic/St_Helena |
| Atlantic/Stanley |

Australia

| Australia/ACT |
| Australia/Canberra |
| Australia/NSW |
| Australia/Sydney |
| Australia/Adelaide |
| Australia/South |
| Australia/Brisbane |
| Australia/Queensland |
| Australia/Broken_Hill |
| Australia/Yancowinna |

Australia/Darwin
Australia/North
Australia/Hobart
Australia/Tasmania
Australia/LHI
Australia/Lord_Howe
Australia/Lindeman
Australia/Melbourne
Australia/Victoria
Australia/Perth Australia/West

Etc/GMT

Etc/GMT+1
Etc/GMT+2
Etc/GMT+3
Etc/GMT+4
Etc/GMT+5
Etc/GMT+6
Etc/GMT+7
Etc/GMT+8
Etc/GMT+9
Etc/GMT+10
Etc/GMT+11
Etc/GMT+12
Etc/GMT-1
Etc/GMT-2
Etc/GMT-3
Etc/GMT-4

Etc/GMT-5
Etc/GMT-6
Etc/GMT-7
Etc/GMT-8
Etc/GMT-9
Etc/GMT-10
Etc/GMT-11
Etc/GMT-12
Etc/GMT-13
Etc/GMT-14

Europe

Europe/Amsterdam
Europe/Andorra
Europe/Athens
Europe/Belfast
Europe/Belgrade
Europe/Ljubljana
Europe/Sarajevo
Europe/Skopje
Europe/Zagreb
Europe/Berlin
Europe/Brussels
Europe/Bucharest
Europe/Budapest
Europe/Chisinau Europe/Tiraspol
Europe/Copenhagen
Europe/Dublin Eire

Europe/Gibraltar
Europe/Helsinki
Europe/Istanbul Asia/Istanbul Turkey
Europe/Kaliningrad
Europe/Kiev
Europe/Lisbon Portugal
Europe/London GB GB-Eire
Europe/Luxembourg
Europe/Madrid
Europe/Malta
Europe/Minsk
Europe/Monaco
Europe/Moscow W-SU
Europe/Oslo Arctic/Longyearbyen Atlantic/Jan_Mayen
Europe/Paris
Europe/Prague Europe/Bratislava
Europe/Riga
Europe/Rome Europe/San_Marino Europe/Vatican
Europe/Samara
Europe/Simferopol
Europe/Sofia
Europe/Stockholm
Europe/Tallinn
Europe/Tirane
Europe/Uzhgorod
Europe/Vaduz

Europe/Vienna
Europe/Vilnius
Europe/Warsaw Poland
Europe/Zaporozhye
Europe/Zurich

Indian

Indian/Antananarivo
Indian/Chagos
Indian/Christmas
Indian/Cocos
Indian/Comoro
Indian/Kerguelen
Indian/Mahe
Indian/Maldives
Indian/Mauritius
Indian/Mayotte
Indian/Reunion

Pacific

Pacific/Apia
Pacific/Auckland NZ
Pacific/Chatham NZ-CHAT
Pacific/Easter Chile/EasterIsland
Pacific/Efate
Pacific/Enderbury
Pacific/Fakaofo

Pacific/Fiji
Pacific/Funafuti
Pacific/Galapagos
Pacific/Gambier SystemV/YST9
Pacific/Guadalcanal
Pacific/Guam
Pacific/Honolulu HST SystemV/HST10 US/Hawaii
Pacific/Johnston
Pacific/Kiritimati
Pacific/Kosrae
Pacific/Kwajalein Kwajalein
Pacific/Majuro
Pacific/Marquesas
Pacific/Midway
Pacific/Nauru
Pacific/Niue
Pacific/Norfolk
Pacific/Noumea
Pacific/Pago_Pago Pacific/Samoa US/Samoa
Pacific/Palau
Pacific/Pitcairn SystemV/PST8
Pacific/Ponape
Pacific/Port_Moresby
Pacific/Rarotonga
Pacific/Saipan
Pacific/Tahiti
Pacific/Tarawa

Pacific/Tongatapu
Pacific/Truk
Pacific/Wake
Pacific/Wallis
Pacific/Yap

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