Vertica® Analytic Database 5.0

Installation Guide

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CONFIDENTIAL

Contents

Technical Support

To submit problem reports, questions, comments, and suggestions, use the Technical Support page on the Vertica Web site.

Notes:

- You must be a registered user in order to access the ***MyVertica Portal http://myvertica.vertica.com/v-zone/overview***.
- If you are not a registered user, you can request access at the ***Technical Support Web page http://www.vertica.com/support***.

Before you report a problem, run the Diagnostics Utility described in the Troubleshooting Guide and attach the resulting `.zip` file to your ticket.

About the Documentation

This section describes how to access and print Vertica documentation. It also includes ***suggested reading paths*** (page 4).

Where to Find the Vertica Documentation

You can read or download the Vertica documentation for the current release of Vertica® Analytic Database from the ***Product Documentation Page http://www.vertica.com/v-zone/product_documentation***. You must be a registered user to access this page.

The documentation is available as a compressed tarball (`.tar`) or a zip archive (`.zip`) file. When you extract the file on the database server system or locally on the client, contents are placed in a `/vertica50_doc/` directory.

Notes:

- The documentation on the Vertica Web site is updated each time a new release is issued.
- A more recent version of the product documentation might be available online. To check for critical product or document information added after the product release, see the Vertica Product Documentation downloads site. You can download the PDF version or browse books online
- If you are using an older version of the software, refer to the documentation on your database server or client systems.

See ***Installing Vertica Documentation*** (page 48) in the Installation Guide.

Reading the Online Documentation

Reading the HTML documentation files

The Vertica documentation files are provided in HTML browser format for platform independence. The HTML files require only a browser that displays frames properly with JavaScript enabled. The HTML files do not require a Web (HTTP) server.

The Vertica documentation is supported on the following browsers:

- Mozilla FireFox
- Internet Explorer
- Apple Safari
- Opera
- Google Chrome (server-side installations only)

The instructions that follow assume you have installed the documentation on a client or server machine.

Mozilla Firefox

1. Open a browser window.
2. Choose one of the following methods to access the documentation:
   - Select **File** > **Open File**, navigate to `..\HTML-WEBHELP\index.htm`, and click **Open**.
   - OR drag and drop `index.htm` into a browser window.
   - OR press **CTRL+O**, navigate to `index.htm`, and click **Open**.

Internet Explorer

Use one of the following methods:

1. Open a browser window.
2. Choose one of the following methods to access the documentation:
   - Select **File** > **Open** > **Browse**, navigate to `..\HTML-WEBHELP\index.htm`, click **Open**, and click **OK**.
   - OR drag and drop `index.htm` into the browser window.
   - OR press **CTRL+O**, Browse to the file, click **Open**, and click **OK**.

Note: If a message warns you that Internet Explorer has restricted the web page from running scripts or ActiveX controls, right-click anywhere within the message and select **Allow Blocked Content**.

Apple Safari

1. Open a browser window.
2. Choose one of the following methods to access the documentation:
   - Select **File** > **Open File**, navigate to `..\HTML-WEBHELP\index.htm`, and click Open.
   - OR drag and drop `index.htm` into the browser window.
   - OR press **CTRL+O**, navigate to `index.htm`, and click **Open**.

Opera

1. Open a browser window.
2. Position your cursor in the title bar and right click > **Customize** > **Appearance**, click the **Toolbar** tab and select **Main Bar**.
3. Choose one of the following methods to access the documentation:
   - Open a browser window and click Open, navigate to `..\HTML-WEBHELP\index.htm`, and click **Open**.
   - OR drag and drop `index.htm` into the browser window.
   - OR press **CTRL+O**, navigate to `index.htm`, and click **Open**.

Google Chrome

Google does not support access to client-side installations of the documentation. You'll have to point to the documentation installed on a server system.

1 Open a browser window.
2 Choose one of the following methods to access the documentation:

   In the address bar, type the location of the `index.htm` file on the server. For example: `file://<servername>//vertica50_doc//HTML/Master/index.htm`

   - OR drag and drop `index.htm` into the browser window.
   - OR press **CTRL+O**, navigate to `index.htm`, and click **Open**.

Notes

The `.tar` or `.zip` file you download contains a complete documentation set.

The documentation page of the ***Downloads Web site http://www.vertica.com/v-zone/download_vertica*** is updated as new versions of Vertica are released. When the version you download is no longer the most recent release, refer only to the documentation included in your RPM.

The Vertica documentation contains links to Web sites of other companies or organizations that Vertica does not own or control. If you find broken links, please let us know.

Report any script, image rendering, or text formatting problems to ***Technical Support*** (on page 1).

Printing Full Books

Vertica also publishes books as Adobe Acrobat™ PDF. The books are designed to be printed on standard 8½ x 11 paper using full duplex (two-sided) printing.

Note: Vertica manuals are topic driven and not meant to be read in a linear fashion. Therefore, the PDFs do not resemble the format of typical books.

Open and print the PDF documents using Acrobat Acrobat Reader. You can download the latest version of the free Reader from the ***Adobe Web site*** (***http://www.adobe.com/products/acrobat/readstep2.html***).

The following list provides links to the PDFs.

- Concepts Guide
- Installation Guide
- Getting Started Guide
- Administrator's Guide
- Programmer's Guide
- SQL Reference Manual
- Troubleshooting Guide

Suggested Reading Paths

This section provides a suggested reading path for various users. Vertica recommends that you read the manuals listed under All Users first.

All Users

- New Features — Release-specific information, including new features and behavior changes to the product and documentation
- Concepts Guide — Basic concepts critical to understanding Vertica
- Getting Started Guide — A tutorial that takes you through the process of configuring a Vertica database and running example queries
- Troubleshooting Guide — General troubleshooting information

System Administrators

- New Features — Release-specific information, including new features and behavior changes to the product and documentation
- Installation Guide — Platform configuration and software installation

Database Administrators

- Installation Guide — Platform configuration and software installation
- Administrator's Guide — Database configuration, loading, security, and maintenance

Application Developers

- Programmer's Guide — Connecting to a database, queries, transactions, and so on
- SQL Reference Manual — SQL and Vertica-specific language information

Where to Find Additional Information

Visit the ***Vertica Web site*** (***http://www.vertica.com***) to keep up to date with:

- Downloads
- Frequently Asked Questions (FAQs)
- Discussion forums
- News, tips, and techniques
- Training

Typographical Conventions

The following are the typographical and syntax conventions used in the Vertica documentation.

Typographical Convention	Description
Bold	Indicates areas of emphasis, such as a special menu command.
Button	Indicates the word is a button on the window or screen.
`Code`	SQL and program code displays in a monospaced (fixed-width) font.
`Database objects`	Names of database objects, such as tables, are shown in san-serif type.
Emphasis	Indicates emphasis and the titles of other documents or system files.
`monospace`	Indicates literal interactive or programmatic input/output.
`monospace italics`	Indicates user-supplied information in interactive or programmatic input/output.
`UPPERCASE`	Indicates the name of a SQL command or keyword. SQL keywords are case insensitive; `SELECT` is the same as `Select`, which is the same as `select`.
`User input`	Text entered by the user is shown in bold san serif type.
↵	indicates the Return/Enter key; implicit on all user input that includes text
Right-angle bracket >	Indicates a flow of events, usually from a drop-down menu.
Click	Indicates that the reader clicks options, such as menu command buttons, radio buttons, and mouse selections; for example, "Click OK to proceed."
Press	Indicates that the reader perform some action on the keyboard; for example, "Press Enter."

Syntax Convention	Description
`Text without brackets/braces`	Indicates content you type as shown.
`< Text inside angle brackets >`	Placeholder for which you must supply a value. The variable is usually shown in italics. See Placeholders below.
`[ Text inside brackets ]`	Indicates optional items; for example, CREATE TABLE [*schema_name.*]*table_name* The brackets indicate that the *schema_name* is optional. Do not type the square brackets.
`{ Text inside braces }`	Indicates a set of options from which you choose one; for example: `QUOTES { ON | OFF }` indicates that exactly one of ON or OFF must

	be provided.You do not type the braces: `QUOTES ON`
Backslash `\`	Continuation character used to indicate text that is too long to fit on a single line.
Ellipses `. . .`	Indicate a repetition of the previous parameter. For example, `option[,...]` means that you can enter multiple, comma-separated options. Note: Showing an ellipses in code examples might also mean that part of the text has been omitted for readability, such as in multi-row result sets.
`Indentation`	Is an attempt to maximize readability; SQL is a free-form language.
`Placeholders`	Items that must be replaced with appropriate identifiers or expressions are shown in italics.
Vertical bar `|`	Is a separator for mutually exclusive items. For example: `[ASC | DESC]` Choose one or neither. You do not type the square brackets.

Preface

Note: For best results, Vertica strongly recommends that you first read the Installation Guide in its entirety, particularly ***Before You Install*** (page 12).

This document explains how to:

- Configure the host or hosts needed to support a Vertica database.
- Obtain and install the Vertica software.

Audience

This guide is intended for anyone responsible for installing and configuring Vertica.

Prerequisites

- This document assumes that you have become familiar with the concepts discussed in the Concepts Guide.
- You must have the root password or sudo access (for all commands) for all cluster hosts. If this requirement conflicts with your organization's security policies, request that the procedures in this manual be performed by authorized personnel.

Terminology

In Vertica, the physical architecture is designed to distribute physical storage and to allow parallel query execution over a potentially large collection of computing resources.

The most important terms to understand are host, instance, node, cluster, and database:

Host — A computer system with a 32-bit (non-production use only) or 64-bit Intel or AMD processor, RAM, hard disk, and TCP/IP network interface (IP address and hostname). Hosts share neither disk space nor main memory with each other.

Instance — An instance of Vertica consists of the running Vertica process and disk storage (catalog and data) on a host. There can be only one instance of Vertica running on a host at any time.

Node — A host configured to run an instance of Vertica. It is a member of a database cluster. For a database to have the ability to recover from the failure of a node requires at least three nodes. Vertica recommends that you use a minimum of four nodes.

Cluster — Refers a collection of hosts (nodes) bound to a database. A cluster is not part of a database definition and does not have a name.

Database — A cluster of nodes that, when active, can perform distributed data storage and SQL statement execution through administrative, interactive, and programmatic user interfaces.

Installation Overview and Checklist

This page provides a brief but detailed overview of installation tasks.

Important notes

Vertica supports installation on one, two, and on multiple host machines. The steps in ***Installing Vertica*** (page 26) are the same, no matter how many hosts are in the cluster. The prerequisites listed in ***Before You Install*** (page 12) are also required for all configurations.

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

Carefully review and follow the instructions in the following sections.

Installation Scenarios

There are three main scenarios for installing Vertica on hosts:

- A single node install, where Vertica is installed on a single host. This form of install cannot be expanded to more hosts later on. This type of install is typically used for development or evaluation purposes.
- Installing to a cluster of physical host hardware. This is the most common scenario when deploying Vertica in a testing or production environment.
- Installing to the cloud (a cluster of virtual servers), such as Amazon's EC2 service. This is similar to installing on a cluster of physical hosts with some network configuration differences due to the nature of the virtual network.

Before you install

The ***Before You Install*** (page 12) section describes how to construct a hardware platform and prepare Linux for Vertica installation. These preliminary steps are broken into two categories:

The steps explained in Installing and Configuring Linux deal with setting up hardware and software for your host or hosts for your Vertica database. The steps in this section are the same, no matter what type of install (single node, multiple physical node, or cloud) you are performing.

- Construct a hardware platform
- Install Linux
- Allocate swap space
- Prepare disk storage locations
- Verify sudo and Python
- Set up default time zone and host locale
- Ensure NTP is running on startup
- Remove nonessential applications

Once the operating system is configured, you need to configure the network settings.

- Configure hostname resolution
- Define the loopback address
- Check subnet masks
- Disable firewalls
- Provide root and SSH access to the cluster
- Ensure that port 5433 is not in use and that `/dev/pts` is mounted
- Run Spread on a separate network (optional)

Install or upgrade Vertica

Once you have completed the steps in the Before You Install section, you are ready to run the install script. The ***Installing Vertica*** (page 26) section describes how to:

- Obtain a Vertica license key
- Back up any existing database
- Download and install the Vertica RPM package.
- Configure a cluster using the `install_vertica` script.
- [Optional] ***Create a properties file*** (page 40) that lets you install Vertica silently.

Additional ***manual procedures*** (page 53) are provided in case you encounter installation problems. Use them only when you are instructed to do so by ***Technical Support*** (on page 1).

Post-installation tasks

The ***After You Install*** (page 44) section describes subsequent steps to take after you install Vertica. Some of the steps can can skipped based on your needs:

- Install the Vertica documentation
- Log in to the DBA account on the administration host and install the license key.
- Verify that kernel and user parameters were set correctly.
- Resolve any SUSE10 issues during spread configuration.

Get started!

- Read the Concepts Guide for a high-level overview of the Vertica® Analytic Database.
- Proceed to the Tutorial in the Getting Started Guide, where you will be guided through setting up a database and loading sample data.

Before You Install

Complete all of the tasks in this section before you install Vertica. When you have completed this section, proceed to ***Installing Vertica*** (page 26).

Configuring Hardware and Installing Linux

The first set of steps you need to take involve setting up your hardware platform and installing and configuring Linux. These steps are essentially the same, no matter if you are installing to a single node, a cluster, or a cloud.

Construct a Hardware Platform

Minimum and recommended requirements for RAM appear below. Other requirements, such as the number of processors and cores as well as the amount and type of storage, depend on your data volume, number of users, performance requirements, and other factors. For guidance, contact Technical Support.

RAM Requirements

The following are minimum and recommended RAM requirements:

Minimum RAM	Recommended RAM
2 GB per core	4 GB or more per core

Example: Minimum and Recommended RAM for a server with two quad-core CPUs:

Minimum RAM	Recommended RAM
16 GB	32 GB+

Install Linux

The same version of Linux must be installed on all host machines within a cluster. The following platforms are supported for the Vertica server.

Supported for All Purposes Including Production

- Red Hat Enterprise Linux 5, 64-bit
- SUSE Linux Enterprise Server 10, 64-bit
- SUSE Linux Enterprise Server 11, 64-bit
- Debian Linux 5.0, 64 bit

Supported for Non-production (Testing and Evaluation) Purposes Only

- Red Hat Enterprise Linux 5, 32-bit
- SUSE Linux Enterprise Server 10, 32-bit

- SUSE Linux Enterprise Server 11, 32-bit
- Fedora Core 10, 32-bit
- Fedora Core 10, 64-bit
- Fedora Core 11, 32-bit
- Fedora Core 11, 64-bit

Allocate Swap Space

Vertica recommends that you allocate 2GB of swap space regardless of the amount of installed RAM. Larger swap space is acceptable, although unnecessary.

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

Prepare Disk Storage Locations

Preparing the disk storage locations for Vertica involves choosing the disk directory paths that contain the catalog and data files (physical schema) for each host in the cluster. These are referred to as catalog path and data path respectively.

You can use a single directory to contain both the catalog and data files or you can use separate directories. Separate directories can be on different drives. The directories can be either on drives local to the host or can be on a shared storage, such as an external disk enclosure or a SAN.

Notes

- The topics in this section are intentionally included in both the Installation Guide and Administrator's Guide because the choice of disk storage locations for a database can be made at installation time, database configuration time, or later during the operation of the database
- The catalog and data directory pathnames must be identical on each host in the cluster, and the directories must be owned by the database administrator.
- The choice of disk storage locations for a database can be made at installation time, database configuration time, or later during the operation of the database.

Disk Space Requirements for Vertica

In addition to actual data stored in the database, disk space is required by a number of data reorganization operations in Vertica, such as mergeout and managing nodes in the cluster. For best results, Vertica 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 they have to spill to disk. Such operators might be encountered during queries, recovery, refreshing projections, and so on. The amount of disk space needed in this manner (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 space on the data disk can be used as temp space, however, it is possible and recommended to provision temp space separate from data disk space. See ***Configuring Disk Usage to Optimize Performance*** (page 15).

Specifying Disk Storage at Installation Time

When you install Vertica, the `data_directory` parameter in the `install_vertica` (page 30) script lets you specify a directory to contain database data and catalog files. The default is the Database Administrator's default home directory:

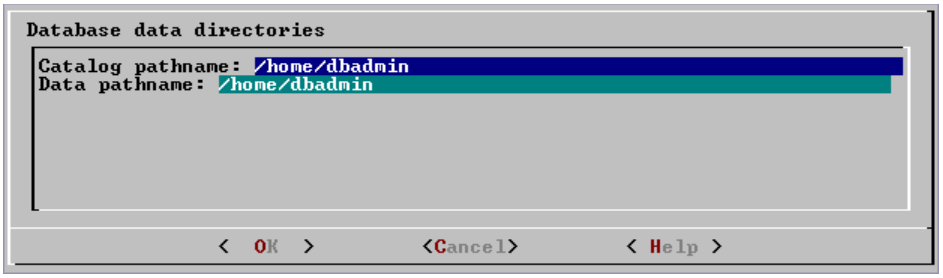
```
/home/dbadmin
```

There is no requirement that you use this directory; it is created for your convenience.

Before you create a database, make sure that the location exists on each host in the cluster and that the location is owned by the database administrator if you decide to use a different location.

Specifying Disk Storage at Database Creation Time

When you invoke the Create Database command in the Administration Tools, the following dialog allows you to specify the catalog and data locations. These locations much exist on each host in the cluster and must be owned by the database administrator.



When you click **OK**, Vertica automatically creates the following subdirectories:

```
catalog-pathname/database-name/node-name_catalog/
data-pathname/database-name/node-name_data/
```

For example, if you use the default value (the database administrator's home directory) of `/home/dbadmin` for the Stock Exchange example database, the catalog and data directories are created on each node in the cluster as follows:

```
/home/dbadmin/Stock_Schema/stock_schema_node1_host01_catalog
/home/dbadmin/Stock_Schema/stock_schema_node1_host01_data
```

Notes

- Catalog and data path names must contain only alphanumeric characters and cannot have leading space characters. Failure to comply with these restrictions will result in database creation failure.

- Vertica refuses to overwrite a directory if it appears to be in used by another database. Therefore, if you created a database for evaluation purposes, dropped the database, and want to reuse the database name, make sure that the disk storage location previously used has been completely cleaned up. See Creating and Configuring Storage Locations for details.

Configuring Disk Usage to Optimize Performance

Once you have created your initial storage location, you can add additional storage locations to the database later. Not only does this provide additional space, it lets you control disk usage and increase I/O performance by isolating files that have different I/O or access patterns. For example, consider:

- Isolating execution engine temporary files from data files by creating a separate storage location for temp space.
- Creating a tiered disk architecture in which projections are stored on different disks based on predicted or measured access patterns.

See Creating and Configuring Storage Locations for details.

Using Shared Storage with Vertica

If using shared SAN storage, ensure there is no contention among the nodes for disk space or bandwidth.

- Each host must have its own catalog and data locations. In other words, hosts cannot share catalog or data locations.
- Configure the storage so that there is enough I/O bandwidth for each nodes to access the storage independently.

For specific information about SAN configuration and recommended hardware configurations, contact ***Technical Support*** (on page 1).

Verify sudo

Verify that sudo is available on all cluster hosts and that you have privileges to use it on these hosts by executing the following command at a shell prompt:

```
# which sudo
/usr/bin/sudo
```

If sudo is not installed, browse to the ***Sudo Main Page http://www.gratisoft.us/sudo/*** and install sudo on all hosts.

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

Vertica requires the sudo user to have privileges on at least the commands listed below. This list can change from release to release.

```
/bin/bash
/bin/sh
/bin/uname
/sbin/ifconfig
rpm
```

```
ps
grep
echo
/etc/init.d/ntpd
/usr/sbin/ntpd
cat
/sbin/sysctl
sed
ulimit
/usr/sbin/groupadd
/usr/bin/id
sh
chown
chmod
/usr/sbin/usermod
su
mkdir
stty
/etc/init.d/spreadd
touch
rm
chgrp
stat
ping
ssh
scp
python
netstat
route
```

Tip: Configuring sudo with privileges for the individual commands can be a tedious and error prone process. Instead, Vertica recommends that you temporarily elevate the sudo user to have all privileges for the duration of the install. After Vertica is installed, sudo privileges can be removed (or reset) to what they were before the installation.

Note: You must be logged in as root to open, view, or copy the sudoers file.

Verify Python

Verify that Python is available on all cluster hosts.

Note: Vertica requires Python version to be at least 2.3.4, but recommends users install the latest Python 2.x supported by their OS. Python 3.x is not supported at this time.

Type the following command at a shell prompt:

```
# which python
/usr/bin/python
```

If Python is not installed, browse to the ***Official Python Web site http://www.python.org/*** and install Python on all hosts.

Verify rsync

Verify that rsync 3.0.5 or later is installed on all cluster hosts.

Type the following command at a shell prompt:

```
# which rsync
/usr/bin/rsync
```

If rsync is installed, you can verify it version with the following command:

```
# rsync --version
rsync  version 3.0.7  protocol version 30
. . .
```

If you hosts do not have rsync installed, or if it is not at least version 3.0.5, you will need to install or upgrade your rsync package. See your Linux distribution's documentation for more information.

Verify pam_limits.so

Description

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 verticad init script would fail to start 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.

Resolution

Modify the `install_vertica` script and append this line to the `/etc/pam.d/su` file:

```
session required pam_limits.so
```

See Also

pam_limits http://man.he.net/man8/pam_limits man page.

Set the Host Locale (Language)

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 `/home/dbadmin/.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 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:

- Vertica-specific error and warning messages. These are always in English at this time.
- Collation of results returned by SQL issued to 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.

Set the Default Time Zone

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.

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 or, if `TZ` is undefined, the operating system time zone.

Configuring Multiple Time Zones

As a convenience to clients in multiple time zones, you can designate specific nodes as having specific default time zones. This flexibility lets a client connect to a specific node and execute SQL statements using the default SQL time zone. In other words, there is no need for the client to use the SQL SET TIME ZONE command.

If you do this, however, be aware that:

- The `install_vertica` script (described in ***Installing Vertica*** (page 26)) issues warnings when the `TZ` (and `LANG`) environment variables are not the same on all cluster hosts.
- A client that does not use the SQL SET TIME ZONE command could get unexpected query results if it connects to the wrong node.
- The timestamps in the each node's log files are based on its default time zone and could be different across the cluster.

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 administrators' 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 /root/.bashrc and add the following line: export TZ=`*`time-zone-name`*

The following time zone names are recognized by Vertica as valid settings for the SQL time zone (the TIME ZONE run-time parameter).

Note: The names listed here are for convenience only and could be out of date. Refer to the ***Sources for Time Zone and Daylight Saving Time Data http://www.twinsun.com/tz/tz-link.htm*** page for precise information.

These names are not the same as the names shown in `/opt/<DBMS_LOWERCASE/share/timezonesets`, which are recognized by Vertica in date/time input values. The TIME ZONE names shown below imply a local daylight-savings time rule, where date/time input names represent a fixed offset from UTC.

In many cases there are several equivalent names for the same zone. These are listed on the same line. The table is primarily sorted by the name of the principal city of the zone.

In addition to the names listed in the table, Vertica accepts time zone names of the form *STDoffset* or *STDoffsetDST*, where *STD* is a zone abbreviation, *offset* is a numeric offset in hours west from UTC, and *DST* is an optional daylight-savings zone abbreviation, assumed to stand for one hour ahead of the given offset. For example, if `EST5EDT` were not already a recognized zone name, it would be accepted and would be functionally equivalent to USA East Coast time. When a daylight-savings zone name is present, it is assumed to be used according to USA time zone rules, so this feature is of limited use outside North America. Be wary that this provision can lead to silently accepting bogus input, since there is no check on the reasonableness of the zone abbreviations. For example, `SET TIME ZONE TO FOOBANKO` works, leaving the system effectively using a rather peculiar abbreviation for GMT.

Time Zone
Africa (on page 63)
America (on page 65)
Antarctica (on page 70)
Asia (on page 71)
Atlantic (on page 74)
Australia (on page 75)
CET
EET
Etc/GMT (on page 76)
Europe (on page 77)
Factory

GMT GMT+0 GMT-0 GMT0 Greenwich Etc/GMT Etc/GMT+0 Etc/GMT-0 Etc/GMT0 Etc/Greenwich
Indian (on page 79)
MET
Pacific (on page 80)
UCT Etc/UCT
UTC Universal Zulu Etc/UTC Etc/Universal Etc/Zulu
WET

See Also

Using Time Zones with Vertica (page 61)

Verify that the NTP Demon is Running

The network time protocol (NTP) demon needs to be running on all of the hosts in the cluster to ensure their clocks are synchronized. The spread demon 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 demon in different ways. For example, SUSE and Debian 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 demon on startup, run the following command:

```
$ chkconfig --list ntpd
```

Note: Debian does not install `chkconfig` by default, but does offer it as an optional package. See the Debian documentation for information on how to obtain and install packages.

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

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

```
$ runlevel
N 3
```

If the current runlevel does not have the NTP demon enabled, you can enable it by running the command:

```
$ chkconfig ntpd on
```

This configures the NTP demon to run in the current runlevel. You then need to either reboot the host, or manually start the NTP demon before continuing the installation process. You can start the demon manually using the command:

```
$ /etc/init.d/ntpd start
```

Remove Nonessential Applications

For optimal performance, Vertica is designed to use all available resources on each host machine. Vertica recommends that you:

- Remove or disable all non-essential applications from cluster hosts
- Deploy Vertica as the only active process on each host—other than Linux processes

Configuring the Network

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

Define the Loopback Address

Make sure that the `/etc/hosts` file exists and that it contains the loopback address 127.0.0.1 with only the name localhost in both fully qualified and unqualified forms. For example:

```
127.0.0.1         localhost.localdomain localhost
```

Notes

Unless you are installing Vertica on a single host machine with no plans to expand to a multiple-node cluster:

- Do not use the loopback address `127.0.0.1` or the name `localhost` in a node definition.
- Do not assign the cluster node hostname to `127.0.0.1`.

See Also

Configure Hostname Resolution (page 22)

Configure Hostname Resolution

Note: It is essential that hostnames of all hosts used to create a cluster resolve correctly. Invalid hostname resolution is a common source of configuration problems. Your Vertica database will not install or work properly unless the hostname resolution is correct.

Even single-node installations must use only static addresses or permanently-leased DHCP addresses. The only exception is if you use localhost for a single host machine, in which case you cannot expand your cluster later.

Setting Up Cluster Hosts

This procedure sets up the minimal hostname resolution required for a Vertica installation.

To set up each host machine that becomes part of the database cluster:

1 **Setup the /etc/hosts file on each node in the cluster.**

Make sure that the `/etc/hosts` file includes all of the hosts that become part of the cluster. For example, if the hosts are named `host01`, `host02`, `host03`, and `host04`, the `/etc/hosts` file on each host looks like this:

```
# Do not remove the following line, or various programs
# that require network functionality will fail.
127.0.0.1               localhost.localdomain localhost
192.168.13.128          host01
192.168.13.129          host02
192.168.13.130          host03
192.168.13.131          host04
```

Note: Replace the example IP addresses shown here with the real addresses. Do not remove the loopback address (127.0.0.1).

2 **Optionally configure separate private and public interfaces.**

Vertica supports machine 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 `-s` option to `install_vertica`) and a separate one for client connections. For simplicity, Vertica recommends that each interface resolve to a different hostname. However, if a host has multiple IP addresses that resolve to the same hostname, the IP address used for the private interface must be the one listed first in `/etc/hosts` on all nodes in the cluster.

For example, if hostname `host01` resolved to both 192.168.10.100 and 172.16.69.100 where the 192.168.10.100 address is a private network to be used for Vertica, then list the 192.168.10.100 address first in `/etc/hosts` file.

All private interfaces should be on the same subnet and have the same broadcast address.

It is not necessary to have hostnames for the private interfaces (e.g., you can use IP addresses without hostname resolution instead). Use the IP addresses for the hosts for the -s parameter of `install_vertica`: -s 192.168.233.101,192.168.233.102,192.168.233.103.

3 **Verify that the hostname resolution works correctly.**

Make sure that the host identifies itself correctly. For example, on `host01`:

```
$ /bin/hostname -f
localhost.localdomain
```

`localhost.localdomain` is incorrect. In this case, you must set the hostname manually. For details, refer to the operating system instructions or consult with the system administrator.

```
$ /bin/hostname host01
$ /bin/hostname -f
host01
```

The command `/bin/hostname host01` sets the hostname to host01 until system reboot.

4 Edit the /etc/sysconfig/network file to set HOSTNAME to host01:

```
HOSTNAME=host01
```

- Ping the host. For example:

```
$ ping host01
PING host01 (192.168.13.128) 56(84) bytes of data.
64 bytes from host01 (192.168.13.128): icmp_seq=0 ttl=64 time=0.086 ms
     ⋮
```

- Compare the ping command output to the hostname. The output of the hostname command must be identical to that of the ping command.
- Check that `/etc/sysconfig/network` contains the same hostname.

Setting the HOSTNAME Environment Variable

Some Linux installations require that the HOSTNAME environment variable be set correctly.

On each host machine that becomes part of the database cluster:

1 If the HOSTNAME environment variable is not defined, add the following line to your `/etc/profile` or `/etc/bashrc` file:

```
export HOSTNAME=`hostname`
```

2 If the HOSTNAME environment variable is already defined, make sure that it matches the hostname output:

```
# echo $HOSTNAME
host01
```

If they do not match, change the value of HOSTNAME in /etc/profile or /etc/bashrc:

```
# export HOSTNAME=`/bin/hostname -f
```

Important Notes

- Network configuration is exactly the same for single nodes as for multi-node clusters, with one special exception. If you install 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 Vertica using `localhost` as the value for `-s`. Do not use the hostname `localhost` in a node definition if you are likely to add nodes to the configuration later.

  Note: Installation using localhost is the only configuration mode where a static IP address is not required. All other configurations require static IP addresses. However, it not possible to expand the cluster from a localhost installation. You need to re-install using IP address or hostname.

- If you are using a host with multiple network interfaces, use the IP address assigned to the NIC that is connected to the other cluster hosts, not the NIC that is used for client connections.
- Use a dedicated gigabit switch. If you do not, a WARNING is returned during installation, and 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. If your private and public interfaces have different hostnames, then you might be able to use DHCP for the public interfaces; however, this configuration is not currently supported or recommended by Vertica.

Examples

The following is an example of an `/etc/hosts` configuration that is recommended. It uses different host names for private and public network interfaces. All hosts for private interface are next to each other followed by all hosts for the public interface.

```
127.0.0.1         localhost.localdomain localhost
192.168.0.1       privhost1.verticacorp.com qa1
192.168.0.2       privhost2.verticacorp.com qa2
192.168.0.3       privhost3.verticacorp.com qa3
192.168.0.4       privhost4.verticacorp.com qa4

10.10.50.123      host01.verticacorp.com qa01
10.10.50.124      host02.verticacorp.com qa02
10.10.50.125      host03.verticacorp.com qa03
10.10.50.126      host04.verticacorp.com qa04
```

See Also

Change the IP Addresses of a Vertica Cluster (page 46)

Check Subnet Masks

All hosts used in a Vertica database must have the same subnet mask.

Note: The only exception to this is when using Amazon EC2. See ***Installing Vertica on Amazon EC2*** (page 43).

Disable Firewalls

Firewalls are not recommended for database hosts. If it is consistent with your security policy, you can disable the Linux firewall and SELinux. Follow the documentation for your specific OS flavor.

See Also

Enable Port 5433 (page 53)

Firewall Configuration in the Troubleshooting Guide

Optionally Run Spread on Separate Control Network

If your query workloads are network intensive, you can use the `-S` parameter with the `install_vertica (page 30)` script to allow spread communications to be configured on a subnet that is different from other Vertica data communications.

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

Provide Root SSH Access to the Cluster

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 now. You can download a free version of the SSH connectivity tools from ***OpenSSH*** (***http://www.openssh.com/***).

See Also

Passwordless SSH Access to Other Sites Failed in the Troubleshooting Guide

Ensure Port 5433 is Not In Use

Vertica requires that port 5433 be available for use for client connectivity (vsql, ODBC,JDBC,etc). Before installing vertica, ensure that port 5433 is not in use by running the following command as the root user:

```
netstat -atup
```

Note that this command will not list the port number if it is identified by a service defined in /etc/services. Some common services that might use port 5433 include pyrrho, nibbler, and postgresql

The following is example output of the netstat command listed above with a vertica instance running:

```
tcp        0      0 *:pyrrho          *:*
LISTEN               3855/vertica
```

Ensure That /dev/pts is Mounted

Make sure that `/dev/pts` is mounted. Installing Vertica on a host that is missing the mount point `/dev/pts` might result in the following error when creating 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
```

Installing Vertica

This section describes how to install the Vertica software on a cluster, though Vertica supports installation on one node or two nodes, as well as on multiple nodes. It assumes that you have already performed the tasks in ***Before You Install*** (page 12).

To install Vertica, follow the complete install procedure for both single-node and multi-node installations.

1 ***Download and install the Vertica install package*** (page 26)
2 ***Run the install script*** (page 28)

Special Notes

- Downgrade installations are not supported.
- Be sure that you download the RPM for the correct operating system and architecture.
- 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`).
- You can remove a node from a K-safe cluster.

Back Up Existing Databases

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

- Catalog directory
- Data directory
- `/opt/vertica/`

See Backing Up the Database in the Administrator's Guide.

Obtain a Vertica License Key

Obtaining a License Key File

To obtain a license key, request one from ***Technical Support*** (on page 1).

Download and Install the Vertica Install Package

1 Use a Web browser to download the Vertica RPM package from http://myvertica.vertica.com/v-zone/download_vertica ***http://myvertica.vertica.com/v-zone/download_vertica***.

Be sure the package you download matches the operating system and the machine architecture on which you intend to install it.

2 If you installed a previous version of 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.

3 Choose one of the cluster hosts to be the Administration Host for the purposes of installing Vertica and using the Administration Tools.

Note: In the event of a node failure, you can use any other node to run the Administration Tools later.

4 If necessary, copy the RPM package to the Administration Host and use the host's console device or a remote terminal window (such as xterm or PuTTY) to perform the installation procedure.

5 If you are using sudo, skip to step 6. 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 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 Vertica is installed, sudo privileges can be removed (or reset) to what they were before the installation. See also ***Verify sudo*** (page 15).

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

- If you are root:

```
# rpm -Uvh pathname
```

- If you are using sudo:

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

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

Note: If the RPM installer reports multiple dependency problems, you are probably trying to install the wrong package. Make sure that the machine architecture (32-bit or 64-bit) of the package you downloaded matches the operating system.

After entering the command, a progress indicator appears:

```
Preparing...
   ########################################### [100%]
    1:vertica
   ########################################### [100%]

Vertica® Analytic Database 5.0.xx successfully installed on host
   hostname.
```

Other useful information might also appear.

Run the Install Script

The installation script takes as required parameters the list of hosts to install on, an RPM package and optionally, a username and password for the administrator. It creates a new Linux user account of specified name (dbadmin by default) with the password that you provide.

When run on a cluster (more than one node), it installs the provided RPM on all nodes and sets up passwordless ssh for the administrator user across all the hosts. (If passwordless ssh was already setup, it verifies that it is functioning correctly. If it is already setup but not functioning correctly, it backs up the existing keys to `.ssh.vtbackup` and sets up new keys.) It checks network connectivity across the hosts.

Note: On a localhost installation, the installer does not set up passwordless ssh. Because Vertica's backup scripts require that the administrator can log into the node via ssh without a password, you need to manually enable passwordless ssh logins for any single-node install if you want to use the backup scripts.

The install script also creates an operating system user called `spread`, which is responsible for running the spread daemon. User `spread` is non-configurable and is set to `no login`.

The install script modifies some operating system configuration settings and warn about issues with the setup that could prevent Vertica from functioning properly.

Note: You should only run the install script using BASH. Other shells give unpredictable results and are not supported.

Following is an example of using this script.

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

Note: If you run the Vertica installation script without parameters, the script performs a single-node install on `localhost`. See ***Installing Vertica Silently*** (page 40) for details.

- If you are root:

```
# /opt/vertica/sbin/install_vertica -s host_list -r rpm_package -u dba_username
```

- If you are using sudo:

```
$ sudo /opt/vertica/sbin/install_vertica -s host_list -r rpm_package -u dba_username
```

Note: The `-r` and `-s` parameters are not required for single-node installations.

`-s host_list`	A comma-separated list of hostnames or IP addresses to include in the cluster; do not include space characters in the list. Examples:
	`-s host01,host02,host03`
	`-s 192.168.233.101,192.168.233.102,192.168.233.103`
	This parameter is required on multi-node installations only. On single-node installations the default is localhost.
	Note: If you are upgrading an existing installation of Vertica, specify one hostname, and Vertica finds the rest.

`-r` *`rpm_package`*	The pathname of the RPM package that you installed in the previous step. Example: `-r "vertica_5.0.x.x86_64.RHEL5.rpm"` This parameter is required on multi-node installations only.
`-u` *`dba_username`*	The name of the Database Administrator Linux account to create. Only this account can run the Administration Tools. If you omit the `-u` parameter, 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. Otherwise you might encounter problems later.

The complete set of ***installation parameters*** (page 30), including optional parameters and example output, is described in `install_vertica` (page 30).

2 When prompted, provide the requested password to allow installation of the RPM 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.

For example, root would see:

```
Vertica Database 5.0 Installation Tool
Please enter password for root@host01:password
```

3 Provide the database administrator account password when prompted:

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

4 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 the filesystem could cause performance problems later on.

5 **Optionally** perform the following steps:

- Install the ODBC and JDBC driver.
- ***Install the vsql client application on non-cluster hosts*** (page 45).

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

- Set certain system parameters correctly.
- Function as the Vertica database administrator.

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

Exception: 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.

7 Log in to the Database Administrator account on the administration host.

8 Install the license key you downloaded previously as described in ***Install the License Key*** (page 44).

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

The install_vertica Script

The `install_vertica` script creates a cluster of nodes on which you can create a database. The script does a number of checks to catch common Linux misconfigurations, such as checking the connectivity and bandwidth characteristics of the communication links among the cluster machines and verifying other prerequisites.

Note: The `install_vertica` requires the calling user's shell to be /bin/bash. Other shells give unpredictable results and are not supported.

Syntax

```
/opt/vertica/sbin/install_vertica
   -s host_list
   -r rpm_package
   [ -d data_directory ]
   [ -g user_group ]
   [ -l dba_home_directory ]
   [ -p dba_password ]
   [ -w ]
   [ -P root_password ]
   [ -u dba_username ]
   [ -z file ]
   [ -A hosts_to_add ]
   [ -B  file ]
   [ -C ]
   [ -E ]
   [ -L license_file ]
   [ -N ]
   [ -Q ]
   [ -R ]
   [ -S ]
   [ -T ]
   [ -U ]
   [ -Y ]
```

Parameters

If you run `install_vertica` without parameters, the script performs a single-node install on localhost. See ***Installing Vertica Silently*** (page 40) for details.

`-s host_list`	A comma-separated list of hostnames or IP addresses to include in the cluster. Do not include space characters in the list. Examples:
	`-s host01,host02,host03`
	`-s 192.168.233.101,192.168.233.102,192.168.233.103`
	The `-s` parameter is required on multi-node installations only. On single-node installations the default is `localhost`.
	Note: If you are upgrading an existing installation of Vertica, be sure to use the same host names that you used previously.

`-r rpm_package`	The name of the RPM package that contained this script. Example: `-r vertica_5.0.x.x86_64.RHEL5.rpm`

	The -r parameter is required on multi-node installations only. It has no default value.
-d *data_directory*	The default directory for database data and catalog files. The default is /home/dba_username
-g *user_group*	The unix group for DBA users. The default is verticadba.
-l *dba_home_directory*	The home directory for the database administrator. The default is /home/dba_username
-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.
-w	Configures spread to output logging output to /opt/vertica/log/spread_<hostname>.log (default).
-P *root_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. **Special note about root 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_passwd> 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 dbapasswd
-u *dba_username*	The name of the database administrator account to create. Only this account can run the Administration Tools. If you omit the -u parameter, the default database administrator account name is dbadmin. **Note:** 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. Otherwise you might encounter problems later.
-z *file*	Accepts an existing properties file created by -B 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.
-A	A comma-separated list of hosts to add to an existing Vertica cluster. -A modifies an existing installation of 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). **Ntes:** ▪ If you have used the -T parameter to configure the spread to use TCP sockets for 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 Vertica from running properly. Examples:

	▪ -A host01 ▪ -A 192.168.233.101 ▪ 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 -A parameter.
-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 -z parameter. This parameter creates the properties file and exits; it has no impact on installation.
-C	Cleans previously stored configuration files if the database is not defined. Use this parameter if you need to change the hosts that are included in your cluster. You can use this parameter only when no database is already defined.
-E	Allows a new node to replace a failed node in the database. Without this parameter, Vertica does not allow the failed node to be dropped because it is still considered in use by the database even though it has failed. This parameter must be used in combination with the -A (add) and -R (remove) host parameters. For example: -A 192.168.233.102 -R 192.168.233.101 -E **Note:** After running install_vertica with -A -R -E to replace a failed host, run install_vertica again with just -R after you have removed the node from the database. This action clears the node that you replaced from the Administration Tools metadata.
-L *license_file*	Silently and automatically deploys the license key to /opt/vertica/config/share. On multi-node installations, the -L value is also propagated throughout the cluster at the end of the installation, at the same time as the Administration Tools metadata.
-N	Indicates that Vertica is installed on hosts that exist on different subnets.
-Q	Ends setup without asking the user to run the Administration Tools.
-R	A comma-separated list of hosts to remove from an existing Vertica cluster. -R modifies an existing installation of 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: -R host01 -R 192.168.233.101 **Notes:** ▪ If you have identified a node using various forms of the host name and IP address, you must identify all the forms you used. For example, you might identify a node with both short and fully-qualified names. Use a comma-separated list to identify two or more forms of the host name. For example: ▪ -R host01, Host01.vertica.com ▪ If you used the -T parameter to configure the spread to use TCP sockets for 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 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.
`-S`	Takes either the value 'default' or a broadcast network IP address to allow spread communications to be configured on a subnet that is different from other Vertica data communications. `-S` is also used to force a cluster-wide spread reconfiguration when changing spread related options—it is needed when you switch between -T and U. -S is not required when adding or replacing a host. **Important:** Stop all databases before you use the `-S` parameter.
`-T`	Configures spread to use direct point-to-point communication between all Vertica nodes. You should use this option if your nodes aren't located on the same subnet (often the case when installing to a cloud service such as ***Amazon EC2*** (page 43)). You should also use this option for all virtual environment installations, regardless of whether the virtual servers are on the same subnet or not. **Important**: When changing the configuration from `-U` (the default) to `-T` or from `-T` to `-U`, the `-S` parameter must also be used. Only use `-T` under the guidance of ***Technical Support.*** (see "***Technical Support***" on page 1)
`-U`	Specifies that Vertica use UDP broadcast traffic by spread between nodes on the subnet. This parameter is automatically used by default. **Important**: When changing the configuration from `-U` (the default) to `-T` or from `-T` to `-U`, the `-S` parameter must also be used.
`-Y`	Silently accepts the EULA agreement. On multi-node installations, the `-Y` value is propagated throughout the cluster at the end of the installation, at the same time as the Administration Tools metadata.

Notes

Do not be concerned by the following message:

```
Checking ...Failed.
```

It indicates that `install_vertica` found and is correcting an incorrect configuration parameter.

For SSH errors, see Passwordless SSH Access to Other Sites Failed and SSH Already Configured in the Troubleshooting Guide.

Example

The following example creates a cluster of nodes (host01, host02, and host03) using the vertica_5.0.x.x86_64.SUSE10 RPM package.

Note: The output is for illustrative purposes only and may change slightly from release to release.

```
# /opt/vertica/sbin/install_vertica -s host01,host02,host03 -r vertica_5.0.x.x86_64.SUSE10.rpm
Vertica Analytic Database 5.0.x Installation Tool Enter password for root@host01 (2 attempts left):
root@host01: -- Checking status of ntpd service --  ...Done
root@host02: -- Checking status of ntpd service --  ...Done
root@host03: -- Checking status of ntpd service --  ...Done
root@host04: -- Checking status of ntpd service --  ...Done
root@host01: -- Checking ntp stratum level --  ...Done
```

```
root@host02: -- Checking ntp stratum level --  ...Done
root@host03: -- Checking ntp stratum level --  ...Done
root@host04: -- Checking ntp stratum level --  ...Done
root@host01: -- Checking readahead parameter for I/O devices --  ...Done
root@host02: -- Checking readahead parameter for I/O devices --  ...Done
root@host03: -- Checking readahead parameter for I/O devices --  ...Done
root@host04: -- Checking readahead parameter for I/O devices --  ...Done
root@host01: -- Checking vm.min_free_kbytes parameter in /sbin/sysctl --  ...Done
root@host02: -- Checking vm.min_free_kbytes parameter in /sbin/sysctl --  ...Done
root@host03: -- Checking vm.min_free_kbytes parameter in /sbin/sysctl --  ...Done
root@host04: -- Checking vm.min_free_kbytes parameter in /sbin/sysctl --  ...Done
root@host01: -- Checking maximum number of open file descriptors in /etc/security/limits.conf --
...Done
root@host02: -- Checking maximum number of open file descriptors in /etc/security/limits.conf --
...Done
root@host03: -- Checking maximum number of open file descriptors in /etc/security/limits.conf --
...Done
root@host04: -- Checking maximum number of open file descriptors in /etc/security/limits.conf --
...Done
root@host01: -- Executing -- sudo /usr/sbin/groupadd verticadba
root@host02: -- Executing -- sudo /usr/sbin/groupadd verticadba
root@host03: -- Executing -- sudo /usr/sbin/groupadd verticadba
root@host04: -- Executing -- sudo /usr/sbin/groupadd verticadba
root@host01: -- Executing -- sudo /usr/bin/id -nu dbadmin
root@host02: -- Executing -- sudo /usr/bin/id -nu dbadmin
root@host03: -- Executing -- sudo /usr/bin/id -nu dbadmin
root@host04: -- Executing -- sudo /usr/bin/id -nu dbadmin
root@host01: -- Executing -- sudo sh -c "chown dbadmin:dbadmin ~dbadmin"
root@host04: -- Executing -- sudo sh -c "chown dbadmin:dbadmin ~dbadmin"
root@host02: -- Executing -- sudo sh -c "chown dbadmin:dbadmin ~dbadmin"
root@host03: -- Executing -- sudo sh -c "chown dbadmin:dbadmin ~dbadmin"
root@host01: -- Executing -- sudo sh -c "chmod 700 ~dbadmin"
root@host04: -- Executing -- sudo sh -c "chmod 700 ~dbadmin"
root@host02: -- Executing -- sudo sh -c "chmod 700 ~dbadmin"
root@host03: -- Executing -- sudo sh -c "chmod 700 ~dbadmin"
root@host01: -- Adding user dbadmin to dbagroup --  ...Done
root@host02: -- Adding user dbadmin to dbagroup --  ...Done
root@host03: -- Adding user dbadmin to dbagroup --  ...Done
root@host04: -- Adding user dbadmin to dbagroup --  ...Done
root@host01: -- Checking /scratch_b/qa directory --  ...Done
root@host02: -- Checking /scratch_b/qa directory --  ...Done
root@host03: -- Checking /scratch_b/qa directory --  ...Done
root@host04: -- Checking /scratch_b/qa directory --  ...Done
root@host01: -- Testing permissions --  ...Done
root@host02: -- Testing permissions --  ...Done
root@host03: -- Testing permissions --  ...Done
root@host04: -- Testing permissions --  ...Done
root@host01: -- Changing the owner of /scratch_b/qa directory to dbadmin --  ...Done
root@host02: -- Changing the owner of /scratch_b/qa directory to dbadmin --  ...Done
root@host03: -- Changing the owner of /scratch_b/qa directory to dbadmin --  ...Done
root@host04: -- Changing the owner of /scratch_b/qa directory to dbadmin --  ...Done
root@host01: -- Write check for /scratch_b/qa directory --  ...Done
root@host02: -- Write check for /scratch_b/qa directory --  ...Done
root@host03: -- Write check for /scratch_b/qa directory --  ...Done
root@host04: -- Write check for /scratch_b/qa directory --  ...Done ===== Host Availability Test
==================================
All hosts are available                          ...  ok
===== Testing fc10-2.vertica.com ==============================
Host availability                                ...  ok
Passwordless SSH access                          ...  ok
Passwordless SSH access to other hosts           ...  ok
Getting various information about the host       ...  ok
Python is installed                              ...  ok
Enough RAM per CPUs                              ...  ok
Getting information about the ports              ...  ok
Port availability for Spread                     ...  ok
Port availability for Vertica                    ...  ok
Gathering information about the network          ...  ok
```

```
Sanity of /etc/hosts                              ...  ok
Hostname resolution                               ...  ok
IP configuration                                  ...  ok

===== Testing fc10-1.vertica.com ================================
Host availability                                 ...  ok
Passwordless SSH access                           ...  ok
Passwordless SSH access to other hosts            ...  ok
Getting various information about the host        ...  ok
Python is installed                               ...  ok
Enough RAM per CPUs                               ...  ok
Getting information about the ports               ...  ok
Port availability for Spread                      ...  ok
Port availability for Vertica                     ...  ok
Gathering information about the network           ...  ok
Sanity of /etc/hosts                              ...  ok
Hostname resolution                               ...  ok
IP configuration                                  ...  ok

===== Testing fc10-3.vertica.com ================================
Host availability                                 ...  ok
Passwordless SSH access                           ...  ok
Passwordless SSH access to other hosts            ...  ok
Getting various information about the host        ...  ok
Python is installed                               ...  ok
Enough RAM per CPUs                               ...  ok
Getting information about the ports               ...  ok
Port availability for Spread                      ...  ok
Port availability for Vertica                     ...  ok
Gathering information about the network           ...  ok
Sanity of /etc/hosts                              ...  ok
Hostname resolution                               ...  ok
IP configuration                                  ...  ok

===== Testing fc10-4.vertica.com ================================
Host availability                                 ...  ok
Passwordless SSH access                           ...  ok
Passwordless SSH access to other hosts            ...  ok
Getting various information about the host        ...  ok
Python is installed                               ...  ok
Enough RAM per CPUs                               ...  ok
Getting information about the ports               ...  ok
Port availability for Spread                      ...  ok
Port availability for Vertica                     ...  ok
Gathering information about the network           ...  ok
Sanity of /etc/hosts                              ...  ok
Hostname resolution                               ...  ok
IP configuration                                  ...  ok

===== Consistency Test ==========================================
IP and Netmask consistency                        ...  ok
All hosts are on the same subnet                  ...  ok
LANG and TZ environment variables                 ...  ok

===== Network Test ==============================================
Network communication                             ...  ok

  Test of host fc10-2.vertica.com (ok) ======================================
    Hostname resolution (ok)
  ----------------------------
    Info: The $HOSTNAME environment variable (fc10-2) does not match the actual hostname
(fc10-2.vertica.com)

  Test of host fc10-1.vertica.com (ok) ======================================
    Hostname resolution (ok)
  ----------------------------
    Info: The $HOSTNAME environment variable (fc10-1) does not match the actual hostname
(fc10-1.vertica.com)
```

```
  Test of host fc10-3.vertica.com (ok) ====================================
    Hostname resolution (ok)
  ---------------------------
    Info: The $HOSTNAME environment variable (fc10-3) does not match the actual hostname
(fc10-3.vertica.com)

  Test of host fc10-4.vertica.com (ok) ====================================
    Hostname resolution (ok)
  ---------------------------
    Info: The $HOSTNAME environment variable (fc10-4) does not match the actual hostname
(fc10-4.vertica.com)

  Network Test (ok)
```

```
    Network communication (ok)
  -----------------------------
    Low throughput fc10-1.vertica.com to fc10-2.vertica.com: 84.2610416353 Mbps; check network
interface/switch configuration
    Low throughput fc10-3.vertica.com to fc10-2.vertica.com: 87.9604060062 Mbps; check network
interface/switch configuration
    Low throughput fc10-4.vertica.com to fc10-2.vertica.com: 87.0131137763 Mbps; check network
interface/switch configuration
    Low throughput fc10-2.vertica.com to fc10-1.vertica.com: 87.9564862945 Mbps; check network
interface/switch configuration
    Low throughput fc10-3.vertica.com to fc10-1.vertica.com: 86.9869472003 Mbps; check network
interface/switch configuration
    Low throughput fc10-4.vertica.com to fc10-1.vertica.com: 85.1561844917 Mbps; check network
interface/switch configuration
    Low throughput fc10-2.vertica.com to fc10-3.vertica.com: 87.5655859204 Mbps; check network
interface/switch configuration
    Low throughput fc10-1.vertica.com to fc10-3.vertica.com: 87.5760989283 Mbps; check network
interface/switch configuration
    Low throughput fc10-4.vertica.com to fc10-3.vertica.com: 87.5283536148 Mbps; check network
interface/switch configuration
    Low throughput fc10-2.vertica.com to fc10-4.vertica.com: 85.1868837143 Mbps; check network
interface/switch configuration
    Low throughput fc10-1.vertica.com to fc10-4.vertica.com: 87.0131137763 Mbps; check network
interface/switch configuration
    Low throughput fc10-3.vertica.com to fc10-4.vertica.com: 87.9585613925 Mbps; check network
interface/switch configuration

root@host01: -- Stopping spread daemon --  ...Done
root@host03: -- Stopping spread daemon --  ...Done
root@host04: -- Stopping spread daemon --  ...Done
root@host01: -- Removing spread daemon --  ...Done
root@host03: -- Removing spread daemon --  ...Done
root@host04: -- Removing spread daemon --  ...Done
root@host01: -- Removing old spread daemon links --  ...Done
root@host04: -- Removing old spread daemon links --  ...Done
root@host02: -- Removing old spread daemon links --  ...Done
root@host03: -- Removing old spread daemon links --  ...Done
root@host01: -- Setting up spread daemon --  ...Done
root@host04: -- Setting up spread daemon --  ...Done
root@host02: -- Setting up spread daemon --  ...Done
root@host03: -- Setting up spread daemon --  ...Done
root@host01: -- Creating spread configuration file --  ...Done
root@host04: -- Creating spread configuration file --  ...Done
root@host02: -- Creating spread configuration file --  ...Done
root@host03: -- Creating spread configuration file --  ...Done
root@host01: -- Executing -- sudo cat /opt/vertica/config/vspread.conf
root@host04: -- Executing -- sudo cat /opt/vertica/config/vspread.conf
root@host02: -- Executing -- sudo cat /opt/vertica/config/vspread.conf
root@host03: -- Executing -- sudo cat /opt/vertica/config/vspread.conf
root@host01: -- Checking /opt/vertica/config directory --  ...Done
root@host04: -- Checking /opt/vertica/config directory --  ...Done
root@host02: -- Checking /opt/vertica/config directory --  ...Done
root@host03: -- Checking /opt/vertica/config directory --  ...Done
root@host01: -- Testing permissions --  ...Done
```

```
root@host04: -- Testing permissions --  ...Done
root@host02: -- Testing permissions --  ...Done
root@host03: -- Testing permissions --  ...Done
root@host01: -- Write check for /opt/vertica/config directory --  ...Done
root@host04: -- Write check for /opt/vertica/config directory --  ...Done
root@host02: -- Write check for /opt/vertica/config directory --  ...Done
root@host03: -- Write check for /opt/vertica/config directory --  ...Done
root@host01: -- Changing the group of /opt/vertica/config directory to verticadba --  ...Done
root@host04: -- Changing the group of /opt/vertica/config directory to verticadba --  ...Done
root@host02: -- Changing the group of /opt/vertica/config directory to verticadba --  ...Done
root@host03: -- Changing the group of /opt/vertica/config directory to verticadba --  ...Done
root@host01: -- Checking /opt/vertica/config/configInfo directory --  ...Done
root@host04: -- Checking /opt/vertica/config/configInfo directory --  ...Done
root@host02: -- Checking /opt/vertica/config/configInfo directory --  ...Done
root@host03: -- Checking /opt/vertica/config/configInfo directory --  ...Done
root@host01: -- Testing permissions --  ...Done
root@host04: -- Testing permissions --  ...Done
root@host02: -- Testing permissions --  ...Done
root@host03: -- Testing permissions --  ...Done
root@host01: -- Write check for /opt/vertica/config/configInfo directory --  ...Done
root@host04: -- Write check for /opt/vertica/config/configInfo directory --  ...Done
root@host02: -- Write check for /opt/vertica/config/configInfo directory --  ...Done
root@host03: -- Write check for /opt/vertica/config/configInfo directory --  ...Done
root@host01: -- Changing the group of /opt/vertica/config/configInfo directory to verticadba --
...Done
root@host04: -- Changing the group of /opt/vertica/config/configInfo directory to verticadba --
...Done
root@host02: -- Changing the group of /opt/vertica/config/configInfo directory to verticadba --
...Done
root@host03: -- Changing the group of /opt/vertica/config/configInfo directory to verticadba --
...Done
root@host01: -- Checking /opt/vertica/config/share directory --  ...Done
root@host04: -- Checking /opt/vertica/config/share directory --  ...Done
root@host02: -- Checking /opt/vertica/config/share directory --  ...Done
root@host03: -- Checking /opt/vertica/config/share directory --  ...Done
root@host01: -- Testing permissions --  ...Done
root@host04: -- Testing permissions --  ...Done
root@host02: -- Testing permissions --  ...Done
root@host03: -- Testing permissions --  ...Done
root@host01: -- Write check for /opt/vertica/config/share directory --  ...Done
root@host04: -- Write check for /opt/vertica/config/share directory --  ...Done
root@host02: -- Write check for /opt/vertica/config/share directory --  ...Done
root@host03: -- Write check for /opt/vertica/config/share directory --  ...Done
root@host01: -- Changing the group of /opt/vertica/config/share directory to verticadba --  ...Done
root@host04: -- Changing the group of /opt/vertica/config/share directory to verticadba --  ...Done
root@host02: -- Changing the group of /opt/vertica/config/share directory to verticadba --  ...Done
root@host03: -- Changing the group of /opt/vertica/config/share directory to verticadba --  ...Done
root@host01: -- Checking /opt/vertica/config/users directory --  ...Done
root@host04: -- Checking /opt/vertica/config/users directory --  ...Done
root@host02: -- Checking /opt/vertica/config/users directory --  ...Done
root@host03: -- Checking /opt/vertica/config/users directory --  ...Done
root@host01: -- Testing permissions --  ...Done
root@host04: -- Testing permissions --  ...Done
root@host02: -- Testing permissions --  ...Done
root@host03: -- Testing permissions --  ...Done
root@host01: -- Write check for /opt/vertica/config/users directory --  ...Done
root@host04: -- Write check for /opt/vertica/config/users directory --  ...Done
root@host02: -- Write check for /opt/vertica/config/users directory --  ...Done
root@host03: -- Write check for /opt/vertica/config/users directory --  ...Done
root@host01: -- Changing the group of /opt/vertica/config/users directory to verticadba --  ...Done
root@host04: -- Changing the group of /opt/vertica/config/users directory to verticadba --  ...Done
root@host02: -- Changing the group of /opt/vertica/config/users directory to verticadba --  ...Done
root@host03: -- Changing the group of /opt/vertica/config/users directory to verticadba --  ...Done
root@host01: -- Checking /opt/vertica/log directory --  ...Done
root@host04: -- Checking /opt/vertica/log directory --  ...Done
root@host02: -- Checking /opt/vertica/log directory --  ...Done
root@host03: -- Checking /opt/vertica/log directory --  ...Done
root@host01: -- Testing permissions --  ...Done
root@host04: -- Testing permissions --  ...Done
```

```
root@host02: -- Testing permissions --  ...Done
root@host03: -- Testing permissions --  ...Done
root@host01: -- Write check for /opt/vertica/log directory --  ...Done
root@host04: -- Write check for /opt/vertica/log directory --  ...Done
root@host02: -- Write check for /opt/vertica/log directory --  ...Done
root@host03: -- Write check for /opt/vertica/log directory --  ...Done
root@host01: -- Changing the group of /opt/vertica/log directory to verticadba --  ...Done
root@host04: -- Changing the group of /opt/vertica/log directory to verticadba --  ...Done
root@host02: -- Changing the group of /opt/vertica/log directory to verticadba --  ...Done
root@host03: -- Changing the group of /opt/vertica/log directory to verticadba --  ...Done
root@host01: -- Testing permissions --  ...Done
root@host04: -- Testing permissions --  ...Done
root@host02: -- Testing permissions --  ...Done
root@host03: -- Testing permissions --  ...Done
root@host01: -- Starting spread daemon --  ...Done
root@host04: -- Starting spread daemon --  ...Done
root@host02: -- Starting spread daemon --  ...Done
root@host03: -- Starting spread daemon --  ...Done
root@host01: -- Checking /opt/vertica/config directory --  ...Done
root@host02: -- Checking /opt/vertica/config directory --  ...Done
root@host03: -- Checking /opt/vertica/config directory --  ...Done
root@host04: -- Checking /opt/vertica/config directory --  ...Done
root@host01: -- Testing permissions --  ...Done
root@host02: -- Testing permissions --  ...Done
root@host03: -- Testing permissions --  ...Done
root@host04: -- Testing permissions --  ...Done
root@host01: -- Write check for /opt/vertica/config directory --  ...Done
root@host02: -- Write check for /opt/vertica/config directory --  ...Done
root@host03: -- Write check for /opt/vertica/config directory --  ...Done
root@host04: -- Write check for /opt/vertica/config directory --  ...Done
root@host01: -- Changing the group of /opt/vertica/config directory to verticadba --  ...Done
root@host02: -- Changing the group of /opt/vertica/config directory to verticadba --  ...Done
root@host03: -- Changing the group of /opt/vertica/config directory to verticadba --  ...Done
root@host04: -- Changing the group of /opt/vertica/config directory to verticadba --  ...Done
root@host01: -- Checking /opt/vertica/config/configInfo directory --  ...Done
root@host02: -- Checking /opt/vertica/config/configInfo directory --  ...Done
root@host03: -- Checking /opt/vertica/config/configInfo directory --  ...Done
root@host04: -- Checking /opt/vertica/config/configInfo directory --  ...Done
root@host01: -- Testing permissions --  ...Done
root@host02: -- Testing permissions --  ...Done
root@host03: -- Testing permissions --  ...Done
root@host04: -- Testing permissions --  ...Done
root@host01: -- Write check for /opt/vertica/config/configInfo directory --  ...Done
root@host02: -- Write check for /opt/vertica/config/configInfo directory --  ...Done
root@host03: -- Write check for /opt/vertica/config/configInfo directory --  ...Done
root@host04: -- Write check for /opt/vertica/config/configInfo directory --  ...Done
root@host01: -- Changing the group of /opt/vertica/config/configInfo directory to verticadba --
...Done
root@host02: -- Changing the group of /opt/vertica/config/configInfo directory to verticadba --
...Done
root@host03: -- Changing the group of /opt/vertica/config/configInfo directory to verticadba --
...Done
root@host04: -- Changing the group of /opt/vertica/config/configInfo directory to verticadba --
...Done
root@host01: -- Checking /opt/vertica/config/share directory --  ...Done
root@host02: -- Checking /opt/vertica/config/share directory --  ...Done
root@host03: -- Checking /opt/vertica/config/share directory --  ...Done
root@host04: -- Checking /opt/vertica/config/share directory --  ...Done
root@host01: -- Testing permissions --  ...Done
root@host02: -- Testing permissions --  ...Done
root@host03: -- Testing permissions --  ...Done
root@host04: -- Testing permissions --  ...Done
root@host01: -- Write check for /opt/vertica/config/share directory --  ...Done
root@host02: -- Write check for /opt/vertica/config/share directory --  ...Done
root@host03: -- Write check for /opt/vertica/config/share directory --  ...Done
root@host04: -- Write check for /opt/vertica/config/share directory --  ...Done
root@host01: -- Changing the group of /opt/vertica/config/share directory to verticadba --  ...Done
root@host02: -- Changing the group of /opt/vertica/config/share directory to verticadba --  ...Done
```

```
root@host03: -- Changing the group of /opt/vertica/config/share directory to verticadba --  ...Done
root@host04: -- Changing the group of /opt/vertica/config/share directory to verticadba --  ...Done
root@host01: -- Checking /opt/vertica/config/users directory --  ...Done
root@host02: -- Checking /opt/vertica/config/users directory --  ...Done
root@host03: -- Checking /opt/vertica/config/users directory --  ...Done
root@host04: -- Checking /opt/vertica/config/users directory --  ...Done
root@host01: -- Testing permissions --  ...Done
root@host02: -- Testing permissions --  ...Done
root@host03: -- Testing permissions --  ...Done
root@host04: -- Testing permissions --  ...Done
root@host01: -- Write check for /opt/vertica/config/users directory --  ...Done
root@host02: -- Write check for /opt/vertica/config/users directory --  ...Done
root@host03: -- Write check for /opt/vertica/config/users directory --  ...Done
root@host04: -- Write check for /opt/vertica/config/users directory --  ...Done
root@host01: -- Changing the group of /opt/vertica/config/users directory to verticadba --  ...Done
root@host02: -- Changing the group of /opt/vertica/config/users directory to verticadba --  ...Done
root@host03: -- Changing the group of /opt/vertica/config/users directory to verticadba --  ...Done
root@host04: -- Changing the group of /opt/vertica/config/users directory to verticadba --  ...Done
root@host01: -- Checking /opt/vertica/log directory --  ...Done
root@host02: -- Checking /opt/vertica/log directory --  ...Done
root@host03: -- Checking /opt/vertica/log directory --  ...Done
root@host04: -- Checking /opt/vertica/log directory --  ...Done
root@host01: -- Testing permissions --  ...Done
root@host02: -- Testing permissions --  ...Done
root@host03: -- Testing permissions --  ...Done
root@host04: -- Testing permissions --  ...Done
root@host01: -- Write check for /opt/vertica/log directory --  ...Done
root@host02: -- Write check for /opt/vertica/log directory --  ...Done
root@host03: -- Write check for /opt/vertica/log directory --  ...Done
root@host04: -- Write check for /opt/vertica/log directory --  ...Done
root@host01: -- Changing the group of /opt/vertica/log directory to verticadba --  ...Done
root@host02: -- Changing the group of /opt/vertica/log directory to verticadba --  ...Done
root@host03: -- Changing the group of /opt/vertica/log directory to verticadba --  ...Done
root@host04: -- Changing the group of /opt/vertica/log directory to verticadba --  ...Done
root@host01: -- Testing permissions --  ...Done
root@host02: -- Testing permissions --  ...Done
root@host03: -- Testing permissions --  ...Done
root@host04: -- Testing permissions --  ...Done
root@host01: -- Checking /opt/vertica/config/users/dbadmin directory --  ...Done
root@host02: -- Checking /opt/vertica/config/users/dbadmin directory --  ...Done
root@host03: -- Checking /opt/vertica/config/users/dbadmin directory --  ...Done
root@host04: -- Checking /opt/vertica/config/users/dbadmin directory --  ...Done
root@host01: -- Testing permissions --  ...Done
root@host02: -- Testing permissions --  ...Done
root@host03: -- Testing permissions --  ...Done
root@host04: -- Testing permissions --  ...Done
root@host01: -- Changing the owner of /opt/vertica/config/users/dbadmin directory to dbadmin --
...Done
root@host02: -- Changing the owner of /opt/vertica/config/users/dbadmin directory to dbadmin --
...Done
root@host03: -- Changing the owner of /opt/vertica/config/users/dbadmin directory to dbadmin --
...Done
root@host04: -- Changing the owner of /opt/vertica/config/users/dbadmin directory to dbadmin --
...Done
root@host01: -- Write check for /opt/vertica/config/users/dbadmin directory --  ...Done
root@host02: -- Write check for /opt/vertica/config/users/dbadmin directory --  ...Done
root@host03: -- Write check for /opt/vertica/config/users/dbadmin directory --  ...Done
root@host04: -- Write check for /opt/vertica/config/users/dbadmin directory --  ...Done Error Monitor
0 errors  0 warnings Installation complete.
To create a database:
1. Logout and login as dbadmin.
2. Run /opt/vertica/bin/adminTools as dbadmin
3. Select Create Database from the Configuration Menu

To ensure that group privileges are properly applied, you will need to log out of any existing sessions
for the user dbadmin and login again.
```

Installing Vertica Silently

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

Note: The procedure assumes that you have already performed the tasks in ***Before You Install*** (page 12).

Installing Vertica silently

1. Download and install the Vertica install package, as described in ***Installing Vertica*** (page 26).
2. Create the properties file that enables non-interactive setup by supplying the parameters you want Vertica to use. For example:

   The following command assumes a multi-node setup:

   ```
   # /opt/vertica/sbin/install_vertica -B file_name -L /tmp/license.txt -Y
   -p password -P password -s host_list -r rpm_package
   ```

   The following command assumes a single-node setup:

   ```
   # /opt/vertica/sbin/install_vertica -B file_name -L /tmp/license.txt -Y
   -p password -P password
   ```

   For single-node installations, the `-s` and `-r` parameters are not required.

`-B file_name`	[Required] Accepts a file name, which when used in conjunction with command line options, creates a properties file that can be used with the -z option during setup. This flag creates the properties file and exits; it has no impact on installation.
`-L license_file`	Silently and automatically deploys the license key to /opt/vertica/config/share. On multi-node installations, the –L value is also propagated throughout the cluster at the end of the installation, at the same time as the admintools metadata.
`-Y`	Silently accepts the EULA agreement during setup.
`-p dba_password`	The password for the Database Administrator account; if not supplied, the script prompts for the password and does not echo the input.
`-P root_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.

`-s host_list`	A comma-separated list of hostnames or IP addresses to include in the cluster; do not include space characters in the list. Examples:
	`-s host01,host02,host03`
	`-s 192.168.233.101,192.168.233.102,192.168.233.103`
	This parameter is required on multi-node installations only. On single-node installations the default is localhost.
	If you are upgrading an existing installation of Vertica, be sure to use the same host names.

`-r rpm_package`	The name of the rpm package that contained this script. Example: `-r vertica_5.0.x.x86_64.RHEL5.rpm`

	This parameter is required on multi-node installations only. It has no default value.

See ***The install_vertica Script*** (page 30) for the complete set of installation parameters.

TIP:
Supply the parameters to the properties file once only. You can then install Vertica using just the -z parameters, as described in the Step 3.

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

- If you are root:

```
# /opt/vertica/sbin/install_vertica -z file_name
```

- If you are using sudo:

```
$ sudo /opt/vertica/sbin/install_vertica -z file_name
```

`-z file_name`	Accepts an existing properties file created by -B 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 -z /tmp/vertica-inst.prp
```

4 If you did not supply a `-P` password parameter to the properties file, you are prompted to provide the requested password to allow installation of the RPM 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 `-p` 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.

Ignore insufficient RAM warnings when installing on VMware.

Note: You can redirect any warning outputs to a separate file, instead of having them display on the system. Use the `redirect_output = filename` parameter.

7 **Optionally** perform the following steps:

- Install the ODBC and JDBC driver.
- ***Install the vsql client application on non-cluster hosts*** (page 45).

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

- Set certain system parameters correctly.
- Function as the Vertica database administrator.

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

Exception: 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.

9 If you supplied the -L parameter to the properties file, skip to step 11. Otherwise, log in to the Database Administrator account on the administration host.

10 Install the license key you downloaded previously as described in ***Install the License Key*** (page 44).

11 Proceed to the Tutorial in the Getting Started Guide and then see Configuring the Database in the Administrator's Guide.

Notes

- Downgrade installations are not supported.
- If you installed Vertica on localhost, add a line in `/etc/hosts` that reads:
  `127.0.0.1 localhost`
- The following are the values within the option parser and are the properties supported by -z:

```
hosts                       // comma separated lists of hosts
add_hosts                   // comma separated list of hosts to add to
   existing cluster
remove_hosts                // comma separated list of hosts to remove
   from cluster
rpm_file_name
vertica_dba_user            (default dbadmin)
vertica_dba_group           (default verticadba)
vertica_dba_user_password   // clear text!
root_password               // clear text!
dba_user_dir
data_dir
debug                       // boolean
clean                       // boolean
ignore_netmask              // boolean
allowUDP                    // boolean
direct_only                 // boolean
forceSpreadReconfiguration  // boolean
replaceHost                 // boolean
skip_network_test           // boolean
license_file
accept_eula                  //boolean
redirect_output             // redirect stdout and stderror here!
```

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

```
accept_eula = True
license_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 Vertica on Amazon EC2

Vertica runs natively on Amazon EC2. You can install Vertica using the following install command settings:

```
install_vertica -r vertica*.rpm -s host1, host2, host3 -N -T
```

Notes

- The `-N -T` options instruct the install script to ignore checks for all nodes to be on the same subnet and to skip connectivity checking between nodes. The multiple subnet configuration is not recommended, in general, because it increases the network latency between the nodes; however, due to the nature of EC2 configurations, it is inevitable to have nodes on different subnets.

  Note: Vertica cannot provide guidelines on performance achieved by this configuration because it is highly dependent on the network latency between the nodes.

- If launching in a non-default security group, you must explicitly open port 5433/TCP, 4833/UDP and TCP, and sufficient higher number ports (see `/proc/sys/net/ipv4/ip_local_port_range`) for cluster communication within the security group. You can open these ports using the ec2auth command:

  ```
  $ ec2auth -p [PORT] [GROUP]
  ```

- You can also restrict the source subnet to your company's public subnet or IP address using the `-s` argument, or to another group within EC2 such as the group, for your application server using the `-o` argument.

After You Install

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:

- Tutorial in 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*** (page 40), the first time you log in as the Database Administrator and run the Vertica Administration Tools, you will be required to Install a License Key.

Follow the instructions in Managing Your License Key in Administrator's Guide.

Verify that Kernel and User Parameters Were Set

During installation, Vertica attempts to set various OS level parameters as shown in the Table below.

Location	Setting	Value	Comment
`/etc/security/limits.conf`	`NOFILE`	65536	Sets the maximum number of open files for the user.
`/etc/security/limits.conf`	`NPROC`	Total RAM on the node in MB (e.g., on 1GB machine, set NPROC to 1000)	Controls the maximum number of threads and processes for each user.
`/etc/sysctl.conf`	`fs.file-max`	65536	Sets the maximum number of file handles that the Linux kernel will allocate.
`/etc/sysctl.conf`	`vm.max_map_count`	Total RAM on the node in KB/16	The maximum number of memory map areas a process might have.
`/etc/rc.local`	`blockdev --setra`	2048	Sets the readahead parameter.
`/etc/sysctl.conf`	`vm.min_free_kbytes`	4096	Changes the page reclaim thresholds. When this number is increased the system starts reclaiming memory earlier, when its lowered it starts reclaiming memory later.
`/etc/security/limits.conf`	`fsize`	unlimited	Sets the maximum file size to the OS limit

After installation is complete, check that the above parameters were correctly set. If for any reason, the installation script failed to do so, you might see warning messages in `adminTools-dbadmin.log`, similar to the following:

```
Feb 5 13:28:56 dbadmin@host01: /opt/vertica/bin/vertica --status -D
/vertica/dbs//amdaily/v_amdaily_node0001_catalog
Feb 5 13:28:56 dbadmin@nohost01: ['1', ["Not enough open file handles allowed (1024 available/32768
required); see 'ulimit -n'."]]
Feb 5 13:28:56 Error code 1 ["Not enough open file handles allowed (1024 available/32768 required);
see 'ulimit -n'."]
```

You can verify and fix the settings manually using the examples in ***Troubleshooting the Install*** (page 53).

- ***Increase the Maximum Number of Files Open*** (page 55) - use this procedure for any settings in `/etc/security/limits.conf` settings.
- ***Increase the max_map_count Parameter*** (page 56) - use this procedure for any settings in `/etc/sysctl.conf`.

Install vsql Client Application on Non-Cluster Hosts (Optional)

You can use the Vertica vsql executable image on a non-cluster Linux host to connect to a 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 5 64-bit, and SUSE 64-bit 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 Vertica server RPM in order to get vsql. Download the appropriate rpm package from the Vertica ***Download Website http://www.vertica.com/v-zone/download_vertica*** 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_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.
-

Install the Vertica-Ganglia Monitoring Package

The Vertica® Analytic Database is integrated with Ganglia, a web-based administration console and monitoring tool that lets you observe the status of a Vertica cluster and its running databases from your browser.

See Monitoring Vertica Using Ganglia in the Administrator's Guide.

Resolve SUSE Spread Configuration Issues

Description

If a SUSE system does not have NTP running on startup, the Vertica installation could fail during spread configuration.

Resolution

To resolve this issue, run the following command:

```
chkconfig --list ntp
```

The output resembles the following:

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

If the output does not look like the above example, run the following command:

```
chkconfig ntp on
```

SUSE users can now run `install_vertica` without spread configuration issues.

Change the IP Addresses of a Vertica Cluster

This section describes how to change the IP addresses of the nodes in a Vertica cluster, if the installation was done using the HOSTNAMES (see ***Configure Hostname Resolution*** (page 22)) and the underlying IP addresses have changed.

1. Edit the `/etc/hosts` file on each nodes in the cluster after you have made the network changes.
2. Stop all databases.
3. Run the ***install_vertica*** (page 26) script with the -S (capital S) parameter in addition to the parameters you used when installing Vertica. The `-S` option handles either the value 'default' or a broadcast network IP address to allow cluster-wide spread reconfiguration. For example, as root, you could run:

   `/opt/vertica/sbin/install_vertica -s` *`host1,host2,...`* `-r` *`vertica_rpm`* `-u` *`dba_username`* `-S 'default'`

   If not logged in as root, use the previous command with sudo.

   Note: If you initially used the `-T` option to configure spread to use direct point-to-point communication between nodes on the subnet and you want to continue to do so, use the `-T` option with `-S`. Otherwise, the entire cluster is reconfigured to use UDP.

See Also

Configure Hostname Resolution (page 22)

Installing Vertica Documentation

The latest documentation for your Vertica release is available on the Vertica ***Product Documentation page http://www.vertica.com/v-zone/product_documentation***. After you install Vertica, install the documentation on your database server and client systems.

Installing the Vertica documentation set on database server systems

To install the documentation on the server host:

1. Log in as root or sudo on the target server:

   ```
   # su - root
   ```

2. Download the Vertica documentation package (`.tar.gz` or `.zip`) from the ***Vertica Download page http://myvertica.vertica.com/v-zone/download_vertica*** and save it to your system; for example, to `/tmp`.
3. Change directory to the location of the package:

   ```
   # cd /tmp
   ```

4. Extract the contents:

   ```
   # tar xzf vertica-user-doc-5.0.tar.gz
   ```

   The extraction process creates a `/vertica50_doc/` folder with the following directories and contents:

   - `HTML/Master/index.htm` contains the `index.htm` file for full Vertica documentation set
   - `JDBC/index.htm` provides access to the JavaDoc HTML files
   - `PDF/book-name.pdf` contains a PDF for each book

Installing the Vertica documentation set on on database client systems

To install a local copy of the documentation on a client system:

1. Download the Vertica documentation package (`.tar.gz` or `.zip`) from the ***Vertica Download page http://myvertica.vertica.com/v-zone/download_vertica*** and save it to your system; for example, to `/tmp`.
2. Change directory to the location of the package:

   ```
   $ cd /tmp
   ```

3. Extract the contents:

   ```
   $ tar xzf vertica-user-doc-5.0.tar.gz
   ```

   The extraction process creates a `/vertica50_doc/` folder with the following directories and contents:

   - `HTML/Master/index.htm` contains the `index.htm` file for full Vertica documentation set
   - `JDBC/index.htm` provides access to the JavaDoc HTML files
   - `PDF/book-name.pdf` contains a PDF for each book

Note: If you have a browser or Adobe Acrobat Reader installed on the cluster host or on each client, you can also access the documentation directly from the ***Product Documentation page http://www.vertica.com/v-zone/product_documentation***, but you need a V-Zone login. All cross-references within the HTML documentation are relative, so there is no location dependency. This is the method that Vertica recommends.

Get Started!

Vertica provides a one-step installation script that lets you create an example database and start using it immediately. The scripts are located in `/opt/vertica/sbin` and are called:

- `install_example` — Creates a database on the default port (5433), generates data, creates the schema and a default superprojection, and loads the data.
- `delete_example` — Drops the database

Notes

- Before you can install the example, you must accept the EULA (one time only) using the Administration Tools.
- For a more advanced but equally-simple example using the Vertica databases, see the Tutorial in the Getting Started Guide.

Installing Client Drivers

After you install Vertica, install drivers on the client systems from which you plan to access your databases. Vertica 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 Vertica packages

You can extend the functionality of your Vertica installation in a number of different ways. You can create your own SQL functions, which allow you to execute complex queries and combine 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 Vertica *packages* to install additional SQL functions to your system. An example of a package is the Vertica Geospatial package, which allows you to query and analyze geographic/spatial data.

Installing packages

Vertica packages are optional; you can decide whether or not you want to install and use them. After you install 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. Vertica is not responsible for migrating any changes you make to package functions to newer versions.

Directory structure for 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 a Vertica package:

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

Upgrading Vertica

The process of upgrading Vertica is similar to installing it. Upgrades must follow a particular path:

- Vertica 2.0 to 2.1.
- Vertica 2.1 to 2.5.
  Note: Upgrading from 2.1 to 2.5 is permanent because the process of loading data into the upgraded system modifies VARCHAR types.
- Vertica 2.5 to 3.0.
- Vertica 3.0 to 3.5.
- Vertica 3.5 to 4.0.
- Vertica 4.0 to 4.1.
- Vertica 4.1 to 5.0.

IMPORTANT NOTE: Vertica strongly recommends that you follow the above upgrade path. If you decide to skip a release and upgrade, for example, from 4.0 directly to 5.0, be sure to read the New Features and New Features for each version you skip. The Vertica documentation is available in the rpm, as well as on the ***Downloads Web page http://www.vertica.com/v-zone/download_vertica*** (which also provides access to previous versions of the documentation).

Follow these steps to upgrade your database:

1 **Mandatory:** Back up your existing database. See Backing Up the Database in the Administrator's Guide.

2 If you are using Ganglia to monitor your database, disable any crontab entry you created for it. Otherwise, it could run during the upgrade and interfere with the installer. See Monitoring Vertica Using Ganglia for more information about Ganglia, and Add a cron job for instructions on editing the crontab.

3 On the administration host, install the new Vertica RPM. See ***Download and Install the Vertica Install Package*** (page 26).

4 Run the install script, passing it the same parameters you passed to it the first time you installed Vertica to upgrade the rest of the nodes in the cluster. See ***Run the Install Script*** (page 28).

5 You should perform another backup after you successfully complete your upgrade.

Additional notes

- Downgrade installations are not supported.
- Vertica includes a DBA UNIX group for tighter control over filesystem access in the `/opt/vertica/` directories.

  During upgrade, a `verticadba` group is created, and existing users are added to the group with permissions set to 775. This setting grants full privileges to the DBA group and read/execute privileges to all other users.

The /opt/vertica/log and /opt/vertica/config directories are the folders with the modified permissions.

Troubleshooting the Install

The topics described in this section are performed automatically by the `install_vertica` script and are described in ***Installing Vertica*** (page 26). This information is provided only to be used in case of installation problems and/or when you are instructed to do so by ***Technical Support*** (on page 1).

If you did not encounter any installation problems, proceed to the Administrator's Guide for instructions on how to configure and operate a database.

Enable Port 5433

Ensure that 5433 is TCP-enabled on all hosts for connections inside and outside the database. (If port 5433 cannot be used for this purpose, contact ***Technical Support*** (on page 1).) This includes making sure that all of the following are correctly configured or disabled.

- Firewalls — not recommended for database hosts; see Firewall Configuration in the Troubleshooting Guide
- SELinux (Security-Enhanced Linux)
- iptables

If it is consistent with your security policy, you can disable the Linux firewall and SELinux by running the command:

```
system-config-securitylevel
```

For More Information About SELinux

- ***NSA's Page on SELinux*** (***http://www.nsa.gov/research/selinux/index.shtml***)
- ***Red Hat's Page on SELinux*** (***http://www.redhat.com/promo/security/?sc_cid=MSI_GSEL_25&s_kwcid=selinux|7319 67321***)

For More Information About iptables

- ***The netfilter.org "iptables" project*** (***http://www.netfilter.org/projects/iptables/index.html***)
- ***Iptables Tutorial 1.2.1*** (***http://www.frozentux.net/documents/iptables-tutorial/***)

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*** (***http://www.openssh.com/***).
2. Log in to the 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 rsa
Generating 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 dev0
Warning: Permanently added 'dev0,192.168.1.92' (RSA) to the list of known
   hosts.
```

This message appears only the first time you ssh to a particular remote host.

See Also

Passwordless SSH Access to Other Sites Failed in the Troubleshooting Guide

The ***OpenSSH*** (***http://www.openssh.com/***) Web site

Increase Free Memory

To increase free memory perform the following steps:

1. Add the following line to `/etc/sysctl.conf` (the kernel sysctl configuration file):
   `vm.min_free_kbytes = 4096`
2. At the root command line prompt, enter:
   `# echo 4096 > /proc/sys/vm/min_free_kbytes`

Increase the Maximum Number of Files Open

Vertica requires a large number of file handles. To avoid "too many files open" errors:

1. Check the current limit:
   `$ ulimit -n`
2. If necessary, permanently increase this limit for all users by editing the file `/etc/security/limits.conf` as root, and adding the lines:
   ```
   * soft NOFILE <value>
   * hard NOFILE <value>
   ```
   where `<value>` = 1 file per MB of RAM, or 65536, whichever is higher.
   Note: The leading asterisk means that the setting applies to all users.
3. Set `file-max` to 1 file per 1 MB of RAM, or 65536, whichever is higher.
   If you see many error messages about running out of file handles, try increasing this value; for example:
   ```
   echo 100000 > /proc/sys/fs/file-max
   ```
   For further details, see the `file-max` section on the ***Linux man proc page http://linux.die.net/man/5/proc***.
4. Log out and log in again. The new shell has the new `ulimit` setting.

If you used sudo to install Vertica:

1. View the /etc/security/limits.conf on each node in the cluster and verify that Vertica inserted the following lines at the end of the file:
   ```
   * soft NOFILE <value>
   * hard NOFILE <value>
   ```
   where <value> = 1 file per MB of RAM, or 65536, whichever is higher.
   Note: The leading asterisk means that the setting applies to all users.
2. Log in as root and restart the system to ensure the settings are implemented:
   # etc/init.d/sshd restart

If restart is not an option, stop and start sshd:
 # etc/init.d/sshd stop; etc/init.d/sshd start

3 Verify the number of open files is 65536 (or 1024 on some operating systems):
 # ulimit -n
65536

4 Log in as the dbadmin user:
 # su dbadmin

5 SSH from one node to another; for example, from host01:
 # ssh host2

6 Check the current file limit:
 # ulimit -n
65536

Notes

- If the correct number of open files has not been established, reboot the host:
  # **sync**
  # **reboot**
  If the settings still do not take effect, enable UsePAM (set value to yes) in `/etc/ssh/sshd_config` and restart SSH once again.
- If the nofile parameter is less than 32768, Vertica fails and logs the following message:
  `Not enough open file handles allowed (1024 available/32768 required); see 'ulimit -n'.`

See Also

Verify that Kernel and User Parameters Were Set (page 44)

Linux man proc page http://linux.die.net/man/5/proc

Increase the max_map_count Parameter

Increase the `max_map_count` kernel parameter to avoid running out of mapped areas, especially on nodes with lots of memory.

1 Issue the following command as root:
$ **sysctl vm.max_map_count=16777216**
Note: The default value is 65536, which might be too low for Vertica to run. At a minimum, set `max_map_count` to 1 map per 16K of memory, or 65536, whichever is higher.
`The above changes will be reverted on machine reboot. To make the change permanent, as root, issue:`
echo "vm.max_map_count = 16777216" | tee -a /etc/sysctl.conf

2 Reload the config file as root:
$ **sysctl -p**

3 Log out and log in again.
Note: Vertica 4.0 automatically attempts to set the value based on the above rules.

Set Up Time Synchronization

Use NTP or some other time-synchronization mechanism to keep all hosts synchronized. Time variances can cause inconsistent query results when using Date/Time Functions.

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

To configure the system time, date, and the Network Time Protocol in the graphical interface: http://kbase.redhat.com/faq/docs/DOC-6731 ***http://kbase.redhat.com/faq/docs/DOC-6731***

To synchronize the system clock to Network Time Protocol: http://kbase.redhat.com/faq/docs/DOC-6902 ***http://kbase.redhat.com/faq/docs/DOC-6902***

To synchronize the system clock to a Network Time Protocol server immediately: http://kbase.redhat.com/faq/docs/DOC-6991 ***http://kbase.redhat.com/faq/docs/DOC-6991***

Managing Large Grouped ROS Containers

If you upgrade your database from Vertica 4.0.x to 4.0 Patchset 1, check for large grouped ROS containers, especially if you used `COPY AUTO` or `COPY` [no keyword] for bulk loads. Note that this issue does not affect a 3.5.x database.

Small Partitioned Tables

Small unpartitioned tables can be merged entirely using the following statement:

```
=> SELECT DO_TM_TASK('mergeout', 'table-name');
```

Important: For large unpartitioned tables, contact Vertica ***Technical Support*** (on page 1).

Large Partitioned Tables

On large partitioned tables, re-merge partitions with grouped ROS containers using the MERGE_PARTITIONS() command. This command eliminates grouped ROSes.

1 Create two views to identify grouped ROS containers that require re-merging:

```
=> CREATE VIEW large_grouped_roses AS SELECT * FROM ( SELECT s.*,
   TO_CHAR(100.0*grouped_bytes::FLOAT/
         (grouped_bytes::FLOAT+NON_GROUPED_BYTES), '999.99') AS PCT
      FROM (
       SELECT sc.schema_name, sc.projection_name,
       SUM(CASE WHEN GROUPING = 'ALL' THEN USED_BYTES ELSE 0 END)
          AS GROUPED_BYTES,
       SUM(CASE WHEN GROUPING = 'ALL' THEN 0 ELSE USED_BYTES END)
          AS NON_GROUPED_BYTES
     FROM storage_containers SC
```

```
      GROUP BY sc.schema_name, sc.projection_name) AS S ) AS Q
    WHERE q.grouped_bytes > 1024000 AND Q.PCT > 10
    ORDER BY Q.GROUPED_BYTES DESC;
=> CREATE VIEW proj_to_merge AS SELECT distinct schema_name,
   projection_name, partition_key
    FROM (
      SELECT gr.schema_name, gr.projection_name, sc.storage_oid,
         used_bytes, partition_key
      FROM large_grouped_roses GR
      NATURAL LEFT JOIN storage_containers SC
      LEFT JOIN partitions P
      ON sc.storage_oid = p.ros_id
      WHERE sc.grouping = 'ALL') Q;
```

2 Execute the following command to identify any large grouped ROS containers:

```
=> SELECT * FROM large_grouped_roses;
```

The following example output identifies two projections:

```
-[ RECORD 1 ]-----+-----------------------------------------
schema_name       | public
projection_name   | product_dimension_DBD_14_seg_vmartdb_design
grouped_bytes     | 1979034
non_grouped_bytes | 0
pct               | 100.00
-[ RECORD 2 ]-----+-----------------------------------------
schema_name       | public
projection_name   | product_dimension_DBD_2_seg_vmartdb_design
grouped_bytes     | 1979034
non_grouped_bytes | 0
pct               | 100.00
```

3 Execute the following command to identify the partition key that belongs to the containers you want to merge:

```
=> SELECT * FROM proj_to_merge;
```

If the table is partitioned, the results should return the affected partition key. If the table is not partitioned, as in the following example, no partition key is returned:

```
-[ RECORD 1 ]---+-----------------------------------------
schema_name     | public
projection_name | product_dimension_DBD_14_seg_vmartdb_design
partition_key   |
-[ RECORD 2 ]---+-----------------------------------------
schema_name     | public
projection_name | product_dimension_DBD_2_seg_vmartdb_design
partition_key   |
```

4 Do one of the following:

1. If a partition_key is listed, execute the following command on the projection/partition:

```
=> SELECT merge_partitions('table_name', 'from_key', 'to_key');
```

2. If no partition key is returned, execute the following command:

```
=> SELECT DO_TM_TASK('mergeout');
```

```
DO_TM_TASK | mergeout for projection 'product_dimension_node0001'
mergeout for projection 'product_dimension_node0002'
mergeout for projection 'product_dimension_node0003'
mergeout for projection 'product_dimension_node0004'
mergeout for projection
   'call_center_dimension_DBD_32_seg_vmartdb_design'
...
```

IMPORTANT: Do not perform step 4b on large partitioned tables. Contact ***Technical Support*** (on page 1) for guidance.

See Also

DO_TM_TASK and MERGE_PARTITIONS in the SQL Reference Manual

Uninstalling Vertica

To uninstall Vertica:

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

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

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

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

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

3. Remove the package:

```
# rpm -e package
```

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:

1. Delete the JDBC driver jar file.
2. Delete ODBC driver data source names.
3. Delete the ODBC driver software. On Windows, go to Start > Control Panel > Add or Remove Programs and look for Vertica. Click **Remove**.

Appendix: Time Zones

Using Time Zones with Vertica

Vertica uses the `TZ` environment variable on each node, if it has been set, for the default current time zone. Otherwise, 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 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: Vertica 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_York',
   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/New_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 Vertica.

```
=> CREATE TEMP TABLE tnoz (ts TIMESTAMP);
=> INSERT INTO tnoz VALUES('2009-02-01 00:00:00');
=> 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

Set the Default Time Zone (page 18)

SET TIMEZONE and Date/Time Data Types in the SQL Reference Manual

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
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America/Cambridge_Bay
America/Campo_Grande
America/Cancun
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America/Cayman
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America/Chihuahua
America/Cordoba America/Rosario
America/Costa_Rica
America/Cuiaba
America/Curacao
America/Danmarkshavn
America/Dawson

America/Dawson_Creek
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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
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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
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America/Vancouver Canada/Pacific
America/Whitehorse Canada/Yukon
America/Winnipeg Canada/Central
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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
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Asia/Aqtobe
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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
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Asia/Tehran Iran
Asia/Thimbu Asia/Thimphu
Asia/Tokyo Japan
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Asia/Urumqi
Asia/Vientiane
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Atlantic/St_Helena
Atlantic/Stanley

Australia

Australia/ACT Australia/Canberra Australia/NSW Australia/Sydney
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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
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Etc/GMT-14

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Europe/Tallinn
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Europe/Warsaw Poland
Europe/Zaporozhye
Europe/Zurich

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Indian/Kerguelen
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Indian/Maldives
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Indian/Mayotte
Indian/Reunion

Pacific

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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
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bzip2

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jseward@bzip.org <mailto:jseward@bzip.org>

bzip2/libbzip2 version 1.0 of 21 March 2000

This program is based on (at least) the work of:

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David Wheeler

Peter Fenwick

Alistair Moffat

Radioed Neal

Ian H. Witten

Robert Sedgewick

Jon L. Bentley

Daemonize

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- lib/gssapi/generic/gssapi_err_generic.et
- lib/gssapi/mechglue/g_accept_sec_context.c
- lib/gssapi/mechglue/g_acquire_cred.c
- lib/gssapi/mechglue/g_canon_name.c
- lib/gssapi/mechglue/g_compare_name.c
- lib/gssapi/mechglue/g_context_time.c
- lib/gssapi/mechglue/g_delete_sec_context.c
- lib/gssapi/mechglue/g_dsp_name.c
- lib/gssapi/mechglue/g_dsp_status.c
- lib/gssapi/mechglue/g_dup_name.c
- lib/gssapi/mechglue/g_exp_sec_context.c
- lib/gssapi/mechglue/g_export_name.c
- lib/gssapi/mechglue/g_glue.c
- lib/gssapi/mechglue/g_imp_name.c

- lib/gssapi/mechglue/g_imp_sec_context.c
- lib/gssapi/mechglue/g_init_sec_context.c
- lib/gssapi/mechglue/g_initialize.c
- lib/gssapi/mechglue/g_inquire_context.c
- lib/gssapi/mechglue/g_inquire_cred.c
- lib/gssapi/mechglue/g_inquire_names.c
- lib/gssapi/mechglue/g_process_context.c
- lib/gssapi/mechglue/g_rel_buffer.c
- lib/gssapi/mechglue/g_rel_cred.c
- lib/gssapi/mechglue/g_rel_name.c
- lib/gssapi/mechglue/g_rel_oid_set.c
- lib/gssapi/mechglue/g_seal.c
- lib/gssapi/mechglue/g_sign.c
- lib/gssapi/mechglue/g_store_cred.c
- lib/gssapi/mechglue/g_unseal.c
- lib/gssapi/mechglue/g_userok.c
- lib/gssapi/mechglue/g_utils.c
- lib/gssapi/mechglue/g_verify.c
- lib/gssapi/mechglue/gssd_pname_to_uid.c
- lib/gssapi/mechglue/mglueP.h
- lib/gssapi/mechglue/oid_ops.c
- lib/gssapi/spnego/gssapiP_spnego.h
- lib/gssapi/spnego/spnego_mech.c

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THE BASIC LIBRARY FUNCTIONS

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In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see http://www.cnri.reston.va.us) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations (now Zope Corporation, see http://www.zope.com). In 2001, the Python Software Foundation (PSF, see http://www.python.org/psf/) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation is a sponsoring member of the PSF.

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0.9.0 thru 1.2		1991-1995	CWI	yes
1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.2	2.1.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2.1	2.2	2002	PSF	yes
2.2.2	2.2.1	2002	PSF	yes
2.2.3	2.2.2	2003	PSF	yes
2.3	2.2.2	2002-2003	PSF	yes
2.3.1	2.3	2002-2003	PSF	yes
2.3.2	2.3.1	2002-2003	PSF	yes
2.3.3	2.3.2	2002-2003	PSF	yes
2.3.4	2.3.3	2004	PSF	yes
2.3.5	2.3.4	2005	PSF	yes
2.4	2.3	2004	PSF	yes
2.4.1	2.4	2005	PSF	yes
2.4.2	2.4.1	2005	PSF	yes
2.4.3	2.4.2	2006	PSF	yes
2.5	2.4	2006	PSF	yes
2.7	2.6	2010	PSF	yes

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zlib

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zlib.h -- interface of the 'zlib' general purpose compression library version 1.2.3, July 18th, 2005

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