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About This Book

The VMware vCenter Operations Enterprise Installation and Administration Guide describes how to install, configure, and maintain VMware® vCenter Operations Enterprise, an automated intelligence system for IT operations.

Intended Audience

This guide is intended for vCenter Operations Enterprise system administrators. For information about using vCenter Operations Enterprise to monitor the performance and efficiency of your network, please refer to the vCenter Operations Enterprise User’s Guide.

VMware Technical Publications Glossary

VMware Technical Publications provides a glossary of terms that might be unfamiliar to you. For definitions of terms as they are used in VMware technical documentation go to http://www.vmware.com/support/pubs.

Document Feedback

VMware welcomes your suggestions for improving our documentation. If you have comments, send your feedback to docfeedback@vmware.com.

VMware vCenter Operations Enterprise Documentation

The documentation set for VMware vCenter Operations Enterprise consists of the following documents.

- Analytics Guide for VMware vCenter Operations Enterprise. Contains conceptual information that describes the principles of the vCenter Operations Enterprise analytics features.
- Integration Guide for vCenter Operations Enterprise and EMC Smarts. Contains conceptual and procedural information on integrating vCenter Operations Enterprise with EMC Smarts.
- VMware vCenter Operations Enterprise online help. Contains conceptual and procedural information to help you complete your tasks when administering and using vCenter Operations Enterprise.
Technical Support and Education Resources

The following sections describe the technical support resources available to you. To access the current version of this book and other books, go to http://www.vmware.com/support/pubs.

Online and Telephone Support

To use online support to submit technical support requests, view your product and contract information, and register your products, go to http://www.vmware.com/support.

Customers with appropriate support contracts should use telephone support for the fastest response on priority 1 issues. Go to http://www.vmware.com/support/phone_support.

Support Offerings

To find out how VMware support offerings can help meet your business needs, go to http://www.vmware.com/support/services.

VMware Professional Services

VMware Education Services courses offer extensive hands-on labs, case study examples, and course materials designed to be used as on-the-job reference tools. Courses are available onsite, in the classroom, and live online. For onsite pilot programs and implementation best practices, VMware Consulting Services provides offerings to help you assess, plan, build, and manage your virtual environment. To access information about education classes, certification programs, and consulting services, go to http://www.vmware.com/services.
This chapter discusses how to install and configure the vCenter Operations Enterprise server. It contains the following sections:

- “Before Installing vCenter Operations Enterprise” on page 9
- “Preparing the vCenter Operations Enterprise Database” on page 13
- “Installing the vCenter Operations Enterprise Server” on page 17
- “The vCenter Operations Enterprise Program Group” on page 30
- “Installing a vCenter Operations Enterprise Collector” on page 30
- “Installing a vCenter Operations Enterprise Adapter” on page 32
- “Installing the Analytics Processor (Optional)” on page 32

Before Installing vCenter Operations Enterprise

Installing vCenter Operations Enterprise is straightforward and should only take a few minutes. It consists of two procedures:

1. Preparing a database in either SQL Server or Oracle to hold the vCenter Operations Enterprise data.
2. Installing the vCenter Operations Enterprise software.

vCenter Operations Enterprise is designed as an enterprise solution, so planning and preparing your environment is critical to successful deployment. You should consider several factors when planning your vCenter Operations Enterprise environment:

- Environment size and landscape—the vCenter Operations Enterprise architecture needs to take into account how large the environment is, including the number of applications, data sources, resources, and metrics, the physical environment distribution (the number of data centers), and the number of users.
- Environment complexity—what specific architectural and service level requirements must be met, including security, availability, and accessibility.

vCenter Operations Enterprise’s architecture allows for deployment flexibility. vCenter Operations Enterprise is a Java-based application with four interdependent components:

- vCenter Operations Enterprise server—Hosts the user interface and coordinates the functions of the software, including controlling communications between the other components.
- vCenter Operations Enterprise analytics—Receives metrics gathered from monitored resources, analyzes the data, and creates statistical models to detect abnormal behavior. This includes the dynamic thresholds processor, which can be installed separately to distribute the processing load, as described in “Installing the Analytics Processor (Optional)” on page 32.
vCenter Operations Enterprise collector—Acts as the gateway between vCenter Operations Enterprise and the adapters used to collect data from the collection landscape. It is installed by default as part of the primary server but can also be distributed as a stand-alone component. You can install one or more remote collectors to navigate firewalls, share bandwidth across data centers, and reduce the load on the vCenter Operations Enterprise server. You can install the collector on a shared server.

vCenter Operations Enterprise messaging—The message bus (ActiveMQ) passes metric information between vCenter Operations Enterprise components.

vCenter Operations Enterprise uses two data storage solutions. A relational database (Oracle or Microsoft SQL Server) stores configuration and state data. A proprietary high-performance file system-based repository (FSDB) stores the collected raw metrics. Figure 1-1 depicts vCenter Operations Enterprise's logical architecture.

**Figure 1-1. vCenter Operations Enterprise Architecture**

The installation script installs all vCenter Operations Enterprise components—server (including messaging), collector, and analytics—in the same folder structure. It also installs several vCenter Operations Enterprise system tools, which are described in Chapter 11.
After installation, the vCenter Operations Enterprise folder structure looks like this (this is intended to give you a general idea of the folder structure; it does not include all folders):

**Figure 1-2. vCenter Operations Enterprise Folder Structure**

The only files that a vCenter Operations Enterprise administrator may need to work with or modify are contained in the folders under `\user`.

Please read the next two sections carefully before installing vCenter Operations Enterprise. They list system configuration and software requirements for vCenter Operations Enterprise and describe assumptions this guide makes.
## System and Software Requirements

The following requirements are meant as general guidelines; for specific sizing recommendations please contact vCenter Operations Enterprise support, as described in “Online and Telephone Support” on page 8.

<table>
<thead>
<tr>
<th>vCenter Operations Enterprise Server Requirements</th>
<th>Operating system</th>
<th>Window 2003 Server, Service Pack 2 or higher (x64 bit), or Windows Server 2008 (x64-bit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk speed</td>
<td>Disk Speed: 150 MB/s sustained read/write performance for each one million metrics collected at five-minute collection intervals with total IOPS of 800.</td>
<td></td>
</tr>
<tr>
<td>Disk Usage</td>
<td>800 GB of usage per 250,000 metrics per year for storage, based on a five-minute collection interval</td>
<td></td>
</tr>
<tr>
<td>RAM minimum</td>
<td>8 GB for 250,000 metrics collection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24 GB if collecting one million or more metrics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>64 GB if collecting four million or more metrics</td>
<td></td>
</tr>
<tr>
<td>CPU minimum</td>
<td>4x64 bit Multi-Core Processors (2 Ghz or faster) if collecting up to 250,000 metrics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8x64 bit Multi-Core Processors (2 Ghz or faster) if collecting up to one million metrics</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> Remote collectors and the analytics processor can also be installed on 32-bit CPUs.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Database server requirements</th>
<th>RAM minimum</th>
<th>At least 2 GB, 8 GB if collecting more than one million metrics.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU minimum</td>
<td>2 CPU (P4 2 GHz or faster), 32-bit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 CPU 64-bit for systems collecting more than 1 million metrics</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Database Application</th>
<th>Oracle 10g R2 or 11g R2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Microsoft SQL Server 2005, Service Pack 2 or higher, or Microsoft SQL Server 2008 (SQL Server not supported if the vCenter Operations Enterprise server runs Linux)</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> The database must be configured and accessible to the vCenter Operations Enterprise server and ping time between the servers should be less than one millisecond. Due to vCenter Operations Enterprise's resource requirements, we suggest the database server hosts only vCenter Operations Enterprise's database.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Client system requirements</th>
<th>RAM minimum</th>
<th>2 GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU minimum</td>
<td>P4 2 GHz or faster</td>
<td></td>
</tr>
<tr>
<td>Browser</td>
<td>Internet Explorer version 7.x or 8.x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mozilla Firefox 3.x</td>
<td></td>
</tr>
<tr>
<td></td>
<td>JavaScript enabled</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Popup blockers removed or disabled</td>
<td></td>
</tr>
<tr>
<td>PDF Viewer</td>
<td>A viewer, such as Adobe Reader, for viewing reports in PDF format</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE** vCenter Operations Enterprise is installed with a configuration designed to make minimum demands on server resources, with fingerprint generation and some dynamic thresholding algorithms disabled. After installation, contact vCenter Operations Enterprise support or professional services for assistance in adjusting the vCenter Operations Enterprise configuration to meet your needs. See “Online and Telephone Support” on page 8.

vCenter Operations Enterprise can run in a virtual environment, on one or several virtual machines. For information on configuring the necessary hardware environment, please contact vCenter Operations Enterprise support, as described on “Online and Telephone Support” on page 8.
Assumptions

The procedures in this chapter assume that, before starting the installation, you have:

- Enough familiarity with your Oracle or Microsoft SQL Server database software to prepare the vCenter Operations Enterprise database using the supplied files. If you are using Oracle, you should know how to define a database connection in the tnsnames.ora file.
- Prepared the hardware for the vCenter Operations Enterprise environment
- Made configuration decisions, including:
  - Whether to use HTTP or HTTPS for client connections to the vCenter Operations Enterprise server.
  - Whether to use standard or non-standard ports.
  - What drive system to use for vCenter Operations Enterprise’s file-system based repository. For best performance, this should not be the same drive where the vCenter Operations Enterprise software is installed.
  - If you are using remote collectors, whether to use a proxy or not.
  - If you are installing a vCenter Operations Enterprise collector, either as part of the vCenter Operations Enterprise server installation or by itself, on a server host which has more than one IP address (a multi-homed server), decide which IP address you want vCenter Operations Enterprise to use.
  - Whether you want to install a separate process on a remote host to process dynamic threshold calculations.

NOTE “vCenter Operations Enterprise Architecture” on page 135 includes some recommendations about where to locate the various parts of the vCenter Operations Enterprise installation.

Preparing the vCenter Operations Enterprise Database

Before you can install vCenter Operations Enterprise, you must create a database in either Microsoft SQL Server or Oracle to hold the vCenter Operations Enterprise data. Follow the directions for your database software.

Preparing a SQL Database for vCenter Operations Enterprise

The vCenter Operations Enterprise software includes an executable file (vcops_SQLServer_xxxx.exe) that prepares a SQL database for vCenter Operations Enterprise. You have your choice of three procedures for preparing the database. Use whichever one is most appropriate for your configuration and security policies:

- If it is allowable to have vCenter Operations Enterprise use a user name with database creation privileges (a “super user”) to communicate with SQL Server, use the first procedure.
- If you do not want vCenter Operations Enterprise to use a super user account, but you can run an executable in your environment, follow the second procedure.
- If you cannot run executables, follow the third procedure.

NOTE At many companies, parts of the procedure will have to be done by the SQL Server administrator.

Prerequisites

Before you begin any of the procedures below, make sure you have done the following:

- Installed SQL Server.
- Created either a Windows authentication account or a SQL authentication account with sufficient privileges to create a new database and new SQL user.
Procedure 1: Running vCenter Operations Enterprise as a Super User

1. If you are using Windows authentication for SQL server, log on as a user with enough privileges to create a database.

2. Navigate to the folder containing the vCenter Operations Enterprise executable files.

3. Use Winzip or any other application with similar capability to extract all files from the vcops_sqlserver.zip file to any available directory.

4. Execute the extracted vcops_SQLServer_xxxx.exe file. The Run Package window appears.

![Run Package Window]

NOTE   You can click Cancel to stop the process at any time.

5. In the Server field, enter the IP address of the database server. If you need to install on a specific instance of the database, enter IP Address\Instance Name.


7. For User name and Password, enter the super user name and password you want vCenter Operations Enterprise to use. The database will be created under this user name.

8. Select Make a database.

9. In the Database field, enter the name to give the database.

NOTE   Do not click the Advanced button unless you have been told to by your vCenter Operations Enterprise representative. The default configuration values work for most installations.

10. Click Run.

11. When asked to verify that you want to continue, click Yes or No.

12. When the dialog box indicating the process is complete appears, click OK.

13. Go to the SQL Server Management Studio and confirm that the new database exists.

14. Continue with the section “Installing the vCenter Operations Enterprise Server” on page 17.
Procedure 2: Running vCenter Operations Enterprise as a Regular User

1. If you are using Windows authentication for SQL server, log on as a user with enough privileges to create a database.

2. Navigate to the folder containing the vCenter Operations Enterprise executable files.

3. Use Winzip or any other application with similar capability to extract all files from the vcops_sqlserver.zip file to any available directory.

4. In SQL Server, create a database to hold the vCenter Operations Enterprise schema and data. You can give this database any name. Remember the name; you will need it later in this procedure and when installing the vCenter Operations Enterprise software.

5. Go to the SQL Server Management Studio or some other tool which allows you to run SQL scripts.

6. Run the createuser.sql script under the database you created in the previous step, using the same super user privileges you used to create the database. By default, this creates a SQL Server user with the name vcops and a default password. If you want to, you can change the user name and/or password by editing the script before you execute it, or change the password after the user is created.

7. Execute the extracted vcops_SQLServer_xxxx.exe file. The Run Package window appears.

**NOTE** You can click **Cancel** to stop the process at any time.

8. In the **Server** field, enter the IP address of the database server. If you need to install on a specific instance of the database, enter **IP Address\Instance Name**.

9. Select **SQL Server authentication**.

10. For **User name** and **Password**, enter the user name and password for the user created in step 5.

11. Select **Upgrade an existing database**.

12. In the **Database** field, enter the name of the database you created in step 4.

**NOTE** Do not click the **Advanced** button unless you have been told to by your vCenter Operations Enterprise representative. The default configuration values work for most installations.

13. Click **Run**.

14. When asked to verify that you want to continue, click **Yes** or **No**.

15. When the dialog box indicating the process is complete appears, click **OK**.

16. Go to the SQL Server Management Studio and confirm that the new database exists.

17. Continue with the section **"Installing the vCenter Operations Enterprise Server"** on page 17.

Procedure 3: Running the SQL Scripts Individually

1. If you are using Windows authentication for SQL server, log on as a user with enough privileges to create a database.

2. Navigate to the folder containing the vCenter Operations Enterprise executable files.

3. Use Winzip or any other application with similar capability to extract all files from the vcops_sqlserver.zip file to any available directory.

4. In SQL Server, create a database to hold the vCenter Operations Enterprise schema and data. You can give this database any name. Remember the name; you will need it later in this procedure and when installing the vCenter Operations Enterprise software.

5. Go to the SQL Server Management Studio or some other tool which allows you to run SQL scripts.
6 Run the createuser.sql script under the database you created in the previous step, using the same super user privileges you used to create the database. By default, this creates a SQL Server user with the name vcops and a default password. If you want to, you can change the user name and/or password by editing the script before you execute it, or change the password after the user is created.

7 Attach to the database you created in step 4 above, using the user name and password you created in step 6.

8 Run the vcops_SQLServer_xxxxSchema.sql script.

9 Run the vcops_SQLServer_xxxxData.sql script.

10 Go to the SQL Server Management Studio and confirm that the new database exists.

11 Continue with the section “Installing the vCenter Operations Enterprise Server” on page 17.

Preparing an Oracle Database for vCenter Operations Enterprise

Before you install vCenter Operations Enterprise, you must prepare a database to accommodate the vCenter Operations Enterprise tablespace and schema. The vCenter Operations Enterprise installation package includes a batch file to do this. It creates a 500 MB Oracle tablespace named vcops10_TS, an Oracle schema named vcops, database objects for vCenter Operations Enterprise including tables, indices, and sequences, and a trigger that makes the database case-insensitive.

If you want more control over the configuration, you can perform these operations manually. For detailed instructions on the manual configuration process, see the Readme.txt file in the vCenter Operations Enterprise installation directory.

Prerequisites

Before you begin the process below, make sure you have done the following:

- Installed Oracle.
- Installed and configured the sqlplus tool.
- Created a user with sufficient Oracle privileges to create a tablespace and user/schemas.
- Decided where on the disk to create the tablespace.

Procedure

To prepare an Oracle schema for vCenter Operations Enterprise

1 Add a connection name to the tnsnames.ora file that the vCenter Operations Enterprise server can use to connect to the Oracle server.

2 Navigate to the folder containing the vCenter Operations Enterprise executable files.

3 Use Winzip or another application with similar capability to extract all files from the vcops.oracle.zip file to any available directory.

4 Run the extracted setup.bat file using the following syntax:

```
setup.bat connection user password
```

`connection` is the connection name as defined in tnsnames.ora. The `user` must have permission to log into the Oracle database as SYSDBA.

5 Verify that the tablespace and user schema were created properly.
If the vCenter Operations Enterprise Oracle database will be on a Linux server, and you cannot connect to the server from a Windows computer to perform the above procedure, you can do the following instead:

1. Using binary mode, upload the vCenter Operations Enterprise installation files to the target Linux host.
2. Navigate to the folder containing setupOracle.sh. Change the permission on this file to make it executable:
   ```bash
   chmod +x setupOracle.sh
   ```
3. Open the vcopsTableSpace.sql file and make sure the value for the OS file name is appropriate for your Oracle instance. You can also adjust the size of the vCenter Operations Enterprise OS file as necessary. The default size is 500 MB.
4. If you changed the tablespace name, open the file vcopsUser.sql and, on the line `DEFINE vcops_tablespace = "vcops10_TS"`, replace `vcops10_TS` with the correct tablespace name.
5. Run this command:
   ```bash
   setupOracle.sh -s SID -u user -p pwd -t -r
   ```
   `SID` is the Oracle System Identifier. `User` is the name of an Oracle user who can log in as SYSDBA, and `pwd` is the password for that user name.

### Installing the vCenter Operations Enterprise Server

You can install the vCenter Operations Enterprise software on a supported version of either Windows or Linux. There are separate procedures for Windows, Linux using GUI mode, and Linux using console mode.

### Installing vCenter Operations Enterprise on Windows

To install vCenter Operations Enterprise on a Windows server

1. Log on as a user with enough privileges to create services. If you are using SQL Server with Windows authentication, you must also be able to create and modify databases. We recommend using an administrator user name.
2. Navigate to the folder containing the vCenter Operations Enterprise executable files.
3. Run the VMware-vCOps-1.0.exe file. The first page of the vCenter Operations Enterprise installation wizard appears.

   **NOTE**  You can click **Cancel** to stop the process at any time.

4. Click **Next**.
5. Read the Patent Agreement in its entirety. Click **Next**.
6. Read the License Agreement in its entirety. Select **I Accept the Terms of the License Agreement** and click **Next**.
7. On the Choose Install Set page, click the icon beside **Full Installation** and click **Next**. This will install all vCenter Operations Enterprise components. (If you are trying to install vCenter Operations Enterprise on a 32-bit system, **Full Installation** will not be a choice. You can install only a vCenter Operations Enterprise remote collector or the separate analytics processor on a 32-bit system.)

   **NOTE**  The **Collector** option installs just the vCenter Operations Enterprise collector on a remote server to improve performance and accessibility; see “Installing a vCenter Operations Enterprise Collector” on page 30. The **Collector with HTTP Post & HP OV Adapters** option installs the Tomcat Web Server; this raises security and resource issues, so we recommend you do this only if advised to by vCenter Operations Enterprise support. For contact information, please see “Online and Telephone Support” on page 8.
8 On the Choose Install Folder page, click OK to accept the default installation folder, or click Browse and select the installation folder you want. The default installation folder is \vmware\vcenter-operations beneath the default program installation folder for your system. We recommend you accept the default. Click Next.

**NOTE** Throughout this manual, we refer to the folder where you install vCenter Operations Enterprise as vcenter-ops.

9 The Pre-installation Summary page lists the components that will be installed. Click Install to begin the installation. When this part of the process is finished (it may take several minutes), the Configuration Mode page appears.

10 On the Configuration Mode page, select Basic or Advanced. Use advanced configuration only if one or more of the following is true:

- Communication between a remote vCenter Operations Enterprise Collector and the vCenter Operations Enterprise Server will be via firewall or HTTP proxy.
- vCenter Operations Enterprise will be monitoring more than 100,000 resources.
- Replication is enabled between the primary vCenter Operations Enterprise server and a backup server.
- For security reasons, you do not want the vCenter Operations Enterprise components to use default passwords and ports.

If you choose Basic, continue this procedure. If you choose Advanced, continue with “Advanced vCenter Operations Enterprise Configuration” on page 24.

11 On the Full Configuration page, select Primary or Backup under Server Configuration.

**NOTE** If you configure a backup server, if there is a problem with your primary server you can use the configuration wizard to make the backup server the primary server. All remote collectors will then send metrics to the new primary server.
12 In the **Database Type** field select **SQL** or **Oracle**. Fields appropriate for the selected database appear on the page. This figure shows the fields for a SQL Server database.

![Database Configuration](image)

For an Oracle database, the **Database Name** and **Instance Name** fields do not appear and an **SID** field is added.

13 If you are using an Oracle database, type its System Identifier in the **SID** field.

14 In the **Database Host** field, enter the IP address of the database server.

15 In the **Database Port** field, leave the default entry (1433 for SQL Server or 1521 for Oracle) unless you installed the database using a different port number.

16 If you are using a SQL Server database, enter the name of the vCenter Operations Enterprise database in the **Database Name** field.

17 If you are using a SQL Server database and need to specify an **Instance Name** for the database, type it in that field.

18 In the **Authentication**, **User Name**, and **Password** fields, select the type of authentication to use (for SQL Server databases only) and enter the user name and password for a user with permission to read and write to the SQL Server database or Oracle schema.

**NOTE**  vCenter Operations Enterprise requires a user account with SQL authentication credentials to establish a connection with the database. If you want to use Windows authentication with SQL Server, there are additional steps to perform after completing the installation. See “Configuring Integrated Windows Security with SQL Server” on page 29.
19 Click the Test button to test the connection to the database. If the test fails, check your entries, make any needed corrections, and try again.

20 In vCenter Operations Server Configuration, choose HTTP or HTTPS. This sets the protocol to use for client connections to the vCenter Operations Enterprise server.

21 If you want adapters which use the HTTP post method to use Web authentication, check the HTTP Post adapter web authentication enabled box. If you check this box, only a vCenter Operations Enterprise user with the Administrative Access right will be able to post data to vCenter Operations Enterprise. See “Configuring Access Rights” on page 117.

22 The vCenter Operations Server Port field displays the default port number for the protocol you chose. If you need to change this, type the correct number.

23 To enable Internet connections to the vCenter Operations Enterprise server, type the server name or public IP address for the server in the vCenter Operations Server Host field. (The installer tries to detect the host name or IP address of the server and fill it in as the default.) If you leave this field blank, users will not be able to connect from outside the local network.

NOTE vCenter Operations Enterprise sends alert e-mail messages containing hyperlinks to the vCenter Operations Enterprise server so administrators can find more information about the alert. If you want offsite administrators to be able to use these links, be sure to enter a public IP address for the vCenter Operations Enterprise server. You should not set the host name to localhost.

24 In the FSDB Home (File System Database) field, type the path to the directory where vCenter Operations Enterprise should save the metrics it collects. You can enter up to eight locations to distribute drive I/O use. If you enter more than one, separate them with semi-colons. For best performance, this should not be on the same drive where the vCenter Operations Enterprise software is installed.

25 In SMTP Host and SMTP Port, enter the host name or IP address and port number for the SMTP server for vCenter Operations Enterprise to use to send e-mail messages.

26 In Recipient, enter one or more e-mail addresses; if you enter more than one, separate them with commas (,). If a vCenter Operations Enterprise service fails or experiences problems, an e-mail will be sent to each recipient.

27 If desired, click the Test button to test the e-mail configuration. This checks the SMTP host and port settings and attempts to send an e-mail message to the entered recipients. It displays an appropriate message if any of its tests fail. However, it cannot ensure that the e-mail addresses entered as recipients actually exist, as sending a message to a non-existent address does not fail immediately.

28 Click Finish to complete the installation. The Install Complete page appears.

29 On the Install Complete page, click Done.

30 If the server host has two IP addresses:

   a Choose No and click Done.

   b Using Notepad or another editor, open the file vcenter-ops\user\conf\collector\wrapper.conf.

   c Add this line to the file:

   wrapper.java.additional.9=Djava.rmi.server.hostname=IP Address/Name

   where IP address/Name is the IP address or host name to use for the collector.

   d Save your change and close the file.

   e Reboot the system.

vCenter Operations Enterprise installation is complete. Please contact vCenter Operations Enterprise support or professional services for assistance in adjusting the vCenter Operations Enterprise configuration to meet your needs. See “Online and Telephone Support” on page 8.
Installing vCenter Operations Enterprise on Linux – GUI Mode

Prerequisites

- The Linux user account for installing vCenter Operations Enterprise must have root-level privileges. If you need to be able to install under a non-root account, please contact VMware Professional Services.
- X Windows System release 11 (X11) needs to be running on the Linux server.
- You must have a standard terminal emulator for X Windows System.

Before the Installation

If a previous version of vCenter Operations Enterprise is already installed on the Linux host, you must stop its processes before you install vCenter Operations Enterprise. You can do this using the `vcenter-ops/vcops.sh` script. Run the script with the `stop` parameter:

```
vcops.sh stop
```

To make sure the services have all stopped, use the `status` parameter:

```
vops.sh status
```

Installation Steps

1. Using binary mode, upload vcops.bin to the target Linux host.
2. Navigate to the folder containing vcops.bin. Change the permission on this file to make it executable:

   `chmod +x vcops.bin`

3. From within any standard terminal emulator for X Windows (for example, X-Win32), execute the program vcops.bin. The first page of the vCenter Operations Enterprise installation wizard appears.
4. Click Next.
5. Read the Patent Agreement in its entirety. Click Next.
6. Read the License Agreement in its entirety. Select I Accept the Terms of the License Agreement and click Next.
7. On the Choose Install Set page, click the icon beside Full Installation and click Next. This installs all vCenter Operations Enterprise components. (If you are trying to install vCenter Operations Enterprise on a 32-bit system, Full Installation will not be a choice. You can install only a vCenter Operations Enterprise remote collector or the separate analytics processor on a 32-bit system.)

   **NOTE** The Collector option installs just the vCenter Operations Enterprise collector on a remote server to improve performance and accessibility. The procedure for this is in the vCenter Operations Enterprise User’s Guide. The Collector with HTTP Post & HP OV Adapters option installs the Tomcat Web Server; this raises security and resource issues, so we recommend you do this only if advised to by vCenter Operations Enterprise support. For contact information, please see “Online and Telephone Support” on page 8.

8. On the Choose Install Folder page, click OK to accept the default installation folder or click Browse and select the installation folder you want. The default installation folder is `/root/vmware/vcenter-operations`. We recommend you accept the default. Click Next.
9. The Pre-installation Summary page lists the components that will be installed. Click Install to begin the installation. When this part of the process is finished (it may take several minutes), the Configuration Mode page appears.
On the Configuration Mode page, select Basic or Advanced. Use advanced configuration only if one or more of the following is true:

- Communication between a remote vCenter Operations Enterprise Collector and the vCenter Operations Enterprise Server will be via firewall or HTTP proxy.
- vCenter Operations Enterprise will be monitoring more than 100,000 resources.
- Replication is enabled between the primary vCenter Operations Enterprise server and a backup server.
- You are installing vCenter Operations Enterprise to be used as a backup server.
- For security reasons, you do not want the vCenter Operations Enterprise components to use default passwords and ports.

If you choose Basic, continue this procedure. If you choose Advanced, continue with “Advanced vCenter Operations Enterprise Configuration” on page 24.

On the Full Configuration page, select Primary or Backup under Server Configuration.

**NOTE** If you configure a backup server, if there is a problem with your primary server you can use the configuration wizard to make the backup server the primary server. All remote collectors will then send metrics to the new primary server.

In the Database Type field, choose Oracle as this is the only database supported on Linux.

Type the Oracle database's System Identifier in the SID field.

In the Database Host field, enter the IP address of the database server.

In the Database Port field, leave the default entry (1521) unless you installed Oracle using a different port number.

In the User Name and Password fields, enter the user name and password for a user with permission to read and write to the Oracle schema.

Click the Test button to test the connection to the database. If the test fails, check your entries, make any needed corrections, and try again.

In vCenter Operations Server Configuration, choose HTTP or HTTPS. This sets the protocol to use for client connections to the vCenter Operations Enterprise server.

If you want adapters which use the HTTP post method to use Web authentication, check the HTTP Post adapter web authentication enabled box.

The vCenter Operations Server Port field displays the default port number for the protocol you chose. If you need to change this, port, type the correct number.

To enable Internet connections to the vCenter Operations Enterprise server, type the server name or public IP address for the server in the vCenter Operations Server Host field. (The installer tries to detect the host name or IP address of the server and fill it in as the default.) If you leave this field blank, users will not be able to connect from outside the local network.

**NOTE** vCenter Operations Enterprise sends alert e-mail messages containing hyperlinks to the vCenter Operations Enterprise server so administrators can find more information about the alert. If you want offsite administrators to be able to use these links, be sure to enter a public IP address for the vCenter Operations Enterprise server. You should not set the host name to localhost.

In the FSDB Home (File System Database) field, type the path to the directory where vCenter Operations Enterprise should save the metrics it collects. You can enter up to eight locations to distribute drive I/O use. If you enter more than one, separate them with semi-colons. For best performance, this should not be on the same drive system where the vCenter Operations Enterprise software is installed.
23 In **SMTP Host** and **SMTP Port**, enter the host name or IP address and port number for the SMTP server for vCenter Operations Enterprise to use to send e-mail messages.

24 In **Recipient**, enter one or more e-mail addresses; if you enter more than one, separate them with commas (,). If a vCenter Operations Enterprise service fails or experiences problems, an e-mail will be sent to each recipient.

25 Click **Finish** to complete the installation. The Install Complete page appears.

26 On the Install Complete page, click **Done**.

27 If the server host has two IP addresses:
   a Choose **No** and click **Done**.
   b Using a text editor, open the file `vcenter-ops/user/conf/collector/wrapper.conf`.
   c Add this line to the file:
      `wrapper.java.additional.9=-Djava.rmi.server.hostname=IP Address/Name`
      where `IP address/Name` is the IP address or host name to use for the collector.
   d Save your change and close the file.
   e Reboot the system.

vCenter Operations Enterprise installation is complete. Please contact vCenter Operations Enterprise support or professional services for assistance in adjusting the vCenter Operations Enterprise configuration to meet your needs. See “Online and Telephone Support” on page 8.

**Installing vCenter Operations Enterprise on Linux – Console Mode**

**Before the Installation**

If a previous version of vCenter Operations Enterprise is already installed on the Linux host, you must stop its processes before you install vCenter Operations Enterprise. You can do this using the script file `vcops.sh`. Run the script with the `stop` parameter:

```
vcops.sh stop
```

To make sure the services have all stopped, use the `status` parameter:

```
vcops.sh status
```

**Installation Steps**

1. Using binary mode, upload `vcops.bin` to the target Linux host.
2. Navigate to the folder containing `vcops.bin`. Change the permission on this file to make it executable:
   ```
   chmod +x vcops.bin
   ```
3. Enter this command to start the console mode installation:
   ```
   ./vcops.bin -i console
   ```
4. All of the information entered in the GUI-mode installation will be prompted for in console mode. For a description of the information required at each prompt, see steps 5 and after on page 21.

After finishing the installation, see “Installing vCenter Operations Enterprise on Linux – Console Mode” on page 23.
Advanced vCenter Operations Enterprise Configuration

If you choose to perform an advanced configuration on the Configuration Mode page, you see a succession of dialog boxes asking for configuration information for various aspects of vCenter Operations Enterprise. Follow the procedure below to complete the installation.

**NOTE**  For additional information about setting any of the advanced parameters, please contact vCenter Operations Enterprise support, as described in “Online and Telephone Support” on page 8.

1. On the Advanced Configuration — vCenter Operations Server dialog box, select **Primary** or **Backup** under **Server Configuration**.

   **NOTE**  If you configure a backup server, if there is a problem with your primary server you can use the configuration wizard to make the backup server the primary server. All remote collectors will then send metrics to the new primary server.

   ![vCenter Operations Enterprise Configuration Dialog Box](image)

2. In **vCenter Operations Server Configuration**, choose **HTTP** or **HTTPS**. This sets the protocol to use for client connections to the vCenter Operations Enterprise server.

3. To enable Internet connections to the vCenter Operations Enterprise server, type the server name or public IP address for the server in the **vCenter Operations Server Host** field. (The installer tries to detect the host name or IP address of the server and fill it in as the default.) If you leave this field blank, users will not be able to connect from outside the local network.

   **NOTE**  vCenter Operations Enterprise sends alert e-mail messages containing hyperlinks to the vCenter Operations Enterprise server so administrators can find more information about the alert. If you want offsite administrators to be able to use these links, be sure to enter a public IP address for the vCenter Operations Enterprise server. You should not set the host name to `localhost`.

4. The **vCenter Operations Server Port** field displays the default port number for the protocol you chose. If you need to change this, port, type the correct number.

5. If you want adapters which use the HTTP post method to use Web authentication, check the **HTTP Post adapter web authentication enabled** box.

6. Under **Memory Configuration**, set the following for the vCenter Operations Enterprise Web JVM process:
   - **Maximum Memory** – maximum heap size allocated to the vCenter Operations Enterprise user.
   - **Maximum Permanent Memory** – maximum heap size allocated to compile and run JVM classes.
Click Next to display the Advanced Configuration — Analytics dialog box.

8 Under **Memory Configuration**, set the following for the vCenter Operations Enterprise Analytics JVM process:
- **Maximum Memory** – maximum heap size allocated to metric calculations.
- **Maximum Permanent Memory** – maximum heap size allocated to compile and run JVM classes.

9 Under **RMI Configuration**, set the host and port for RMI access to the analytics service.

10 Under **Data Storage Location**, set the location of the **FSDB Home**. You can enter up to eight locations to distribute drive I/O use. If you enter more than one, separate them with semi-colons. For best performance, the FSDB should not be on the same drive where the vCenter Operations Enterprise software is installed.

11 Under **Replication Server**, check the Enable Replication box if you want to enable FSDB replication. When enabled, vCenter Operations Enterprise will push FSDB data to a remote server. Enter the following parameters for the remote MQ server: **Host**, **Port**, **Protocol**, **Control Queue**, **Response Queue**, **Data Queue**, **User Name**, and **Password**.

Check Enable Synchronization is you want to synchronize existing data between this server and the replication server. If you do not check this box, only data gathered from this point forward will be copied to the replication server. This option is most often used when setting up a replication server after initial vCenter Operations Enterprise installation.
12 Click Next to display the Advanced Configuration—Message Queue dialog box.

13 Under Memory Configuration, set the following for the vCenter Operations Enterprise Message Queue JVM process:

- **Maximum Memory** – maximum heap size allocated to the vCenter Operations Enterprise user.
- **Maximum Permanent Memory** – maximum heap size allocated to compile and run JVM classes.

14 Under Message Queue Configuration, check the Enable JMX box if you want to enable JMX monitoring on vCenter Operations Enterprise. If you enable JMX monitoring, set the following MQ parameters: **Host**, **Port**, **Protocol**, **Collector Queue**, **Controller Queue**, **Data Queue**, **User Name**, and **Password**.

15 Click Next to display the Advanced Configuration—Collector dialog box.

16 Under Memory Configuration, set the following for the vCenter Operations Enterprise Collector JVM process:

- **Maximum Memory** – maximum heap size allocated to the vCenter Operations Enterprise resources.
- **Maximum Permanent Memory** – maximum heap size allocated to compile and run JVM classes.
17 Under **Collector Configuration**, set the following connection parameters for the collector:

- **Collector Name**
- **RMI Port**
- **Max Threads**
- **Min Data Send Size** – this is measured by the number of vCenter Operations Enterprise resources.
- **Heart Beat Sleep Time** – this checks the health of the collector. Measured in milliseconds.

18 Check the **Enable Http Proxy** box to enable HTTP Proxy from the collector to vCenter Operations Enterprise. If you enable it, set the **Host** and **Port**.

19 In **SMTP Host** and **SMTP Port**, enter the host name or IP address and port number for the SMTP server for vCenter Operations Enterprise to use to send e-mail messages.

20 In **Recipient**, enter one or more e-mail addresses; if you enter more than one, separate them with commas (,). If a vCenter Operations Enterprise service fails or experiences problems, an e-mail will be sent to each recipient.

21 Click **Next** to display the Advanced Configuration—Replication Server dialog box. The settings on this page are only used if the vCenter Operations Enterprise server is running in Backup mode.

22 Under **Message Queue Configuration**, set the parameters for the replication server: **Host**, **Port**, **Protocol**, **Collector Queue**, **Controller Queue**, **Data Queue**, **User Name**, and **Password**.

23 Under **Data Storage Location**, set the location of the local **FSDB Home**. You can enter up to eight locations to distribute drive I/O use. If you enter more than one, separate them with semi-colons.

24 Click **Next** to display the Advanced Configuration—Database dialog box. The settings on this page define the connection to the vCenter Operations Enterprise database.
25 In the **Database Type** field select **SQL** or **Oracle**. Fields appropriate for the selected database appear on the page. This figure shows the fields for a SQL Server database.

For an Oracle database, the **Database Name** and **Instance Name** fields do not appear and an **SID** field is added.

26 If you are using an Oracle database, type its System Identifier in the **SID** field.

27 In the **Database Host** field, enter the IP address of the database server.

28 In the **Database Port** field, leave the default entry (1433 for SQL Server or 1521 for Oracle) unless you installed the database using a different port number.

29 If you are using a SQL Server database, enter the name of the vCenter Operations Enterprise database in the **Database Name** field.

30 If you are using a SQL Server database and need to specify an **Instance Name** for the database, type it in that field.

31 In the **Authentication, User Name**, and **Password** fields, select the type of authentication to use (for SQL Server databases only) and enter the user name and password for a user with permission to read and write to the SQL Server database or Oracle schema.

**NOTE** vCenter Operations Enterprise requires a user account with SQL authentication credentials to establish a connection with the database. If you want to use Windows authentication with SQL Server, there are additional steps to perform after completing the installation. See “Configuring Integrated Windows Security with SQL Server” on page 29.

32 Click the **Test** button to test the connection to the database. If the test fails, check your entries, make any needed corrections, and try again.

33 Click **Finish** to complete the installation. The Install Complete page appears.

34 On the Install Complete page, choose whether to restart the computer automatically or manually. If the server host has only one IP address, choose **Yes, restart the system** and click **Done**. The system reboots.

If the server host has two IP addresses:

a  Choose **No** and click **Done**.

b  Using Notepad or another editor, open the file `vcenter-ops\user\conf\collector\wrapper.conf`.

c  Add this line to the file:

```
wrapper.java.additional.9=-Djava.rmi.server.hostname=IP Address/Name
```

where **IP Address/Name** is the IP address or host name to use for the collector.

d  Save your change and close the file.

e  Reboot the system.

vCenter Operations Enterprise installation is complete. Please contact vCenter Operations Enterprise support or professional services for assistance in adjusting the vCenter Operations Enterprise configuration to meet your needs. See “Technical Support and Education Resources” on page 8.
Configuring Integrated Windows Security with SQL Server

To have vCenter Operations Enterprise use a Windows user name to connect to SQL Server, you must perform additional steps after completing the installation wizard. Certain files necessary for this authentication method are not included with vCenter Operations Enterprise. Follow these steps:


2. Rename or delete the original sqljdbc.jar from vcenter-ops\common\lib. If you choose to rename it, you must change the extension to something other than jar.

3. In the package you downloaded from Microsoft, find the sqljdbc.jar file and copy it to vcenter-ops\common\lib.

4. Open the vcenter-ops\user\conf\analytics\wrapper.conf in a text editor. In the line wrapper.java.classpath.41=%VCOPS_BASE%\common\lib\sqljdbc.jar, change sqljdbc.jar to sqljdbc4.jar. Save your change and close the file.

5. In the package you downloaded from Microsoft, find the correct sqljdbc_auth.dll file for your platform. For vCenter Operations Enterprise, this should be the one in enu\auth\x64. Copy this file to vcenter-ops\common\bin.

6. In Window Services dialog box, for each vCenter Operations Enterprise service—ActiveMQ, vcopsWebService, AnalyticsService, and CollectorService—follow these steps to change the Log On As user name to the Windows user you entered as the database user name when installing vCenter Operations Enterprise.
   a. Right-click the service and select Properties.
   b. Click the Log On tab.
   c. Select This Account.
   d. Type the user name and password. The user name must have read access to the vcenter-ops directory.
   e. Save your changes.

7. To test the configuration:
   a. Reboot the server.
   b. Start the vCenter Operations Enterprise services if they did not start automatically.
   c. If you can get to the login screen for vCenter Operations Enterprise, then the web project was able to start. It requires a database connection to start.
   d. To see if the analytics process is running, look in the analytics.log file.
   e. If you cannot log in using the user name and password admin, look in the vcenter-ops\user\log\controller.log for JDBC exception errors indicating a connection problem to the SQL Server database.
The vCenter Operations Enterprise Program Group

Installing vCenter Operations Enterprise on Windows creates a vCenter Operations Enterprise program group beneath the VMware program group on the Windows Start, All Programs menu. This program group contains four items:

- **Configure VMware vCenter Operations** – Lets you change vCenter Operations Enterprise’s configuration settings. You can select either basic or advanced configuration. You then see the same dialog boxes as either basic installation (see Step 10 on page 18) or advanced installation (see “Advanced vCenter Operations Enterprise Configuration” on page 24).

- **Start all services** – Starts all vCenter Operations Enterprise-related services on this server:
  - vcopsWebService
  - AnalyticsService
  - ActiveMQ
  - CollectorService
  - DTProcessorService (runs only if Analytics Processor is installed)
  - ReplicationServerService (runs only on a vCenter Operations Enterprise replication server)

- **Stop all services** – Stops all vCenter Operations Enterprise-related services, as listed above.

- **Uninstall** – Uninstalls vCenter Operations Enterprise. This uninstalls the components installed by the vCenter Operations Enterprise installer—the vCenter Operations Enterprise server, vCenter Operations Enterprise collector, and analytics. It does not uninstall any adapters, or any vCenter Operations Enterprise components on remote servers.

See “Starting and Stopping vCenter Operations Enterprise Services” on page 126 for how to start and stop individual services on Windows or Linux servers.

Installing a vCenter Operations Enterprise Collector

To install just the vCenter Operations Enterprise collector on a remote host, follow the procedure below. You may want to do this to distribute vCenter Operations Enterprise activity for better performance. This procedure is written for Windows; follow similar steps for a Linux remote host.

1. Log on as a user with enough privileges to create services. We recommend using an administrator user name.

2. Navigate to the folder containing the vCenter Operations Enterprise executable files.

3. Run the vcops.exe file. The first page of the vCenter Operations Enterprise installation wizard appears.

   **NOTE** You can click Cancel to stop the process at any time.

4. Click Next.

5. Read the License Agreement in its entirety. Select I Accept the Terms of the License Agreement and click Next.

6. On the Choose Install Set page, click the icon beside Collector and click Next.

7. On the Choose Install Folder page, click OK to accept the default installation folder, or click Browse and select the installation folder you want. The default installation folder is \vmware\vcenter-operations beneath the default program installation folder for your system. Click Next.

8. The Pre-installation Summary page lists the components that will be installed. Click Install to begin the installation. When this part of the process is finished (it may take several minutes), the Configuration Mode page appears.
On the Configuration Mode page, select **Basic**.

In **Collector Name**, the default value is **vCenter Operations Server**, which is the same name as the local collector. Do not use the default; enter a unique name for the collector.

In **vCenter Operations Server Configuration**, choose **HTTP** or **HTTPS**. This sets the protocol to use for communicating heartbeat signals to the vCenter Operations Enterprise server. This should match the protocol set on the vCenter Operations Enterprise Server.

In **vCenter Operations Server Host**, enter the IP address of the vCenter Operations Enterprise Server.

In **vCenter Operations Server Port**, enter the same port set on the vCenter Operations Enterprise Server.

In **Host**, enter the IP address of the message queue. This is typically the same as the vCenter Operations Enterprise Server host.

In **Port**, leave the default entry (61616) unless MQ is using a different port number.

Click **Finish** to complete the installation. The Install Complete page appears. Click **Done**.

If the host has two IP addresses, you need to define which one the collector should use:

a. Using Notepad or another editor, open the file `vcenter-ops\user\conf\collector\wrapper.conf`.

b. Add this line to the file:

   \texttt{wrapper.java.additional.9=-Djava.rmi.server.hostname=IP Address/Name}

   where \textit{IP address/Name} is the IP address or host name to use for the collector.

c. Save your change and close the file.

d. After changing wrapper.conf, restart the collector service:

   - If the host uses Windows, from the Windows Start menu, select **Control Panel, Administrative Tools, Services**. Restart the **CollectorService** service.

   - If the host uses Linux, enter these commands:

     \texttt{cd vcenter-ops/collector/bin}

     \texttt{CollectorService.sh restart}

Installation of the vCenter Operations Enterprise collector is complete.
Installing a vCenter Operations Enterprise Adapter

When you install the vCenter Operations Enterprise server, three adapters are deployed by default:

- The vCenter Operations Enterprise adapter – This adapter monitors vCenter Operations Enterprise itself and allows you to manage resource tags, as described later in this manual.
- The HTTP Post adapter – This is a generic adapter used to push data to vCenter Operations Enterprise via HTTP.
- The Container adapter – vCenter Operations Enterprise uses this adapter to create container resources.

All other adapter files are supplied separately. Ask your vCenter Operations Enterprise representative for the installation files for the adapters you need. Once you have the adapter installation files, follow the procedure below. See the documentation supplied with the adapter for possible additional instructions.

You need to install an adapter only on the vCenter Operations Enterprise server, not on any remote vCenter Operations Enterprise collectors you have installed. The adapter is “pushed” to all remote collectors when you click the Describe button in step 5, below.

To install an adapter

1. Open the compressed file supplied by VMware for the adapter and extract all files from it into a temporary folder.
2. In the temporary folder, execute the AdapterName_install.exe file.
3. Follow the instructions on the setup dialog boxes.
4. Sign in to vCenter Operations Enterprise as an administrator.
5. From the Admin menu, select Support.
6. On the Info tab, click the Describe icon in the Adapters Info pane. This causes the vCenter Operations Enterprise server to find the new adapter files, gather information about the abilities of the adapter, and update the vCenter Operations Enterprise user interface with information about the adapter. It also installed the adapter on any remote collectors.
7. You can now define credentials for the new adapter and create instances for it. See Chapter 3.

Installing the Analytics Processor (Optional)

The vCenter Operations Enterprise server installation includes a process which performs all of the various vCenter Operations Enterprise analytics calculations: dynamic thresholds, fingerprinting, and so on. vCenter Operations Enterprise also gives you the option of installing a separate analytics processor on one or more remote hosts to handle only the dynamic threshold computation; this is called the DT Processor. This has two benefits:

- It distributes the analytics processing among two or more hosts to improve performance and reduce the demand on the server.
- When you have a separate process just for the dynamic threshold calculations, a problem with dynamic thresholds does not stop the entire analytics process.

You can install the DT Processor on one or more remote hosts. It is supported on both Windows and Linux hosts; the installation process is the same on either.

To install the DT Processor

1. Perform the first six steps of the vCenter Operations Enterprise server installation, as described in either “Installing vCenter Operations Enterprise on Windows” on page 17 or “Installing vCenter Operations Enterprise on Linux – GUI Mode” on page 21.
2. On the Choose Install Set page, select Analytics Processor and click Next.
3 On the Choose Install Folder page, accept the default or click Choose and browse to the folder where you want to install the processor. Click Next.

4 The Pre-installation Summary page lists the components that will be installed. Click Install to begin the installation.

5 On the DT Processor Configuration page, type the host name or IP address of the vCenter Operations Enterprise server host in the vCenter Operations Server field, then type the port number for RMI access to the analytics service in the Port field; the default is 1199. Click Save.

6 On the Install Complete page, click Done.

7 On the vCenter Operations Enterprise server host, use Notepad or another editor to edit the file vcenter-ops\user\conf\analytics\advanced.properties.

8 Find the property distributedDTCalculationEnabled and set it to true.

9 Save your change and close the file.

10 Restart the Analytics service on the vCenter Operations Enterprise server host.

11 You may want to make sure the service started on the remote host. The service name to look for is Analytics Processor.

Installation of the DT processor is complete. You can repeat this on another host if desired.

Validating the vCenter Operations Enterprise Installation

After completing the installation of your vCenter Operations Enterprise server, you can perform the following procedure to make sure the installation completed successfully and vCenter Operations Enterprise is operating as it should. (These instructions are for a Windows server. Adjust them as necessary if your vCenter Operations Enterprise server runs on Linux.)

1 If you did not use the Test button to validate the database connection during installation, use the Configure VMware vCenter Operations utility to do so:
   a From the Start menu, select All Programs, VMware, vCenter Operations Enterprise, Configure VMware vCenter Operations.
   b On the Full Configuration dialog box, click Test.

2 Open the Services window (from the Control Panel, select Administrative Tools, Services) and make sure the vCenter Operations Enterprise services are running: ActiveMQ, vcopsWebService, AnalyticsService, CollectorService.

3 In your browser, go to the vCenter Operations Enterprise URL and login with the user admin and password admin. See “Logging On” on page 41.

4 On the Home page, make sure the default dashboards load properly.

5 From the Environment menu, select Environment Overview. Make sure the default tags are listed on the left and the vCenter Operations Enterprise resources show on the right.

6 After 15 minutes, validate that the health for the vCenter Operations Enterprise resources has turned from blue to green. See “Health” on page 39.

7 From the Admin menu, select Support. On the Support page, click the Info tab. Make sure the Describe Info pane shows Adapter describe successfully finished.
8 Click the **About** tab. Make sure the vCenter Operations Enterprise version and database version are correct.

9 Click the **Logs** tab. Make sure the services have started successfully for each of these logs:

- In the vCenter Operations Web folder, the `controller.log`
- In the vCenter Operations Analytics folder, the `analytics.log`
- In the vCenter Operations Collector folder, the `collector.log`

For more information about the various tabs of the Support page, see “**Support**” on page 122.

For general instructions on using vCenter Operations Enterprise, see the *vCenter Operations Enterprise User's Guide*. 
This chapter introduces you to the vCenter Operations Enterprise environment, including some key vCenter Operations Enterprise terms and concepts, the user interface, and the overall configuration process. It discusses the following topics:

- “Product Overview” on page 35
- “vCenter Operations Enterprise Concepts” on page 36
- “The vCenter Operations Enterprise User Interface” on page 40
- “Logging On” on page 41
- “Configuring vCenter Operations Enterprise” on page 42

Product Overview

vCenter Operations Enterprise collects and analyzes the data from the monitoring products you already have. vCenter Operations Enterprise’s advanced analytic algorithms learn to recognize the normal behavior of every entity (or resource) it tracks, and how the behavior of each resource interacts with other resources. This enables it to recognize patterns of data which may lead to serious problems with your enterprise, or specific areas of it, and warn you before they occur so they can be avoided.

The key to getting the greatest possible benefit from vCenter Operations Enterprise is configuring it properly: defining the resources it tracks information for, the information it stores for each one, which types of information are most important (the key performance indicators, or KPI), how related resources fit together into groups, and how those groups relate to each other. While vCenter Operations Enterprise can do some of this for you—like discovering the resources it can collect data from—other parts of the process must be done manually. This guide describes how to configure all of these aspects of vCenter Operations Enterprise.

This chapter explains the terminology vCenter Operations Enterprise uses for these entities and concepts, then gives an overview of what you need to do to define your environment to vCenter Operations Enterprise and a brief introduction to vCenter Operations Enterprise’s user interface.
vCenter Operations Enterprise Concepts

Resources

A resource is any entity in your environment for which vCenter Operations Enterprise can collect data. For example, a typical environment might contain any of the following resources: routers, switches, firewalls, databases, application servers, TCP/IP-based applications—essentially, anything in your environment that data can be collected from. vCenter Operations Enterprise provides comprehensive metric collection, predictive analysis, and alerting for your resources.

In addition to single entities—such as a database—you can define resources to use as containers to “hold” other resources. This lets you get combined metrics for logically grouped resources. For example, if you have several Web servers, you would define each one as a resource, then define another resource which contains all the individual Web servers and allows you to monitor their combined performance. Applications and tiers are types of container resources.

Configuring resources is described in detail in Chapter 4.

Applications

An application is a special type of container resource. An application defines an interdependent set of hardware and software components delivering a specific capability in support of your business. You build application topologies to make it easier for you to determine how applications are affected when one or more resources contained in them experience problems. Once you have configured an application, you can view real-time analysis for any or all affected resources in it to help you understand where in the application problems arise, and how they spread to other resources.

In vCenter Operations Enterprise, applications are three-level hierarchies. Each application contains one or more tiers; each tier contains one or more resources. The resources that make up a tier can also contain other resources, but they do not have to.

Because of their importance in vCenter Operations Enterprise, applications are configured separately from other types of resources. Configuring applications is described in Chapter 6.

Tiers

A tier is a group of resources that perform a specific task in an application—for example, all of the database servers could be grouped into a tier. Multiple tiers can exist (and generally do) in a given application. Only applications can contain tiers.

The screenshot below shows configured tiers in a page launched by editing an existing application.

Tags

A large enterprise can easily have thousands of resources defined in vCenter Operations Enterprise. Resource tags allow you to index and categorize resources. Whenever you select resources in vCenter Operations Enterprise, you can do it by first selecting a tag you’ve assigned to the resource, then looking through the list of resource associated with that tag. Defining tags and tag values appropriate for your environment will make it much easier to find the resources and metrics you want.
A tag is a type of information, such as Application or GEO Location (both of these tags always exist in vCenter Operations Enterprise). Tag values are individual instances of that type of information. For example, for the GEO Location tag, you could define values of New York, London, and Mumbai, if that’s where your offices are located.

You can assign any number of resources to each tag value, and you can assign a single resource to tag values under any number of tags. In most cases, you may want to be able to find a resource by looking under its application, its location, its tier, and possibly other tags as well.

There is one tag hierarchy for all resources and a separate tag hierarchy just for applications. Working with resource tags is described on page 61. Working with application tags is described on page 94.

**Attributes and Metrics**

vCenter Operations Enterprise may collect several different kinds of data for a single resource. For example, for a database server, vCenter Operations Enterprise may receive data on disk free space, CPU utilization, average response time for a database request, and so on. Each different type of data vCenter Operations Enterprise collects is called an attribute. You define attribute packages—different combinations of attributes—and assign each resource the attribute package that contains the attributes you want to track for that resource. Working with attribute packages is described in Chapter 5.

An instance of an attribute for a particular resource is called a metric. For each metric, vCenter Operations Enterprise collects and stores multiple readings over time. For example, a particular software program may provide information about its performance every 30 seconds or every minute. Each piece of data collected is called a metric observation or value. If a program has response time defined as an attribute, vCenter Operations Enterprise collects metrics tracking the response time.

**Thresholds**

A threshold is the value that marks the boundary between normal values for a metric and abnormal ones. When a metric crosses one of its thresholds, vCenter Operations Enterprise generates an anomaly, as described on page 38.

vCenter Operations Enterprise uses two types of thresholds, hard and dynamic:

- A **hard threshold** is a value you define for a metric when defining an attribute package (see Chapter 5). A hard threshold is static; it changes only if you change it.
- A **dynamic threshold** is defined by vCenter Operations Enterprise based on the incoming and historical metric data. vCenter Operations Enterprise adjusts dynamic thresholds as new data allow it to better define what is normal for a metric and what isn’t. Dynamic thresholds automate the massive manual effort that could be needed with hard thresholds, where you might need to configure thresholds for hundreds or thousands of metrics.

Dynamic thresholds add context that helps vCenter Operations Enterprise discriminate between normal and abnormal behavior. They enable vCenter Operations Enterprise to evaluate the performance of IT components in context with historical conditions and determine if an anomaly is truly warranted. By determining what is normal in the environment, vCenter Operations Enterprise can filter out alerts that are associated with normal behavior—the alerts that would be triggered by hard thresholds—and instead generate alerts only for abnormal behaviors that are precursors to real problems in your environment.

For more detailed information on thresholds, see the vCenter Operations Enterprise Analytics Guide.

**Super Metrics**

It can be useful to track combinations of metrics, either from a single resource or, more commonly, from multiple resources. In vCenter Operations Enterprise, you can combine different metrics using mathematical operations to define a super metric, which vCenter Operations Enterprise then tracks like any other metric.

For example, you can track the average free disk space for all database servers by defining a super metric combining and averaging the free disk space metrics for each server. See “Defining Super Metrics” on page 78 for more information.
Alerts and Anomalies

In vCenter Operations Enterprise, a metric is a single piece of information monitored for a specific resource—for example, the amount of memory used on a particular server. For every metric, vCenter Operations Enterprise maintains thresholds, either hard thresholds you define or dynamic thresholds that vCenter Operations Enterprise defines and updates based on the normal range of values for the metric. (See page 37 for more about thresholds).

When a metric violates its threshold—for example, CPU use goes out of range, or a transaction on a Web server takes longer than usual, vCenter Operations Enterprise generates an anomaly. vCenter Operations Enterprise continually tracks all anomalies; when its correlation algorithms determine that the current combination of anomalies may indicate a real problem with a resource, vCenter Operations Enterprise generates an alert. (If you’ve designated a metric as a Key Performance Indicator, any anomaly triggers an alert.) The screenshot below shows the Metric Graph widget for a metric. The shaded gray area shows the dynamic threshold for the metric—as long as the value stays in that area it is performing normally. The yellow areas indicate out-of-range values which generated anomalies.

An alert is a notification to inform you of an abnormal condition that may require attention. Each alert includes details about the anomaly or anomalies that triggered it, as well as the effect it could have on other resources. An alert may indicate a problem with any type of resource, either a resource that represents a single entity or a container resource such as a tier or application.

The screenshot below shows the vCenter Operations Enterprise Alert Summary page displaying a sample alert, including what triggered it, its impact, and likely root causes.
vCenter Operations Enterprise can generate several kinds of alerts. One type that deserves special mention is an *early warning* alert. An early warning indicates that, according to vCenter Operations Enterprise’s algorithms, the collection of anomalies for an application indicates a 90% or greater chance that a problem is occurring. An early warning is always a critical alert.

The various types of alerts, and how to list all alerts or see detailed information about a single one, are described in the *vCenter Operations Enterprise User’s Guide*.

**Health**

vCenter Operations Enterprise's health rating gives you a quick overview of the current state of any resource, from an individual operation up to your entire network. vCenter Operations Enterprise calculates health by looking at the internally-generated metrics for the resource and using its proprietary analytics formulas to determine an overall health score, from 0 to 100. See *"vCenter Operations Enterprise-Generated Metrics"* on page 73 for more information about vCenter Operations Enterprise-generated metrics.

vCenter Operations Enterprise indicates health in two ways: the number score, or a colored indicator based on the range of the health score:

- **Green**: 76 - 100. Resource is behaving normally. No attention required.
- **Yellow**: 51 - 75. Resource is experiencing some level of problems. Check and take appropriate action.
- **Orange**: 26 - 50. Resource could have serious problems. Check and take appropriate action as soon as possible.
- **Red**: 0 - 25. Resource is either not functioning properly or is predicted to stop functioning shortly. Take action immediately.
- **Blue**: No data is available for any metrics for this resource. This shows as a question mark on pages where the numeric score is shown, and as -1 on historic health graphs.

**NOTE** A blue health indicator means that vCenter Operations Enterprise does not know the health of the resource. It is not the same as a 0 health score. A 0 health score indicates that vCenter Operations Enterprise has received information from the adapter instance indicating that the resource is down. A blue (-1) score means that vCenter Operations Enterprise is not receiving data. This could indicate that metrics are not being collected for the resource or that the resource cache is being reloaded. The cache is reloaded whenever the vCenter Operations Enterprise services are restarted or if there are configuration changes to the resource or its parent.

When an adapter instance cannot connect to its data source, the adapter instance resources and all of its child resources will show blue.

These are the default numeric ranges for each color. You can change them, if desired, as described in *“Modifying Health Ranges”* on page 120.

Anywhere the resource is listed in vCenter Operations Enterprise, you can see the health score, the indicator, or both.

**Root Cause**

The root cause of an alert is the condition, or symptom, that was the first step in the chain of events that led to the alert. For example, a slowdown in network traffic could lead to an increased time-per-transaction for users of your Web site, which in turn leads to an alert being issued for the Web server resource.

For any alert, you can see a list of the conditions vCenter Operations Enterprise calculates as the most likely root causes of the symptom that caused the alert, ranked in order. See the *vCenter Operations Enterprise User’s Guide* for more information about viewing alert information.
Forensics

In addition to generating alerts for specific out-of-threshold values, vCenter Operations Enterprise includes several forensic features: ways for you to see where in your enterprise problems are occurring, how serious they are, and what the likely causes were. These include cross-silo analysis, top-n (and bottom-n) analysis, and the problem fingerprint library.

All forensics displays are described in detail in the *vCenter Operations Enterprise User’s Guide*.

Cross-Silo Analysis

vCenter Operations Enterprise’s Cross-Silo Analysis page shows a histogram—a graph showing the number of abnormalities (anomalies) over time—for any resource, based on data collected from any adapter. You can zoom the graph to focus on any desired period of time, such as just before a particular alert was issued. You can click at any point in the graph to see a ranking of the likely root causes for the abnormalities at that point. For applications, the histogram also includes a line showing the vCenter Operations Enterprise-determined 90% threshold. If the number of anomalies exceeds this threshold, vCenter Operations Enterprise generates an early warning alert, as there is a strong probability that there is a problem with the application.

Top-N Analysis

The Top-N Analysis page shows you the top resources, metrics, or alerts in one or more categories you select. For example, you can see the five most or least healthy resources in a tier. You can select the resource tag and time frame to analyze and the categories to show.

Problem Fingerprint Library

When a KPI for an application or a tier belonging to an application violates a threshold, vCenter Operations Enterprise examines the events leading up to the violation. If it finds enough related information (such as other anomalies), it captures the set of events which preceded and led up to the violation. This captured series of events is called a fingerprint. vCenter Operations Enterprise can then monitor events in the future, and, if it finds a similar series of events, issue a predictive alert warning that the KPI violation is likely to occur.

Fingerprinting captures models of problems you can use for detailed forensics. This helps you identify problems and resolve them more quickly than in a traditional IT environment by:

- Helping you to isolate problems. vCenter Operations Enterprise narrows the number of possible silos/tiers in which the problem may have occurred, so you can find and resolve it more quickly.
- Capturing the precursors to problems for root-cause analysis.
- Notifying you of problems before they occur, enabling you to solve problems.

Capacity Analysis

Some metrics, such as disk space usage or network traffic measurements, frequently show long-term trends—they tend to either rise or fall over time, though short term fluctuations can hide this or make it difficult to calculate. vCenter Operations Enterprise’s capacity analysis looks at the overall value trend for a selected metric and tells you when it is predicted to reach a threshold you set and how confident vCenter Operations Enterprise is of the prediction. This can help with planning for infrastructure upgrades, such as adding additional storage capacity, network routers, and so on.

The vCenter Operations Enterprise User Interface

The user interface is described in detail in the *vCenter Operations Enterprise User’s Guide*. In general, you access an vCenter Operations Enterprise feature or screen display in one of two ways:

- By selecting a feature from one of the menus at the top of the window. Most features open a dialog box for you to view information and make selections and entries.
- Through a dashboard
The current dashboard occupies most of the vCenter Operations Enterprise window. You select a dashboard by clicking its tab or through the **Dashboards** menu. Each dashboard contains one or more widgets—individual panes which give a particular view of vCenter Operations Enterprise’s data collection and analysis. vCenter Operations Enterprise includes a number of preconfigured dashboards, but both widgets and dashboards are configurable. You can select what widgets appear on a dashboard and in what order, and define what data—which metrics or analytics for which resources—each widget includes. How to configure widgets and dashboards, including how to add new dashboards, is described in the *vCenter Operations Enterprise User’s Guide.*

The display you see when you log on to vCenter Operations Enterprise, showing your default dashboard, is called your **Home page.**

![Dashboard Example](Image)

**Logging On**

**NOTE**  vCenter Operations Enterprise works best with either the Microsoft Internet Explorer (IE) 7 or Mozilla Firefox 3 browser.

Once vCenter Operations Enterprise is installed and its services are running, you can connect to the vCenter Operations Enterprise server using a supported Web browser. Do the following:

1. In your browser, go to the following URL:

   http://ip_address/

   *ip_address* is the IP address or server name of the vCenter Operations Enterprise server. If you are using the HTTPS protocol for the server, enter **HTTPS** instead of **HTTP**.

   The Login page appears.

2. Enter the default administrator user name and password:

   **Username:** admin

   **Password:** admin
3 Click Go.

**NOTE** You should change the administrator password as soon as possible, using the User Preferences link at the top of the page.

4 vCenter Operations Enterprise displays your Home page. You can customize the default dashboards shown to suit your needs. See the vCenter Operations Enterprise User’s Guide for details.

**NOTE** Your vCenter Operations Enterprise session will time-out after 30 minutes of inactivity, and you will have to log in again.

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**Configuring vCenter Operations Enterprise**

The remainder of this document describes the various procedures necessary to configure and maintain vCenter Operations Enterprise in your environment. To start using vCenter Operations Enterprise, you need to do the following:

- Define the adapter instances vCenter Operations Enterprise will collect data through. Defining adapters is covered in Chapter 3.
- Define the resources for vCenter Operations Enterprise to collect data from. Defining resources in described in Chapter 4.
- Define the attributes for vCenter Operations Enterprise to collect from each resource, which ones are key performance indicators (KPI), and the type of threshold to use for each. This is described in Chapter 5. You may also want to define super metrics, which are covered in the same chapter.
- Create applications and tiers to define the topology of your resource hierarchy. Configuring applications is covered in Chapter 6.

Once you have performed these operations, vCenter Operations Enterprise is ready to start collecting and analyzing your data. You can then configure vCenter Operations Enterprise for your users:

- Create users and user groups and assign them access rights to the features they need to use. You can also define the default dashboards for each user group. See Chapter 8, for more information.
- Set up alert notifications, so the staff members responsible for dealing with alerts find out about them as quickly as possible, even if they are not viewing an vCenter Operations Enterprise page. Configuring alert notifications is described in Chapter 7.
Managing Adapters

In this section, we discuss how to configure and manage adapters. It contains the following topics:

- “Adapter Overview” on page 43
- “Managing Credentials” on page 44
- “Managing Adapter Instances” on page 46
- “Connecting to HP OpenView Operations” on page 47
- “Setting Adapter Kind Icons” on page 48

Adapter Overview

An adapter is a component that enables the exchange of information between vCenter Operations Enterprise and the data collection landscape. The adapter connects to and collects data from the designated data source, transforms the collected data into the format vCenter Operations Enterprise is designed to consume, and passes the data to the vCenter Operations Enterprise collector for final processing.

Installing the vCenter Operations Enterprise server includes only the vCenter Operations Enterprise self-monitoring adapter. You must also install the adapters to monitor your resources. Each adapter is provided and installed separately. The general procedure for adapter installation is in “Installing a vCenter Operations Enterprise Adapter” on page 32. Contact your VMware representative to receive the adapters for your installation and any additional documentation which is available for them. Additionally, there is a full API for creating customized adapters.

vCenter Operations Enterprise uses two kinds of adapters: embedded and external.

- An embedded adapter is a Java component designed to run inside the vCenter Operations Enterprise collector. The adapter is configured and managed through the vCenter Operations Enterprise user interface. An example of an embedded adapter is the vCenter Operations Enterprise ITM adapter. The advantages of the embedded adapter are better maintainability, control, and visibility into the management of the adapter and the data it collects. The adapter also leverages the common functional needs, such as job scheduling, that have already been created as part of the collector. The embedded adapter is the most common type of adapter used in vCenter Operations Enterprise. Depending on the data collection methods used, embedded adapters support two resource creation methods. The first method is a probing discovery, where you send a request to the data source to return all available resources, then pick and choose which resources to add to vCenter Operations Enterprise. The second method is referred to as auto-discovery, where any new resource identified during the data collection process is automatically created in vCenter Operations Enterprise. Regardless of how a resource is created in vCenter Operations Enterprise, once it is created the management of the data collection is handled through the user interface.

- An external adapter is any component designed to use the vCenter Operations Enterprise OpenAPI to send information to vCenter Operations Enterprise, but managed outside of the core vCenter Operations Enterprise domain. There are two forms of the vCenter Operations Enterprise OpenAPI. The simple form accepts data through an HTTP request; the advanced form uses RMI.
An example of an external adapter is the HP Openview adapter which runs inside the HPOV agent. Another example could be a Perl script which reads a file and sends the extracted data to vCenter Operations Enterprise. The key advantage to an external adapter is flexibility in both how the adapter is created and how it is deployed. External adapters use the auto-discovery method described above. For more information about external adapters and the vCenter Operations Enterprise OpenAPI, please contact vCenter Operations Enterprise support, as described in “Technical Support and Education Resources” on page 8.

You must create an adapter instance for each monitoring server (data source) you want to collect data from using an embedded adapter. The instance defines the type of adapter to use to connect to the data source and the information needed to identify and access the source. The exact information in an adapter instance definition differs depending on the type of adapter, but generally includes the data access method and a host, port, and credential (user name and password combination). Once you have defined an adapter instance, you can discover and define resources for it, as described in Chapter 4.

Defining adapter instances is a two-step process: because each instance requires a credential, you first create one or more credentials, so you can use the correct credential when creating an adapter instance. However, you can also create the credential while defining the instance.

External adapters do not require you to define an adapter instance, as vCenter Operations Enterprise passively accepts data from the adapter rather than actively connecting to it to get the data.

Managing Credentials

Credentials are the user names and passwords vCenter Operations Enterprise uses to connect to the adapter instances which supply it with metric data. You must define credentials for each adapter instance you use to provide data to vCenter Operations Enterprise. When you define an adapter instance, you include the credential to use in the instance definition. If two instances use the same user name and password, they can use the same credential.

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**NOTE** You do not need to set up credentials before running a discovery. Discovery is described in “Discovering Resources” on page 51.

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Viewing Credentials

To view the list of defined credentials

1. From the **Environment** menu, select **Configuration, Credentials**. This opens the Manage Credentials window.

2. In the **Collector** field, select the collector to use. Unless a name was assigned to the collector during installation, the only option is **vCenter Operations Server**.

3. In the **Adapter kind** field, select the adapter to list credentials for.

4. In the **Credential kind** field, choose the credentials to list. The credential kind varies depending on the adapter kind. (For example, if you chose **Hyperic Adapter**, the credential kind you select might be **Hyperic database credentials**.)

   This lists any existing instances for the credential kind you chose.
Adding Credentials

To add a new credential

1 Follow the procedures in “Viewing Credentials” on page 44 to list the credentials for the desired Collector, Adapter Kind, and Credential Kind.

**NOTE** If you do not display a list of credentials, you can still add a credential by clicking the Add link. The interface is slightly different, but you must still fill in the appropriate fields.

2 At the top of the list of credentials, next to Action, click Add. This adds the fields Instance Name, User Name, and Password to the Manage Credentials window.

3 In the Instance Name field, enter the name to give the credential instance. This name should be unique.

4 In the User Name field, enter the user name to use to connect to the adapter.

5 In the Password field, enter the password for the user.

6 Fill in any additional fields. The additional fields in the screenshot above allow you to automatically change the password for the credential.

7 Click OK.

Your added credential appears in the list in the Manage Credentials window.

Editing Credentials

To edit an existing credential

1 Follow the procedures in “Viewing Credentials” on page 44 to list the credentials for the desired Collector, Adapter Kind, and Credential Kind.

2 In the list of credentials, click the Edit link next to the credential to edit. This adds the Instance Name, User Name, and Password fields to the Manage Credentials window, with their values for this credential.

3 Make all desired changes, then click OK.

Your credentials are now modified.

Deleting Credentials

To delete an existing credential

1 Follow the procedures in “Viewing Credentials” on page 44 to list the credentials for the desired Collector, Adapter Kind, and Credential Kind.

2 In the list of credentials, click Delete next to the credential to delete.

3 In the confirmation dialog that appears, click Yes.

Your credential is now deleted.
Managing Adapter Instances

As described in “Adapter Overview” on page 43, you must create an adapter instance for each data source you want vCenter Operations Enterprise to pull data from using an embedded adapter. The sections below describe how to add, modify, and delete adapter instances.

**NOTE** Each adapter instance is itself a resource in vCenter Operations Enterprise; you can monitor its performance and health like any other resource. As described in “Automatic Tagging” on page 61, each instance is also a value of the Adapter Instances tag, making it easy to list the resources using a particular adapter instance.

Adding an Adapter Instance

The exact information you enter to define an adapter instance varies depending on the adapter type. For example, an ITM instance requires only a portal host, portal port, and credential, while a Hyperic instance requires a host, port, credential, JDBC driver class, and database name. While the exact fields vary, the overall procedure is the same.

**To add an adapter instance**

1. From the **Environment** menu, select **Configuration, Adapter Instances**. This opens the Manage Adapter Instances window.

2. In the **Collector** field, select the collector to use. Unless a name was assigned to the collector during installation, the only choice is **vCenter Operations Server**.

3. Select the **Adapter Kind** to add.

4. At the top of the list of existing instances, next to **Action**, click **Add**. Several additional fields appear above the **Instance** bar. The exact fields depend on the adapter type. The screenshot below shows the fields for an EMC Smarts adapter.

![Add Adapter Instance](image)

5. In **Instance Name**, enter the name for the adapter you are adding.

6. Fill in the rest of the information needed for the adapter instance. The exact fields depend on the adapter type.

7. In the **Credential** field, select the credential to use to sign on to this data source. To add a new credential for this adapter instance, click **Add**. For instructions on adding a credential, see “Adding Credentials” on page 45.

8. Click **OK** in the Manage Adapter Instances window to save your configurations. Alternatively, you can click **Reset** to clear your settings.
Editing an Adapter Instance

To edit an adapter instance

1. From the Environment menu, select Configuration, Adapter Instances. This opens the Manage Adapter Instances window.

2. If you want to shorten the list to make it easier to find the instance to edit:
   a. In the Collector field, select the collector to use. Unless a name has been assigned to the collector upon installation, the only option that appears is vCenter Operations Server.
   b. Select the Adapter Kind of the instance to edit.

3. Click Edit beside the adapter instance to edit.

4. Make all desired changes, then click OK.

Deleting an Adapter Instance

To delete an adapter instance

1. From the Environment menu, select Configuration, Adapter Instances. This opens the Manage Adapter Instances window.

2. If you want to shorten the list to make it easier to find the instance to delete:
   a. In the Collector field, select the collector to use. Unless a name has been assigned to the collector upon installation, the only option that appears is vCenter Operations Server.
   b. Select the Adapter Kind of the instance to delete.

3. Click Delete beside the adapter instance to delete.

4. In the confirmation dialog box that appears, click Yes.

Connecting to HP OpenView Operations

vCenter Operations Enterprise supports HP OpenView Operations (OVO) for Windows and UNIX. It can collect and analyze metrics from devices monitored by OpenView. Metrics are “pushed” to the vCenter Operations Enterprise collector for registration via a custom SmartLink (SPI) and then forwarded to vCenter Operations Enterprise. As with other external adapters (see “Adapter Overview” on page 43), you do not need to configure OpenView-monitored resources (referred to as nodes) within the vCenter Operations Enterprise user interface.

The OpenView adapter is highly scalable and reliable since metrics are fed directly into the vCenter Operations Enterprise collector. The functionality is only limited by the amount of network I/O (input/output) and drive I/O. The adapter can be scaled up by adopting additional SPIs or by implementing a hardware load balancer.

Although virtually all OpenView-collected metrics are sent to the vCenter Operations Enterprise collector, you can designate which specific metrics to analyze and store, if necessary.

The user who configures OVO for integration with vCenter Operations Enterprise must be highly experienced with the software. It is recommended you do not attempt to implement OVO services with vCenter Operations Enterprise if you are not proficient in OVO.

For additional information about implementing the OpenView adapter for vCenter Operations Enterprise, please contact vCenter Operations Enterprise support, as described in “Technical Support and Education Resources” on page 8.
Setting Adapter Kind Icons

In many locations where resources are listed, vCenter Operations Enterprise includes icons to show the kind of adapter each resource is accessed through. For example, you can see this in the **Data Source** column of widgets which list resources. You can select the icon to show for each adapter kind.

vCenter Operations Enterprise includes default icons to choose from, or you can upload your own graphics files to use. If you choose to use your own icon files, each file must be 16 x 16 pixels in size, in PNG format.

**To set icons for adapter kinds**

1. From the **Environment** menu, select **Advanced, Adapter Kind Icons**. The Manage Adapter Kind Icons window opens.

2. To assign an existing icon to an adapter kind:
   a. Select the adapter kind in the list.
   b. Click the icon to assign.
   c. Click the **Assign Icon** icon.

3. To upload your own icon to use:
   a. Click the **Upload Icon** icon. This opens a standard Windows Choose file dialog box.
   b. Browse to and select the file to use.
   c. Click **Open**. The file is added to the icon list and you can assign it to adapter kinds like any other icon.

4. To return an adapter to using the default for its type, select the adapter kind and click the **Assign Default Icons** icon.

   **NOTE** To change the icon assigned to an adapter kind, you do not have to remove the old icon first. Just assign the new icon, as described in step 2, and it will replace the existing icon for the type.

5. When you are done assigning icons, click **OK**.

Removing an icon from the adapter kind it is assigned to, as described in step 4 above, does not delete it from the icon list. You cannot remove an icon file from the list from within vCenter Operations Enterprise. To remove an icon, go to the folder where the files are stored, `vcenter-ops\tomcat\webapps\ROOT\images\adpknd`, and delete the file.
Managing Resources

In this section, we discuss how to configure and manage resources. This section contains the following topics:

- “Resource Overview” on page 49
- “Discovering Resources” on page 51
- “Adding a Resource” on page 53
- “Editing a Resource” on page 55
- “Deleting Resources” on page 56
- “Setting Defaults for Resource Kinds” on page 56
- “Starting and Stopping Metric Collection” on page 57
- “Maintenance Mode” on page 58
- “Working with Tags” on page 61
- “Resource Relationships” on page 67
- “Setting Resource Kind Icons” on page 69

**Resource Overview**

As described in “Resources” on page 36, a resource is any entity in your environment for which vCenter Operations Enterprise can collect data. Before you start collecting data with vCenter Operations Enterprise, you define the resources you want to collect it from.

vCenter Operations Enterprise collects data through adapters which communicate with your monitoring software or other data source. As discussed in “Adapter Overview” on page 43, vCenter Operations Enterprise has two kinds of adapters: *embedded adapters*, which actively connect to a data source and pull values from it, and *external adapters*, which push data from outside sources to vCenter Operations Enterprise. For the purpose of resource configuration, the key difference between the two types is that resources which use an external adapter are added to vCenter Operations Enterprise automatically, while you must define resources which use an embedded adapter using the procedures in this chapter.

This chapter describes the various procedures for adding and maintaining resources in vCenter Operations Enterprise. It also describes resource tags and how to use them, and how to set up resource relationships for combined metric tracking and analysis.

**Defining Resources Overview**

For vCenter Operations Enterprise to collect metrics from a resource using an embedded adapter, it must know the following information about it:

- The adapter instance to get the metric data from
- The credential (user name and password) to use to connect to the adapter instance
The name of the resource
What kind of resource it is
What attributes to collect from the resource

To define this information
1 Define the credentials to use for your various adapter instances.
2 Define the adapter instances themselves.
3 Perform a resource discovery for each adapter instance. During a discovery, vCenter Operations Enterprise lists all the resources it finds for the adapter instance, and you select the ones you want to track with vCenter Operations Enterprise. (Some adapters do not support resource discovery—you can define resources for those adapters individually.)
4 For any resource where you do not want vCenter Operations Enterprise to collect all available attributes, define the combination of attributes (called an attribute package) and assign it to the desired resources.

The first two steps of this process were described in Chapter 3. The third step, along with other aspects of maintaining resources in vCenter Operations Enterprise, is described in this chapter. Creating attribute packages is covered in Chapter 5.

The Environment Overview Page

You define and maintain resources through the Environment Overview page, which is shown in the screenshot below. To open this page, select Environment Overview from the Environment menu. The left pane shows resource tags, which are discussed in “Working with Tags” on page 61. The resources are displayed in the List tab on the right of the page, one page at a time. You can select the number of Resources per Page (from 50 to 1000).

For a brief introduction to resources, see “Resources” on page 36.

The right pane of the Environment Overview page can have two other tabs: Geographical and Group. The Geographical tab is described in “Assigning Locations to Resources” on page 65. The Group tab gives an overview of the health of your network: it shows icons representing the health of each resource for the selected tag value(s). By default, it shows the current health. You can use the slider at the bottom of the tab to show the health at any time in the last six hours, in five-minute increments. The health rating is described in “Health” on page 39. Hovering the pointer over an icon shows you the name and health rating of that resource. To see the Resource Detail page for a resource, click it, then click the Resource Detail icon. The Resource Detail page is described in the vCenter Operations Enterprise User’s Guide.
Discovering Resources

You can add resources to vCenter Operations Enterprise through the Environment Overview page in one of two ways: by using the Add Resources icon (see “Adding a Resource” on page 53), or through the discovery process. Discovering resources is more efficient in most circumstances, and we recommend you use this method unless you have an adapter type which does not support it.

To discover resources in your environment

1. Select Environment Overview from the Environment menu. The currently-available resources are displayed in the List pane on the right side of the Environment Overview page.

2. Click the Discover Resources icon in the List pane. The Resource Discovery window opens. Only the Collector field appears initially. As you choose an item in each field, additional applicable fields appear.

3. In the Collector field, select your preferred collector. Unless you have added additional collectors, the only collector listed is vCenter Operations Server.

4. In the Adapter kind field, select the desired adapter kind (for example, ITM).
5 In the **Adapter instance** field, select the desired adapter instance. The window now appears.

6 (optional) If you need to, you can create an adapter instance by clicking the **Add** link to the right of the **Adapter Instance** field. For instructions on adding an adapter instance, see “Adding an Adapter Instance” on page 46. After you add the adapter instance, you will return to the Resource Discovery window.

7 In the **Discovery Info** field, select the type of discovery info you want (for example, **ITM**).

8 Depending on the adapter kind that you choose, other configuration fields may appear. Make all applicable choices.

9 If you don’t want the discovery results to include resources which have already been added to vCenter Operations Enterprise, check the **Only New Resources** box.

10 Click **OK**. The discovery can take anywhere from a few seconds to several minutes. Once it is complete, the Discovery Results window displays a list of your resource kinds.

11 Double-click each resource kind containing one or more resources you want included in vCenter Operations Enterprise. The list of resources shows all resources of that kind.

**NOTE** You can sort the resource list by any column by clicking the column header. Click the header again to reverse the sort order.
12 To find a specific resource in the list, you can type all or part of the resource name in the **Search** field and click the **Search** icon.

13 If you want to import a resource into vCenter Operations Enterprise, but do not want to start collecting data for it immediately, click its checkbox under the **Import** column.

14 For each resource you want to begin collecting data for:
   a. Click the checkbox under the **Collect** column. (This automatically checks the **Import** box as well.)
   b. The resource is assigned the default **Attribute Package** for its resource kind. If desired, you can select a different package.

   If you do not click the **Collect** checkbox for a resource, it appears in your resource list in the Environment Overview page, but is listed as **Not Collecting** and vCenter Operations Enterprise will not store any data or perform any analysis for it.

   **NOTE** If you want to define a new attribute package for the resource, click the **Add** link to the right of the **Attribute Package** field. For more information, see “Managing Attribute Packages” on page 74.

15 When you’ve selected all the resources you want, click the **OK** button. The Discovery Results window closes, and you see the new resources in the **List** pane of the Environment Overview page.

Adding resources for this adapter instance through the discovery process is now complete.

**NOTE** Resources added through discovery are assigned the default super metric package for their resource kind. If you want to change that, you must edit the resource after adding it, as described in “Editing a Resource” on page 55.

### Adding a Resource

While in most cases you will define resources to vCenter Operations Enterprise through discovery, in some cases you may need or want to add an individual resource by entering its information. For example, you cannot use resource discovery with some types of adapters.

To add a resource, you must determine all the specific information about it, most importantly the kind of adapter to use to make the connection and the connection method. You can add just about any device and application server available in the environment.

By default, vCenter Operations Enterprise includes a self-monitoring adapter, the HTTP Post adapter, and the Container adapter. You can add additional adapters that you custom configure for use with vCenter Operations Enterprise. vCenter Operations Enterprise is highly flexible, and its analytics can process metrics from virtually any resource. For more information, please contact vCenter Operations Enterprise support, as described in “Technical Support and Education Resources” on page 8.

**NOTE** If you use HP OpenView Operations (OVO), you do not have to define the individual resources it monitors. See “Connecting to HP OpenView Operations” on page 47 for further details.

### To add a resource

1. Select **Environment Overview** from the **Environment** menu to display the Environment Overview page. The resources are displayed in the **List** pane of the Environment Overview page.

2. Click the **Add Resource** icon at the top of the resource list. The Resource Management window appears.

3. Enter a name for the resource in the **Resource Name** text box.

   **NOTE** Use only letters and numbers in resource names. Do not use non-alphanumeric characters such as the semi-colon (:), as problems may arise. Spaces are not allowed.

4. Enter a **Resource description**. This is for informational purposes only.
5 Select the **Collector** to use. Unless a name was assigned to the collector during installation, the only option that appears is **vCenter Operations Server**.

6 Select the **Adapter kind**. The available adapters depend on how vCenter Operations Enterprise was installed and configured. Based on your choice, the remaining configuration options may change.

   **NOTE** For a Hyperic resource or IM portal server to appear in the list in the **Resource Kind** field, you must first install its attribute files (obtained from the software supplier) on the vCenter Operations Enterprise collector.

7 Select an **Adapter instance** (for example, **Hyperic Postgres**). To add a new adapter instance for this resource, click **Add**. For instructions on adding an adapter instance, see “Adding an Adapter Instance” on page 46.

8 Select a **Resource kind** (for example, **Exchange 2003**). After you select a resource kind, appropriate additional fields appear.

9 Enter the name of the **Target to collect from**. This reflects the name of the resource which the adapter monitors. This must be the name for the resource within the adapter’s operating environment. For instance, if the **Adapter kind** is **Hyperic** and you choose **MS SQL 2005 Database** as the **Resource kind**, in **Target to collect from**, you would enter the name Hyperic assigns, such as **MSSQL 2005 MSSQL.4**. The same would be true for ITM or other adapter types.

   **NOTE** If you do not know the **Target to collect from** name, we suggest you use the discovery process to add the resource, if possible.

10 Accept the default **Attribute package** or select a different one. To define a new attribute package for the resource, click **Add**. For more information, see “Managing Attribute Packages” on page 74.

11 Accept the default **Super Metric package** or select a different one. To define a new super metric package for the resource, click **Add**. For more information, see “Defining Super Metrics” on page 78.

   **NOTE** The default attribute package and super metric package are determined by the resource kind. See “Setting Defaults for Resource Kinds” on page 56.
12 Set the desired Collection Interval (in minutes).

13 Enable or disable Dynamic Thresholding. We recommend you leave dynamic thresholding enabled (the default).

14 Enable or disable Early Warning Smart Alerts for this resource. By default, this is enabled only for applications. Early warning smart alerts work best for applications and application-like container resources (resources which have at least two levels of resources beneath them, such as an application containing tiers, which each contain resources).

**NOTE** Even if you enable this field, early warning smart alerts are generated for a resource only if the resource and its children have at least the required number if metrics defined. By default, this minimum is 40 (not including vCenter Operations Enterprise generated metrics). If you want to change this number, please contact vCenter Operations Enterprise support, as described in “Technical Support and Education Resources” on page 8.

15 If you know the resource is taken offline for maintenance at regular intervals, select the Maintenance Schedule for it to use. To define a new maintenance schedule to use for the resource, click the Add link. For more information, see “Managing Maintenance Schedules” on page 59.

16 (optional) Click the Test button to verify the information you’ve entered.

17 Click the OK button.

**NOTE** Each new resource is automatically assigned tag values for its collector and its resource kind. You may want to assign it to other tag values, as well. See “Working with Tags” on page 61 for more information.

**Editing a Resource**

Editing a resource means modifying any of its permanent characteristics, such as its collector, attribute package, and so on. To temporarily change a resource’s state—to start or stop collection or place it in or take it out of maintenance mode—do not edit it. Instead, use the appropriate icon in the List pane tool bar, as described elsewhere in this chapter.

**To edit a resource**

1 Click Environment Overview in the Environment menu. This opens the Environment Overview page.

2 Using the tag list and the List pane, select the resource to edit.

3 Click the Edit Resource icon on the top of the list. The Resource Management window opens.

   The items displayed depend on the type of resource you are modifying; for example, an ITM resource will show different items than a Hyperic resource.

4 Make your desired changes. You can change any of the fields shown.

**CAUTION** Modifying some fields for your resource (for example, changing the Adapter kind) can have unintended consequences.

5 Click the OK button.

**Editing Multiple Resources**

At times, you may want to change the same property for multiple resources at once. For example, you could have created a new attribute package and want to assign it to several resources, or all resources of a given resource kind. You can change one or more properties for multiple resources at once, while leaving their other properties unchanged.
To edit multiple resources
1  Click **Environment Overview** in the **Environment** menu. This opens the Environment Overview page.
2  In the **List** pane, select the resources to edit. You can use CTRL-click to select individual resources or SHIFT-click to select a range.
3  Click the **Edit Resource** icon on the top of the list. The Resource Management window opens.

![Resource Management Window]

Only fields which you can change for the selected combination of resources are shown. If you select resources of different kinds, the window may include only the **Super Metric package** field.

4  For each value you want to change, check the box next to it, then select the value you want.
5  Click **OK**.

Only the fields you checked are changed. Each resource keeps its values for all other properties.

Deleting Resources

To delete resources
1  Click **Environment Overview** in the **Environment** menu. This opens the Environment Overview page.
2  On the **List** pane, select one or more resources to delete. Hold down the CTRL key while clicking to select multiple resources, or hold down SHIFT while clicking to select a range.
3  Click the **Delete Resource** icon at the top of the list. The Confirm dialog box appears.
4  Click **Yes**.

Each resource you selected is marked for deletion and locked. The actual deletion is performed in the background and may take a few seconds, or longer, depending on the number of resource you are deleting.

Setting Defaults for Resource Kinds

Frequently, most or all resources of a particular resource kind will use the same attribute package and super metric package. You can set the default packages to use for each resource kind, as well as the defaults for whether or not resources will generate early warning smart alerts and use dynamic thresholds. These defaults are then used when you add a new resource of that kind, either manually or through resource discovery. You can change the defaults if you want, either while adding the resource or by editing it later.

**NOTE** You cannot change the super metric package assigned to a resource while adding it using discovery. In this case, if you want to change the super metric package, you must edit the resource after it is added.
To set the default attribute and super metric packages for a resource kind

1. From the Environment menu, select Configuration, Resource Kind Defaults. This opens the Manage Resource Kind Defaults window.
2. Select the Adapter Kind containing the resource kind to set the defaults for.

3. Select the resource kind in the list on the left.
4. Select the default Attribute package and Super Metric package in those fields.
5. Select the defaults for whether to enable early warning Smart Alerts and calculate dynamic thresholds (DT) for resources of this kind.
6. Repeat for each desired resource kind.
7. Click OK.

Starting and Stopping Metric Collection

When you add a resource to vCenter Operations Enterprise, whether in the Resource Management window or by performing a discovery, vCenter Operations Enterprise does not automatically start collecting metrics for it. You must turn metric collection on. If you performed a discovery for the resource, you can use the option to start collection on the discovery results page or follow the procedure below later. If you added the resource manually, you must use the procedure below. You can also turn metric collection on or off for any resource at any time.

If you stop collection for a resource, vCenter Operations Enterprise retains its metric data in case you restart collection.

You can also start and stop collection for an adapter instance for one or more resources—resources that don’t use that adapter instance won’t be affected. If a resource collects metrics through more than one adapter instance, only the metrics collected through that instance are stopped or started; its other metrics remain in the same collection state. See the second procedure below.

**NOTE** Because tag values (see “Working with Tags” on page 61) are stored in vCenter Operations Enterprise as resources, you can start or stop collection for them. If you start collection on a tag value, the vCenter Operations Enterprise-generated metrics are collected for it, which lets you see a health score that reflects all the resources with that tag value.
To start or stop collection for a resource

1. Click Environment Overview in the Environment menu. This opens the Environment Overview page.

2. In the List pane, the collection status for each resource is listed in the Collection Status column. Select the resource or resources you want to start or stop collecting on. Select multiple resources while holding down the SHIFT or CTRL key.

3. Either:
   - To begin collecting metrics for the selected resources, click the Start Collecting icon.
   - To stop collecting metrics for the selected resources, click the Stop Collecting icon.

To start or stop collection for an adapter instance

1. Click Environment Overview in the Environment menu. This opens the Environment Overview page.

2. In the List pane, the collection status for each resource is listed in the Collection Status column. Select the resource or resources you want to affect. Select multiple resources while holding down the SHIFT or CTRL key.

3. Click the Perform Multi-Collecting icon. This opens the Adapter Instance Resources dialog box, listing all the adapter instances used for any of the selected resources.

4. Click the adapter instance to start or stop collection for. Select multiple instances while holding down the SHIFT or CTRL key. To select all the listed instances, click the heading row.

5. Click the Start Collecting or Stop Collecting icon.

This starts or stops collection through the selected adapter instance(s) for the selected resource(s). Metrics collected through other adapter instances are not affected, and resources that weren't selected aren't affected, even if they use the selected adapter instance.

Maintenance Mode

Many resources in the enterprise may be intentionally taken offline for maintenance from time to time. For example, a server could be de-activated to update software or simply to be rebooted. If vCenter Operations Enterprise continued to collect metrics during this maintenance period, it could generate incorrect anomalies and alerts, or it could affect the data vCenter Operations Enterprise uses to set the dynamic thresholds for the resource's attributes. For this reason, vCenter Operations Enterprise lets you put resources into maintenance mode. When a resource is in maintenance mode, vCenter Operations Enterprise does not collect metrics from it or generate anomalies or alerts for it.

There are two ways to place a resource into maintenance mode:

- If resource undergoes maintenance at fixed intervals, you can create a maintenance schedule and assign it to the resource. For example, you could put a resource in maintenance mode from midnight until three A.M. each Tuesday night.

- You can manually put a resource in maintenance mode, either indefinitely or for a specified period of time.

These methods are not mutually exclusive. You can manually put a resource into maintenance mode, or take it out, even if it has an assigned maintenance schedule. This lets you easily deal with unplanned maintenance tasks.

The following sections describe how to use each of these methods.
Managing Maintenance Schedules

You can use maintenance schedules to automatically put certain resources into maintenance mode at specified times. The scheduled maintenance time can be daily, weekly, monthly, or yearly.

Using maintenance schedules is a two-step process. You create the schedules as described below, then assign the desired schedule to a resource when adding it or by editing it. You can create many maintenance schedules and assign each one to as many resources as desired. See “Adding a Resource” on page 53 or “Editing a Resource” on page 55 for instructions on assigning a maintenance schedule to a resource.

Adding Maintenance Schedules

To add new maintenance schedules

1. Select Maintenance Schedules from the Environment menu. This opens the Manage Maintenance Schedules window.

2. At the top of the list of maintenance schedules, click the Add Schedule icon. The second Manage Maintenance Schedules window appears.

3. In Schedule Name, type the name to give the maintenance schedule.

4. Set the Start Time and End Time that resources assigned this schedule will be in maintenance mode.

5. In Recurrence Pattern, select one of these four options:
   a. Daily – Set the number of days between maintenance periods or set to every weekday.
   b. Weekly – Set the number of weeks between maintenance periods and the day of the week.
   c. Monthly – Set the number of months between maintenance periods and either the day of the month or the week and day.
   d. Yearly – Set to a specific date or a specific month, day, and week.

6. Click OK.

The new maintenance schedule appears in the list in the Manage Maintenance Schedules window and is available when you are adding or editing resources.
Editing Maintenance Schedules

To edit a maintenance schedule

1. Select Maintenance Schedules from the Environment menu. This opens the Manage Maintenance Schedules window.
2. Select the maintenance schedule to edit, then, click the Edit Schedule icon.
3. Change the Schedule Name, Start Time, End Time, and/or Recurrence Pattern, as desired.
4. Click OK.

Deleting Maintenance Schedules

To delete an existing maintenance schedule

1. Select Maintenance Schedules from the Environment menu. This opens the Manage Maintenance Schedules window.
2. Select the maintenance schedule to delete, then click the Remove Schedule icon.
3. In the confirmation dialog that appears, click Yes.

Manual Maintenance Mode

You can place one or more resources into maintenance mode, or take them out of it, using icons on the Environment Overview page.

Starting Maintenance

To start maintenance mode on a resource

1. Click Environment Overview in the Environment menu. This opens the Environment Overview page.
2. In the List pane, select the resource or resources to start maintenance mode on. Select additional resources while holding down the SHIFT or CTRL keys.
3. Click the Start Maintenance icon. This opens the Start Maintenance window.

4. Select how long to keep the resource in maintenance mode:
   a. I will come back... – An administrator will have to manually end maintenance for the resource.
   b. End maintenance in – Resource will be under maintenance for the number of minutes you enter.
   c. End maintenance on – Resource will be in maintenance mode until the date and time you enter.

The resource is now in maintenance mode. The Collection Status column shows either In Maintenance (Manual) or In Maintenance till..., depending on your selection.
Ending Maintenance

If a resource has been placed in maintenance mode for an unspecified period of time, the only way to remove it and restart metric collection is to manually end maintenance. You can also use this procedure to end maintenance mode for a resource which has been put in maintenance for a specified period of time, or one which is in maintenance due to its assigned maintenance schedule.

To take a resource out of maintenance mode

1. Click Environment Overview in the Environment menu. This opens the Environment Overview page.
2. In the List pane, select the resource or resources to stop maintenance mode on. Select additional resources while holding down the SHIFT or CTRL keys.
3. Click the End Maintenance icon. This ends maintenance mode on the selected resource.

Working with Tags

Resource tags allow you to index and categorize resources. When you select resources in vCenter Operations Enterprise, whether on the Environment Overview page or when selecting the metrics to include in a widget display, you can do it through the resource tag hierarchy. Defining tags and tag values appropriate for your environment will make it much easier to find the resources and metrics you want.

A tag is a type of information, such as Application or GEO Location (both of these tags always exist in vCenter Operations Enterprise). Tag values are individual instances of that type of information. For example, for the GEO Location tag, you could define values of New York, London, and Mumbai, if that’s where your offices are located.

You can assign any number of resources to each tag value, and you can assign a single resource to tag values under any number of tags. In most cases, you may want to be able to find a resource by looking under its application, its location, its tier, and possibly other tags as well.

NOTE Each tag value is also considered a resource by vCenter Operations Enterprise. When you create a tag value, vCenter Operations Enterprise automatically starts collecting the vCenter Operations Enterprise-generated metrics (see “vCenter Operations Enterprise-Generated Metrics” on page 73) for it. This means you can view the health score for any tag value.

Automatic Tagging

vCenter Operations Enterprise has several predefined tags. It automatically creates values for most of these tags and assigns resources to the values. For example, whenever you add a resource, vCenter Operations Enterprise assigns it to the tag value for the collector it uses and the kind of resource it is, first creating those tag values if they don’t already exist. The default tags are:

- Collectors (Full Set) — Each defined collector is a tag value and each resource is assigned to the tag value for the collector it uses when you add it to vCenter Operations Enterprise. (The default collector is vCenter Operations Server.)
- Application — Each defined application is a tag value. When you add a tier to an application, it is automatically assigned to that tag value. Resources which belong to the tiers are not given the tag value.
- Applications (Full Set) — Each defined application is a tag value. When you add a tier to an application, or a resource to a tier in an application, it is automatically assigned to that tag value.
- Maintenance Schedules (Full Set) — Each defined maintenance schedule is a tag value, and resources are assigned to the value when you give them a schedule when adding or editing them. See “Managing Maintenance Schedules” on page 59 for more information.
- Adapter Kinds — Each adapter kind is a tag value; each resource using that adapter kind is given the tag value.
- Adapter Instances — Each adapter instance is a tag value, each resource is assigned the tag value for the adapter instance (or instances) its metrics are collected through.
- Resource Kinds — Each kind of resource is a tag value; each resource is assigned to the tag value for its kind when you add the resource.
- Recently Added Resources — There are tag values for the last day, seven days, ten days, and 30 days. Resources have this tag value as long as it applies to them.
- Health Ranges — There are tag values for Good (green), Abnormal (yellow), Degraded (orange), Bad (red), and Unknown (blue) health statuses. Each resource is assigned the value for its current health. See “Health” on page 39.
- Entire Enterprise — The only tag value is Entire Enterprise Applications. Each application is assigned this tag value.
- GEO Location — This tag always exists, but there are no default values for it. You must create values and assign resources to them manually. See “Assigning Locations to Resources” on page 65 for more information.
- Tiers — Each defined tier is a tag value. When you add a resource to a tier, it is automatically assigned to that tag value.

Using Resource Tags

When you need to select a resource in vCenter Operations Enterprise, the tag list is on the left side of the window, with a list of all resources on the right. Rather than searching through the entire resource list, you can find the one you want more easily using the tags:

1. Click a tag the resource has been assigned a value for. This expands the list of values beneath it. The number of resources associated with each value is shown beside it.

   ![Resource Tag List](image)

   If you want to collapse an expanded tag, click it again.

2. Click the desired tag value. This lists the resources with that tag value in the right-hand pane. You can click multiple tag values. If you do, vCenter Operations Enterprise follows these rules:

   - If you select more than one value for the same tag, the list includes resources that have either value.
   - If you select values for two or more different tags, the list includes only resources that have all the selected values.
For example, if you select two values of the GEO Location tag, such as New York and London, it shows resources with either value. If you also select the Tier value of the Resource Kind tag, only tiers which are in New York or London are listed. Tiers in other locations are not, and neither are resources in those cities which are not tiers.

You can also “negatively select” tag values. If you click the Invert Result icon, the list will include resources which do not match the tag values you’ve selected. For example, if you select New York and London, then click Invert Result, you will see all resources that are not in either of those cities.

3 Select the resource from the list.

Some tag values have plus signs next to them. This indicates they are also tags, and contain other tag values. You can click the plus sign to see the subvalues. Some tag values which can also be tags are Applications and Resource Kinds. For example, the Applications tags has values for each application defined in vCenter Operations Enterprise, such as Online Banking. Each of these applications is also a tag, with values equal to the tiers it contains. The Online Banking application could have tag values for Web Servers, DB Servers, and so on. These tiers could also contain subvalues. Simply expand the tag value list until you can select the value you want to see resources for.

The toolbar buttons above the tag list on the Environment Overview page let you do the following:

- **Collapse All** – Collapse all resource tag branches.
- **Expand All** – Expand all resource tag branches.
- **Deselect All** – Clear all selected resource tags.
- **Manage Tags** – Open the Manage Resource Tags window. See “Configuring Resource Tags” on page 63.
- **Manage Resource Kind Tags** – Open the Manage Resource Kind Tags window. See “Configuring Resource Kind Tags” on page 64

## Configuring Resource Tags

There are two steps to configuring the resource tags you want to use in addition to vCenter Operations Enterprise’s automatic tagging: adding the tags and adding the tag values.

### To add a resource tag

1 From the Environment menu, select Environment Overview.

2 Click the Manage Tags icon on the left side of the Environment Overview page. The Manage Resource Tags dialog box appears.

3 Click the Add Tag icon to add a new row. Enter the name of the tag in the row.
4. To add another tag, repeat step 3. To add values to a tag, continue with step 2 of the next procedure.

5. When you’re done adding tags, click OK. The new tags will appear in the tag list on the Environment Overview window.

**To add values to a tag**

1. Click the **Manage Tags** icon on the left side of the window. The Manage Resource Tags dialog box appears.

2. Select the tag to add values to and click the **Add Tag Value** icon.

3. Type the name of the tag value in the new row. For instance, if your resource group is composed of JBoss servers and you have assigned the name “JBoss” to the tag, in this text box you type a name to associate with one of the JBoss servers, such as “JBoss1.”

4. Repeat steps 2 and 3 for all values you want to add.

5. When you are done adding values, click OK. The new tag values will appear in the tag list on the Environment Overview window.

**NOTE** If a tag is locked, you cannot add values to it. Locked tags are maintained automatically by vCenter Operations Enterprise.

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### Configuring Resource Kind Tags

If desired, you can create a tag for any resource kind that has existing resources. The tag has a tag value for each resource of that kind. For example, if you have a resource kind of AppServers, and resources of that kind named AppServer1, AppServer2, and so on, You can create a resource kind tag named AppServers, and it will have tag values of AppServer1, AppServer2, and so on.

**To create resource kind tags**

1. From the **Environment** menu, select **Environment Overview**.

2. Click the **Manage Resource Kind Tags** icon on the left side of the Environment Overview page. The Manage Resource Kind Tags dialog box appears.
3. To create a resource kind tag for a resource kind, double-click `false` in the Show Tag column of its row, then check the box that appears. Repeat for each desired resource kind.

4. Click OK.

If there are any resources of the kind you selected, a tag for that kind will appear in the tag list in the Environment Overview page. If you expand the tag, you will see a tag value for each resource of that type. You can assign resources to these tag values like any others. See “Assigning Resource Tags” on page 65.

**Assigning Resource Tags**

To associate a resource with a tag value, drag it from the list in the right pane of the Environment Overview window onto the tag value’s name. You can select one resource, press the SHIFT key to select more than one sequentially, or press the CTRL key to select multiple resources individually. The resource(s) will be associated with the tag value you chose.

**To remove a resource from a tag value**

1. In the Environment Overview window, select the tag value to display its assigned resources in the list on the right.

2. At the end of the tag list on the left is a line labeled Untag. Drag the resource to remove from the list on the right to this line.

**NOTE** If a tag is locked, you cannot add resources to or remove resources from any of its values. Locked tags are maintained automatically by vCenter Operations Enterprise.

**Editing Resource Tags**

**To edit a resource tag or tag value**

1. Click the Manage Tags icon on the left side of the window. The Manage Resource Tags dialog box appears.

2. To change a tag name, double-click it. Enter the new name of the tag.

3. To change a tag value name, expand the tag to display its values. Double-click the value to change and enter the new name.

4. Click OK. Your changes will appear in the tag list on the Environment Overview window.

**Deleting Resource Tags**

**To delete a resource tag or tag value**

1. Click the Manage Tags icon on the left side of the window. The Manage Resource Tags dialog box appears.

2. To delete a tag, click the tag name and click Remove Tag.

3. To delete a tag value, expand its tag, select the value, and click Remove Tag Value.

4. Click Close. The removed tags and values will not appear in the tag list on the Environment Overview window.

**Assigning Locations to Resources**

It may be helpful to be able to see the health of some or all of the resources on your network, grouped by their physical location. You can do this by performing these steps:

1. Activating the geographical location feature.

2. Creating values for the GEO Location tag for each of your offices and defining those values to the mapping software.
3 Assigning each resource you want to track by location to one of the GEO Location tag values.

4 Looking at the Geographical tab or GEO widget.

**Activating the Geographical Location Feature**

The Environment Overview page's Geographical tab and/or the GEO widget show a world map with the locations of resources you have assigned to GEO Location tag values. These maps use the Google Maps API. You must license the Google Maps API to use this feature. Go to the Google web site, read the license agreement for the API, and follow the procedure there to license the API for your use. You can find the license agreement for the API at:

https://support.google.com/enterprise/doc/gme/terms/maps_purchase_agreement.html

Once you have licensed the API, you can activate geographical locations in vCenter Operations Enterprise. To do so:

1 From the vCenter Operations Enterprise Admin menu, select Global Settings.
2 In Geo Panel Provider, select Google.
3 In Google Map Key, type the key you received from Google.
4 Click OK.

Once you have completed this procedure, any user connecting to the vCenter Operations Enterprise server can use the Geographical tab or GEO widget.

**Creating GEO Location Tag Values**

Before you can assign resources to a location, you must create that location as a value of the GEO Location tag and define its position on the map. Follow this procedure:

1 Select Environment Overview from the Environment menu. This launches the Environment Overview page.
2 Click the Manage Tags icon on the left side of the window. The Manage Resource Tags dialog box appears.
3 Select GEO Location in the tag list.
4 In the Tag Value pane, click the Add Tag Value icon.
5 Type the name for the location and press ENTER.
6 Select the new tag value and click the Manage Location icon. This displays the Manage Location dialog box.
7 In the Search field, type the location you want to find, then click Search. Your entry does not have to match the tag value exactly. For example, you could create a tag value of Los Angeles, then search for Los Angeles, CA.
8 In the list of search results, click the location you want. You must do this even if only one result is shown.
9 Click Save.
10 Repeat steps 4 through 9 for each location. When you are finished, close the Manage Resource Tags dialog box.

**Assigning Resources to Locations**

You define a resource's location by assigning it to the desired value of the GEO Location tag. You do this the same way you assign a resource to any tag value, by dragging it from the Environment Overview List tab to the tag value in the left pane, as described in “Assigning Resource Tags” on page 65. Do this for each resource you want to be able to view on the Geographical tab.
Viewing the Resource Map

The Geographical tab of the Environment Overview page is a world map which can show the health of the resources at some or all of your defined locations.

By default, the Geographical tab shows all resources for all locations. If you select one or more tag values under the GEO Location tag in the left pane, it shows only those locations. You can move the map by dragging or by using the direction arrows at the top left. You can zoom the map by using the plus and minus buttons beneath the direction arrows.

You can also add the GEO widget to any dashboard. It shows a map very similar to the one on the Geographical tab. The GEO widget is described in the vCenter Operations Enterprise User’s Guide.

Resource Relationships

Most, if not all, of the resources in an enterprise environment are related to other resources in that environment. They are either part of some larger resource, or they contain smaller component resources (or both). vCenter Operations Enterprise lets you define these relationships so its analytics can take them into account when calculating health scores: the health score of any resource is based partly on its own metrics and partly on the metrics of its child resources.

The most common resource relationships gather similar resources into tiers and related tiers into applications. You define those relationships on the Applications Overview page, as described in Chapter 6. However, there are frequently other relationships between resources. For example, an application server resource could have each application that runs on it defined as a child resource. You can define these other resource relationships as described below.

You can view resource relationships using the Health Tree widget, as described in the vCenter Operations Enterprise User’s Guide.

NOTE You cannot use this procedure to add resources to tiers or tiers to applications. You must use Applications Overview to define applications and tiers.
To configure resource relationships

1 From the Environment menu, select Advanced, Resource Relationship. The Resource Relationship window opens.

2 In the Parent Selection column, expand the desired resource tag and select a tag value that contains the resource you want as the parent. This tag value’s resources appear in the top pane of the second column.

3 Select the parent resource in the list. If the list is long, you can type all or part of the resource name in the Search field above the pane and click the Search button to list only resources matching your entry.

4 The next step is to select the child resource(s) to add to the parent. You do this in the List pane on the right. As the full resource list is usually quite long, you can filter the list in two ways:
   - In the resource tag list on the right, expand the desired resource tag and select a tag value that contains the resource you want as the child. This tag value’s resources appear in the top pane of the List column. You can click multiple tag values. If you do, vCenter Operations Enterprise follows these rules:
     - If you select more than one value for the same tag, the list includes resources that have either value.
     - If you select values for two or more different tags, the list includes only resources that have all the selected values.
   
   You can also “negatively select” tag values. If you click the Invert Result icon the list will include resources which do not match the tag values you’ve selected.
   - In the Search field at the top of the List pane, type all or part of a resource name and press ENTER or click the Search icon. Only resources containing your entry will be listed.

5 To make one or more of the listed resources children of the selected parent, select the resource or resources in the List pane and drag them to the parent resource in the top pane of the second column. You can hold down CTRL and click to select multiple resources or hold down SHIFT and click to select a range.

   To make all of the listed resources children of the selected parent, click the Add All Resources to Parent icon. vCenter Operations Enterprise will ask you to confirm this selection.

6 Repeat steps 2 through 5 for each parent resource.
Setting Resource Kind Icons

In most locations where metric data for resources is shown, vCenter Operations Enterprise includes an icon to show the kind of each resource. You can keep the default icons assigned by vCenter Operations Enterprise or select the icon to show for any resource kind. vCenter Operations Enterprise includes default icons to choose from, or you can upload your own graphics files to use. If you change the icons being used, your changes take effect for all users.

If you choose to use your own icon files, each file must be in PNG format. It should have the same height and width; the preferred size is 256 x 256 pixels.

To set icons for resource kinds


2. By default, all resource kinds are listed with their default icons. To list resource kinds for only one adapter, select it in Adapter kind.

3. To assign an existing icon to a resource kind:
   a. Select the resource kind in the list.
   b. Click the icon to assign.
   c. Click the Assign Icon icon.

4. To upload your own icon to use:
   a. Click the Upload Icon icon. This opens a standard Windows Choose file dialog box.
   b. Browse to and select the file to use.
   c. Click Open. The file is added to the icon list and you can assign it to resource kinds like any other icon.

5. To return an adapter to using the default for its type, select the adapter kind and click the Assign Default Icons icon.

   **NOTE**  To change the icon assigned to a resource kind, you do not have to remove the old icon first. Just assign the new icon, as described in step 3, and it will replace the existing icon for the type.

6. When you are done assigning icons, click OK.
Removing an icon from the adapter kind it is assigned to, as described in step 5 above, does not delete it from the icon list. You cannot remove an icon file from the list from within vCenter Operations Enterprise. To remove an icon, go to the folder where the files are stored, \vcenter-ops\tomcat\webapps\ROOT\images\resknd, and delete the file.
Creating and Modifying Attribute Packages

This section discusses how to create and modify attribute packages. It also covers the concepts of hard and dynamic thresholds and key performance indicators (KPI). This section contains the following topics:

- “Data Collection Key Concepts” on page 71
- “Managing Attribute Packages” on page 74
- “Defining Super Metrics” on page 78

Data Collection Key Concepts

Each different type of data vCenter Operations Enterprise collects is called an attribute. You define attribute packages—different combinations of attributes—and assign each resource the attribute package that contains the attributes you want to track for that resource. You can assign the same attribute package to more than one resource. A metric is an attribute for a particular resource.

Defining an attribute package for a resource does not automatically start collecting data for it. You must also turn metric collection on. See “Starting and Stopping Metric Collection” on page 57.

Dynamic Thresholds

vCenter Operations Enterprise defines dynamic thresholds for a metric based on the incoming and historical data for the metric. vCenter Operations Enterprise adjusts dynamic thresholds as new data allow it to better define what is normal for a metric and what isn’t. Dynamic thresholds automate the massive manual effort that would be needed with hard thresholds, where you could need to configure thresholds for hundreds or thousands of metrics.

Dynamic thresholds add context that helps vCenter Operations Enterprise discriminate between normal and abnormal behavior. They enable vCenter Operations Enterprise to evaluate the performance of IT components in context with historical conditions and determine if an anomaly is truly warranted. By determining what is normal in the environment, vCenter Operations Enterprise can filter out alerts that are associated with normal behavior—the alerts that would be triggered by hard thresholds—and instead generate alerts only for abnormal behaviors that are precursors to real problems in your environment.

By default, vCenter Operations Enterprise uses dynamic thresholding for all metrics except system attributes.

vCenter Operations Enterprise’s analytics.properties file contains several parameters that define dynamic thresholding. Some of these parameters can be adjusted, but such adjustments must only be performed by a qualified, advanced user of vCenter Operations Enterprise.

**NOTE** One of the options in analytics.properties controls when vCenter Operations Enterprise recalculates dynamic thresholds each day (the default is 1:00 AM). Another controls whether it checks the integrity of each metrics file in the FSDB once a week during the recalculation. If it finds a problem, it can either generate a system alert for that resource or try to repair the file and generate the system alert only if it cannot do so.

For a full discussion of dynamic thresholding, see the vCenter Operations Enterprise Analytics Guide.
**Hard Thresholds**

You can choose to set specific threshold values for any attribute—these are called hard thresholds. You can set as many thresholds as desired for an attribute, each with a different criticality level. You can then define what criticality level the metric must violate for it to be considered a KPI breach. So, if a value goes slightly out of range it is a normal metric violation, but if it goes farther out of range and violates a higher criticality threshold, it is a KPI breach.

Hard thresholds that are not set as KPI generate notification alerts if they are violated. For more information about alert types, please see the vCenter Operations Enterprise User’s Guide.

To use the full power of vCenter Operations Enterprise, we recommend you use dynamic thresholding rather than hard thresholding.

**Key Performance Indicators**

You can define attributes which are particularly critical to your enterprise as Key Performance Indicators (KPI). vCenter Operations Enterprise treats KPIs differently than other attributes: threshold violations by a KPI generate different types of alerts than violations by non-KPI attributes.

**Fingerprints**

When a KPI for an application or a tier belonging to an application violates a threshold, vCenter Operations Enterprise examines the events leading up to the violation. If it finds enough related information (such as other anomalies), it captures the set of events which preceded and led up to the violation. This captured series of events is called a fingerprint. vCenter Operations Enterprise can then monitor events in the future, and, if it finds a similar series of events, issue a predictive alert warning that the KPI violation is likely to occur.

Fingerprints can enable you to identify problems and resolve them more quickly than in a traditional IT environment by:

- Helping you isolate problems. vCenter Operations Enterprise narrows the number of areas where the problem may have occurred, so you can find and resolve them more quickly.
- Capturing the precursors to problems for root-cause analysis.
- Notifying you of problems before they occur, enabling you to solve problems.

You can also generate a manual fingerprint for an application at any time. For further information on fingerprinting, see the vCenter Operations Enterprise User’s Guide section on fingerprints, including how to generate a manual fingerprint and the vCenter Operations Enterprise Analytics Guide.

**Metric Types**

Most of the data vCenter Operations Enterprise stores and analyzes is numeric, but vCenter Operations Enterprise can track other types of data as well, and alert you if the values are not what is expected. For example, if a resource sends the string “Good” when operation is normal and “Bad” when there is a problem, vCenter Operations Enterprise's analytics can learn that and generate an anomaly whenever vCenter Operations Enterprise receives “Bad.”
In most cases, vCenter Operations Enterprise automatically detects the type of data it is receiving for an attribute and stores and analyzes it accordingly. However, in some cases you may need to tell vCenter Operations Enterprise what type of data to expect when configuring the attribute. Setting the correct data type ensures that vCenter Operations Enterprise will use the proper analytic algorithms when evaluating the metric. The data types you can select from are:

- **common** — The attribute data is numeric. This is by far the most common type of attribute.
- **multinomial** — The attribute data is one of a limited set of possible values, either string or numeric.
- **sparse** — If you know vCenter Operations Enterprise will not receive data for an attribute regularly, you can define its data type as Sparse. This prevents vCenter Operations Enterprise from generating anomalies when it does not receive the metric as expected.

You can set the data type for a metric when defining the attribute package, as described in “Adding Attribute Packages” on page 74.

### vCenter Operations Enterprise-Generated Metrics

For every resource you define, vCenter Operations Enterprise generates and stores a number of metrics automatically: the total number of alerts and anomalies for the resource, the number of KPI alerts, the number of active alerts, and more. These are all collected in an attribute package metric group called vCenter Operations Generated, which appears whenever you list the metrics for a resource. You cannot remove any metrics from this attribute package.

vCenter Operations Enterprise uses these metrics when calculating the health for the resource. (See “Health” on page 39.) While these are metrics like any other metrics you define, so you could mark them as KPI or include them in other attribute packages, there is almost never any reason to do so.

Any vCenter Operations Enterprise-generated metric that starts with “Self” includes data only for the resource (except for Self - Total Anomalies, as described below). Metrics that start with “Full Set” include data for all of the resource’s children, all the way down the resource tree, but do not include the resource itself. These are the vCenter Operations Enterprise-generated metrics:

- **Self - Health Score**: The health score of the resource.
- **Self - Metric Count**: The number of metrics defined for the resource.
- **Self - KPI Count**: The number of KPI defined for the resource. See “Key Performance Indicators” on page 72.
- **Self - Active Anomaly Count**: The number of currently active anomalies for the resource.
- **Self - New Anomaly Count**: The number of new anomalies for the resource. An anomaly is new if it occurred for the first time in the most recent collection cycle.
- **Self - Active KPI Breach Count**: The number of KPI for the resource which are currently violating their thresholds.
- **Self - New KPI Breach Count**: The number of KPI for the resource with new threshold violations. A breach is new if it occurred for the first time in the most recent collection cycle.
- **Full Set - Metric Count**: The number of metrics defined for the resource’s children.
- **Full Set - KPI Count**: The number of KPI defined for the resource’s children.
- **Full Set - Active Anomaly Count**: The number of currently active anomalies for the resource’s children.
- **Full Set - New Anomaly Count**: The number of new anomalies for the resource’s children. An anomaly is new if it occurred for the first time in the most recent collection cycle.
- **Full Set - Active KPI Breach Count**: The number of KPI for the resource’s children which are currently violating their thresholds.
- **Full Set - New KPI Breach Count**: The number of KPI for the resource’s children with new threshold violations. A breach is new if it occurred for the first time in the most recent collection cycle.
| Self - Total Anomalies: The total number of active anomalies for the resource and all its children. This is the only vCenter Operations Enterprise-generated metric which includes both the resource itself and its children. If you display the metric graph for this attribute, it includes the calculated “noise line” for the resource—the number of anomalies that triggers an early warning alert. |
| Availability: This is either 1 (data is being received properly), 0 (resource is down), or -1 (adapter resource is not receiving data for this resource). |

**NOTE** You can turn off collection of the vCenter Operations Enterprise-generated metrics like you can any other metric. However, if you do, vCenter Operations Enterprise will not be able to properly calculate the health of the resource.

**Managing Attribute Packages**

Attribute packages are groups of attributes, related to a specific resource, that you choose to collect metrics for. When you perform a discovery or add resources manually, you can assign a configured attribute package to a resource or use the default attribute package for its resource kind. More than one resource can use the same attribute package. To set the default attribute package for a resource kind, see “Setting Defaults for Resource Kinds” on page 56.

**NOTE** The vCenter Operations Generated metric group is automatically part of every attribute package.

**Adding Attribute Packages**

**To configure an attribute package**

1. From the Environment menu, select Configuration, Attribute Packages. The Manage Attribute Packages window appears.

2. Choose the Adapter Kind and Resource Kind you want to add an attribute package for. The list shows only attribute packages for your selections.
3 Click the **Add New Attribute Package** icon. The Manage Attribute Packages window shows the fields for defining a new package, as shown below.

![Manage Attribute Packages window](image)

4 Enter the name to give the attribute package in the **Package Name** field.

5 Enter the **Collection Interval** value. A collection interval represents how often, in minutes, vCenter Operations Enterprise retrieves metrics.

**NOTE** You can assign collection intervals to both resources and attribute packages. The collection interval for a resource takes precedence over the one set for an attribute package. For example, if the collection interval for a resource is set to 1 and its associated attribute package is set to 5, vCenter Operations Enterprise collects metrics every minute.

6 Select the check box beside each attribute you want to include in this package. For each attribute, you can choose whether violating the upper or lower dynamic threshold is a KPI. You can also use the **Advanced Configuration** pane to set hard thresholds and/or the data type, if desired. See “**Advanced Attribute Configuration**” on page 77 for details.

7 Click **OK**.

8 On the Manage Attribute Packages window, click **OK**.

**Editing an Attribute Package**

**To edit an existing attribute package, follow these steps**

1 Select **Configuration, Attribute Packages** from the **Environment** menu. The Manage Attribute Packages window appears.

2 (Optional) Choose the **Adapter Kind and Resource Kind** for the desired attribute package. The window updates based on your choices.
In the list that appears, select the attribute package you want to modify and click the **Edit Selected Attribute Package** icon. The window displays the attribute details for that package.

If desired, change the **Package Name** or **Collection Interval**.

To add an attribute to or remove it from the package, check or clear the check box next to the attribute name.

To change settings for an attribute, select it in the left pane and make your changes in the right pane. To change hard thresholds or the metric type for an attribute, see “Advanced Attribute Configuration” on page 77.

When done, click **OK** to save your changes.

On the Manage Attribute Packages window, click **OK**.

**Removing an Attribute Package**

To remove an attribute package

1. Select **Configuration, Attribute Packages** from the **Environment** menu. The Manage Attribute Packages window appears.

2. (Optional) Choose the **Adapter Kind** and **Resource Kind** for the desired attribute package in their respective fields. The window updates based on your choices.

3. From the list that appears, select the attribute package to delete. Click the **Remove Selected Attribute** icon.

4. A popup window appears asking you to confirm you want to delete the attribute package. Click **Yes** to delete the package.

**Cloning an Attribute Package**

To clone an attribute package

1. Select **Configuration, Attribute Packages** from the **Environment** menu. The Manage Attribute Packages window appears.

2. (Optional) Choose the **Adapter Kind** and **Resource Kind** for the desired attribute package in their respective fields.
3 From the list that appears, select the attribute package you want to clone and click the **Clone Selected Attribute Package** icon.

4 A popup window appears asking for the name to give the cloned attribute package. Click **OK** to create the new attribute package.

**Advanced Attribute Configuration**

By default, vCenter Operations Enterprise uses dynamic thresholding and automatically recognizes what type of data it receives for each attribute. To set hard thresholds for an attribute, or to explicitly set the metric type, you must use the advanced attribute configuration fields.

For more information, see “**Hard Thresholds**” on page 72 or “**Metric Types**” on page 72.

**To set or change hard thresholds or the data type for an attribute**

1 Select **Configuration, Attribute Packages** from the **Environment** menu. The Manage Attribute Packages window appears.

2 Choose the **Adapter Kind** for the desired attribute package.

3 Choose the **Resource Kind** for the desired attribute package. The Manage Attribute Package window lists the attribute packages for just that resource kind.

4 Select the attribute package you want and click the **Edit Selected Attribute Package** icon. The window shows the attribute details for that package.

5 In the directory tree in the left pane, drill down into the list and select the attribute you want. Information about the attribute appears in the right pane.

6 On the far right of the **Advanced Configuration** bar, click the arrow. Additional configuration options appear.

7 To set the type of data for this metric, select it in the **DT Type** field. If you don't make a selection, vCenter Operations Enterprise will automatically detect the metric type. If the metric type is sparse, you must set it here; vCenter Operations Enterprise cannot detect a sparse data metric automatically. See “**Metric Types**” on page 72 for more information.

8 If desired, set the fields for hard thresholds as follows:

   - Set the **Critical Level**. Choose from **Info**, **Warning**, **Immediate**, and **Critical**.
   - Set the **Threshold Operator**. Choose from > (greater than), >= (greater than or equal to), < (less than), or <= (less than or equal to).
   - Enter the desired value in the **Compare Value** text box.
Enter the desired value in the Wait Cycle text box. The wait cycle for a hard threshold is multiplied by the collection interval to calculate the number of minutes it must be out of bounds before generating an anomaly.

Enter the desired value in the Cancel Cycle text boxes. The cancel cycle for a hard threshold is the number of times the attribute must be within the threshold before an anomaly is canceled. It is multiplied by the collection interval to calculate the number of minutes the metric must be in-bounds before canceling the anomaly.

Repeat these steps for each hard threshold. If you want to add an additional row, click the Add New Row icon.

9 To delete a previously set hard threshold, select the row of fields and click the Remove Selected Row icon.

10 Select the Violation of the Hard threshold is a Key Indicator check box if you want violation of the hard threshold to be considered a KPI violation. See the vCenter Operations Enterprise User’s Guide for more information on KPI.

11 If you select Violation of the Hard threshold is a Key Indicator, then in Select Criticality Level at which a Hard Threshold becomes Key Indicator set the criticality level which must be reached for a violation to be considered a KPI breach.

12 Click OK.

13 Click OK to close the Manage Attribute Packages window.

Defining Super Metrics

Sometimes, no single metric can tell you what you want to know about the behavior of your enterprise: only a combination of metrics can let you know if your systems are behaving normally. For example, consider the transfer of packets along a network. The ratio of packets in to packets out should stay approximately equal to 1; a slight deviation can indicate abnormality. This abnormality cannot be detected if packets in and packets out are studied separately. You need to be able to track the ratio of these two metrics.

vCenter Operations Enterprise’s super metrics are designed for this type of situation. A super metric is a formula containing one or more metrics for one or more resources, combined in essentially any way you want. Super metrics can include any number of mathematical operators (such as addition or division) and/or functions (such as the average or sum of a number of metrics, or the sine of a single one).

Super metrics are very flexible, but that means that defining the right super metric can be complex. Before you build the formula for a super metric, you should know:

- What resource or resources are involved in the behavior you want to track. When defining the metrics to use, you can select either specific resources or resource kinds. For example, you could choose the specific resources Database Server 2 and Database Server 4, or you could choose the resource kind “Database Servers.” When you select a resource kind, the super metric will use all resources of that kind that are children of the resource you assign the super metric to (as discussed below).

- What metric or metrics you want to include in the super metric. In the example above, this would be the packets in and packets out metrics, as you are interested in the ratio of those metrics. In another common use of super metrics, it may be average CPU utilization or average memory use of the resource kind you select.
- How do you want to combine or compare the metrics? To find the ratio of packets in to packets out, you need to divide these two metrics. If you’re tracking CPU use for a resource kind, you might want the average use, or you might want to know what the highest or lowest use is for any resource of that kind. These are simple examples: in some situations you may want a complex formula using constants, trigonometric functions, and more. A super metric can be as simple or complex as it needs to be to track the desired behavior.

- What resource or resources do you want to assign the super metric to? As with attributes, you place super metrics in packages, then assign those packages to resources. For many super metrics, the resource you assign it to decides exactly which resources it covers; you would assign it to an application to have it monitor all the resources of the specified kind in that application. For others, the resources being tracked are defined in the super metric, but the resource you assign it to still determines where the alert will occur if the super metric shows abnormal behavior. Super metrics are frequently assigned to a tier or application, but they do not have to be.

To summarize, the key to building a super metric that does what you want—that alerts you to the situation you want it to test for—is knowing your enterprise and your data. Super metric configuration is not an exact science, and it may take some time before you establish the proper formulas and thresholds to get the results you want.

Using super metrics is a three-step process:

- Create one or more super metrics.
- Define super metric packages, each one containing one or more super metrics.
- Assign each super metric package to the desired resource.

The following sections describe what you can include in a super metric formula, then give instructions for each of these steps.

**NOTE** Super metrics are the only attributes that can be assigned directly to a tier or an application (see Chapter 6 for information about tiers and applications). For example, if you have an application tier that contains all your Web servers, you could create a super metric that is the average CPU usage for all servers and assign it to the tier. If you want vCenter Operations Enterprise to be able to generate problem fingerprints for your applications (which can then help predict future problems with the application before they occur), you must assign super metrics to an application or its tiers and designate them as KPI. See the *vCenter Operations Enterprise User’s Guide* for more information on problem fingerprints.

### The Super Metric Formula

Super metric formulas consist of one or more of these types of information:

- Metric specifications. You can specify a particular resource and metric, such as CPU use for Database Server 2, or you can specify a metric and say to use “this resource” (the one the super metric is assigned to). For example, if you select the transaction time metric and tell vCenter Operations Enterprise to use this resource, when the super metric is in a package assigned to Web Server 1, it will use the transaction time for Web Server 1. If you assign the package to Web Server 2, it will use the transaction time for Web Server 2. If you use this feature, be sure to assign any package containing the super metric only to resources the metric is collected for. You can combine specific resource metrics and “this resource” metrics in the same formula.

- Super metric functions, as described in the next section.

- Arithmetic operators, such as the plus or minus sign.

- Constants. You can enter any number as part of the formula.

### Super Metric Functions

vCenter Operations Enterprise includes many functions for use in super metric formulas. There are two kinds of functions: looping functions which work on more than one value, and single functions, which work on only a single value or, in the case of pow, a single pair of values.
All looping functions have four possible formats:

- **funct(res:met)** — In this format, the function looks down one level from the indicated resource and acts on the values of the metric for all the resource’s children. For example, \( \text{avg(Tier1:CPUuse)} \) returns the average of the CPUUse metric for all the children of the Tier1 resource.

- **funct(reskind:met)** — In this format, the function looks down the resource tree and acts on the values of the metric for all resources of the indicated resource kind that are beneath the resource the super metric is assigned to. The metric may be either a specific metric or an attribute kind. For example, \( \text{sum(DomCont:BytesReadSec)} \) totals the value of all instances of the BytesReadSec attributes for all resources of DomCont kind beneath the resource you assign the super metric to.

- **functN(res:met,n)** — This is similar to the first format, except that instead of working on just the immediate children, the function looks down (or up) the number of levels indicated by \( n \). This is inclusive. For example, \( \text{avgN(App1:CPUuse,3)} \) averages the CPUUse metric for the children, grandchildren, and great-grandchildren of the App1 resource. If \( n \) is negative, the function looks up to the resource’s parents instead of down to its children. If \( n \) is 1 — \( \text{functN(res:met,1)} \) — this is exactly the same as the first format.

- **funct(val1,val2,val3...)** — This is the array format of a looping function. It can include any number of values, separated by commas. Each value may be:
  - A resource:metric pair (or resource kind:metric). The function will take the value of the specified resource, not its children, unless you include a resource kind. If you use a resource kind, you must specify a single metric for it, not a metric kind. The function will look down to all resources of that type beneath the resource it is assigned to and act on the value of the specified metric for those resources.
  - A constant.
  - A function or expression which returns a single value, such as \( \text{floor($This:AvgTransTime)} \) or \( 180-($DBServer3:MemoryUsed) \).

For example, \( \text{max($This:CPUavg,Host3:CPUavg,VM:CPUavg)} \) will find the value of the CPUavg metric for the resource the super metric is assigned to, for the resource called Host3, and for all resources of type VM that are beneath the resource the super metric is assigned to in the resource tree. Note that while this example uses the same metric in all three res:met pairs, you do not need to. For example, you could have one function take the average of the physical memory used (one attribute) and the virtual memory used (a different attribute) for one or more defined resources.

**Table 5-1. Super Metric Looping Functions**

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>avg</td>
<td>Average of the collected values</td>
</tr>
<tr>
<td>combine</td>
<td>Combines all the values of the metrics of the included resources into a single metric timeline.</td>
</tr>
<tr>
<td>count</td>
<td>Number of values collected.</td>
</tr>
<tr>
<td>max</td>
<td>Maximum of the collected values.</td>
</tr>
<tr>
<td>min</td>
<td>Minimum of the collected values</td>
</tr>
<tr>
<td>sum</td>
<td>Total (sum) of the collected values.</td>
</tr>
</tbody>
</table>

The table below shows vCenter Operations Enterprise’s single-value functions for super metrics. In these formats, \( x \) and \( y \) are any expression that yields a single value, such as a constant, a resource:metric pair, or another function description.

**Table 5-2. Super Metric Single Functions**

<table>
<thead>
<tr>
<th>Function</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>abs</td>
<td>abs(x)</td>
<td>Absolute value of ( x ). ( x ) can be any floating point number.</td>
</tr>
<tr>
<td>acos</td>
<td>acos(x)</td>
<td>Arccosine of ( x )</td>
</tr>
<tr>
<td>asin</td>
<td>asin(x)</td>
<td>Arcsine of ( x )</td>
</tr>
</tbody>
</table>
Creating and Editing Super Metrics

This section describes how to create, modify, or delete a super metric.

**NOTE** You may find it helpful to open two vCenter Operations Enterprise browser tabs while creating super metrics. In one tab, you create the super metric. In the other, you can display a dashboard showing, for example, the Resource Selector, Metric Selector, and Metric Graph widgets. This lets you display the metric graph of a metric to make sure it is the one you want before using it in the super metric.

**To create a super metric**

1. From the Environment menu, select Advanced, Super Metrics, Super Metrics Editor. This opens the Manage Super Metrics window.

2. Click the Add New Super Metric icon.

---

### Table 5-2. Super Metric Single Functions (Continued)

<table>
<thead>
<tr>
<th>Function</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>atan</td>
<td>atan(x)</td>
<td>Arctangent of x</td>
</tr>
<tr>
<td>ceil</td>
<td>ceil(x)</td>
<td>The smallest integer that is greater than or equal to x.</td>
</tr>
<tr>
<td>cos</td>
<td>cos(x)</td>
<td>Cosine of x</td>
</tr>
<tr>
<td>cosh</td>
<td>cosh(x)</td>
<td>Hyperbolic cosine of x</td>
</tr>
<tr>
<td>exp</td>
<td>exp(x)</td>
<td>e raised to the power of x</td>
</tr>
<tr>
<td>floor</td>
<td>floor(x)</td>
<td>The largest integer that is less than or equal to x.</td>
</tr>
<tr>
<td>log</td>
<td>log(x)</td>
<td>Natural logarithm (base e) of x</td>
</tr>
<tr>
<td>log10</td>
<td>log10(x)</td>
<td>Common logarithm (base 10) of x</td>
</tr>
<tr>
<td>pow</td>
<td>pow(x,y)</td>
<td>Raises x to the y power.</td>
</tr>
<tr>
<td>rand</td>
<td>rand(x:y)</td>
<td>Generates a random number between x and y</td>
</tr>
<tr>
<td>sin</td>
<td>sin(x)</td>
<td>Sine of x</td>
</tr>
<tr>
<td>sinh</td>
<td>sinh(x)</td>
<td>Hyperbolic sine of x</td>
</tr>
<tr>
<td>sqrt</td>
<td>sqrt(x)</td>
<td>Square root of x</td>
</tr>
<tr>
<td>tan</td>
<td>tan(x)</td>
<td>Tangent of x</td>
</tr>
<tr>
<td>tanh</td>
<td>tanh(x)</td>
<td>Hyperbolic tangent of x</td>
</tr>
</tbody>
</table>
3 In **Super Metric Name**, type the name to give the new super metric.

4 Define the formula for the super metric. You can do this by selecting, in order, each function or operator to use and the metrics or attribute kinds to use in each function or with each operator.

As you build the formula, keep these procedures and rules in mind:

- To use a function, select it in the **Function** field, then select the resource or resource kind and metric or attribute kind to use in its argument.

- For looping functions used in `functN` format, you have to type the comma and value of `n` in the function argument.

- To select a resource and metric, click the resource in the **Resources** pane, then double-click the metric in the **Metrics** pane. The database IDs of the resource and metric appear in the formula line at the top of the window.

- To define a metric for the resource the super metric is assigned to, in the **Resources** pane click any resource containing the metric to use. Click the **This Resource** icon or type `$this` on the formula line. (If the icon is already selected, do not click it again.) Double-click the metric in the **Metrics** pane.

- Once you have clicked the **This Resource** icon, you must click it again to turn it off before you can add a specific resource to the formula.

- You can select a resource kind and attribute kind only as an argument for a looping function. To do so, click the kind in the **Resource Kinds** pane, then double click the kind in the **Attribute Kinds** list. The database IDs of the resource kind and attribute kind appear in the formula line.

- You can shorten the resource kinds list by typing all or part of the resource kind in the **Search** field and clicking the arrow next to it.

- For looping functions used in array mode, you have to type the brackets enclosing the array and the commas between each value.

- All of the values you define in the formula must be of the same type, either single values or arrays. Arrays are defined when you select a resource kind and attribute kind instead of a particular metric.

- You can select a resource kind and single metric only as part of the argument for a looping function. Otherwise, if you select a resource kind, you must select an attribute kind.

- To see the formula with resource and metric names instead of IDs, click the **Show Formula Description** icon or in the area beneath the formula line.
You can type function names and formats, and arithmetic operators, on the formula line instead of selecting them from the lists.

You can use parentheses to determine the order of operations in the formula; you can either select them in the Operators field or type them directly on the formula line.

At any point, you can clear the Metrics or Attribute Kinds list by clicking the Clear Selection icon in the Resources or Resource Kinds pane.

NOTE  For more information about super metric formulas, see “The Super Metric Formula” on page 79.

To see if the formula behaves the way you expect, you can display a metric graph that shows what the value would have been during a past time period. This can help you decide if the entered formula is the one you want. To do so:

a  Click the Visualize Super Metric icon. This replaces the Metrics and Attribute Kinds panes with a metric graph pane.

b  If you are prompted to select a resource, in the Resources pane, select any resource you will assign this super metric to.

c  Click the Date Controls icon and select the date range you want to see data for.

d  If the formula uses resource kinds, and you want the graph to use only resources which are currently collecting, check the Only Monitoring Resources box.

e  Click the Show Graph icon.

When you have finished the super metric formula, click OK. vCenter Operations Enterprise checks the syntax of your formula to make sure it is legal—for example, that there are the same number of opening and closing parentheses, and that you have not mixed single values and arrays. If it is not, you see a message telling you the formula is not valid and where the error is. You must correct the formula before you can save the super metric.

To edit a super metric

1  From the Environment menu, select Advanced, Super Metrics, Super Metrics Editor. This opens the Manage Super Metrics window.

2  In the list, select the super metric you want to change.

3  Click the Edit Selected Super Metric icon.

4  If desired, edit the Super Metric Name.

5  If desired, change the formula for the super metric. You can select metrics or attribute kinds as described in “To create a super metric” on page 81, and select operators or functions or type them directly on the formula line.

6  When you have finished your changes, click OK. vCenter Operations Enterprise checks the syntax of your formula to make sure it is legal—for example, that there are the same number of opening and closing parentheses. If it is not, you see a message telling you the formula is not valid and where the error is. You must correct the formula before you can save the super metric.

To delete a super metric

1  From the Environment menu, select Advanced, Super Metrics, Super Metrics Editor. This opens the Manage Super Metrics window.

2  In the list, select the super metric you want to delete.

3  Click the Remove Selected Super Metric icon.
Defining Super Metric Packages

You cannot assign a super metric directly to a resource. You must define a super metric package, then assign the package to the desired resource. A super metric package can contain one or more super metrics, and the same super metric can be part of more than one package. For example, you could create one super metric package containing just the super metrics for WebServer1 and another containing all super metrics for all web servers. The super metrics for WebServer1 would be in both packages.

When you define a super metric, you define not only the super metrics to include in it, but also the threshold characteristics to use for the super metric in that package: whether to use dynamic or hard thresholds, what the hard thresholds are, and whether threshold violations should be considered KPI. If a super metric is in more than one package, you can set these characteristics differently in each package.

Creating and Editing Super Metric Packages

This section describes how to create, modify, or delete a super metric package.

To create a super metric package

1. From the Environment menu, select Advanced, Super Metrics, Super Metric Packages. This opens the Manage Super Metric Packages window.

2. Click the Add New Super Metric Package icon.

   NOTE  You can also add a super metric package when creating or editing a resource. Click Add next to the Super Metric package field.

3. Type a Package Name for the super metric package.

4. Check the box for a super metric to include in the package. Fields where you can set the characteristics of the super metric for this package appear in the right pane of the dialog box.

5. To set either an upper or lower dynamic threshold violation of this super metric as a KPI, check either or both boxes.
If you want to set and use hard thresholds for this super metric, click the down arrow to the right of Advanced Configuration.

Set the fields for the hard threshold as follows:

- Set the Critical Level. Choose from Info, Warning, Immediate, and Critical.
- Set the Threshold Operator. Choose from > (greater than), >= (greater than or equal to), < (less than), or <= (less than or equal to).
- Enter the desired value in the Compare Value text box.
- Enter the desired value in the Wait Cycle text box. The wait cycle for a hard threshold is multiplied by the collection interval to calculate the number of minutes it must be out of bounds before generating an anomaly.
- Enter the desired value in the Cancel Cycle text boxes. The cancel cycle for a hard threshold is the number of times the attribute must be within the threshold before an anomaly is canceled. It is multiplied by the collection interval to calculate the number of minutes the metric must be in-bounds before canceling the anomaly.
- Select the Violation of the Hard threshold is a Key Indicator check box if violation of the hard threshold should be considered a KPI. See the vCenter Operations Enterprise User's Guide for more information on KPI.
- Set the criticality level of the hard threshold violation from the Select Criticality Level at which a Hard Threshold becomes Key Indicator list. This field works in combination with Violation of the Hard threshold is a Key Indicator.

Repeat steps 4 - 7 for each super metric to include in the package.

Click OK.

To modify a super metric package

1. From the Environment menu, select Advanced, Super Metrics, Super Metric Packages. This opens the Manage Super Metric Packages window.
2. Select the package to modify.
3. Click the Edit Selected Attribute Package icon.

NOTE You can also edit a super metric package when creating or editing a resource. Select the package in the Super Metric package field, then click Edit.
You can change the package name, select new super metrics to include in it by checking their boxes, or remove super metrics from it by clearing their boxes.

To change the characteristics of a super metric in the package, select it. You can then modify the dynamic and/or hard threshold settings, as described in “To create a super metric package” on page 84.

When you are finished with your changes, click OK.

To delete a super metric package

1. From the Environment menu, select Advanced, Super Metrics, Super Metric Packages. This opens the Manage Super Metric Packages window.
2. In the list, select the super metric package to delete.
3. Click the Remove Selected Attribute Package icon.

Assigning Super Metric Packages

Once you have created super metric packages, you can assign each one to a resource. You can assign any package to any resource, whether or not any metrics from that resource are used in the super metric package. In most cases, each super metric package is assigned to a related resource. For example, if a package includes the average free space for all database servers, you could assign the package to the database server tier. If another package includes all the super metrics defined for a particular application, it would probably be assigned to the application.

The resource you assign a super metric to may determine more than just what resource it appears under. If you have used any looping functions with resource kinds or “this resource” metrics, it also determines what resources’ metrics are included in the super metric.

If you use resource discovery, each resource you add is assigned the default super metric package for its resource kind. When adding a resource manually, you can accept the default or assign a different super metric package. To change the super metric package for one or more existing resources, edit the resources, as described in “Editing a Resource” on page 55 or “Editing Multiple Resources” on page 55. Select the package you want from the list in the Super Metric package field.

To set the default super metric package for a resource kind, see “Setting Defaults for Resource Kinds” on page 56.

Super Metric Use Case

Consider an application, such as a Web-based business, where all the servers in a tier are performing a similar activity, such as processing transactions. In this situation, it could be useful to know the average of a metric, such as CPU usage, for all these servers. You could define a super metric to track this number, then assign it to the tier.

To define this super metric

1. From the Environment menu, select Advanced, Super Metrics, Super Metrics Editor. This opens the Manage Super Metrics window.
2. Click the Add New Super Metric icon.
3. In Super Metric Name, type the name to give the new super metric, such as Average CPU Use.
4. Click the arrow next to the Functions field, then select avg from the list of functions.
5. In the Search field of the Resource Kinds tab (on the right), type all or part of the name of the resource type for the transaction servers, for example, AppServ. Click the arrow next to the field.
6. Click the correct resource kind from the list. This displays their attributes in the Attribute Kinds pane.
7. Double-click the AvgCPUUtil attribute. The database ID of the resource and metric appear in the formula line at the top of the window.
8 If desired, click below the formula line to see the resource name and metric name.

9 Click OK to save the new super metric.

10 Either add the new super metric to an existing super metric package, or create a new super metric package containing just this metric. See “Creating and Editing Super Metric Packages” on page 84.

11 Assign the super metric package to the tier, as described in “Assigning Super Metric Packages” on page 86.
In this section, we explore how to configure applications in vCenter Operations Enterprise. It contains the following topics:

- “About Applications” on page 89
- “About Fingerprinting” on page 90
- “Working with Applications” on page 91

About Applications

An application is essentially an interdependent set of hardware and software components delivering a specific capability in support of your business. vCenter Operations Enterprise allows you to build application topologies to make it easier for you to determine how applications are affected when mission-critical resources contained in them experience problems. Once you have specified an application topology, you can view real-time analysis for all affected resources to help you understand where in the topology the problems occur.

In vCenter Operations Enterprise, applications are three-level hierarchies. each application contains one or more tiers; each tier contains one or more resources. The resources that make up a tier can also contain other resources, but they do not have to.

The Add Application window allows you to place resources in a hierarchical format representing the communication topology to complete an application.
About Fingerprinting

One reason to define application hierarchies for your resources is that vCenter Operations Enterprise can calculate and store fingerprints for applications. When a KPI for an application or a tier belonging to an application violates a threshold, vCenter Operations Enterprise examines the events leading up to the violation. If it finds enough related information (such as other anomalies), it captures the set of events which preceded and led up to the violation. This captured series of events is called a fingerprint.

vCenter Operations Enterprise can then monitor events in the future, and, if it finds a similar series of events, issue a predictive alert warning that the KPI violation is likely to occur.

A fingerprint provides information for future detection and analysis of precursor events. More importantly, it equips event correlation to recognize when the problem is recurring in order to issue a fingerprint alert. The information obtained after the fingerprint was generated assists you in correcting the problem.

The only type of attribute that can be assigned directly to a tier or application is a super metric. Therefore, vCenter Operations Enterprise will generate fingerprints only if you have super metrics assigned to a tier or application and marked as KPI. For information about creating super metrics and configuring them as KPI, see “Defining Super Metrics” on page 78.

vCenter Operations Enterprise generates fingerprints only for applications.

To maintain as high a server performance as possible, vCenter Operations Enterprise tracks each captured fingerprint to see if the set of conditions it represents recurs, and if it is useful: if those conditions do help to predict future problems. If, over time, a fingerprint is not useful in predicting problems, vCenter Operations Enterprise deactivates it and no longer checks for its recurrence.

For more information on fingerprints, please see the vCenter Operations Enterprise User’s Guide.
Working with Applications

This section describes how to view, add, edit, and delete applications.

Viewing an Application

To view a list of existing applications, select Applications Overview from the Environment menu. The Application Overview page appears.

The left pane displays all configured application tags. Application tags make it easier to categorize and manage applications in the environment. The number of applications associated with each tag is shown beside it. See “Application Tags” on page 94 for more information about application tags. You can associate an application with any tag on this page, as described in "Assigning Application Tags" on page 95.

The right pane displays the list of applications. If no application tag is selected, it shows all applications; if you select an application tag and tag value, it shows only applications with that tag value. By default, for each application, vCenter Operations Enterprise shows a graph of application health over the last 24 hours, the current health score, icons indicating the health of each tier, and the number of active Smart Alerts and Classic Alerts.

You can add, edit and delete applications here, as described later in this chapter.

To see more information about an application, double-click it in the list to open the Application Detail page. For a description of this page, see the vCenter Operations Enterprise User’s Guide.
Adding an Application

To build an application topology

1. On the Application Overview window, click the Add New Application icon. The Add A New Application dialog box appears.

2. Under Add New Template, select your preferred template, or select Custom to define your own application from a blank template. The default tiers available for each template are shown next to the template name; the tiers for the selected template also appear at the bottom of the dialog box (for example, the Basic n-tier Web App template has Network, Web, App, and DB tiers available).

3. Click Go. This opens the Application Overview: Add Application page.

4. Type a name for your application in the Application field.

5. Use the Tiers pane to add or remove tiers from the application. To add a tier, click the Add New Tier icon, then type the tier name in the new row that appears. For instance, if you are configuring a tier of Web servers, you could type Web Servers.

   To remove a tier from the application, select it in the list, then click the Remove Selected Tier icon.

   To change the name of a tier, double-click the existing name and type the new name.
6 To add a resource to a tier:
   a Select the tier in the Tiers pane.
   b In the Resources-Tags pane in the lower half of the window, select the resource(s) to add to the tier from the resource list on the right. By default, this shows all resources. You can select a resource tag and tag value in the tag tree on the left to show only resources with that tag value. If you select multiple tag values:
      • If you select more than one value for the same tag, the list includes resources that have either value.
      • If you select values for two or more different tags, the list includes only resources that have all the selected values.
   c Drag the selected resource(s) from the Resources-Tags to the Tier Resource pane.
   
      You can also add all listed resources to the tier by clicking the Add All Resources To Tier icon.

      NOTE A resource remains listed in the Resources-Tags pane after you’ve added it to a tier. If desired, you can add the same resource to more than one tier.

7 Continue selecting and dragging resources into the appropriate tiers.

   To delete a resource from a tier, select it and click the Remove Selected Resources From Tier icon.

8 Click Save to save the new application. It is added to the list of applications in Application Overview.

Editing an Application

To edit an application

1 On the Application Overview page, select the application to reconfigure.
2 Click the Edit Selected Application icon. This launches the Application Overview: Edit Application page, which looks just like the Add Application page.
3 Make the configuration changes to the application.
4 Click the Save icon. This applies the changes and brings you back to the Application Overview page.

   CAUTION When you edit an application, do not delete a tier containing resources for which metrics are being collected. Doing so generates alerts regarding the negative performance of individual resources corresponding with their respective application. In addition, metric collection may malfunction. Please consult with the vCenter Operations Enterprise administrator before proceeding.

Deleting an Application

To delete an application

1 On the Application Overview page, select the application to delete.
2 Click the Remove Selected Application icon.
3 On the Confirm dialog box, select Yes.
Your application is now deleted.

**NOTE**  When you delete an application, the fingerprints, alerts, and anomalies associated with it are also deleted.

### Application Tags

Application tags let you index applications for ease of manageability. When you select applications in vCenter Operations Enterprise, you can do it through the application tag hierarchy. Defining tags and tag values appropriate for your environment will make it easier to find the applications you want. Application tags are very similar to resource tags, which are described in “Working with Tags” on page 61.

You configure tags in the Applications Overview window. You can assign any number of applications to each tag value, and you can assign a single application to tag values under any number of tags. The number of applications associated with each tag value is shown beside its. Click the tag to reveal its associated applications. Rather than searching through thousands of applications in a long list, you can easily pinpoint the ones you want through their tags.

### Configuring Application Tags

There are two steps to configuring application tags: adding the tags and adding the tag values.

#### To add an application tag

1. Click the **Manage Tags** icon on the left side of the Application Overview window. The Manage Application Tags dialog box appears.

   ![Manage Application Tags](image)

2. Click the **Add Tag** icon to add a new row. Enter the name of the tag in the row.

3. To add another tag, repeat step 2. To add values to a tag, continue with step 2 of the next procedure.

4. When you’re done adding tags, click **OK**. The new tags will appear in the tag list on the Application Overview window.

#### To add values to a tag

1. Click the **Manage Tags** icon on the left side of the window. The Manage Application Tags dialog box appears.

2. Select the tag to add values to and click the **Add Tag Value** icon.

3. Type the name of the tag value in the new row.

4. Click **OK**. The new tag values will appear in the tag list on the Application Overview window.
Assigning Application Tags

To associate an application with a tag value, drag it from the list in the right pane of the Application Overview window onto the tag value's name. You can select one application, press the SHIFT key to select more than one sequentially, or press the CTRL key to select multiple applications individually. The application(s) will be associated with the tag value you chose.

If you want to remove an application from a tag value:
1. In the Application Overview window, select the tag value to display its assigned applications in the list on the right.
2. At the end of the tag list on the left is a line labeled Untag. Drag the application to remove from the list on the right to this line.

Using Application Tags

On the Application Overview window, the tag list is on the left side of the window, with a list of all applications on the right. Rather than searching through the entire application list, you can find the one you want more easily using the tags:

1. Click a tag the application has been assigned a value for. This expands the list of values beneath it. The number of applications associated with each value is shown beside it.

If you want to collapse an expanded tag, click it again.

2. Click the tag value assigned to the application. This lists the applications with that tag value in the right-hand pane.
3. Select the application from the list.

The toolbar buttons let you do the following:
- **Collapse All** – Collapse all resource tag branches.
- **Expand All** – Expand all resource tag branches.
- **Deselect All** – Clear all selected resource tags.
- **Manage Tags** – Open the Manage Resource Tags window.

You also use application tags to select the applications to show in the Heat Map widget, as described in the *vCenter Operations Enterprise User’s Guide*

Editing Application Tags

To edit an application tag or tag value

1. Click the **Manage Tags** icon on the left side of the window. The Manage Application Tags dialog box appears.
2. To change a tag name, double-click it. Enter the new name of the tag.
3. To change a tag value name, expand the tag to display its values. Double-click the value to change and enter the new name.
4. Click **OK**. Your changes will appear in the tag list on the Application Overview window.
Deleting Application Tags

To delete an application tag or tag value

1. Click the Manage Tags icon on the left side of the window. The Manage Application Tags dialog box appears.

2. To delete a tag, click the tag name and click Remove Tag.

3. To delete a tag value, expand its tag, select the value, and click Remove Tag Value.

4. Click OK. The removed tags and values will not appear in the tag list on the Application Overview window.
This section describes how to configure vCenter Operations Enterprise’s alert notification feature. It contains the following topics:

- “Alert Notification Overview” on page 97
- “Sending Alert Notifications by Email Filter” on page 98
- “Sending Alert Notifications as SNMP Traps” on page 106
- “Saving Alert Notifications in a Log File” on page 107
- “Sending Alert Notification to EMC Smarts” on page 108

Alert Notification Overview

When vCenter Operations Enterprise generates an alert, the alert shows on the Alerts Overview page, in the Alert Watch List, and in the Alerts widget. However, this notifies the proper user of the alert only if he or she is looking at the correct display at the right time. To get the most benefit from vCenter Operations Enterprise’s alerting functionality, you can configure vCenter Operations Enterprise to send alert notifications to the users who may need to respond to them. Notifications are sent for all new, updated, and canceled alerts.

For complete information about viewing and working with vCenter Operations Enterprise alerts, please see the vCenter Operations Enterprise User’s Guide.

There are four ways to send alert notifications: via email filter, as an SNMP trap, saved in a text file, or, if you use EMC Smarts, sent to the SAMS Global Console. Using any method, if the attempt to send notification fails, vCenter Operations Enterprise will continually retry the notification. If it still fails after five minutes, vCenter Operations Enterprise generates an administrative system alert, but it continues to try to send the notification until it succeeds.

To configure alert notification, from the Admin menu, select Configure Outbound Alert. This opens the Outbound Alert Setup page.

The toolbar at the top of the page contains the following buttons:

- **Start** – Activate the selected alert handler. It will show as Started in the Alert Handler Status column. All handlers are started automatically when created.
- **Stop** – Make the selected alert handler inactive. It will show as Stopped in the Alert Handler Status column.
- **Add Alert Handler** – Create a new alert handler configuration.
- **Edit Alert Handler** – Edit an existing alert handler configuration.
- **Delete Alert Handler** – Remove an existing alert handler configuration.

You can add as many instances as you want of any or all alert handler types, as described in the following sections.
Sending Alert Notifications by Email Filter

To send alerts via email messages, you use vCenter Operations Enterprise's email plug-in, which sends messages to users specified in filter rules in the `vcenter-ops\user\plugins\outbound\filter_alertplugin\conf\emailFilter.xml` configuration file. The filter rules let you email different alert notifications to the proper users, based on the affected application, resource kind, alert level, and other criteria.

There are two ways to configure the filter rules: using the configuration file editor or editing the emailFilter.xml file directly. These methods are described in the following sections. We recommend you use the configuration file editor, as editing the XML file directly can be prone to errors, and any mistake could keep the outbound alerts from functioning correctly.

vCenter Operations Enterprise includes a number of default message templates, containing the body text for the notification messages. The message templates to use are defined in emailFilter.xml. Modifying the templates, or creating your own custom templates, is described in "Email Message Templates" on page 106.

To send filtered email notifications of generated alerts

1. From the Admin menu, select Configure Outbound Alert. The Outbound Alert Setup page appears.
2. Click the Add Alert Handler icon.
3. Select Email in the Alert Handler Type field.
4. Type the Instance Name you want to give this configuration.
5. Enter the IP address of the SMTP server in the SMTP_Host field. The SMTP server facilitates the delivery of email messages to recipients.
6. Type the SMTP port number to use in the SMTP_Port field. The default value is 25.
7. To test the filter, click Test. This does the following:
   - Makes sure the SMTP host and port you entered are valid.
   - Checks the syntax and data of the emailFilter.xml file.
   If it finds any problems, it displays an appropriate message. If it does not find any problems, it sends a test message to each recipient defined in emailFilter.xml.
8. Click OK to save your configuration.
Using the Configuration File Editor

The Configuration File Editor provides a graphical interface you can use to define the two types of information which determine when email notifications are sent and who they go to. These types are:

- **Templates** - These define what template file to use for a given alert type, subtype, and status. vCenter Operations Enterprise includes several default template files, and you can create additional custom templates if needed. In general, you would use the default templates for most notifications, and custom templates for specific users who require different information in their notifications. See “Email Message Templates” on page 106 for more information about templates. You can create custom template files, as described in that section, either before or after creating template definitions for them in the editor. You will almost certainly have more template definitions than template files: there may be many template definitions, for different combinations of alert types and recipients, pointing to any one template file.

- **Filtering Rules** - These define the email addresses to send the alert notifications to, based on the conditions you choose, such as alert type, the collector or application the alert occurred on, or the value of any resource tag you select.

In brief, the templates define what message to send and the filter rules define who to send it to. The following sections describe how to start and work with the Configuration File Editor and how to use it to create and manage templates and filter rules.

You can use the Configuration File Editor to edit the `vcenter-ops\user\plugins\outbound\filter_alertplugin\conf\emailFilter.xml` directly. You can also create or modify other XML files. You may want to do this if you are making changes and want to be able to review them before having them take effect. However, the email filter plug-in always uses `emailFilter.xml`—if you want your changes used by vCenter Operations Enterprise, you must save them in that file.

Using the Configuration File Editor

The Configuration File Editor is not added to any menu when you install vCenter Operations Enterprise. You must start it by executing its *.jar file. To start the Configuration File Editor:

1. Use any standard Windows method to execute the file `vcenter-ops\tools\FilterPluginConfEditor.jar`. You see the Configuration File Editor dialog box.
To select an existing configuration file to work with, from the Actions menu, select Open. To create a new file, select New.

Continue by working with either templates or filter rules, as described below.

You can also set these parameters:

- **Subject** - if vCenter Operations Enterprise cannot find a valid email template to use to send a particular alert message, it sends a generic message to the defined recipient. This is the subject line to use for that generic message.

- **Email sender** - the address all notification messages are sent from. If you do not enter one, the messages are sent from vcops@vmware.com

- **File reload time** - how often vCenter Operations Enterprise checks the emailFilter.xml file to see if it has changed. The default is 30 minutes.

After making all your changes and additions, use one of these choices from the Actions menu:

- **Save** - Saves your changes to the currently open file.

- **Save As** - Saves your changes to a different file.

- **Close** - Closes the program.

Remember, to have your changes effect the behavior of the email filter plug-in, you must save them to the emailFilter.xml file.

**Working With Templates**

The list on the left of the Configuration File Editor shows all your existing template definitions. To create a new template definition:

1. Click the Add icon near the top center of the dialog box. This displays the Email Template dialog box.

2. To define which alerts this template should be used for, select the:

   - **Alert Type** - Can be SMART, CLASSIC, or ADMINISTRATIVE.

   - **Alert Sub-type** - Select the alert subtype the template is for.

   - **Status** - The change in alert condition generating the notification. Select New, Active (meaning an existing alert was updated), or Cancel.

3. If you want this template used only for a notification being sent a specific email address, enter it in the Send to field. This is an additional condition for the use of this template. It does not mean that all notifications meeting the other conditions will be sent to this address; it means that only notifications being sent to this address (as defined in a filter rule) will use this template.
4 In Template, type the name of the template file to use for notifications meeting the conditions you entered. This file does not have to exist yet. You can define the template here, then create the actual XML template file afterward if desired.

5 When done, click OK.

To edit an existing template definition

1 Select it in the template list on the left.
2 Click the Edit icon near the top center of the dialog box. This displays the Email Template dialog box.
3 Change any of the entries as described above.
4 When finished, click OK.

You can delete a template definition by clicking its Delete icon.

Working With Filter Rules

The list on the right of the Configuration File Editor dialog box shows existing filter rules. To create a new filter rule:

1 Click the Add icon near the top right of the dialog box. This displays the Filtering Rule dialog box.

![Filtering Rule dialog box]

The list on the left shows existing conditions for this filter rule; the list on the right shows the addresses to send notification messages to if they meet the conditions for this rule. You can create any number of conditions and any number of addresses for a filter rule.

2 Type a name for this filtering rule in the Rule name field.
3. Click the **Add** icon near the top center of the dialog box. This displays the Filtering Condition dialog box.

4. Select a **Condition type**, then a **Condition value** for that type. Possible conditions types are: **Level**, **ResourceKind**, **Status**, **Tag**, **Collector**, **AlertType**, **AlertSubType**, **State**, **Application**, **Tier**, and **RootCauseTier**.

5. Click **OK**.

6. Repeat steps 3 - 5 for each condition you want to add to the filter. An alert must meet all the conditions you enter to be considered a match for the filter.

7. To add addresses to the filter rule, click the **Add** icon near the top right of the dialog box. This displays the Address dialog box.

8. In **Address type**, select either **email** or **SMS**. If you select **SMS**, only the message subject, not the message text, will be sent to this address.

9. In **Address value**, type the destination address.

10. **Resend value** is optional. If this address should receive messages at intervals as long as the alert condition remains in effect, type the interval here. For example, type 60 here to send a notification every hour as long as the alert condition is met.

11. **Delay value** is also optional. It is the interval between when an alert meeting the conditions of this filtering rule occurs and when the first message is sent to this recipient. For example, you could delay the message if this recipient should be notified only if the condition is not corrected for some length of time.

12. After making your entries, click **OK**.

13. Repeat steps 7 - 12 for each address for this filtering rule.

14. You can go back and edit any condition or address by selecting it in the list and clicking the appropriate **Edit** icon.

    You can delete a condition or address by clicking its **Delete** icon.

15. When you are finished defining this rule, click **OK** on the Filtering Rule dialog box.

**To edit an existing filtering rule**

1. Select it in the rule list on the right.

2. Click the **Edit** icon near the top right of the dialog box. This displays the Filtering Rule dialog.
3 Change any of the entries as described above.
4 When finished, click **OK**.

You can delete a filter rule by selecting it in the list and pressing the **Delete** key.

**Configuring the emailFilter.xml File**

emailFilter.xml is an XML file that defines:

- The template files to use for notification messages. Each template is a file defining the text of the message.
- The filter rules. Each filter rule is a set of conditions and addresses. If an alert meets the conditions in a filter rule, it is sent to the addresses for that rule.

The file also contains some settings which apply to all email alert notification messages.

You should attempt to configure emailFilter.xml only if you are familiar with XML structure and syntax. A mistake in formatting the file could keep email notification from working at all. We recommend you use the Filter Configuration File editor for all configuration changes. If you do choose to configure the file yourself, make a backup copy before making any changes. For assistance, please contact vCenter Operations Enterprise support, as described in “Technical Support and Education Resources” on page 8.

Here is a sample file:

```xml
<EmailFilter >
<Templates>
<Template alert_type="Administrative" alert_subtype="Environment" status="New">New-Administrative-Environment.html</Template>
<Template alert_type="Administrative" alert_subtype="Environment" status="Cancel">Cancel-Administrative-Environment.html</Template>
<Template alert_type="Administrative" alert_subtype="System" status="New">New-Administrative-System.html</Template>
<Template alert_type="Administrative" alert_subtype="System" status="Cancel">Cancel-Administrative-System.html</Template>
...
</Templates>
<FileReloadTimeInMinutes>120</FileReloadTimeInMinutes>
<SendFromEmail>name1@example.com</SendFromEmail>

<FilterRule name="WebTierAlerts">
<Conditions>
  <condition type="Application">Online Trading</condition>
  <condition type="Tier">Online Trading:Web</condition>
  <condition type="Level">Critical</condition>
</Conditions>
<Addresses>
  <sendTo type="email">name2@example.com</sendTo>
  <sendTo type="sms">9495554444@vtext.com</sendTo>
</Addresses>
</FilterRule>
<FilterRule name="ResourceKindAlerts">
<Conditions>
  <condition type="ResourceKind">OPEN_API:DEMO</condition>
  <condition type="Status">New</condition>
  <condition type="Tag">Location:NewYork</condition>
</Conditions>
<Addresses>
  <sendTo type="email">name3@example.com</sendTo>
  <sendTo type="sms">9495551212@vtext.com</sendTo>
</Addresses>
</FilterRule>
</EmailFilter>
```

**NOTE** None of the entries in emailFilter.xml are case-sensitive. You can enter elements and attributes in either upper or lower case.
All of the contents of the file are contained inside the <EmailFilter> tag. The file must begin with <EmailFilter> and end with </EmailFilter>.

The first part of the file is a <Templates> element which contains a series of <Template> elements. Each one specifies the template file to use for messages for alerts of a particular type, subtype, and status. There are two types of template files:

- Default templates - These files are provided with vCenter Operations Enterprise and are used for a given alert type, subtype, and status unless there is a custom file specified for the recipient. emailFilter.xml should include a <template> element for each default template. Not all of these are shown in the sample file. We recommend you do not change these elements. If you want to change the message sent to all users for a particular alert type, you can modify the default message template.

- Custom templates - These files are unique to your installation. They are used for particular users. The <template> element for a custom template also includes a <sendTo> attribute specifying the recipient to use it for.

Here are sample elements for a default template and custom template:

```xml
<Template alert_type="ADMINISTRATIVE" alert_subtype="ENVIRONMENT" status="NEW">
  New-Administrative-Environment.html</Template>
<Template sendTo="abc@example.com" alert_type="ADMINISTRATIVE" alert_subtype="ENVIRONMENT" status="NEW">abc-New-Administrative-Environment.html</Template>
```

The attributes of <template> are:

- **alert_type** - RESOURCE, TIER, APPLICATION, FINGERPRINT_PREDICTION, FINGERPRINT_GENERATION, SMART, CLASSIC, or ADMINISTRATIVE
- **alert_subtype** - For smart alerts: EARLYWARNING, KPI_BREACH, or KPI_PREDICTION. For classic alerts: KPI_HT_BREACH, NOTIFICATION, or ABNORMALITY. For administrative alerts: SYSTEM or ENVIRONMENT.
- **status** - The change in alert condition generating the notification, either NEW, UPDATE, or CANCEL.
- **sendTo** - Used only with custom templates. Use this template for notifications being sent to this address.

The content of the <template> element is the file name of the template file.

The next two tags set general options for email alert notifications:

- <FileReloadTimeInMinutes> is optional. If it is included, it sets how often vCenter Operations Enterprise checks the emailFilter.xml file to see if it has changed. If you do not include this element, the file is reread every 30 minutes.
- <SendFromEmail> is optional. If included, it sets the address to use as the “from” address for all email alert notifications. If it is not included, the message will be sent from vops@vmware.com.

The rest of the file contains one or more <FilterRule> elements. Each one defines a set of conditions for an alert, and one or more email addresses to send notifications to for all alerts that meet the conditions. <FilterRule> should have a name attribute, as shown. This can be any text to describe the filter rule.

Each <FilterRule> has one or more conditions, contained in a <Conditions> tag. Each <condition> element includes a type setting and a value to match. For example, these are the conditions for the first rule in the sample file:

```xml
<Conditions>
  <condition type="Application">Online Trading</condition>
  <condition type="Tier">Online Trading:Web</condition>
  <condition type="Level">Critical</condition>
</Conditions>
```
This rule contains three conditions. The first is of type Application and checks for the value Online Trading, and so on. The type setting defines the type of data to check for the matching value to determine if the condition is met. Valid types are:

- AlertSubType - the subtype of the alert. Valid values are EARLYWARNING, KPI_BREACH, KPI_PREDICTION, KPI_HT_BREACH, NOTIFICATION, SYSTEM, ENVIRONMENT, and ABNORMALITY. For example:
  <condition type="AlertSubType">ENVIRONMENT</condition>

- AlertType - the type of alert. Valid values are SMART, CLASSIC, and ADMINISTRATIVE. For example:
  <condition type="AlertType">ADMINISTRATIVE</condition>

- Application - the name of an vCenter Operations Enterprise application. The condition will match if the alert is for any resource in the application. For example:
  <condition type="Application">Online Trading</condition>

- Collector - the unique name of an vCenter Operations Enterprise collector. For example:
  <condition type="Collector">vCenter Operations Collector</condition>

- Level - the minimum alert criticality level. Alerts of this level or above match this condition. Valid types are NONE, INFO, WARNING, IMMEDIATE, and CRITICAL. For example:
  <condition type="Level">immediate</condition>

- ResourceKind - the name of a resource kind, in the format AdapterKind:ResourceKind. For example:
  <condition type="ResourceKind">OPEN_API:DEMO</condition>

- RootCauseTier - a tier within an application. It is a match if one of the root causes of the alert is on the tier. You must include the application name and the tier name, in the format Application:Tier. For example:
  <condition type="RootCauseTier">Online Trading:Network</condition>

- State - the state of the alert. Valid values are OPEN, ASSIGNED, SUSPENDED, and SUPPRESSED. For example:
  <condition type="State">Open</condition>

- Status - the status of the alert: ACTIVE, NEW, or CANCEL. For example:
  <condition type="Status">Cancel</condition>

- Tag - a tag name-value pair in the format TagName:TagValue. For example:
  <condition type="Tag">Geo Location:Chicago</condition>

- Tier - a tier within an application. You must include the application name and the tier name, in the format Application:Tier. The condition will match if the alert is for any resource in the tier. For example:
  <condition type="Tier">Online Trading:Network</condition>

If there are multiple conditions in the filter, as in the example, an alert must meet all of them to be considered a match for the filter.

Following the conditions, each rule contains an <Addresses> element with one or more <sendto> sub-elements, each specifying a single email address to send the alert notification to, the type of message to send, and, optionally, a delay time and resend time.

The type is the type of message to send, either email or sms:

- email - send full alert message
- sms - send only header information

The address is the address to send the notification to.

If it is present, resend sets the repeat interval for the notification. For example, set this to 60 to send a notification to this address every hour as long as the alert condition is met.
If it is present, delay is the interval between when an alert meeting the conditions of this filtering rule occurs and when the first message is sent to this address. For example, you could delay the message if this recipient should be notified only if the condition is not corrected for some length of time.

For example, this element sends a notification to the email address name3@example.com. The first message is sent two hours after the alert condition occurs, and the message repeats every hour until the condition is resolved.

```
<sendTo type="email" delay="120" resend="60">name3@example.com</sendTo>
```

You can enter as many `<FilterRule>` elements as needed to filter alert notifications and send each one to the correct members of your organization. If an alert matches the conditions for more than one filter, it will be sent to the address for each one it matches.

### Email Message Templates

vCenter Operations Enterprise's default notification message templates are in the folder `vcenter-ops\user\plugins\outbound\filter_alertplugin\conf\default_templates`.

You must put any custom notification message template files you create in `vcenter-ops\user\plugins\outbound\filter_alertplugin\conf\custom_templates`.

Each template is a text (.txt) or HTML (.html) file. (The default templates are all HTML files.) If you use an HTML file, it can include standard HTML formatting tags. The template can include a single line for the message subject, and any amount of text for the message body. The subject line must start with `$SUBJECT= `. The text following the equals sign becomes the message subject. If you do not include a subject line, the message uses a default subject.

All template files can include placeholders which will be replaced with information from the alert the notification is for. Placeholders must be enclosed in double braces `{{ }}` as shown in the list below. There are two kinds of placeholders, ones which are always replaced by a single value, such as the alert type, and those which can represent multiple values, such as the health of the parent or child resources. The subject line, if included, can use only single-value placeholders.

The single-value placeholders are:

- `{{AffectedResourceKind}}`
- `{{AffectedResourceName}}`
- `{{AlertCancelTime}}`
- `{{AlertCriticality}}`
- `{{AlertGenerateTime}}`
- `{{AlertId}}`
- `{{AlertMessage}}`
- `{{AlertOwner}}`  `{{AlertStatus}}`
- `{{AlertSubType}}`
- `{{AlertTrigger}}`  `{{AlertType}}`
- `{{AlertUpdateTime}}`
- `{{FilterRuleName}}`

Multiple-value placeholders are:

- `{{KPIFiring}}`  `{{Alarms}}`  `{{ChildrenHealth}}`
- `{{ParentsHealth}}`  `{{AlertRootCause}}`  `{{AlertRootCauseDetails}}`

### Sending Alert Notifications as SNMP Traps

When you send alert notification as SNMP traps, vCenter Operations Enterprise sends all alerts, of all types, to the destination host. Any filtering, by alert type or any other criteria, must be done on the destination host.

**To send alert notifications as SNMP traps**

1. From the Admin menu, select Configure Outbound Alert. The Outbound Alert Setup page appears.
2. Click the Add Alert Handler icon.
3 Select **SnmpTrap** in the **Alert Handler Type** field.

4 Type the **Instance Name** to give this configuration.

5 In the **Destination_host** field, enter the IP address of the SNMP trap receiving host.

6 Enter the **Port** number. The default for SNMP traps is 162.

7 In the **Community** text box enter the community name of the SNMP trap receiver, which by default is **public**.

8 Click **Test** to send a test trap with test data to the configured destination. If the attempt fails, an error message is displayed.

9 Click **OK** to save your configuration.

### Saving Alert Notifications in a Log File

**To save alert notifications in a text log file**

1 From the **Admin** menu, select **Configure Outbound Alert**. The Outbound Alert Setup page appears.

2 Click the **Add Alert Handler** icon.

3 Select **Log File** in the **Alert Handler Type** field.

4 Type the **Instance Name** to give this configuration.

5 In **Alert Output Folder**, enter the path to save the log file in. Remember that this path is on the vCenter Operations Enterprise server. The complete path must be 50 characters or less. If the path you enter is too long, you will see a message saying vCenter Operations Enterprise could not update the alert instance.

6 Click **OK** to save your configuration.

**NOTE**  The **Test** button does not work with a log file handler.
Sending Alert Notification to EMC Smarts

If you use vCenter Operations Enterprise with EMC Smarts, you can set up an alert handler to send alerts directly to the EMC Smarts SAM Global Console. EMS Smarts users will see vCenter Operations Enterprise alert information in their Smarts display. From their, they can open vCenter Operations Enterprise to see alert details.

To send alerts to the EMC Smarts SAM Global Console

1. From the Admin menu, select Configure Outbound Alert. The Outbound Alert Setup page appears.
2. Click the Add Alert Handler icon.
3. Select Smarts SAM Notification in the Alert Handler Type field.
4. Type the Instance Name to give this configuration.
5. Fill in the rest of the fields with the values for your Smarts configuration. For more information, see the vCenter Operations Enterprise/EMC Smarts Integration Guide.
6. To test the alert handler, click Test. This checks to make sure all required fields are filled in and vCenter Operations Enterprise can connect to Smarts using the values.
7. Click OK to save your configuration.
In this section, we present how to perform some basic administrative tasks in vCenter Operations Enterprise. This section includes the following topics:

- “Configuring Users” on page 109
- “Configuring Groups and Access Rights” on page 116
- “Managing the Password Policy” on page 117
- “Running Audit Reports” on page 118
- “Modifying Health Ranges” on page 120
- “Setting the Interaction Metrics Count” on page 121
- “Setting the Number of Root Cause Groups” on page 121
- “Deleting Old Data” on page 121
- “Support” on page 122
- “Starting and Stopping vCenter Operations Enterprise Services” on page 126
- “External Monitoring” on page 127

### Configuring Users

vCenter Operations Enterprise provides user group-based security. Each user can be placed in one or more groups; permissions are then assigned to the groups. For example, one group may only be allowed to view the resource integrity levels, while another can configure resources and a third may have root permissions to administer other users. The vCenter Operations Enterprise administrator is responsible for adding users to vCenter Operations Enterprise and assigning them to groups.

You can create administrators in addition to the default admin user by assigning users to the Administrators group and making sure that the group has permissions to perform tasks such as adding users and groups. However, some vCenter Operations Enterprise features, such as querying the vCenter Operations Enterprise database directly, can only be performed by the admin user.

In addition to adding users by creating them one at a time, if you use an LDAP user database, you can import some or all of your LDAP users into vCenter Operations Enterprise.

By default, new users are set to use the light color scheme and local browser time, and have no administrative privileges.
Adding a User

To use vCenter Operations Enterprise, a user must have a user name and password.

To create a new user account

1. From the Admin menu, select Security. The Manage Security page appears.

2. Under the User Accounts pane of the User Management tab, click the Add New User Account icon. The Add User window appears.

3. Enter the following information:
   - First Name
   - Last Name
   - User Name
   - Password - Be sure to confirm the password in the corresponding text box.
   - E-Mail
   - Description (optional) – information about the user, such as the purpose of the user’s interaction with vCenter Operations Enterprise.
- **Is Enabled** – Check this box to activate the user profile. If this checkbox is cleared, the user is inactive and cannot log in to vCenter Operations Enterprise. This is checked by default.
- **Is Locked** – Check this box to lock the user profile and prevent the user from accessing vCenter Operations Enterprise. If this box is cleared, the user can use vCenter Operations Enterprise. This is not checked by default.
- **Change Pswd At Next Login** – Check this box to force the user to change his or her password at the next login. This is not checked by default.

4. Click OK to save your configuration. The new user will appear in the **Account Groups** pane.

### Importing LDAP Users

If you use an LDAP (Lightweight Directory Access Protocol) database to manage users and groups, you can import users from one or more groups into vCenter Operations Enterprise, creating vCenter Operations Enterprise user records and assigning them to vCenter Operations Enterprise groups in one operation. To do so, you need connection information for the LDAP server: host, port, and a user name and password to use to connect to the database.

When you import LDAP users into vCenter Operations Enterprise, only the user name is imported; the password is not. Whenever an LDAP user logs in to vCenter Operations Enterprise, vCenter Operations Enterprise queries the LDAP database to validate the password. An LDAP user cannot change his or her password in vCenter Operations Enterprise; all password-related fields on the Edit User window are disabled.

You have two choices when importing LDAP data: **manual import or auto-synchronization**:

- With manual import, you run the import whenever you want. vCenter Operations Enterprise retrieves the LDAP users matching your criteria. You can import them all or select the ones to import, and select the vCenter Operations Enterprise group to add each one to.
- With auto-synchronization, the import runs automatically at an interval you set—by default, this is one hour. When you set up auto-synchronization, you map LDAP groups to vCenter Operations Enterprise groups. The import retrieves all members of those groups and adds them to the mapped vCenter Operations Enterprise group.

Performing LDAP import consists of two procedures:

- Defining the LDAP host, including whether to use auto-synchronization
- Importing the users. You perform this part only when using manual import.

With either manual import or auto-synchronization, you can use SSL to communicate securely with the LDAP server. However, to do this, a security certificate must be imported on the vCenter Operations Enterprise server. See “Importing the Certificate for SSL” on page 113.

**NOTE** To import users from LDAP, you must have the Import From LDAP access right. This is found under the Security/User rights folder. See “Configuring Access Rights” on page 117.

### To define the LDAP host

You can use this procedure both to define a new LDAP host and to change the settings for any host already defined.

1. From the **Admin** menu, select **Security**. The Manage Security page appears.

2. In the **User Accounts** pane, click the **Import from LDAP** icon. The Import Users window appears, as shown in Figure 1 on page 114.
3 To define a new host Click Add.

To edit an existing host, select it in the Ldap host field, then click Edit.

In either case, this displays the Manage LDAP Host window.

![Manage LDAP Host window](image)

**NOTE** You can also delete an existing LDAP host by selecting it in the Ldap host field and clicking Delete.

4 In LDAP Host Name, type the host name or IP address.

5 Type the Port to use to connect to the LDAP host.

6 Check the SSL box to use SSL to communicate with the LDAP host. You can only use SSL if you have imported the correct certificate into vCenter Operations Enterprise. See “Importing the Certificate for SSL” on page 113.

7 In Username Field, select or type the LDAP field to use as the user name in vCenter Operations Enterprise.

8 Type the Base DN (Distinguished Name) for the user search. Only users under this base will be found.

9 Type the Username and Password to use to connect to the LDAP database.

10 To use auto synchronization, check the Auto Sync box. This adds the group lists to the bottom of the window, as shown in the screenshot below. To use manual import, skip to Step 14.

![Manage LDAP Host window with Auto Sync checked](image)

11 Click Load LDAP Groups. This fills in the LDAP Groups list.
For each LDAP group you want to import to vCenter Operations Enterprise:

a  In **Account Groups**, select the vCenter Operations Enterprise group to import the group to.

b  Click the **Add Group** icon.

c  Select the LDAP group to import to the selected vCenter Operations Enterprise group.

Repeat this step for each group to import.

To stop importing an LDAP group:

a  In **Account Groups**, select the vCenter Operations Enterprise group the LDAP group is imported to.

b  Click the **Remove Group** icon. The **LDAP Groups** list will show all groups imported to this vCenter Operations Enterprise group.

c  Select the group to stop importing.

This not only stops importing users from this group, the next synchronization also removes from vCenter Operations Enterprise any existing users who are only in the selected group.

Click **OK** to save the host definition and return to the Import Users window. The **Ldap host**, **Username**, and **Password** fields are filled in with the information you entered.

If you are using manual import, continue with “To import LDAP users” on page 114.

**Importing the Certificate for SSL**

With either manual import or auto-synchronization, you have the option to use SSL to communicate securely with the LDAP host. To use SSL, you must first import a security certificate into the keystore. This only needs to be done once for each vCenter Operations Enterprise server.

**To import the certificate**

1  Open a DOS command window.

2  Enter this command:

```
"%VCOPS_BASE%\jre\bin\keytool.exe" -import -alias NDSCERT -file certificate.cer -keystore "%VCOPS_BASE%\user\conf\truststore" -storepass oxygen
```

where *certificate.cer* is the name of the certificate file.

3  Restart the vCenter Operations Web service. You can stop and start all vCenter Operations Enterprise services using vCenter Operations Enterprise program group options. See “The vCenter Operations Enterprise Program Group” on page 30.
To import LDAP users

1. From the Admin menu, select Security. The Manage Security page appears.
2. In the User Accounts pane, click the Import from LDAP icon. The Import Users window appears.

![Import Users Window]

3. In Ldap host, select the LDAP host to import from. (If the host is not in the list, you must define it. See “To define the LDAP host” on page 111.) This fills in the Username and Password fields.
4. In Group, type all or part of an LDAP group name to limit the users found to those in the matching group or groups. If you enter a partial name, follow it with an asterisk (*). To find users in all LDAP groups, leave the field blank.

**NOTE** To change any of the information for the host you select, click Edit to display the Manage LDAP Host window. Make your changes and click OK.

5. Click Lookup. vCenter Operations Enterprise searches the LDAP data and lists all users it finds.
6. For each user to import:
   a. To import all the users in a group, check Import All for the group.
   b. To select an individual user, click in the Import column, then select true.
   c. In the Groups column, select the group to add the user to in vCenter Operations Enterprise.
7. After selecting all the users and assigning groups, click Import.

**NOTE** If a user found by the search has already been imported in vCenter Operations Enterprise, that row is gray and locked. You cannot re-import a user. If you try to import a user and a user with that name already exists in vCenter Operations Enterprise, you will receive a message saying one or more users couldn’t be imported, and the rows for those users will be yellow.
Editing a User

To edit the information for a user account

1. From the Admin menu, select Security. The Manage Security page appears.
2. Under the User Accounts pane of the User Management tab, click the Edit Selected User Account icon. The Edit User window appears.
3. Modify the user fields as desired. If you change the password, be sure to confirm it in the Confirm Password text box.
4. Click OK to save the new information.

NOTE If a user was imported from LDAP, you cannot change the user name or password-related fields, but you can edit the other fields.

Removing a User

To remove a user account

1. From the Admin menu, select Security. The Manage Security page appears.
2. Under the User Accounts pane of the User Management tab, click the Remove Selected User Account icon. The Confirm window appears.
3. Click Yes to remove the user account
Configuring Groups and Access Rights

A group defines a number of users and the vCenter Operations Enterprise features they can use. You can assign access rights to entire menus or individual menu items.

The vCenter Operations Enterprise administrator has access privileges and administrative rights for all groups. We recommend you perform access rights-related tasks only when logged on as a user with administrative privileges.

Adding a Group

To add a group

1. From the Admin menu, select Security. The Manage Security page appears.

2. Under the Account Groups pane of the User Management tab, click the Add New Group icon. The Add Group window appears.

3. Enter the following information:
   - Group Name
   - Description (optional) - information about the group, such as the purpose of the group’s interaction with vCenter Operations Enterprise.

4. Click OK to save your configuration. The new group will appear in the Account Groups pane.

Editing a Group

To edit a group

1. From the Admin menu, select Security. The Manage Security page appears.

2. Under the Account Groups pane of the User Management tab, click the Edit Selected Group icon. The Edit User window appears.

3. Modify the group fields as desired.

4. Click OK to save the new information.

Removing a Group

To remove a group

1. From the Admin menu, select Security. The Manage Security page appears.

2. Under the Account Groups pane of the User Management tab, click the Remove Selected Group icon. The Confirm window appears.

3. Click Yes to remove the group.

Adding Users to a Group

Once you have created a group, you can assign users to it. You can assign any number of users to a group, and each user can belong to any number of groups.

To assign a user to a group

1. From the Admin menu, select Security. The Manage Security page appears.

2. Under the User Accounts pane of the User Management tab, select the user you wish to assign to a group. To select multiple users, hold the Ctrl- or Shift- key while clicking them.

3. Drag the user(s) to the Account Groups pane and drop into the desired group. The number under the Users Assigned column will reflect the number of users added.
Configuring Access Rights

You can assign each group access rights to allow its users to perform certain actions in vCenter Operations Enterprise. You can define which menus users within a group can access and the functions they can perform.

To configure access rights

1. From the Admin menu, select Security. The Manage Security page appears.
2. Select the Access Rights pane.
3. In the Account Groups pane, select the group to assign access rights for.
4. The Access Rights pane contains an expandable list of the vCenter Operations Enterprise menus: Alert, Dashboard, Environment, Fingerprint, Reports, Security, and Support. Check the box for each menu or menu option you want the group’s users to be able to access. If a box is cleared, the group can’t access that feature.
5. Click the Save Changes icon to save the access rights for the group.

Managing the Password Policy

You can set three aspects of vCenter Operations Enterprise’s password policy:

- **Account Lockout Policy** – Are users locked out after a number of failed login attempts, and how many attempts is that?
- **Password Change Policy** – Are users required to change their passwords? How often, and how far ahead of time are they warned that their passwords will expire?
- **Password Strength Policy** – How long must a password be, must it include both letters and numbers, and can it be the same as the user name?

**NOTE** vCenter Operations Enterprise sessions time-out after 30 minutes of inactivity and require the user to log in again. You cannot change this time-out value.
To set the password policies


2. Under Account Lockout Policy, check the Active box if users should be locked out after a certain number of failed attempts to log on. Enter the number of attempts in the Allowed Login Attempts field.

3. Under Password Strength Policy, check the Active box to set requirements for passwords. You can then set:
   - **Password Min Length** – enter the minimum number of characters in a password.
   - **Password Must Have Letters and Numbers** – check this box to require passwords to have at least one letter and at least one number.
   - **Password Must Not Equal To User** – check this box to prevent a user from using his or her user name as the password.

4. Under Password Change Policy, check the Active box to force users to change their password after the number of days in the Password Expiration Period field. In Password Prior Expiration, enter how many days before expiration a user should be warned his or her password is about to expire.

5. Click the Save Policy icon to save your configurations.

Running Audit Reports

You can run two different kinds of audit reports from the Admin menu, the Audit report and the User Audit report. These reports are described in the following sections.

The Audit Report

The Audit report provides a quick summary of key vCenter Operations Enterprise measures. It gives the number of: resources configured, resources having data collected, resource kinds, resources for each defined adapter, metrics configured and being collected, super metrics, vCenter Operations Enterprise-generated metrics, and applications.
To run an Audit report

2. In the Select Report Type field, choose whether to display the report in HTML format in a new browser window or as a .pdf file.
3. Click Submit. The Audit Report window is displayed.

Audit Report as of Feb 18, 2011

Resources

- Resources Configured: 38
- Resources Collecting: 38
- Resource Kinds: 10

Adapters

- VMware-Http: 4
- Apache: 6
- WebSphere: 6
- EventsAK: 1
- Crystal: 1
- SMARTS: 7
- Cisco: 6
- Oracle: 6
- Gomez: 1

Metrics

- Metrics Configured: 198
- Metrics Collecting: 198
- Super Metrics: 25
- Alive Generated: 367

Applications Count: 1

The User Audit Report

The User Audit report shows information about the user/groups/access rights configuration of your vCenter Operations Enterprise system. It lists each user. For each user it shows the groups he or she belongs to and the access rights granted to each group. The access rights are arranged by group, as on the Manage Security page.

To run a User Audit report

2. In the Select Report Type field, choose whether to display the report in HTML format in a new browser window or as a .pdf file.
3 Click **Submit**. The User Audit Report window is displayed.

### User Audit Report

<table>
<thead>
<tr>
<th>User</th>
<th>Group</th>
<th>Access Group</th>
<th>Access Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>root</td>
<td>Operators</td>
<td>Environment</td>
<td>View Environment Overview</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Formetrics</td>
<td>View Capacity Analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>View Cross-Section Analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dashboard</td>
<td>Add</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Publish Global Dashboard</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Edit Widget</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Delete</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Edit (Add/Remove Widgets)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Copy To Self</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Move/Resize Widgets</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Change Interactions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Environment/Attribute Package</td>
<td>Add</td>
</tr>
</tbody>
</table>

### Modifying Health Ranges

As described in “**Health**” on page 39, the health score of a resource is a quick way to get a general idea of its current state. A colored indicator showing the range the health score is in appears on each vCenter Operations Enterprise screen with information about the resource.

By default, the health color ranges are:

- **Green**: 76 - 100
- **Yellow**: 51 - 75
- **Orange**: 26 - 50
- **Red**: 1 - 25
- **Blue**: 0

If desired, you can change all of these ranges except blue. You can also choose whether to have the health chart that appears on many vCenter Operations Enterprise pages (it graphs the resource’s health for the recent past) colored according to the health score for each time period. To change these health options:

1. From the **Admin** menu, select **Global Settings**.
2. On the Global Settings dialog box, type the desired settings in the **Health States** area.

![Health States Table]

3. To change whether or not the health chart is colored, check or clear the **Health Chart Colored** box.
4. Click **OK**.
**Setting the Interaction Metrics Count**

In several locations in vCenter Operations Enterprise, you select an object to see items of another type that are related to it. For example, you can click a resource in the Resources widget to see its metrics in the Metric Sparklines widget, or select a root cause for an alert to see the symptoms which contribute to it. You can select how many of the associated items are displayed when you perform an interaction of this kind: five, 10, or 15. The default is five. Follow the procedure below to change it:

1. From the Admin menu, select Global Settings.
2. On the Global Settings dialog box, select 5, 10, or 15 in the Important Metrics Count field.
3. Click OK.

**Setting the Number of Root Cause Groups**

When vCenter Operations Enterprise shows root cause information (in the Root Cause widget or on the Alert Summary or Cross-Silo Analysis page), it breaks the causes into groups. For example, for an application, the first-level root cause grouping is by tier. You can set the maximum number of first-level root cause groupings vCenter Operations Enterprise will show for any condition. Follow the steps below to change this setting.

**NOTE** The number of first-level groups vCenter Operations Enterprise stores when it captures root cause information is set in the advanced.properties file. By default, this is 50. If you set the number of root cause groups to show to a higher number than the number of groups captured, it has no effect.

1. From the Admin menu, select Global Settings.
2. On the Global Settings dialog box, type the desired number in the Root Cause Groups to Show field.
3. Click OK.

**Deleting Old Data**

By default, vCenter Operations Enterprise keeps all of the data it collects in its file system database (FSDB) indefinitely. However, you have the option to have the analytics engine remove old, unneeded data from its database.

If you want vCenter Operations Enterprise to remove old data, you need to make certain changes to vCenter Operations Enterprise’s configuration to define how old data must be before it is removed and how often the process should run to remove it. Follow this procedure:

1. Make a backup copy of the file vcenter-ops\user\conf\analytics\advanced.properties.
2. Use Notepad or another text editor to open the original advanced.properties file.
3. Find these lines in the file:
   ```
   #Old Data Cleaner Execution Frequency. Default is 0(Off) days
   oldDataCleanerExecutionFrequency=0
   #Old date range. Default is 900 days
   oldDataCleanerDateRange=900
   ```
   The lines that start with # are comments.

4. Change oldDataCleanerExecutionFrequency to how often, in days, you want to erase old data. For example, set it to 7 to erase old data once a week.
5. Change oldDataCleanerDateRange to how old data must be before it gets erased. The default erases only data that is 900 or more days old.
6. Save your changes and close the file.
7. Restart the analytics engine.

vCenter Operations Enterprise will delete old data for the first time once the frequency you enter elapses. For example, if you set the frequency to 7, the first data purge will occur one week later.
To stop deleting old data, edit advanced.properties again and set oldDataCleanerExecutionFrequency back to 0.

**NOTE** Be very careful when you make changes to the `advanced.properties` file, and always make a backup copy of the file. Errors in this file could adversely affect the way vCenter Operations Enterprise operates. Contact VMware support if you have any questions or want assistance.

**Support**

The four tabs of the Support page display information you may need if you think you’re having a problem with vCenter Operations Enterprise. To display this page, select **Support** from the **Admin** menu.

**Status Tab**

vCenter Operations Enterprise monitors its own operation: it is automatically configured as an application containing several self-monitoring resources. The **Status** tab shows performance information related to this vCenter Operations Enterprise application. The information shown is the same shown for other applications on the Application Detail page. See the **vCenter Operations Enterprise User’s Guide** for a description.
Logs Tab

You can view and configure all vCenter Operations Enterprise system logs on the Logs tab, similar to opening the log files using an external text viewer. You can also generate a support bundle containing logs and configuration files to send to vCenter Operations Enterprise support. How to contact support is described in “Technical Support and Education Resources” on page 8.

NOTE To turn on logging for widgets, edit the file \user\conf\web\log4j.properties. After the line log4j.rootLogger=ERROR add log4j.logger.com.integrien.alive.ui=debug. Save your change and close the file.

The Logs pane contains all viewable logs, sorted by type. To view a log file:

1. Double-click a folder (or click the plus sign next to it) to show the logs it contains.
2. Double-click the log file to display it in the Log Content pane.

Each folder contains logs related to that component of the vCenter Operations Enterprise software. The Admin Log folder contains the Action log, which shows specific actions taken by vCenter Operations Enterprise users: adding, editing, or deleting resources, generating or deleting fingerprints, and starting or stopping monitoring or maintenance on a resource. It also includes every time a user logs in or out of vCenter Operations Enterprise.

There are separate log files for each adapter instance. There is a folder for each installed collector. Each collector folder contains folders for each adapter installed on it; each adapter folder contains a folder for each instance, which contains the instance log file.

The toolbar in this pane contains the following buttons:

- **Delete Selected File** – Deletes the selected files.
- **Edit Properties** – Opens a window to manage logging levels for a selected log type. Each resource contains a Root Logger level (ALL, DEBUG, ERROR, FATAL, INFO, OFF, or WARN), maximum backup days, and also an area to set logging level for various component groups. You can only edit properties for the vCenter Operations Web, vCenter Operations Analytics, or vCenter Operations Collector logs.
- **Expand All** – Expands all log type folders.
- **Collapse All** – Collapses all log type folders.
- **Reload Tree** – Reloads the log tree information and collapses all open log type folders.
- **Recalculate Data Source** – vCenter Operations Enterprise assigns a data source to each resource when the resource is added to vCenter Operations Enterprise. If you think the data source for any of your resources has changed, click this button to recalculate the data sources for all resources.

The **Log Content** pane shows the contents of the log file you double-click in the **Logs** pane.

The **Log Content** pane's toolbar contains two fields you can use to display the desired part of a log file:
- **Line Position** – Determines the starting line of the selected log.
- **Row Limit** – Determines the maximum lines of the selected log.

**Support Bundle**

The **Support Bundle** pane lets you package all log and configuration files in one compressed .zip file. You can then attach the file to an e-mail message and send it to vCenter Operations Enterprise support. How to contact support is described in “Technical Support and Education Resources” on page 8.

### To assemble a support bundle

1. Click the **Create Support Bundle** icon. The name of the .zip file for your support bundle appears. It contains the date when it was created (for example, VCOpsSupport2008.03.07-16.52.28-0400.zip). All support bundles are created on the vCenter Operations Enterprise server in the `vcenter-ops\tomcat\webapps\ROOT\support` folder. This folder is created the first time you create a support bundle.

2. Click the **Download Support Bundle** icon to save the selected .zip file to your local hard drive. Attach the .zip file to an e-mail message and send it to vCenter Operations Enterprise support.

3. Click the **Delete Support Bundle** icon to delete the selected .zip file from the list.

**About Tab**

The **About** tab shows all version and license information. The **vCenter Operations Info** pane contains the following:
- Version number
- Build number
- Database schema version number

The **Licenses** pane contains the licenses of the various vCenter Operations Enterprise components. Expand each license to view a detailed description.
Info Tab

The Info tab shows information about the status of the various parts of vCenter Operations Enterprise: the collectors, adapters, and dynamic threshold calculations (part of vCenter Operations Enterprise analytics). The parts of this tab are:

- **Describe Info** pane – Shows the status of the describe process. The describe process sends information about the data that can be collected from each adapter to the vCenter Operations Enterprise server. The describe status for individual adapters is shown in the Adapter Info pane.

- **Collectors Info** pane – Shows the status of the synchronize process run by vCenter Operations Enterprise for each collector. The synchronize process sends any updated configuration information from the controller to each adapter. The describe process sends information about the data that can be collected from each adapter to the vCenter Operations Enterprise server.

- **Adapter Info** pane – Shows information about each installed adapter: the status of the describe process for the adapter, the adapter version, and any message from the adapter. The adapter version consists of major and minor versions and the build number.

**NOTE** In addition to the version number shown here, the describe.xml file contains a separate adapter version number. That number is changed only when a change to the adapter requires the describe process to be re-run (generally, if the metrics collected by the adapter or its credentials format is changed). You should not need to refer to this other version.

Usually, the synchronize and describe processes are run only when the vCenter Operations Enterprise server process starts. If you have made changes and want to run these processes without restarting vCenter Operations Enterprise, click the Describe icon in the Adapters Info pane.

- **Replication Info** pane – If you are using a replication server to back up the primary vCenter Operations Enterprise server, this shows the replication status: whether or not synchronization is on, when it started, and the percentage completed.

- **DT Calculation Info** pane – Shows statistics about dynamic threshold calculations. You can click the Generate Dynamic Thresholds icon in this pane to manually generate dynamic thresholds on all collected metrics. (Dynamic thresholds are usually calculated automatically based on the schedule set in the analytics.properties file.) Click Yes when asked to confirm that you want to start the threshold calculations.

- **Slowest DT Objects** pane – Shows the five resources which took the longest to calculate dynamic thresholds for. This information may help VMware support diagnose certain types of problems you could encounter.

**NOTE** The regular schedule for calculating dynamic thresholds is set by the updateTime property in the analytics.properties file. If you set it to a positive number, thresholds are calculated once a day, starting at the hour you enter, in military time (for example, 23 starts at 11:00 PM). Or, to calculate dynamic thresholds every x hours, enter the number of hours as a negative number—for example, to start every six hours, set updateTime=−6.
Starting and Stopping vCenter Operations Enterprise Services

At times, you may want to start or stop one or more of the vCenter Operations Enterprise services. There are six services, though they will never all be running on the same vCenter Operations Enterprise server:

- vcopsWebService
- AnalyticsService
- ActiveMQ
- CollectorService
- DTProcessorService (runs only on a server where analytics processor is installed)
- ReplicationServerService (runs only on a vCenter Operations Enterprise replication server)

To start or stop all services on a Windows vCenter Operations Enterprise server, from the Windows Start menu, select All Programs, Vmware, vCenter Operations Enterprise, then Start all services or Stop all services.

To start or stop individual services on Windows, you can use the Windows Services dialog box (from the Control Panel, select Administrative Tools, Services). You can also use open a DOS command window and use the sc command in this format:

- To start a service: `sc start %SERVICENAME%`
- To stop a service: `sc stop %SERVICENAME%`

Where SERVICE_NAME is one of the service names listed above.

On a Linux server, you can start or stop services from the Background Services tab of the Service Configuration dialog box, or you can use the `service vcops` command. The format is:

- To start a service: `service vcops start SERVICE_NAME`
- To stop a service: `service vcops stop SERVICE_NAME`

The service names to use in this command are slightly different. They are:

activemq  vcopsserver  collector
analytics  replication  dtprocessor
If you do not include a service name, the command will start or stop all vCenter Operations Enterprise services.

**NOTE** You can also use the command `vcops.sh start|stop SERVICENAME`. To use this format, you must be in the common/bin directory.

You can also use the `service vcops` command to list the vCenter Operations Enterprise-related environment variables. Enter `service vcops env`.

### External Monitoring

In most circumstances, vCenter Operations Enterprise's self-monitoring features can show you all the information you need about vCenter Operations Enterprise's operation and status. However, there are also some external tools you can use to monitor vCenter Operations Enterprise's behavior.

Two of these tools, the Java Console and the FSDBReader tool, are described in Chapter 11. You can start the Java Console using vCenter Operations Enterprise's run-jconsole tool and use it to monitor any vCenter Operations Enterprise service. FSDBReader shows detailed data—including every collected value—for any metric for any resource. You can use it to make sure data is being collected properly. See “Run-jconsole” on page 147 and “FSDBReader” on page 145.

You can also use a log file monitoring tool to search for significant messages in vCenter Operations Enterprise's log files and have it notify you if they are found. The sections below list some of the message strings you may want to check for in the various log files.

#### The Analytics Log File – analytics.log

These messages could indicate the Oracle database is down:

```plaintext
ERROR [Thread-10] com.integrien.alive.common.hibernate.util.OracleConnectionProvider.getConnection - Exception trying to set up connection
java.sql.SQLException: Io exception: Connection reset by peer: socket write error
```

These messages indicate the AnalyticsService service has started successfully:

```plaintext
INFORMATION [WrapperListener_start_runner] com.integrien.analytics.AnalyticsMain.start - AnalyticsService has been started 10.1.11.40
INFORMATION [Thread-1] com.integrien.analytics.AnalyticsMain.doRun - Ready
```

#### The Controller Log File – controller.log

These messages indicate a problem with the SQL Server database:

```plaintext
org.hibernate.exception.GenericJDBCException: Cannot open connection
```

These messages indicate the ActiveMQ service is down:

```plaintext
```

NOTE You can also use the command `vcops.sh start|stop SERVICENAME`. To use this format, you must be in the common/bin directory.

You can also use the `service vcops` command to list the vCenter Operations Enterprise-related environment variables. Enter `service vcops env`.
These messages indicate the vcopsWebService service has started successfully:

```
INFORMATION [Thread-1] com.integrien.alive.ui.util.MainPortalListener.contextInitialized - AliveService has been started 10.1.11.40
INFORMATION [Describe thread] com.integrien.alive.controller.collector.DescribeThread.describe - Staring describe
INFORMATION [Describe thread] com.integrien.alive.controller.collector.DescribeUtils.constructAdapterDescribes - Beginning Describe on Controller
INFORMATION [Describe thread] com.integrien.alive.controller.collector.DescribeThread.describe - Finished describe in 2281 ms
```

**The Collector Log File – collector.log**

These messages indicate the ActiveMQ service is down:

```
2010-04-12 19:04:10,715 ERROR [ActiveMQ Task] org.apache.activemq.transport.failover.FailoverTransport.doReconnect - Failed to connect to transport after: 5 attempt(s)
2010-04-12 19:04:10,715 ERROR [Communicator] com.integrien.alive.collector.CommunicatorThread.connect - Can not connect to the MQ Broker. The reason is Connection refused: connect
```

These messages indicate the CollectorService service started successfully:

```
INFORMATION [WrapperListener_start_runner] com.integrien.alive.collector.CollectorMain.start - CollectorService has been started 10.1.11.40
INFORMATION [Communicator] com.integrien.alive.collector.CommunicatorThread.connect - Collector by id 1 successfully connected to MQ.
```
This section describes the various types of system administrative alerts and gives recommendations on how to respond to them.

**Administrative System Alerts Description**

An administrative system alert indicates a problem with one of vCenter Operations Enterprise’s components. This chapter describes the various problems that can cause a system alert and gives suggested courses of action for each cause.

This section lists system alerts in alphabetical order, according to the message displayed in the Reason pane of the Alert Summary page for the alert.

For detailed information about vCenter Operations Enterprise’s alerting feature, all of vCenter Operations Enterprise’s alert types, how to work with alerts in vCenter Operations Enterprise, and suggested courses of action for other alert types please see the alerting chapter of the vCenter Operations Enterprise User’s Guide.

---

**Analytics FSDB Overloaded**

**Caused By**

There are no more FSDB saving threads

**Recommended Actions**

1. Increase the number of FSDB saving threads by modifying the FSDBSaveThreads parameter in vcenter-ops\user\conf\analytics\advanced.properties. The default value for this parameter is 3; you can increase it up to the number of CPU cores on the host.

2. Use the FSDBHomeChanger tool to create additional mount points for the FSDB so files are distributed on multiple file system.

3. Use the FSDBHomeChanger tool to move the FSDB home to a bigger and/or faster drive.

4. Reduce the number of resources and metrics being collected to reduce the demands on the drive.
Analytics Threshold Checking Overloaded

**Caused By**
There are no more threshold checking threads. This could be because the vCenter Operations Enterprise Analytics server is CPU bound or because the database access has reached its limit.

**Recommended Actions**
1. Check CPU usage on the Analytics server. If there are unused CPU cycles, increase the number of dynamic threshold processing threads by changing the DTProcessingThreads parameter in the `vcenter-ops\user\conf\analytics\advanced.properties` file. The default setting is 25; the maximum is 25 or the number of CPU cores, whichever is larger.
2. Reduce the number of resources and metrics being collected to reduce the demands on the vCenter Operations Enterprise server host CPU.
3. If database access is causing the problem, check the latency between the vCenter Operations Enterprise server and the database server. It should be less than two milliseconds.
4. You may need to upgrade the database server so it can handle the load from vCenter Operations Enterprise.

Collector Is Down

**Complete Reason panel message:** Collector *collector ID* is down

**Caused By**
By default, each collector sends a heartbeat to the controller/web service every three seconds to indicate it is up and running. This alert indicates a heartbeat was not sent by one of the collectors for five minutes.

**Recommended Actions**
1. Make sure the collector service is running. If it is not running, check the collector and Java service wrapper log files located in the `vcenter-ops\user\log` directory. The file names are `collector.log` and `collector-wraper.log`.
2. To check if the network connection is available between the collector and the vCenter Operations Enterprise Server, try to Telnet from the collector to the vCenter Operations Enterprise server on port 80 or 443, whichever is configured for communication.

Controller Is Unable to Connect to MQ

**Caused By**
The controller cannot connect to MQ.

**Recommended Actions**
1. If this happens during installation, there might be a port conflict preventing the service from starting. You can check for the conflict in two ways:
   - Check the log file `vcenter-ops\user\log` directory\activemq-wraper\log for messages indicating a conflict.
   - Run the command `netstat -ano`. Look for the process ID using ports 1099 and 61616, which are used by ActiveMQ.
2. Check to see if the ActiveMQ service is running:
   - If it is, enter the command `jconsole ipaddress:1099` to see if the queues are up and running (sendQueue, receiveQueue, and dataQueue).
   - If it is not, check for the following problems:
- Enter the command `jconsole ipaddress:1099`. A sendQueue ConsumerCount attribute of greater than one indicates a problem, since it thinks it is talking to more than one web service. If this is the problem, restart the vCenter Operations Enterprise service.
- Check the `vcenter-ops\user\log\activemq\wrapper.log` file for a message indicating the database behind MQ is corrupted.
- Check the `vcenter-ops\user\log\activemq\wrapper.log` file for an out of memory error. You can fix this temporarily by increasing the memory allocation in `vcenter-ops\user\conf\activemq\wrapper.com` and restarting Active MQ.

**NOTE** The JConsole tool used in this procedure is part of the Java SDK, which is not included with vCenter Operations Enterprise.

## DataQueue is Filling Up

### Caused By

**NOTE** The JConsole tool used in this procedure is part of the Java SDK, which is not included with vCenter Operations Enterprise.

The size of the data queue sequentially reaches the predefined maximum value.

### Recommended Actions

1. Make sure the analytics service is running. If it is not, restart it. If it is, continue with step 2.
2. From the Admin menu, select Support. On the Status tab, look at the DT Calculation Info panel and make sure DT Calculation: On. This indicates the dynamic threshold processing engine is running. If it is, the queue could be filling up due to contention when the DT processing engine tries to read FSDB files. Reducing the number of DT threads to reduce the I/O load could correct this:

   Change the DTProcessingThreads parameter in the `vcenter-ops\user\conf\analytics\advanced.properties` file. The minimum setting for this parameter is 1.

3. If DT Calculation: Off, the dynamic threshold processing engine is not running. This could mean the drive system is not fast enough for the number of resources and metrics being processed. In this case:
   - Use the FSDBHomeChanger tool to create additional mount points for the FSDB so files are distributed on multiple file system.
   - Use the FSDBHomeChanger tool to move the FSDB home to a bigger and/or faster drive.
   - Reduce the number of resources and metrics being collected to reduce the demands on the drive.

## Describe Failed

### Caused By

Failed to write describe for one of the adapters. This can happen when you make changes to an adapter and try to update it; this event can be generated only if the vCenter Operations Enterprise Web resource already exists. If the first describe for an adapter fails, an error is written to the log file and a Describe failed email is sent.

### Recommended Actions

1. Verify the changes to the adapter and try the update again.
2. Roll back the changes, revert to the older version of the adapter and contact vCenter Operations Enterprise support, as described in “Technical Support and Education Resources” on page 8.
Failed to Repair Corrupted FSDB file(s)

Complete Reason panel message: Failed to repair corrupted FSDB file(s) for resource(s): resource ID list

Caused By
The FSDB repair option was enabled for the analytics process, but the FSDB check was unable to repair one or more corrupted FSDB files.

Recommended Actions
This indicates a significant problem with FSDB file for the resources listed in the alert. Metric data for these resources may not be recorded until problem is resolved. Contact vCenter Operations Enterprise support immediately, as described in “Technical Support and Education Resources” on page 8

File Queue Is Full

Complete Reason panel message: The File queue is full, replication MQ is no longer available. Data replication has been disabled.

Caused By
The number of data points in the replication file queue has reached its maximum. The hard drive is full because the replication service is not able to pull data out of the queue fast enough.

Recommended Actions
1 Increase the size of the disk drive where the MQ resides.
2 Increase the network bandwidth between the vCenter Operations Enterprise server and the replication server and/or the processing capacity of the replication server. Increasing replication server performance enables it to pull data from the queue faster, preventing the queue from filling the disk.

FSDB file(s) Corrupted for Resource(s)

Complete Reason panel message: FSDB file(s) corrupted for resource(s): resource ID list

Caused By
The analytics process had the FSDB check enabled, and it found one or more corrupted FSDB files. The FSDB repair option was disabled.

Recommended Actions
1 Use the FSDBCheck tool to repair the corrupted files.
2 Contact vCenter Operations Enterprise support, as described in “Technical Support and Education Resources” on page 8

FSDB Storage Drive Free Space Is Less Than 10%

Caused By
Free space in one of the FSDB drives is less than 10%

Recommended Actions
1 Add storage capacity to the existing drive system.
2 Use the FSDBHomeChanger tool to move the FSDB location to a drive system with more capacity.
3 Purge old metric data from vCenter Operations Enterprise. See “Deleting Old Data” on page 121.

The minimum metric data required for vCenter Operations Enterprise analytics is three times the length of your normal business cycle or data pattern. The business cycle may be weekly, monthly, quarterly, or yearly.
No DT Processors Connected

Caused By
The vCenter Operations Enterprise server has not received any data requests from the remote dynamic threshold calculation process (the Analytics Processor service) for at least the time period defined in the externalDTAlertGenerationTime settings in the vcenter-ops\user\conf\analytics\advanced.properties file.

Recommended Actions
1 Check to see if the AnalyticsProcessor service is running on the remote server where it is installed. If it is not, try to start it. Look at the log for the analytics process (in the vCenter Operations Analytics logs folder) for the cause of the problem. See “Logs Tab” on page 123.
2 If you know the server where the Analytics Processor service was running was brought down for maintenance or any other reason, or there is a network outage between the vCenter Operations Enterprise server and the remote server, you can change the configuration so dynamic thresholds are processed on the vCenter Operations Enterprise server.

One or More Resources Were Not Started ...

- Complete Reason panel message: One or more resources were not started because the maximum number of collecting resources/metrics was reached.
- Complete Reason panel message: One or more resources/metrics were not started/created because the maximum number of resources/metrics was reached.

This section describes two similar system alerts, each of which reflects a failure to start a resource or metric.

Caused By
One of the following has occurred:
- vCenter Operations Enterprise analytics has reached the maximum number of resources or metrics and didn't load caches for one or more resources. Those resources will be stopped automatically.
- The controller would not create a resource because it has reached the maximum number of resources or metrics in the database.

Recommended Action
1 If it was the analytics process that failed, remove recently added resources and restart analytics.
2 Make arrangements to upgrade vCenter Operations Enterprise to a more powerful server host. You can then increase the resource and metric limits based on the new server host.

Outbound Alert Send Failed

Complete Reason panel message: Outbound Alert Send Failed for alert plug-in name

Caused By
One of the alert handler plug-ins failed to send an outbound alert. This can happen with any handler: e-mail filter, SNMP trap, log file, or EMC Smarts console.

Recommended Actions
1 Check the alert handler configuration for possible errors.
2 Make sure the alert destination is available; for example, for alerts sent to a log file, make sure the disk is not full, for e-mail alerts, make sure the SMTP server is up.
Replication MQ Sender Is Blocked

Complete Reason panel message: Replication MQ sender is blocked, data replication has been disabled.

Caused By
The replication queue has reached its maximum size and cannot accept any more data from the vCenter Operations Enterprise server. This happens if the replication server cannot keep up due to either a lack of resources or a slow network connection.

Recommended Actions

1. Check for possible data bottlenecks:
   - The most likely cause is lack of network bandwidth between the vCenter Operations Enterprise server and the replication server. Increase your network capacity.
   - If the disk drive on the replication server is slow, replace it with one with faster I/O.
   - If replication server CPU is the limiting factor, replace it with a faster processor.

2. Decrease the amount of data being replicated by either decreasing the number of resources being monitored or increasing the monitoring interval between metric data collection samples.
This section describes backup, recovery, and emergency failover needs and procedures for both the vCenter Operations Enterprise software and data stored by vCenter Operations Enterprise.

Introduction

This section contains general guidelines for backup and recovery of the vCenter Operations Enterprise environment, including both data and processing components. It describes the key files and databases which should be backed up so that you can restore any particular data component if necessary, or restore all vCenter Operations Enterprise data from the point of backup if you install a new vCenter Operations Enterprise system. It also describes the various options for redundancy of the separate vCenter Operations Enterprise processing components.

At a minimum, include the vCenter Operations Enterprise data components in the standard backup procedures of your organization and that you perform a complete backup of vCenter Operations Enterprise data before upgrading the vCenter Operations Enterprise software.

The appropriate amount of component redundancy varies from organization to organization. You can configure vCenter Operations Enterprise to handle a variety of options, including high- availability clustering and remote failover.

vCenter Operations Enterprise Architecture

Before discussing procedures for backing up or replicating and, if necessary, restoring the vCenter Operations Enterprise data and software, here are brief descriptions of the various locations of vCenter Operations Enterprise files and data.

Data Components

vCenter Operations Enterprise stores data in three locations: the file system database, its relational database, and its system files.

File System Database (FSDB)

All metric values vCenter Operations Enterprise collects are stored in its FSDB. This allows vCenter Operations Enterprise's analytics software high access rates to the large amounts of data vCenter Operations Enterprise stores. The FSDB is located on the vCenter Operations Enterprise server, in either internal hard drives or a high-speed Storage Area Network (SAN) device.

vCenter Operations Enterprise does not support NAS or NFS file systems.

The default location for the FSDB is vcenter-ops\data, which is suitable for smaller environments. In larger environments, we recommend you place the FSDB in a different file system than the vCenter Operations Enterprise software. The FSDB can be stored in one path location or split into multiple locations.
Each resource has its own folder within the FSDB; the resource ID is the folder name. Each resource folder contains one data file for each month's data; each file contains all metric values for all metrics for that resource for that month.

While vCenter Operations Enterprise is collecting data, the current month's files in the FSDB are continually being updated.

**Relational Database (RDB)**

vCenter Operations Enterprise's RDB contains configuration and state information such as dynamic threshold results, anomalies, alerts, and data correlation results that are used by vCenter Operations Enterprise Analytics and the vCenter Operations Enterprise GUI. In most cases, we recommend you put the RDB on a dedicated database server which is separate from the vCenter Operations Enterprise server but in close network proximity to it: that is, in the same data center within the same firewall. In smaller environments, it may be suitable to host the RB on the vCenter Operations Enterprise server,

**vCenter Operations Enterprise System Files**

vCenter Operations Enterprise uses a number of system files for configuration, integration, and logging. These files are found within the vCenter Operations Enterprise software directory tree.

**Processing Components**

**vCenter Operations Enterprise Server**

The vCenter Operations Enterprise Server runs the services which make up the vCenter Operations Enterprise application: vcopsWebService, CollectorService, ActiveMQ and AnalyticsService. vCenter Operations Enterprise usually requires a dedicated server, as it is a high-performance and resource intensive application.

**vCenter Operations Enterprise Remote Collector**

An vCenter Operations Enterprise Remote Collector is a remote host with just the vCenter Operations Enterprise collector installed. You may want to install one or more remote collectors to navigate firewalls, reduce bandwidth across data centers, and reduce the load on the vCenter Operations Enterprise server. It is acceptable to install a remote collectors on a shared server.

**DT Processor**

As mentioned above, the vCenter Operations Enterprise Server includes a process that performs analytics calculations. You can distribute this load by slanting a separate analytics process on one or more remote hosts to perform just the dynamic threshold (DT) portion of analytics processing. It is acceptable to install the DT processor on a shared server.

**Database Server**

vCenter Operations Enterprise uses commercially available relational databases. For a list of supported database, see “System and Software Requirements” on page 12 or the Release Notes for your version of vCenter Operations Enterprise. The database server must be installed and available before you install vCenter Operations Enterprise.
Data Component Backup & Recovery

Backup Guidelines

The following sections give guidelines and suggestions for backing up your vCenter Operations Enterprise data.

File System Database (FSDB)

Back up all files in vCenter Operations Enterprise’s FSDB folder regularly. You define these folders during installation, and can find what they are by looking at the FSDB_HOME folder specification in the Configure VMware vCenter Operations Enterprise utility.

You can copy the FSDB at any time without stopping any vCenter Operations Enterprise services. The timing of the backup does not depend on any other file backup. Performing incremental backups can greatly reduce backup time and storage requirements, as only the most recent month's files are being updated at any given time.

Over time, the FSDB can grow to be very large, over 100 GB. An efficient way to make incremental backups is to take advantage of the FSDB Replication Sync capability, described below, which is provided to enable disaster recovery failover. This requires a separate vCenter Operations Enterprise server and FSDB data store which runs in a warm/passive mode.

NOTE: We recommend you contact vCenter Operations Enterprise support, as described in “Technical Support and Education Resources” on page 8, before changing any replication or synchronization settings.

FSDB Replication

Setting up FSDB replication requires two vCenter Operations Enterprise servers: one primary and one backup. Both servers must use the same version and build number of vCenter Operations Enterprise.

You can use the Configure VMware vCenter Operations Enterprise utility to switch the server configuration from primary to backup, or vice-versa. In a clustered environment, make sure that the cluster resources are offline before making any changes:

- On the primary vCenter Operations Enterprise server, on the Analytics page, check the Enable Replication box and set the host to the Backup vCenter Operations Enterprise server.
- On the backup vCenter Operations Enterprise server, on the Replication Server page, set the host to be the local server.

Note that whenever you save the configuration by clicking Finish, the vCenter Operations Enterprise services are reinstalled and restarted. If you do not make any changes, click Exit, not Finish, to close the utility.

In the vcenter-ops\user\conf\analytics\replication.properties file, you can set enabled=true to enable replication of FSDB content or enabled=false to disable it. Restart the Analytics service on the primary vCenter Operations Enterprise server if this flag is changed.

If a resource file is deleted on the primary vCenter Operations Enterprise server, it is also deleted on the replication server.

FSDB Synchronization

In the vcenter-ops\user\conf\analytics\replication.properties file, setting synchronize=true enables synchronization of FSDB content between the primary and backup vCenter Operations Enterprise server, while synchronize=false disables it. This property never becomes true automatically. Set this property to true only if there is missing or different data that needs to be updated on the backup vCenter Operations Enterprise server, for example, if you configure and start the backup server after vCenter Operations Enterprise has already been collecting data.

You must restart the analytics service on the primary vCenter Operations Enterprise server if you change the synchronize setting.
When synchronization is enabled, the task is sent to the replication server on the backup vCenter Operations Enterprise server. If the replication server is running, it returns a response to the primary analytics service, which then sends all missing and different data to the replication server.

After synchronization has completed, the analytics service will automatically set the synchronize flag back to false. Analytics will continue to send real-time incoming data to the backup server, but not data from the FSDB.

Relational Database (RDB)
There are no special requirements for backing up the vCenter Operations Enterprise database. Your organization’s database administrator can use standard corporate RDB procedures to back up the vCenter Operations Enterprise RDB on a regular basis.

vCenter Operations Enterprise System Files
Analytics Configuration
The vCenter Operations Enterprise analytics configuration folder, `vcenter-ops\user\conf\analytics`, contains files with parameters for the various analytic algorithms, including which algorithms are enabled. These files are rarely updated once vCenter Operations Enterprise is in production. Back up this directory after vCenter Operations Enterprise is installed and configured, and again if you make any configuration changes.

This folder and its files are copied to the `.vcenter-ops.save` folder during vCenter Operations Enterprise software upgrades.

Analytics Plug-in Configuration
The vCenter Operations Enterprise analytics plug-ins folder, `vcenter-ops\user\conf\plugins`, contains the various algorithms used by vCenter Operations Enterprise analytics, including those delivered with the software plus any future algorithms which may become available. It contains a subfolder for each Dynamic Threshold algorithm installed. Within each plug-in folder, there is a plug-in properties file containing parameters for the algorithms at the path:

`vcenter-ops\user\conf\plugins\plugin_name\conf\plugin_name.properties`

These files are typically updated very rarely once vCenter Operations Enterprise is in production. Back up the `vcenter-ops\user\conf\plugins` folder after vCenter Operations Enterprise is installed and configured, and again if you make any configuration changes.

Outbound Alert Plug-ins
The outbound alert plug-ins folder, `vcenter-ops\user\plugins\outbound`, contains various alert notification formats used by vCenter Operations Enterprise. These files are typically updated very rarely once vCenter Operations Enterprise is in production. Back up the folder after vCenter Operations Enterprise is installed and configured, and again if you make any changes to notification configuration.

These files are overwritten during vCenter Operations Enterprise software upgrades.

vCenter Operations Enterprise Collector Adapters
The vCenter Operations Enterprise collector adapters folder, `vcenter-ops\collector`, contains all currently installed and configured collector adapters, and their configurations. These files and folders are updated whenever adapters are added and removed from the system. You should back up this folder, on the vCenter Operations Enterprise server and any remote server, after installation and after installing any new adapters.

These files and folders are not overwritten during vCenter Operations Enterprise software upgrades, unless there is a code change to any adapter.
**vCenter Operations Enterprise Collector Configuration**

The vCenter Operations Enterprise collector config folder, `vcenter-ops\user\config\collector`, contains files with parameters for the CollectorService and the trap listener. These files are rarely updated once vCenter Operations Enterprise is in production. You should back up this folder, on the vCenter Operations Enterprise server and any remote server, after installation and after installing any new adapters.

This folder and its files are copied to the `.vcenter-ops.save` folder during vCenter Operations Enterprise software upgrades.

**vCenter Operations Enterprise Installation Variables**

The install variables file, `vcenter-ops\uninstall_vcops\installvariables.properties`, contains key data from the initial install which is reused for upgrades and vCenter Operations adapter. This file is rarely updated once vCenter Operations Enterprise is in production. You should back up this file after installation.

This file is overwritten during vCenter Operations Enterprise software upgrades.

**ActiveMQ Logging Properties**

The ActiveMQ logging properties file, `vcenter-ops\activemq\conf\log4j.properties`, contains various log4j parameters for ActiveMQ logging. This file is rarely updated once vCenter Operations Enterprise is in production. You should back up this file after installation.

This file is overwritten during vCenter Operations Enterprise software upgrades.

**vCenter Operations Enterprise Logs**

vCenter Operations Enterprise's logs files are in the `vcenter-ops\user\logs` folder. The logs found here include:

- vCenter Operations Analytics Logs (optional) – Log files for the AnalyticsService. The level of logging is user configurable through the vCenter Operations Enterprise user interface, as described in “Logs Tab” on page 123. However, if logging is set to DEBUG, the log files will quickly grow very large. Leave logging at the ERROR level unless directed otherwise by vCenter Operations Enterprise Support.

- vCenter Operations Collector Logs (optional) – Log files for the CollectorService.

Both types of log files are rolled over on a daily basis. By default vCenter Operations Enterprise is configured to keep up to seven daily log files of each type, but you can adjust this limit. If you want to be sure to have a copy of these files, you can back up this folder regularly on both the vCenter Operations Enterprise server and any remote servers.

You can copy the log files at any time without stopping any vCenter Operations Enterprise services. However, to restore these log files, you must stop the vCenter Operations Enterprise services.

**Recovery Guidelines**

None of the data components depends on the others—they do not need to be absolutely in sync relative to backup and recovery times. It is most important to keep the RDB and the vCenter Operations Enterprise system files as up to date as possible, as they contain the configuration of the vCenter Operations Enterprise system, integration adapters, and monitored environment.

If you need to recover the FSDB or vCenter Operations Enterprise system files, simply copy and paste the backup files back to their live locations, as described earlier.

Some files, particularly log files, are locked by vCenter Operations Enterprise processes and cannot be restored until the associated process is stopped. vCenter Operations Enterprise processes include vcopsWebService, AnalyticsService, ActiveMQ and CollectorService.

If you need to restore the RDB, follow the guidelines provided by your database administrator.

After restoring all files, restart the vCenter Operations Enterprise processes: vcopsWebService, AnalyticsService, ActiveMQ and CollectorService.
Processing Component Backup & Recovery

vCenter Operations Enterprise Server

The vCenter Operations Enterprise Server, and by extension the FSDB data store, is being used by many organizations as a mission critical application. As such, you can configure vCenter Operations Enterprise to be implemented on a set of clustered servers for high availability, and/or on a set of remote servers for disaster recovery or failover purposes. Both of these configurations are outlined below.

vCenter Operations Enterprise Server - High Availability

High availability capability is implemented through shared disks and clustering software. When one server goes down, the cluster software manages the switch to the backup server.

Requirements

- Shared disk (that is, SAN) to install the vCenter Operations Enterprise software and vCenter Operations Enterprise FSDB.
- Two separate servers on which to deploy vCenter Operations Enterprise services and environment variables.
- Cluster software on both servers to manage vCenter Operations Enterprise services.
- A virtual IP address representing the cluster, to be used by both end users and remote collectors pointing to the vCenter Operations Enterprise server.

See your specific clustering documentation for more information on installation and configuration of a clustered environment.

Expected Behavior

When a server hosting vCenter Operations Enterprise goes down, the clustering software should map the shared disk and vCenter Operations Enterprise services to the backup server and bring them online.

vCenter Operations Enterprise Impacts

If an vCenter Operations Enterprise server goes down and is remapped as described above, the impact on vCenter Operations Enterprise will be:

- Any users logged into vCenter Operations Enterprise will be logged out.
- The vCenter Operations Enterprise system will be unavailable for about 15 seconds.
- There will be no impact on the FSDB, because it is installed on the shared disk.
- There will be no impact on the RDB, because it is installed on a different server than the vCenter Operations Enterprise software, and is accessible from both servers.

vCenter Operations Enterprise Server - Disaster Recovery

vCenter Operations Enterprise has built-in abilities to enable a quick transition to a completely separate backup vCenter Operations Enterprise server or cluster should the primary server/cluster be unavailable. This separate backup server is typically located in a different location than the primary system for disaster/recovery purposes.

The remote backup server/cluster contains an vCenter Operations Enterprise instance serving as a backup replication server. It keeps a warm, updated copy of the FSDB. When the primary server or cluster goes down, you can manually switch the vCenter Operations Enterprise software to use what had been the backup server/cluster as the primary server/cluster.
Requirements

- A separate remote vCenter Operations Enterprise instance configured as a backup server.
- An vCenter Operations Enterprise FSDB replication server enabled, with the replication service started. Once the remote FSDB is synchronized with the local FSDB, the data should be virtually identical.
- vCenter Operations Enterprise database synchronized via appropriate vendor software.
- Key vCenter Operations Enterprise files copied manually or via scheduled batch file. See the section “vCenter Operations Enterprise System Files” on page 138 for additional details on the vCenter Operations Enterprise files needed on the backup server.

Expected Behavior

When a server or cluster hosting vCenter Operations Enterprise goes down, the following should occur:

- The vCenter Operations Enterprise database should failover to the backup database via appropriate vendor software.
- On the backup server, from the Windows Start, All Programs menu, select VMware, vCenter Operations Enterprise, Configure VMware vCenter Operations. On the Full Configuration screen, change the Server Configuration setting from Backup to Primary. This converts the vCenter Operations Enterprise system on the backup server to serve as the new primary server.
- You should update the server IP, or the virtual IP representing the cluster, to the correct IP for the new primary server/cluster. The new IP must be used by both end users and remote collectors pointing to the vCenter Operations Enterprise server.

**IMPORTANT** If you need to switch a vCenter Operations Enterprise replication server to the primary server, contact vCenter Operations Enterprise support, as described in “Technical Support and Education Resources” on page 8. You may need to make changes in addition to those described here.

vCenter Operations Enterprise Impacts

If the primary vCenter Operations Enterprise server goes down and must be remapped to the backup server, the impact on vCenter Operations Enterprise will be:

- Any users logged into vCenter Operations Enterprise will be logged out.
- The vCenter Operations Enterprise system will be unavailable until the backup server is configured to be the primary server and all services are turned back on. The typical critical path timing item will be the restoration of the RDB.
- All alerts in the vCenter Operations Enterprise system at the time of the most recent RDB backup will be active. However, vCenter Operations Enterprise analytics should reset all alerts to the appropriate state after fifteen minutes.

vCenter Operations Enterprise Database Server

If the vCenter Operations Enterprise RDB is unavailable, the vCenter Operations Enterprise system will be down. As with the vCenter Operations Enterprise Server, if you require high availability or remote failover capability, you should configure the RDB server to use clustering and/or a remote warm backup.

Instances configured against a single database will be unavailable if that database goes down. In this scenario, a high availability strategy with a clustered database environment enables the cluster to immediately switch the shared disks and the vCenter Operations Enterprise instance to the backup server if one database goes down.
vCenter Operations Enterprise Remote Collector

vCenter Operations Enterprise remote collectors are simply servers which are running the CollectorService and passing data through to the primary vCenter Operations Enterprise server. The remote collectors do not store any data. If a remote collector server goes down, the primary vCenter Operations Enterprise server will not receive data from that portion of the monitored environment configured for that particular remote collector.

While a remote collector could be installed on a cluster, typical implementations simply have a separate remote collector instance installed on another server. This backup remote collector should have the exact same vCenter Operations Enterprise collector adapters folder and same vCenter Operations Enterprise collector configuration folder as the primary remote collector. If the primary remote collector goes down, the backup remote collector is simply brought on line. The collector adapters folder and collector configuration folder are described in “vCenter Operations Enterprise System Files” on page 138.

vCenter Operations Enterprise Remote DT Processor

An vCenter Operations Enterprise remote processor running the DT processor simply performs analytics calculations related to dynamic threshold processing. It does not store any data. Should a remote processor server go down, vCenter Operations Enterprise will continue to collect and store data, but dynamic thresholds will not be recalculated based on the new data.

There is no need to have a backup of a remote processor. If the remote processor becomes unavailable, you have two choices:

- On the vCenter Operations Enterprise server host, in the file vcenter-ops\user\conf\analytics\advanced.properties. Find the property distributedDTCalculationEnabled and set it to false. This causes the analytics process on the vCenter Operations Enterprise server to perform the dynamic threshold calculations.

- Install the remote DT analytics process on a different remote host. See “Installing the Analytics Processor (Optional)” on page 32.
This section gives descriptions and instructions on using each of the system tools shipped with vCenter Operations Enterprise.

List of Tools

The system tools installed with vCenter Operations Enterprise include:

- **FSDBCheck** – Checks for and, if possible, repairs, problems in the vCenter Operations Enterprise’s file system data base (FSDB), such as data corruption due to power failure.
- **FSDBHomeChanger** – Allows you to move vCenter Operations Enterprise’s FSDB to a new location; in addition to moving the FSDB, it updates all properties associated with its location.
- **FSDBJDBCDriver** – Is a driver for accessing metrics from FSDB using a standard JDBC driver.
- **FSDBReader** – Takes a data file which stores metric information for a resource in binary format and generates individual human-readable output files containing the data for each metric.
- **FSDBCleaner** – Removes all vCenter Operations Enterprise-generated metrics from the FSDB.
- **Run-jconsole** – Starts the Java JConsole tool to open the Java application console, which can be used to troubleshoot certain vCenter Operations Enterprise performance issues. To use Run-jconsole, you must have the Java SDK, which includes JConsole, installed. JConsole is not shipped with vCenter Operations Enterprise.
- **HeartbeatSender** – Uses a heartbeat to check communication between vCenter Operations Enterprise server and collector. Usually used to verify remote collector, but can also be used with local collector. This tool is installed in \vcenter-ops\collector\bin folder.
- **Reporting Repository Adapter** – Copies a defined subset of data from the vCenter Operations Enterprise FSDB to another database, where it can be used for reporting purposes.
- **runvcopsServerConfiguration** – Estimates how many resources a server can support based on the server CPU, memory, disk space, and file I/O specifications.

The rest of this section consists of brief instructions for using each tool, except for the FSDBJDBC Driver, which is described in Chapter 12, and the EMC Smarts integration tools, which are described in the vCenter Operations Enterprise/EMC Smarts Integration Guide.

**NOTE** Each tool is provided as both a .bat file for Windows and a *.sh file for Linux.
FSDBCheck

The FSDBCheck tool checks for, and, if possible, repairs, problems in the vCenter Operations Enterprise's file system database (FSDB), such as data corruption due to power failure. It stores a corrected copy of the entire FSDB in the designated output directory. After running FSDBCheck, you should switch vCenter Operations Enterprise to use this copy of the FSDB, as described in the procedure below.

To use FSDBCheck

1. Stop the AnalyticsService service. See “Starting and Stopping vCenter Operations Enterprise Services” on page 126.
2. Execute the file vcenter-ops\tools\FSDBCheck\fsdbcheck.bat or vcenter-ops/tools/FSDBCheck/fsdbcheck.sh. The format of the command is:

   path_fsdbcheck fsdb_dir [-out fsdb_outdir] [-t count]

   where:
   - path_fsdbcheck is the path to the fsdbcheck.bat (on Windows) or fsdbcheck.sh (on Linux) file.
   - fsdb_dir is the path to the FSDB home directory to check.
   - fsdb_outdir is the path to the output directory for the checked files. It will be created if it does not exist. If you do not include -out, the output directory is vcenter-ops\data_backup_yyyy_mm_dd_HH_mm_ss.
   - count is the number of threads to use for the command, from 1 to 100. The default thread count is 1. For best load balancing, we recommend setting it to the number of cores in the server where you are running the command.
   - -out and -t are optional.
3. The final lines of the output will say whether any files were fixed. If any files were changed, you have two choices:
   - To switch vCenter Operations Enterprise to use the new copy of the FSDB, use FSDBHomeChanger. Use the FSDBCheck output directory as the new home directory. Do not include the -o option, as you do not want to overwrite the files in the new directory. See “FSDBHomeChanger” on page 144.
   - To continue using the current FSDB home directory, use Windows Explorer to copy the files from the FSDBCheck output directory back to the home directory, overwriting the files there.
4. Restart the AnalyticsService service. See “Starting and Stopping vCenter Operations Enterprise Services” on page 126.

FSDBHomeChanger

The FSDBHomeChanger tool copies all of the files in vCenter Operations Enterprise’s FSDB to a new location and updates all the vCenter Operations Enterprise properties associated with the FSDB location to use the new location. You can use FSDBHomeChanger to move the FSDB to a new disk drive or file system. You also need to use it after running FSDBCheck to correct any problems in the database.
To use FSDBHomeChanger

1. Stop the AnalyticsService service if it is running. See “Starting and Stopping vCenter Operations Enterprise Services” on page 126.

2. Execute the file `vcenter-ops\tools\FSDBHomeChanger\fsdbhomechanger.bat` or `vcenter-ops/tools/FSDBHomeChanger/fsdbhomechanger.sh`. The format of the command is:
   
   ```
   path_fsdbhomechanger fsdb_indir -out fsdb_outdir [-o] [-s]
   ```

   where:
   - `path_fsdbhomechanger` is the path to the `fsdbhomechanger.bat` (on Windows) or `fsdbcheck.sh` (on Linux) file.
   - `fsdb_indir` is the path to the source FSDB home directory.
   - `fsdb_outdir` is the path to the output directory for the copied files. It will be created if it does not exist.
   - `-o` causes FSDBHomeChanger to overwrite files if they already exist in the output directory. By default existing files are not overwritten.
   - `-s` puts all data for each resource in a single file, instead of having separate files for each month's data for each resource. Using `-s` reduces I/O operations, but slows the calculation of dynamic thresholds.

3. Restart the AnalyticsService service. See “Starting and Stopping vCenter Operations Enterprise Services” on page 126.

Using FSDBHomeChanger After FSDBCheck

The FSDBCheck command checks every file in the FSDB for file corruption and corrects any problems it finds. It places a copy of the FSDB in a new directory. If it corrects any files, you may want to change the FSDB home directory to the FSDBCheck output directory so it uses the corrected files. To do so, enter the command below (the sample command assumes you are using a Windows server and have changed to the directory where `fsdbhomechanger.bat` is located):

```
FSDBHomeChanger homedir -out FSDBCheck_output_dir
```

where `homedir` is the currently defined FSDB home directory and `FSDBCheck_output_dir` is the output directory from the FSDBCheck command. Note that you should not include the `-o` option in this case, as you do not want to overwrite the corrected files in the new location. See “FSDBCheck” on page 144.

FSDBReader

The FSDBReader tools takes a data file which stores metric information for a resource in binary format and generates individual human-readable output files containing the data for each metric.

To use FSDBReader

1. On Windows, execute the file `vcenter-ops\tools\FSDBReader\fsdbreader.bat`.
   
   On Linux, execute the file `vcenter-ops/tools/FSDBReader/fsdbreader.sh`.

2. To point the tool to your FSDB, from the File menu, select FSDB Root.

3. Click Add, then browse to your FSDB root directory and click Open.

4. If you have multiple FSDB root directories, you can repeat step 3 for each one.
The tool reads data from your FSDB. The picture below shows sample data for resource 1 and metric 1.

<table>
<thead>
<tr>
<th>Res: 1</th>
<th>Attr: 1</th>
<th>Resources</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Res: 2</td>
<td>Attr: 2</td>
<td>Attributes</td>
<td>21</td>
</tr>
<tr>
<td>Res: 3</td>
<td>Attr: 3</td>
<td>Resource Id</td>
<td>1</td>
</tr>
<tr>
<td>Res: 4</td>
<td>Attr: 4</td>
<td>Attribute Id</td>
<td>1</td>
</tr>
<tr>
<td>Res: 5</td>
<td>Attr: 5</td>
<td>Data points</td>
<td>1429</td>
</tr>
<tr>
<td>Res: 8</td>
<td>Attr: 8</td>
<td>Min Value</td>
<td>0.0</td>
</tr>
<tr>
<td>Res: 9</td>
<td>Attr: 9</td>
<td>Max Value</td>
<td>0.0</td>
</tr>
<tr>
<td>Res: 10</td>
<td>Attr: 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Res: 11</td>
<td>Attr: 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Res: 12</td>
<td>Attr: 12</td>
<td></td>
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<tr>
<td>Res: 13</td>
<td>Attr: 13</td>
<td></td>
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<tr>
<td>Res: 14</td>
<td>Attr: 14</td>
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<tr>
<td>Res: 15</td>
<td>Attr: 15</td>
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<tr>
<td>Res: 16</td>
<td>Attr: 16</td>
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<td>Res: 17</td>
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<td>Res: 18</td>
<td>Attr: 18</td>
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<td>Res: 19</td>
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<td>Res: 20</td>
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<td>Res: 21</td>
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<td>Res: 22</td>
<td>Attr: 22</td>
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<td>Res: 23</td>
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<tr>
<td>Res: 24</td>
<td>Attr: 24</td>
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<tr>
<td>Res: 25</td>
<td>Attr: 25</td>
<td></td>
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</tr>
<tr>
<td>Res: 26</td>
<td>Attr: 26</td>
<td></td>
<td></td>
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<tr>
<td>Res: 27</td>
<td>Attr: 27</td>
<td></td>
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<tr>
<td>Res: 28</td>
<td>Attr: 28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Res: 29</td>
<td>Attr: 29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Res: 30</td>
<td>Attr: 30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The FSDBReader dialog box displays the following information:

- The left column lists all the resources in the FSDB. These IDs are those shown in the ID column of vCenter Operations Enterprise's Environment Overview page. (The Environment Overview ID column is hidden by default.)
- The second column lists the metrics for the selected resource.
- The top-right pane shows information about the FSDB and the selected resource and attribute:
  - The total number of resources in the FSDB
  - The number of attributes for the selected resource
  - The currently selected resource and attribute
  - The number of values (data points) collected for the selected metric, when the first and last values were collected, and its maximum and minimum values.
- The bottom-right pane lists each value collected for this attribute.
FSDBCleaner

The FSDBCleaner tool removes all vCenter Operations Enterprise-generated metrics from the FSDB. When you run it, it renames the FSDB root directory, then writes all metric values except the vCenter Operations Enterprise-generated metrics back to a recreated FSDB root directory.

FSDBCleaner is generally used only during an Historical Proof of Concept (HPOC) for vCenter Operations Enterprise. In an HPOC, historical data is stored in the vCenter Operations Enterprise database, and the product analyzes the data to show what alerts and anomalies would have been generated if the data had been collected in real time. You can use FSDBCleaner during an HPOC to remove the system-generated metrics so you can change configuration parameters and re-run the analysis to show how it changes the results.

There is usually no reason to use FSDBCleaner during normal vCenter Operations Enterprise operation.

To use FSDBCleaner

1. On Windows, execute the file \vcenter-ops\tools\FSDBCleaner\fsdbcleaner.bat.
   On Linux, execute the file \vcenter-ops\tools\FSDBCleaner/fsdbcleaner.sh.

   The format of the command is:

   ```
   path_fsdbcleaner [-in <fsdb_dir_in>] [-t <thread_count>]
   ```

   where:

   - `path_fsdbcleaner` is the path to the `fsdbcleaner.bat` (on Windows) or `fsdbcleaner.sh` (on Linux) file.
   - `fsdb_dir_in` specifies the path to the FSDB home directory. If you have more than one FSDB home directory, you can enter multiple paths, separated by semi-colons. If you do not include `-in`, FSDBCleaner uses the path(s) defined in vCenter Operations Enterprise configuration and stored in the analytics.properties file.
   - `thread_count` specifies the number of threads the tool should spawn to perform the cleaning. If you do not include `-t`, FSDBCleaner will use one thread for each CPU on the vCenter Operations Enterprise server.

   Both `-in` and `-t` are optional.

   After you enter the command, FSDBCleaner does the following:

   - Renames each specified FSDB root directory to `<fsdb_dir_in>_cleanerbackup_yyyy_MM_dd_HH_mm_ss`.
   - Recreates each FSDB root directory.
   - Creates the specified number of threads to process the data.
   - Retrieves all metrics from the renamed FSDB home directory and saves the filtered metrics to `<fsdb_dir_in>_cleanerbackup_yyyy_MM_dd_HH_mm_ss` directory.
   - Logs its activity in a log file created in \vcenter-ops\tools\FSDBCleaner\logs.

Run-jconsole

The run-jconsole tool starts the Java JConsole tool to open the Java application console, which can be used to troubleshoot certain vCenter Operations Enterprise performance issues. To use run-jconsole, you must have the Java SDK, which includes JConsole, installed. JConsole is not shipped with vCenter Operations Enterprise.
To use Run-jconsole

1. On Windows, execute the file \vcenter-ops\tools\run-jconsole.bat. On Linux, execute the file \vcenter-ops\tools\run-jconsole.sh.

2. The file will ask you to enter the name of the service you want to monitor. Enter all, web, analytics, collector, or mq.

This opens JConsole. Below is a sample display showing the Web service:

![Sample Display of JConsole](image)


HeartbeatSender

Uses a heartbeat to check communication between vCenter Operations Enterprise server and collector. Usually used to verify remote collector, but can also be used with local collector. This tool is installed in the \vcenter-ops\collector\bin folder.

To use HeartbeatSender

1. Open a DOS command window.
2. Change to the \vcenter-ops\collector\bin folder.
3. Type HeartbeatSender.bat.

The command gives the URL of the collector it is sending the heartbeat to, then the result of the test, as shown here.

Sending Heartbeat request to the URL http://10.118.48.125:80/heartbeatservlet?Controller successfully responded to test heartbeat
Reporting Repository Adapter

The Reporting Repository Adapter populates a database with a subset of data from the vCenter Operations Enterprise FSDB, automatically, based on a schedule you set. This data can then be used to generate reports without affecting the performance of vCenter Operations Enterprise or requiring additional data collection from the targeted data source(s). The destination can be either a relational database or a comma-separated text file.

During vCenter Operations Enterprise installation, the Reporting Repository Adapter is installed in the vcenter-ops\tools\RepositoryAdapter folder.

Configuring the Report Repository Adapter

Before you can use the Reporting Repository Adapter, you must configure it. There are several types of information to configure:

- Connection information for the source vCenter Operations Enterprise database and the output database.
- The schedule for the tool to run on.
- The columns of the output database to put the exported data into.
- Operation options
- The resources and metrics to export values for

This configuration information is set in two files in the vcenter-ops\tools\RepositoryAdapter folder: conf.properties and conditions.properties. conditions.properties defines the resources and metrics to export values for from vCenter Operations Enterprise; all other settings are in conf.properties.

Configuring the Source and Destination Columns

The source and destination columns are defined in the insertCommand statement at the beginning of the conf.properties file. There are two sets of values in parentheses in this statement. The first set defines the columns in the output database, the second (after values in the statement) defines the columns being output from the vCenter Operations Enterprise database and the vCenter Operations Enterprise FSDB.

Here is the statement from the default file:

```
insertCommand=INSERT INTO TestTable (RID1; RNAME1; MID1; MNAME1; RKNAME1; MKNAME1; AKNAME1; timestamp1; min_threshold1; value1; max_threshold1) values(alive.RID; alive.RNAME; alive.MID; alive.MNAME; alive.RKNAME; alive.MKNAME; alive.AKNAME; fsdb.timestamp; fsdb.min_threshold; fsdb.value; fsdb.max_threshold)
```

This exports the alive.RID field from the vCenter Operations Enterprise database into the RID1 column of the output database, alive.RNAME into the RNAME1 column, and so on. Source field names that start with alive come from the vCenter Operations Enterprise database. Fields that start with fsdb come from the FSDB. The fields are:

<table>
<thead>
<tr>
<th>Field</th>
<th>Contents</th>
<th>Field</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>alive.RID</td>
<td>Resource ID</td>
<td>alive.AKNAME</td>
<td>Adapter kind name</td>
</tr>
<tr>
<td>alive.RNAME</td>
<td>Resource name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>alive.MID</td>
<td>Metric ID</td>
<td></td>
<td></td>
</tr>
<tr>
<td>alive.MNAME</td>
<td>Metric name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>alive.RKNAME</td>
<td>Resource kind name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>alive.MKNAME</td>
<td>Metric kind name</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Change **TestTable** to the correct name for your output table. You can change the names of the columns in the output database as necessary for your environment. The sample file includes all the possible source fields. You can change the order of the source fields or remove fields if you do not want all of the data, but you cannot add source fields. If you make any change to the source fields, be sure to change the output column list to match.

**Configuring the Database Connections**

The Repository Adapter requires connections to the vCenter Operations Enterprise relational database, the FSDB, and the output database. This information is in the conf.properties file.

The relational database is defined by properties starting with **sourcedb**. For a SQL Server database, you must set the database driver name, URL, database name, and the user name and password to use to connect to the database. Here is an example:

```java
#source DB
sourcedbDriver=com.microsoft.sqlserver.jdbc.SQLServerDriver
sourcedbUrl=jdbc\:sqlserver\:\:\192.168.1.130\:1433
sourcedbName=sa
sourcedbUserName=testSourceDB
sourcedbPassword=111
```

If the source database is an Oracle database, you must change the **sourcedbDriver** setting, and do not include a database name. Here is the format for an Oracle definition:

```java
#source DB properties for Oracle
sourcedbDriver=oracle.jdbc.driver.OracleDriver
sourcedbUrl= jdbc:oracle:thin:@<server>:<port>:orcl
sourcedbName =
sourcedbUserName = username
sourcedbPassword = password
```

The FSDB is defined by two statements starting with **sourcefsdb**. You should not need to change the driver name. Change the URL to be correct for your vCenter Operations Enterprise installation. Here is a sample:

```java
#source FSDB
sourcefsdbDriver=com.integrien.fsdbjdbcdriver.FSDBJDBCDriver
sourcefsdbUrl=rmi:\:\192.168.1.130\:1199\:DBMS
```

The output database may be either a relational database or a comma-separated text (CSV) file. You need to define only one of these destinations. Which one is used is determined by the exportToCsv setting. If it is true, the CSV definition is used. If it is false, the destdb parameters are used.

To output to a database, you must set **exportToCsv** = false and define the database driver, URL, name, and the user name and password to use to connect. Here is a sample definition for a SQL Server database:

```java
#destination DB
destdbDriver=com.microsoft.sqlserver.jdbc.SQLServerDriver
destdbUrl=jdbc\:sqlserver\:\:\192.168.1.130\:1433
destdbName=sa
destdbUserName=testDestDB
destdbPassword=111
```

As with the source database, if the output database uses Oracle, do not include a database name, and change the **destdbDriver** to the correct driver for Oracle. Here is the format to use:

```java
#destination DB properties for Oracle
destdbDriver=oracle.jdbc.driver.OracleDriver
destdbUrl= jdbc:oracle:thin:@<server>:<port>:orcl
destdbName =
destdbUserName = username
destdbPassword = password
```

To output to a CSV file, you must set **exportToCsv** = true and define the path to the CSV file and the delimiter to use between fields. The delimiter is usually a comma, but does not have to be. For example:

```java
exportToCsv = true
csvFilePath = C:\csv.csv
csvDelimiter = ,
```
If the output file does not exist, the Repository Adapter will create it.

**NOTE** When entering the user names and passwords for the database connections, enter them in plain text, and make sure the encrypted parameter is set to false. When the Repository Adapter runs, it will encrypt the values and set encrypted=true. If you need to change the values, enter them in plain text and set encrypted=false.

### Setting the Schedule

You can set the Repository Adapter to run either at a particular time each day or on a defined interval by modifying the scheduleTime parameter: in conf.properties

- If scheduleTime is set to a positive number, it runs once per day, at the defined hour (24 equals midnight, 1 equals 1:00 AM, and so on). For example, scheduleTime=23 runs at 11:00 PM each day.
- If scheduleTime is set to a negative number, it runs every x hours, where x is the value of scheduleTime. For example, scheduleTime=−1 runs once per hour.

### Setting Operation Options

There are three operation options set in conf.properties:

- Whether the data retrieval should be incremental. If incremental is set to true, each run of the adapter retrieves only values collected by vCenter Operations Enterprise since the last time the adapter ran. If incremental is false, each run retrieves information based on the maxDays setting.
- The maximum number of days to retrieve information for. The maxDays setting is used only if incremental is set to false. In that case, the adapter retrieves values for the number of days set by maxDays. The default value, maxDays=365, retrieves data for the past year.
- How many times to try to reconnect if the program cannot connect to the database or loses its connection, and how long to wait between retries. The number of retries is set by retryConnectCount. The interval, in milliseconds, is set by delayBetweenRetries.

### Configuring the Resources and Metrics to Export

The resources and metrics to export values for are defined in the conditions.properties file. This file contains one or more statements. Each statement consists of the name of one of the output columns in the destination database, as defined in the insertCommand statement in conf.properties, and one or more values, separated by semi-colons. You can define either the values to include, using an equals sign (=), or the values to exclude, using a not equals operator (=<>). The formats are:

```
Column=value1:value2; etc.
Column=<value1:value2; etc.
```

If a line uses the equals sign, a value is exported only if its value for the corresponding field in the vCenter Operations Enterprise database matches one of the listed values. If a line uses the not equals operator, a value is exported only if its value for the corresponding field in the vCenter Operations Enterprise database does not match any of the listed values.

If the values are strings, you must enclose them in single quotes. If the values are numeric (for example, resource or attribute IDs) do not. For strings, you can include the * wildcard character. It will match any number of characters, including zero. It can be at either the beginning or end of the string.

Each value must match all conditions which apply to it. If you define conditions for both resources to export and metrics to export, only those metrics for those resources will be included. Other metrics for the defined resources will not be, and value for the defined metrics for other resources will not be.

For example, assume the resource name field is mapped to the RNAME1 output column, the metric name is mapped to MKNAME, and conditions.properties contains these statements:

```
RKNNAME=Collector:'Web':'Analytics';'Business**
MKNAME=<>'health':'avail**
```
Data will be exported only for resources named Collector, Web, or Analytics, or with a name starting with Business. Data will not be exported for the health metric, or for any metric starting with avail.

Do not create a statement for any column you do not want to filter by. If a column does not appear in condition.properties, the Repository Adapter will not consider it when determining the values to export.

**Sampleconf.properties File**

Here is a sample conf.properties file.

```properties
insertCommand=INSERT INTO TestTable (RID1; RNAME1; MID1; MNAME1; RKNAME1; MKNAME1; AKNAME1; timestamp1; min_threshold1; value1; max_threshold1) values(alive.RID; alive.RNAME; alive.MID; alive.MNAME; alive.RKNAME; alive.MKNAME; alive.AKNAME; fsdb.timestamp; fsdb.min_threshold; fsdb.value; fsdb.max_threshold)
# time to run.
scheduleTime=24
# source DB
sourcedbDriver=com.microsoft.sqlserver.jdbc.SQLServerDriver
sourcedbUrl=jdbc:sqlserver://192.168.1.130:1433
sourcedbName=sa
sourcedbUserName=testSourceDB
sourcedbPassword=111
# source FSDB
sourcefsdbDriver=com.integrien.fsdbjdbcdriver.FSDBJDBCDriver
sourcefsdbUrl=rmi://192.168.1.130:1199/DBMS
# destination DB
destdbDriver=com.microsoft.sqlserver.jdbc.SQLServerDriver
destdbUrl=jdbc:sqlserver://192.168.1.120:1433
destdbName=sa
destdbUserName=testDestDB
destdbPassword=111
encrypted=false
# incremental = false means full for maxDays days
incremental = false
maxDays = 365
retryConnectCount = 5
# milliseconds
delayBetweenRetries = 10000
exportToCsv = true
csvFilePath = C:/csv.csv
csvDelimiter = ,
```

**Running the Reporting Repository Adapter**

Once you have completed configuration, to run the adapter, simply execute its file:

- On Windows, `vcenter-ops\tools\RepositoryAdapter\run.bat`
- On Linux, `vcenter-ops/tools/RepositoryAdapter/run.sh`

Once you have started the adapter, it will repeat at the interval set in conf.properties.

**runvcopsServerConfiguration**

The runvcopsServerConfiguration tool estimates how many resources a given host can support data collection for. You specify the vCenter Operations Enterprise configuration: number of containers, metrics per resource, how often values are collected, and so on. The tool takes your entries and the current host's available CPU, memory, disk space, and file I/O and calculates the number of resources the host can support with acceptable performance.

**runvcopsServerConfiguration Configuration Files**

Before using runvcopsServerConfiguration, you must set parameter values in its two configuration files, `vcops_parameters.properties` and `vcops_server_configuration.properties`. Both files are found in the `vcenter-ops\tools\vcopsServerConfiguration\vcops_server_configuration\conf` folder.
The `vcops_parameters.properties` File
runvcopsServerConfiguration uses the parameters in the `vcops_parameters.properties` file to estimate the maximum number of resources the server host can support. Set each parameter to the correct value, or the best estimate of the correct value, for the server host.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUMBER_INBOUND_ADAPTERS_ON_ALIVE_SERVER</td>
<td>The number of inbound adapters vCenter Operations Enterprise will use.</td>
</tr>
<tr>
<td>NUMBER_CONTAINERS</td>
<td>The estimated number of container resources that will be configured.</td>
</tr>
<tr>
<td>NUMBER_RESOURCES</td>
<td>The number of resources for the tool to use as a starting point for the estimation. Set this number to approximately twice the maximum number of resources you estimate this installation needs to support.</td>
</tr>
<tr>
<td>NUMBER_METRICS_PER_RESOURCE</td>
<td>The average number of metrics to track for each resource.</td>
</tr>
<tr>
<td>NUMBER_APPLIED_SUPERMETRICS_PER_CONTAINER</td>
<td>The average number of super metrics for each container resource.</td>
</tr>
<tr>
<td>MINUTE_COLLECTION_PERIOD</td>
<td>How often metric values will be collected, in minutes.</td>
</tr>
<tr>
<td>DAYS_DATA_RETENTION</td>
<td>The number of days metric data will be retained.</td>
</tr>
<tr>
<td>CONCURRENT_USERS</td>
<td>The estimated average number of concurrent vCenter Operations Enterprise users.</td>
</tr>
<tr>
<td>REMOTE_COLLECTORS</td>
<td>The number of installed remote collectors.</td>
</tr>
<tr>
<td>OUTBOUND_ADAPTERS</td>
<td>The number of outbound adapters.</td>
</tr>
<tr>
<td>NUMBER_FSDB_WRITE_CYCLES</td>
<td>The number of times to write data to the FSDB during the file I/O test. The higher the number, the more accurate the estimation, but the longer the test will take.</td>
</tr>
<tr>
<td>GOAL_HOURS_DT_CALCULATION</td>
<td>The maximum number of hours dynamic threshold calculations should take to complete.</td>
</tr>
<tr>
<td>NUMBER_DT_PLUGINS</td>
<td>The average number of dynamic threshold processors that will be used for dynamic threshold calculations. See “Installing the Analytics Processor (Optional)” on page 32.</td>
</tr>
</tbody>
</table>

The `vcops_server_configuration.properties` File
The `vcops_server_configuration.properties` file contains connection information for the vCenter Operations Enterprise server on the host. This allows runvcopsServerConfiguration to connect to the host to determine information about it. You need to set these properties only on a Windows server host. You do not need to modify this file if the server host runs Linux.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALIVE_SERVER_HOSTNAME</td>
<td>The host name or IP address of the server host. If you are using the tool on the server host, you can set this to localhost.</td>
</tr>
<tr>
<td>ALIVE_SERVER_USERNAME</td>
<td>The user name to use to connect to the host.</td>
</tr>
<tr>
<td>ALIVE_SERVER_PASSWORD_ENCRYPTED</td>
<td>Leave this set to false. When you first run the tool, it will encrypt the password value and change this value to true.</td>
</tr>
<tr>
<td>ALIVE_SERVER_PASSWORD</td>
<td>The password for the user named in <code>ALIVE_SERVER_USERNAME</code>. This will be encrypted when you run the tool.</td>
</tr>
</tbody>
</table>
Running runvcopsServerConfiguration

Once you have set all configuration parameters, you can run the tool.

1. On Windows, execute the file
   `vcenter-ops\tools\vcopsServerConfiguration\runvcopsServerConfiguration.bat`.

   On Linux, execute the file
   `vcenter-ops/tools/vcopsServerConfiguration/runvcopsServerConfiguration.sh`.

   The format of the command is:
   
   path_runvcopsServerConfiguration -mode

   where:

   - **path_runvcopsServerConfiguration** is the path to the `runvcopsServerConfiguration.bat` (on Windows) or `runvcopsServerConfiguration.sh` (on Linux) file.
   - **mode** is either print or test:
     - Print mode returns a summary showing the number of CPU cores on the host, its total physical memory, available free space on the drives or file systems where the vCenter Operations Enterprise FSDB is located, and the estimated number of resources that the system can support.
     - Test mode returns all of the same information as print mode. It also runs a file I/O test. This test writes data to the defined FSDB home directory and uses the measured speed of the writes in its estimation of the maximum number of resources. The number of times it writes to the FSDB is determined by the value of the NUMBER_FSDB_WRITE_CYCLES parameter in the `vcops_parameters.properties` file. Test mode takes longer than print mode but generally returns a more accurate estimate.

**NOTE** If there are FSDB home directories defined on more than one Windows drive or Linux file system, when figuring the amount of disk space available for the FSDB, runvcopsServerConfiguration uses the minimum amount of available space on any of the defined drives or file systems and multiplies it by the defined number of drives or file systems. If the drives or file systems have very different amounts of available space, this could result in the tool underestimating the amount of available space. For example, if there are FSDB homes defined on two drives, and one drive has 40 GB available while the other has 300 GB, runvcopsServerConfiguration estimates the disk space as 40 GB x 2 = 80 GB.

The maximum number of resources calculated is an approximation. In many cases the server host may be able to support a slightly higher number of resources. For example if runvcopsServerConfiguration estimates the host can support 1485 resources, it can probably really support 1500.
This section describes vCenter Operations Enterprise's FSDB JDBC driver. It includes general information, a standard description of the SQL format the driver uses, and instructions on using the driver with Crystal Reports.

**FSDB JDBC Driver Overview**

vCenter Operations Enterprise's FSDB JDBC driver is a standard JDBC (Java Database Connectivity) driver that connects to vCenter Operations Enterprise's analytics software through either an RMI or HTTP interface to retrieve metric data from vCenter Operations Enterprise's file system database (FSDB).

vCenter Operations Enterprise analytics has a DBMS class bound to the RMI registry. The FSDB JDBC driver uses RMI to connect to analytics, then uses this class to execute SQL queries. The queries are actually executed by the analytics process.

In addition, the driver can connect to the analytics DBMS object using HTTP through a servlet proxy. The servlet acts as a proxy to the DBMS class bound to the RMI registry of the analytics process. This can be useful when a firewall or other condition prevents you from obtaining an RMI connection. When using HTTP, the servlet runs using the same Tomcat host and port as the vCenter Operations Enterprise Web application, and so requires authentication with an vCenter Operations Enterprise administrator user name and password.

Using either RMI or HTTP, the driver needs to know the exact location of the vCenter Operations Enterprise DBMS, so the URL used when instantiating the driver needs to include connection information. so the URL should be specified while instantiating the driver.

- When using the RMI method, the URL should specify the RMI port for the analytics process. By default, this is 1199. For example: rmi://localhost:1199/DBMS.
- When using HTTP, the URL should include the same Tomcat host and port used by the vCenter Operations Enterprise Web application. For example: http://localhost:80/FsdbJdbcOverHttpServlet.

In addition, you must provide a valid vCenter Operations Enterprise administrator user name and password to the FSDB JDBC Driver in order to connect with either RMI or HTTP.

**Figure 12-1** shows how the driver makes the connection when using HTTP.

*Figure 12-1. FSDB JDBC Driver Connection Using HTTP*
FSDB Database Scheme

To use the FSDB JDBC driver, you need to know the layout used by the vCenter Operations Enterprise FSDB. The FSDB model has one catalog named FSDB_CAT and one scheme named FSDB_SCHEME. The FSDB_CAT catalog contains the FSDB table. This table contains the following columns:

<table>
<thead>
<tr>
<th>Column</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>resource_ID</td>
<td>Integer</td>
<td>ID of the resource</td>
</tr>
<tr>
<td>attrkey_ID</td>
<td>Integer</td>
<td>ID of the attribute key</td>
</tr>
<tr>
<td>timestamp</td>
<td>String</td>
<td>Time when the value was received</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>The metric value received by vCenter Operations Enterprise</td>
</tr>
<tr>
<td>min_threshold</td>
<td>String</td>
<td>The minimum value for the dynamic threshold</td>
</tr>
<tr>
<td>max_threshold</td>
<td>String</td>
<td>The maximum value for the dynamic threshold</td>
</tr>
<tr>
<td>historical_min_threshold</td>
<td>String</td>
<td>The historical minimum value for the dynamic threshold</td>
</tr>
<tr>
<td>historical_max_threshold</td>
<td>String</td>
<td>The historical maximum value for the dynamic threshold</td>
</tr>
</tbody>
</table>

NOTE All the fields with a type of String are represented as floating point numbers.

FSDB JDBC Driver SQL Formal description

Below is the FSDB JDBC Driver SQL formal description in Backus-Naur form:

```sql
SELECT "*" | <variables_list> FROM [FSDB_CAT]?FSDB [WHERE <logical_expression>]?  
variables_list ::= [FSDB.?<field_name>[, [FSDB.?<field_name>]*  
field_name ::= column names from the FSDB table  
logical_expression ::= [[]* [FSDB.?<field_name> | <constant>] ["<"] | ["="] | [">="]  
<constant ::= [0-9] | [.0-9].0-9]  
logical_operation ::= and | or.```

Using the FSDB JDBC Driver from Crystal Reports 11

To configure Crystal Reports for use with FSDB JDBC driver

1. Open the file C:\Program Files\Common Files\Business Objects\3.0\java\CRConfig.xml in a text editor. Find the <DataDriverCommon> element. In the <classpath> tag of that element, add the full path to the FSDB JDBC Driver\FSDBJDBCDriver.jar file and to the FSDB JDBC Driver\lib\common.jar file.

2. Start Crystal Reports and, from the File menu, select New and either standard report or blank report.

3. On the Standard Report Creation Wizard - Data dialog box, expand Create new connection, then JDBC (JNDI).

4. This opens the JDBC (JNDI) dialog box, with JDBC Connection selected. In Connector URL, enter the analytics DBMS RMI URL (for example, rmi://localhost:1199/DBMS), as described in “FSDB JDBC Driver Overview” on page 155.
5 In **Database classname**, enter the class name of the driver, which is `com.integrien.fsdbjdbcdriver.FSDBJDBCDriver`.

![JDBC (JNDI) dialog box](image1.png)

6 Click **Finish**.

7 This adds a new entry under **JDBC(JNDI)** in the **Available Data Sources** list on the Standard Report Creation Wizard - Data dialog box. Under this new entry, expand **Qualifiers**, then, if it is not expanded, **FSDB_CAT**.

8 Select **FSDB**, then click the right arrow (>) button. See the screenshot below.

![Standard Report Creation Wizard](image2.png)
9. If there is nothing else to add to the report, click **Next**.

10. The Standard Report Creation Wizard - Fields dialog box displays the columns of the FSDB table, as shown in the screenshot below. Select each field to include in the report and either drag it to the **Fields to Display** area or click the right arrow (>) button. After selecting all the desired fields, click **Next**. (You can also just click **Next** and add the fields later.)

![Standard Report Creation Wizard](image)

11. If you selected fields on the Standard Report Creation Wizard - Fields dialog box, the next dialog box asks what items you want to group entries by. Click **Next** without making any entries; the FSDB JDBC driver currently does not support the SQL **GROUP BY** keyword.

12. Click **Next**. If necessary, specify the desired filtering.

13. Click **Next**. Choose the template to use and click **Finish**.

14. If you selected fields in step 10, they will be visible in the report. If you did not, you can add fields by using the **Field explorer**, **Database fields** item. Expand it and drag and drop the FSDB fields which you want included in the report.

**Configuring SQL SQuirreL to Use FSDB JDBC Driver**

**To configure SQL SQuirreL for use with the FSDB JDBC driver**

1. Start the SQuirreL SQL Client.

2. To add the driver to SQuirreL, from the **Drivers** menu, select **New Driver**.
3. Fill in the Change Driver dialog box as shown in the screenshot below.

![Change Driver dialog box]

NOTE: Refer to the common.jar file in the `vcenter-ops\common\lib` folder, not the one in the `FSDBJDBCDriver\lib` folder. If you are performing this setup on a remote server, copy common.jar from the vCenter Operations Enterprise server to the local `vcenter-ops\common\lib` folder.

4. Click OK.

5. Stop and restart SQuirrel.

6. Next, create an alias. From the SQuirrel client Aliases menu, select New Alias.

7. Fill in the Add Alias dialog box as shown below.

![Add Alias dialog box]
8 Click Test. On the Connect to dialog box, click Connect.

9 If everything is correct, you will see a Connection successful message box.

10 On the Add Alias dialog box, click OK.

11 You can now connect to the alias you just created. Select it from the alias list and click the Connect icon. You do not need to enter a user name and password.
To make sure the driver connection is working, you can try a simple query first, such as `SELECT * FROM FSDB WHERE resource_id=1`. If you are using an Oracle database, use `resource_id=1000`, as resource IDs start at 1000 in Oracle.

**NOTE** Make sure to clear the **Limit rows** box, as shown. The driver does not currently support this feature.
Installation and Configuration Checklist

This chapter contains a checklist you can use to track the progress of vCenter Operations Enterprise installation and configuration, including any changes you make from the default configuration settings. Changing the configuration settings is not covered in this manual—consult your VMware representative to determine the proper settings for your installation.

## Installation Checklist

<table>
<thead>
<tr>
<th>Action Item</th>
<th>Notes</th>
<th>Assigned</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-Installation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acquire hardware based on sizing projection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Download software from VMware FTP site</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Prepare the Database</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If using SQL Server:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ Install SQL Server</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ Create a Windows or SQL authentication account with sufficient privileges to create a new database</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ Run vCenter Operations Enterprise database installer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If using Oracle:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ Install Oracle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ Install and configure SQLPlus tool</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ Create a user with sufficient Oracle privileges to create a tablespace and user schemas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ Run vCenter Operations Enterprise database installer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Prepare Hardware</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirm external port access to vCenter Operations Enterprise server and the database server (defaults: vCenter Operations Enterprise server if using remote collectors 80/1100/61616: DB server, if external 1433/1521)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirm ports are reserved on vCenter Operations Enterprise server (1099, 1100, 1199, 1201, 1202, 1203, 61616)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirm response time between vCenter Operations Enterprise server and database server is &lt; 1 ms</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Installation

Install and configure the primary vCenter Operations Enterprise server as described in “Installing the vCenter Operations Enterprise Server” on page 17.

- Test vCenter Operations Enterprise database configuration
- Validate FSDB Home path
- Before completing configuration wizard, move all unused adapters (for example, Hyperic, ITM, SCOM, and so on) to the plugins directory

(Optional) Install and configure a secondary server using the backup option

(Optional) Install and configure any remote collectors, as described in “Installing a vCenter Operations Enterprise Collector” on page 30

### Post-Installation

Validate and adjust vCenter Operations Enterprise properties as needed for Analytics. The properties are located in `vcops:/opt/vmware/vcenter-operations`

#### Analytics
**DT Plugins**

- `dtPluginLinear` Default: true New Value: true
- `dtPluginCusum` Default: false New Value: false
- `dtPluginACPD` Default: false New Value: true
- `dtPluginCCPD` Default: false New Value: true
- `dtPluginSigmaDT` Default: false New Value: true
- `dtPluginSparseSigmaDT` Default: false New Value: true
- `dtPluginpSigmaDT` Default: true New Value: true
- `dtPluginpMultinomial` Default: true New Value: true
- `dtPluginpNoise` Default: true New Value: true
- `dtPluginDeltaVariance` Default: true New Value: true
- `dtPluginNullPlugin` Default: true New Value: true

**External Server Setting**

- `AliveServerExternalHost` Default: localhost New Value: dns name or ip address

Java virtual memory settings for Analytics

- `vcenter-ops/user/conf/analytics/wrapper.conf`
<table>
<thead>
<tr>
<th>Action Item</th>
<th>Notes</th>
<th>Assigned</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| - wrapper.java.initmemory | Default: 512  
New Value: | | |
| - wrapper.java.maxmemory | Default: 4096  
New Value: | | |
| Maximum server/metric counts  
(vcenter-ops/user/conf/analytics/ advanced.properties) | | | |
| - maxNumberOfResources | Default: 0 (unlimited)  
New Value: | | |
| - maxNumberOfAttributes | Default: 0 (unlimited)  
New Value: | | |
| FSDB and DT Processing Threads  
(vcenter-ops/user/conf/analytics/ advanced.properties) | | | |
| - FSDBProcessingThreads | Default: 2  
New Value:  
(Suggestion: ½ processors) | | |
| - FSDBSaveThreads | Default: 3  
New Value: FSDB + 1 | | |
| - DTProcessingThreads | Default: 1  
New Value: FSDB - 1 | | |
| Hibernate connection pool settings  
(vcenter-ops/user/conf/analytics/hibernate.properties) | | | |
| - hibernate.c3p0.max_size | Default: 40  
New Value: 200 | | |
| - hibernate.c3p0.min_size | Default: 5  
New Value: 50 | | |
| Web | | | |
| Java virtual memory settings for  
vCenter Operations Enterprise Web  
(vcenter-ops/user/conf/tomcat/ wrapper.conf) | | | |
| - wrapper.java.initmemory | Default: 256  
New Value: | | |
| - wrapper.java.maxmemory | Default: 4096  
New Value: | | |
| Maximum server/metric counts  
(vcenter-ops/user/conf/web/ controller.properties) | | | |
| - maxResourceCount | Default: 0 (unlimited)  
New Value: | | |
| - maxMetricCount | Default: 0 (unlimited)  
New Value: | | |
| Web DB Connections  
(vcenter-ops/tomcat/ROOT/ META-INF/ context.xml) | | | |
| - maxActive | Default: 10  
New Value: | | |
| Collector | | | |
| Java virtual memory settings for  
vCenter Operations Enterprise Collector  
(vcenter-ops/user/conf/collector/ wrapper.conf) | | | |
| - wrapper.java.initmemory | Default: 128  
New Value: | | |
| - wrapper.java.maxmemory | Default: 2048  
New Value: | | |

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<table>
<thead>
<tr>
<th>Action Item</th>
<th>Notes</th>
<th>Assigned</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ActiveMQ</strong></td>
<td>Java virtual memory settings for ActiveMQ (vcenter-ops/user/conf/activemq/wrapper.conf)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ wrapper.java.initmemory</td>
<td>Default: none New Value: none</td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ wrapper.java.maxmemory</td>
<td>Default: 512 New Value: 768</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ActiveMQ updates</strong></td>
<td>(vcenter-ops/activemq/conf/activemq.xml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ memoryLimit for dataQueue</td>
<td>Default: 128 New Value: 256</td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ producerFlowControl</td>
<td>Default: true New Value: false</td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ memoryLimit for default queue</td>
<td>Default: 16 New Value: 64</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Replication Server</strong></td>
<td>Java virtual memory settings for vCenter Operations Enterprise Replication Server (vcenter-ops/user/conf/ReplicationServer/wrapper.conf)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ wrapper.java.initmemory</td>
<td>Default: 256 New Value:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>■ wrapper.java.maxmemory</td>
<td>Default: 512 New Value:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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