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http://www.vmturbo.com/Portals/71270/docs/vmturbo_eula.pdf
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What’s New

This release of VM{Turb}o Operations Manager includes the following new features:

- **Support for Load Balancers**
  Operations Manager now supports Load Balancers as targets, and can discover their virtual applications (sometimes called virtual application servers, or vservers). For more information, see Target Configuration - page 137 and Adding Load Balancers as Targets - page 141.

- **New Home Tab**
  Operations Manager has a new Home tab that displays dashboards for a quick view of your environment’s health. Operations Manager ships with the following standard dashboards that answer the following questions:
  - **Assure Service Performance** - page 47
    How do you assure workloads have the resources they need to perform well — how do you prevent performance degradation?
  - **Improve Overall Efficiency** - page 52
    How do you consolidate workloads to utilize underlying physical infrastructure more efficiently?
  - **Cluster Projection** - page 56
    When and where will you need additional resources to satisfy growing workload demand?
  You can also create custom dashboards to focus on specific groups and clusters. For more information, see The Home Tab - page 46.

- **Changes to Actions and Problems**
  To clarify the presentation of Operations Manager actions, we have made the following changes:
  - To Do List — The Recommended Actions log has been renamed To Do (see Viewing Recommended Actions - page 35 and Executing Recommended Actions - page 36).
  - Risks/Opportunities list — The Problems log has been renamed Risks/Opportunities. This is to emphasize that Operations Manager intelligently recommends actions, rather than just listing problems. Risks and opportunities are tightly related to the actions in the To Do list, and you can think of them as justifying the recommended actions (see Viewing Risks and Efficiency Opportunities - page 37).
  - Action Categories — We have simplified the categories of actions, risks, and opportunities, and use them more consistently (see Action Categories - page 40).
• Operations Manager can perform the following additional actions with Virtual Datacenters (discovered through cloud management targets):
  - Recommend to resize the Organization VDC by increasing or decreasing CPU, memory, and storage on the underlying physical resources.
  - Reconfigure VMs directly through the cloud management system (not through the underlying hypervisor). Operations Manager actions can reconfigure VMemory and VCPUs.

• General User Interface Changes
  - Paging Data Grids — To improve request performance, we added paging to tables that can display large amounts of data. For example, the To Do list now uses paging. By loading one page at a time, a single request will not bog down the user interface.
  - Scrolling List of Chart Options — Some chart panels include a number of options to choose what they display. To display these options in smaller panels, we now include a button to scroll options into view (see Chart Display Radio Buttons - page 24.
  - Search in Help — You can now search for text in the online help documentation.
Introducing Operations Manager

Thank you for choosing VMTurbo Operations Manager, the premier solution for intelligent workload management of cloud and virtual environments. Operations Manager maintains your environment within the *optimal operating zone*—operating conditions that achieve these conflicting goals at the same time:

- Assured application performance
  - Prevent bottlenecks, provision physical resources, upsize VMs, prioritize workload
- Efficient use of resources
  - Consolidate workload, downsize VMs, prevent VM sprawl and dormant VMs

Keeping a virtual infrastructure within the optimal zone is not a simple problem. You have to consider many different resources, numerous control points for each device, and how devices and resources are used in relation to each other. As you add devices to your infrastructure, the factors for each decision increase exponentially. On top of that, the environment is constantly changing—to stay in the optimal zone, you are constantly trying to hit a moving target.

To perform intelligent workload management, Operations Manager models the environment as a *market* made up of *buyers* and *sellers*. These buyers and sellers make up a *supply chain* that represents tiers of devices in your inventory. Operations Manager uses *Virtual Currency* to give a budget to buyers and assign cost to resources. This virtual currency assigns value across all tiers of your environment, making it possible to compare the cost of application transactions with the cost of space on a disk or physical space in a data center.

The price that a seller charges for a resource changes according to the seller’s supply. As demand increases, prices increase. As prices increase, buyers and sellers react. Buyers are free to look for other sellers that offer a better price, and sellers can duplicate themselves (open new storefronts) to meet increasing demand. Operations Manager uses its *Economic Scheduling Engine* to analyze the market and make these decisions. The effect is an invisible hand that dynamically guides your IT infrastructure to the optimal use of resources.

To get the most out of VMTurbo Operations Manager, you should understand how it models your environment, the kind of analysis it performs, and the optimal state it works to achieve. This section describes the following in more detail:

- The Optimal Operating Zone - page 4
- The Market and Virtual Currency - page 5
- The Economic Scheduling Engine - page 5
- The Operations Manager Supply Chain - page 6
- Operations Manager Actions - page 16
- Supply Chain Terminology - page 16
The Optimal Operating Zone

The goal of workload management is to assure performance while maintaining efficient use of resources. When performance and efficiency are both maintained, you are in the optimal operating zone. You can measure performance as a function of delay, where zero delay gives the ideal QoS for a given service. Efficient use of resources is a function of utilization where 100% utilization of a resource is the ideal for the most efficient utilization.

If you plot delay and utilization, the result is an asymptotic curve. Up to a point, as you increase utilization, the increase in delay is slight. There comes a point on the curve where a slight increase in utilization results in an unacceptable increase in delay. On the other hand, there is a point in the curve where a reduction in utilization doesn’t yield a meaningful increase in QoS. The optimal operating zone lies within these points on the curve.

Figure 2-1. The Optimal Operating Zone

You could set a threshold to post an alert whenever the upper limit is crossed. In that case, you would never react to a problem until delay has already become unacceptable. To avoid that late reaction you could set the threshold to post an alert before the upper limit is crossed. In that case, you guarantee QoS at the cost of over-provisioning—you increase operating costs and never achieve efficient utilization.

Instead of responding after a threshold is crossed, Operations Manager analyzes the operating conditions and constantly recommends actions to keep the entire environment within the optimal operating zone. If you execute these actions (or let Operations Manager execute them for you), the environment will maintain operating conditions that assure performance for your customers, while saving you as much as possible by efficient utilization of your resources.
The Market and Virtual Currency

To perform workload balancing, Operations Manager models the environment as a market, and uses market analysis to balance resource supply and demand. For example, bottlenecks form when local workload demand exceeds the local capacity—in other words, when demand exceeds supply. By modeling the environment as a market, Operations Manager can use economic solutions to efficiently redistribute the demand or increase the supply.

Operations Manager uses two sets of abstraction to model the environment:

- **Modeling the virtualized IT stack as a service supply chain**
  The supply chain models devices in your environment as managed entities. These include applications, VMs, host machines (physical machines, or PMs), and data centers. Every entity is a buyer and/or a seller. A host machine buys physical space, power, and cooling from a data center. The PM sells host resources such as CPU cycles and memory to VMs. In turn, VMs buy host services, and then sell their hosting services (VMem and VCPU) to applications.

- **Using virtual currency to represent delay or QoS degradation, and to balance the supply and demand of services along the modeled supply chain.**
  The system uses virtual currency to value these buy/sell transactions. Each managed entity has a running budget, and draws from that budget to pay for the resources it consumes. The price of a resource is driven by its utilization — the more demand for a resource, the higher its price.

![Figure 2-2. Modeling the Environment as a Market](image)

These abstractions open the whole range of the virtualized environment to a single mode of analysis—market analysis. Resources and services can be priced to reflect changes in supply and demand, and pricing can drive resource allocation decisions. For example, a bottleneck (excess demand over supply) results in rising prices of the given resource. Applications competing for the same resource can lower their costs by shifting their workloads to other resource suppliers. As a result, utilization for that resource even out across the environment and the bottleneck is resolved.

The Economic Scheduling Engine

Operations Manager tracks the *Utilization Index* (UI) for specific resources in your environment. The higher this index, the more that resource is utilized, the greater the delay for consumers of that resource, and the greater the risk to your QoS. Operations Manager constantly works to keep the UI within acceptable bounds. You can think of UI as the cost for a resource—Operations Manager works to keep the cost at a competitive level. This is not simply a matter of responding to threshold conditions. Operations Manager analyzes the full range of buyer/seller relationships, and each buyer constantly seeks out the most economical transaction that is available.
This last point is crucial to understanding Operations Manager. The virtual environment is dynamic, with constant changes to workload and optimal workload distribution that correspond with the varying requests your customers make of your applications and services. By examining each buyer/seller relationship, the economic engine arrives at the optimal workload distribution for the current state of the environment.

For example, assume a PM that hosts one VM with a critical application, and two VMs with non-critical applications. Consider these similar situations:

- The critical application has increased use, and the non-critical applications are dormant
  In this case, Operations Manager can suspend the two unused VMs (reduce VM sprawl) and devote more host resources to the critical application.
- The critical application has increased use, and both non-critical applications see increased use
  In this case, Operations Manager can move the non-critical VMs to another host and devote more host resources to the critical application.

This is an over-simple case, but it illustrates the value of constant analysis of all the relationships. For the critical application, the results are the same. But for the environment as a whole, the results arrive at different, economical solutions, to reflect the given conditions. The economic engine considers all the entities and resources in your environment, and analyzes them asynchronously to constantly tend toward the optimal operating zone.

NOTE: In principal, you can run Operations Manager with nothing more than its default settings. However, it’s likely that your environment has special services and resources that require different management decisions. Operations Manager provides a full range of policies that you can set to control how the software manages specific groups of entities. However, before you make such policy settings, you should understand how Operations Manager works by default. For more information about policies, see The Policy Tab - page 150.

The Operations Manager Supply Chain
Operations Manager models your environment as a market of buyers and sellers. At its simplest, a market model could classify each entity as just a buyer and a seller. However, a virtual environment has tiers of resources and services. Also, different targets that Operations Manager can monitor represent different tiers or groupings. For example, a hypervisor represents applications, VMs, PMs, data stores, and data centers, while a load balancer represents virtual applications and a cloud stack represents virtual data centers. These tiers form a chain of supply and demand, where one tier supplies resources to meet the demands of another tier.

The Operations Manager user interface displays the supply chain in the following tiers. To see the full inventory, with navigation lists that show the full supply chain, see The Inventory Tab - page 46.

- Virtual Application - page 7
- Applications - page 8
- Virtual Machines - page 9
- Physical Machines - page 11
- Storage - page 12
- Datacenters - page 13
- Provider Virtual Datacenters - page 14
- Organization Virtual Datacenters - page 15
Virtual Application

A virtual application is the logical application server (sometimes called a vserver) that a load balancer uses to marshall access to load-balanced applications. In the load balancer, each virtual application has bindings to the applications it manages. End users make requests to the virtual application, and the load balancer forwards those requests to the actual applications.

<table>
<thead>
<tr>
<th>Synopsis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Budget:</strong></td>
</tr>
<tr>
<td><strong>Provides:</strong></td>
</tr>
<tr>
<td><strong>Consumes:</strong></td>
</tr>
<tr>
<td><strong>Discovered through:</strong></td>
</tr>
</tbody>
</table>

Operations Manager displays virtual applications in the inventory as follows:

![Inventory](image)

Figure 2-3. Virtual Applications

Load balancers manage the traffic of requests to applications in your environment. The virtual application is a logical construct of the load balancer. For information about binding load-balanced applications to the virtual application, see Discovery Policies - page 170.

Operations Manager does not recommend actions to perform on the virtual application itself, but it does recommend actions to perform on the VMs that host bound applications. For example, assume a virtual application that manages three SQL databases. If a surge in requests degrades performance across all three databases, then Operations Man-
The Operations Manager can start a new VM to run another instance of the database application, and bind it to the virtual application. On the other hand, if SQL requests drop off so that the load balancer only forwards requests to two of the databases, Operations Manager can suspend the dormant database and unbind it from the virtual application.

Applications

In a virtualized environment, an application is a process running on a VM. Applications typically serve human users, or other applications.

Synopsis

| Budget: | An application gains its budget to buy resources as a function of its activity. The more active an application is (the more transactions the application performs), the more Operations Manager assumes the application is selling its services to a user. This gives the application more budget to purchase resources from a hosting VM. Operations Manager doesn’t perform actions on applications. Instead, it performs actions on the host VMs. If utilization is high enough on an application, Operations Manager can create a new copy of the host VM. When an application is idle, it looses budget. Ultimately, if the budget falls enough, Operations Manager will suspend or terminate the host VM. You can declare that an application is critical. Doing this gives the application unlimited budget, so its host VM will never be suspended. For more information, see Application Priority - page 169. |
| Provides: | Transactions to other applications, to load balancer Virtual Application Servers, and to end users. |
| Consumes: | VM resources, including VCPU, VMem, and VStorage. |
| Discovered through: | Operations Manager uses WMI to discover applications through the current target hypervisors (see Adding and Removing Target Virtual Management Servers - page 138). |

Operations Manager displays applications in the inventory as follows:

![Inventory]

Figure 2-4. Applications
By default, Operations Manager discovers the following applications:

<table>
<thead>
<tr>
<th>Application Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSASS</td>
<td>Microsoft Active Directory services</td>
</tr>
<tr>
<td>IIS</td>
<td>Microsoft Internet Information Services</td>
</tr>
<tr>
<td>XenDesktop</td>
<td>Citrix XenDesktop</td>
</tr>
<tr>
<td>VMView</td>
<td>VMWare View</td>
</tr>
<tr>
<td>MSSQL</td>
<td>Microsoft SQL Server</td>
</tr>
<tr>
<td>SharePoint</td>
<td>Microsoft Sharepoint Server</td>
</tr>
<tr>
<td>Guest Load</td>
<td>The resources that Operations Manager has not assigned to any specific application (for more information, see Guest Load - page 9)</td>
</tr>
</tbody>
</table>

In addition, your installation of Operations Manager might be configured to discover other applications running in your environment. For more information, see Application Discovery - page 170.

**NOTE:** Operations Manager uses Microsoft Windows Management Integration (WMI) to discover and manage application processes. With the exception of Guest Load, all managed applications run on Windows machines (for more information, see Guest Load - page 9).

**Guest Load**

The **Apps_GuestLoad** item is a special entry in the Applications hierarchy. This item tracks the resources that Operations Manager has not assigned to any specific application. This can occur for the following reasons:

- You do not have the licences required to support Application monitoring
  In this case, Operations Manager lists all the consumed VM resources in the Apps_GuestLoad entry—this is the only entry under Applications.
- Operations Manager fails to discover some applications
  In this case, Operations Manager displays entries for the applications it has discovered, and lists the VM resources that are not accounted for under Apps_GuestLoad.
- VM resources are devoted to infrastructure, and not part of any application
  Operations Manager lists these resources under Apps_GuestLoad, and provides entries for the applications it has discovered.

**Virtual Machines**

A virtual machine (VM) is a software emulation of a physical machine, including OS, virtual memory and CPUs, and network ports.

**Synopsis**

**Budget:** A VM gains its budget by selling resources to the applications it hosts. The more activity there is on its hosted applications, the more budget the VM has to purchase resources from its physical host. If utilization is high enough, Operations Manager can create a new copy of the given VM. If utilization falls off, the VM looses budget. Ultimately, if the budget isn’t enough to pay for the host services it consumes, Operations Manager will suspend or power off the VM.
The Operations Manager Supply Chain

Chapter 2: Introducing Operations Manager

Figure 2-5. Virtual Machines

Note that the inventory groups VMs by the physical machines that host them. In the user interface, this is a logical grouping that makes it easier to visualize the distribution of VMs across your environment. Also, the VM icons identify managing hypervisors by vendor, and VM state (see Resource Icons - page 22).
Physical Machines

A physical machine (PM or host) is a server that runs a hypervisor process. This means the PM can host VMs that are managed by the given hypervisor. Note that a PM is not necessarily a physical box, or computing iron. A VM can be set up as a server that runs a hypervisor, and it can in turn host other VMs within its processing space. However, it’s most usual to use iron as your PMs.

### Synopsis

**Budget:**
A PM gains its budget by selling resources to the VMs it hosts. The more VMs running on a PM, the more budget the PM has to purchase storage and datacenter resources. If utilization of a PM is high enough, Operations Manager can recommend that you provision a new PM. If utilization falls off, the PM loses budget. Ultimately, if the budget isn’t enough to pay for the services it consumes, Operations Manager will suspend or power off the PM.

**Provides:**
- Host resources for VMs to use:
  - Mem (Kbytes)
  - CPU (MHz)
  - IO (throughput on the I/O bus)
  - Net (network throughput)
  - Swap (swap rate capacity measured in bytes/sec)
  - Balooning (sharing of memory among hosted VMs)
  - CPU Ready Queue (wait time on the queue in ms)

**Consumes:**
Datacenter resources (physical space, cooling, etc.) and storage.

**Discovered through:**
Operations Manager discovers PMs through hypervisor targets (see Adding and Removing Target Virtual Management Servers - page 138). For some hypervisor vendors, the PM is the target, and for others the PMs are managed by the specified target.

Operations Manager displays PMs in the inventory as follows:

![Inventory](image)

**Figure 2-6. Physical Machines**
Storage

Storage is represented in Operations Manager as Datastores. A Datastore is a logical grouping of one or more physical storage devices that serve PM storage requirements.

### Synopsis

**Budget:**
A Datastore gains its budget by selling resources to the PMs it hosts. If utilization of a Datastore is high enough, Operations Manager can recommend that you provision a new one.

**Provides:**
Host resources for VMs to use:
- Storage amount
- IOPs (storage access operations per second)
- Latency (capacity for disk latency in ms)

**Consumes:**
Disk arrays.

**Discovered through:**
Operations Manager discovers Datastores through hypervisor targets (see Adding and Removing Target Virtual Management Servers - page 138).

Operations Manager displays Datastores in the inventory as follows:

![Inventory](image)

Figure 2-7. Datastores
Datacenters

For Operations Manager, a datacenter is the sum of VMs, PMs, datastores, and network devices that are managed by a given hypervisor target.

**Synopsis**

<table>
<thead>
<tr>
<th>Budget:</th>
<th>A Datastore has unlimited budget.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides:</td>
<td>Datacenter resources (physical space, cooling, etc.).</td>
</tr>
<tr>
<td>Consumes:</td>
<td>N/A</td>
</tr>
<tr>
<td>Discovered through:</td>
<td>Operations Manager discovers Datastores through hypervisor targets (see Adding and Removing Target Virtual Management Servers - page 138).</td>
</tr>
</tbody>
</table>

Operations Manager displays Datacenters in the inventory as follows:

![Inventory](image)

**Figure 2-8. Datacenters**
Provider Virtual Datacenters

A provider virtual datacenter (vDC) is a collection of physical resources (PMs and datastores) managed by a cloud stack. The cloud administrator has access to these resources, and defines the datacenter members. Usually a provider vDC is created to manage resources that will be exposed to external customers through one or more organizational vDCs.

### Synopsis

| Budget: | A Provider vDC gains its budget by selling resources to the Organization vDCs that it hosts. If utilization falls off, the datacenter loses budget. Ultimately, if the budget isn’t enough to pay for the services it consumes, Operations Manager will terminate the Provider vDC. |
| Provides: | Physical resources such as PMs and datastores. |
| Consumes: | PMs and datastores |
| Discovered through: | Operations Manager discovers vDCs through cloud stack managers such as vCloud Director (see Adding and Removing Target Virtual Management Servers - page 138). |

Operations Manager displays Provider vDCs in the inventory as follows:

<table>
<thead>
<tr>
<th>Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary</td>
</tr>
<tr>
<td>▶ Virtual Applications (3)</td>
</tr>
<tr>
<td>▶ Applications (65)</td>
</tr>
<tr>
<td>▶ Virtual Machines (58)</td>
</tr>
<tr>
<td>▶ Physical Machines (16)</td>
</tr>
<tr>
<td>▶ Storage (15)</td>
</tr>
<tr>
<td>▶ Datacenters (4)</td>
</tr>
<tr>
<td>▶ Provider Virtual Datacenters (3)</td>
</tr>
<tr>
<td>▶ VMTurbo vCloud Dedicated</td>
</tr>
<tr>
<td>▶ VMTurbo vCloud Shared1</td>
</tr>
<tr>
<td>▶ VMTurbo vCloud Shared2</td>
</tr>
<tr>
<td>▶ Organization Virtual Datacenters (4)</td>
</tr>
</tbody>
</table>

Figure 2-9. Provider Virtual Datacenters
Organization Virtual Datacenters

An Organization Virtual Datacenter (vDC) is a collection of resources that are available for external customers to manage through the cloud. It is an environment customers can use to store, deploy, and operate virtual systems.

<table>
<thead>
<tr>
<th>Synopsis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Budget:</strong></td>
</tr>
<tr>
<td><strong>Provides:</strong></td>
</tr>
<tr>
<td><strong>Consumes:</strong></td>
</tr>
<tr>
<td><strong>Discovered through:</strong></td>
</tr>
</tbody>
</table>

Operations Manager displays Provider vDCs in the inventory as follows:

![Inventory](image)

Figure 2-10. Operation Virtual Datacenters

While users can see some of the physical resources that support the organization vDC, organization-level users cannot modify these physical resources. Users of organization vDCs make changes to how the virtual devices are deployed in that environment, but the must ask administrators to add more physical resources to the organization vDC. Likewise, Operations Manager can change VMs running in the vDC, but it does not make any changes to physical resources through this vDC.
Operations Manager Actions

Operations Manager does more than track problems in your environment. Before problems occur, Operations Manager identifies actions you can take to avoid the problems. You can perform these actions manually, direct Operations Manager to perform the actions on command, or direct Operations Manager to perform actions automatically as they arise. You can set different action modes (whether to automate or not) for individual actions (see The Policy Tab - page 150).

The actions Operations Manager can recommend or perform include:

<table>
<thead>
<tr>
<th>Virtual Machine</th>
<th>Physical Machine</th>
<th>Datastore</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Move between hosts&lt;br&gt;• Move between datastores&lt;br&gt;• Start&lt;br&gt;• Stop&lt;br&gt;• Suspend&lt;br&gt;• Change # of CPU&lt;br&gt;• Change configured vMEM&lt;br&gt;• Change thin provisioned storage&lt;br&gt;• Provision required network&lt;br&gt;• Provision required datastore</td>
<td>• Start&lt;br&gt;• Stop&lt;br&gt;• Suspend&lt;br&gt;• Provision&lt;br&gt;• Decommission</td>
<td>• Provision&lt;br&gt;• Decommission&lt;br&gt;• Reconfigure HBA: throttle I/O bandwidth</td>
</tr>
</tbody>
</table>

Supply Chain Terminology

VMTurbo introduces specific terms to express IT resources and utilization in terms of supply and demand. These terms are largely intuitive, but you should be sure you understand how they relate to the issues and activities that are common for IT management.

<table>
<thead>
<tr>
<th>VMTurbo Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commodity</td>
<td>The basic building block of VMTurbo supply and demand. Everything a VMTurbo product represents or analyzes is a commodity. For example, the CPU capacity or memory that a physical machine can provide is a commodity. The VMTurbo appliance can also represent clusters and segments as commodities. When the user interface shows commodities, it’s showing the resources a service provides. When the interface shows commodities bought, it’s showing what that service consumes.</td>
</tr>
<tr>
<td>Composed Of</td>
<td>The resources or commodities that make up the given service. For example, in the user interface you might see that a certain VM is composed of commodities such as one or more physical CPUs, an Ethernet interface, and physical memory. Compare Composed Of to Consumes, where consumption refers to the commodities the VM has bought. Also compare Composed Of to the commodities a service offers for sale. A physical machine might include four CPUs in its composition, but the commodities the machine offers will show these CPUs aggregated as a single commodity.</td>
</tr>
<tr>
<td>Consumes</td>
<td>The services and commodities a service has bought. A service consumes other commodities. For example, a VM consumes the commodities offered by a physical machine, and an application consumes commodities from one or more VMs. Note that in the user interface you can explore the services that provide the commodities the current service consumes.</td>
</tr>
<tr>
<td>Environment</td>
<td>The sum of data center, network, physical machine, storage, VM, and application resources that you are monitoring.</td>
</tr>
<tr>
<td>Inventory</td>
<td>The list of all commodities in your environment.</td>
</tr>
</tbody>
</table>
Utilization Index: A measure of the risk to Quality of Service (QoS) that a consumer will experience. The higher the UI on a provider, the more risk to QoS for any consumer of that provider’s services. For example, a physical machine provides host services to one or more VMs. The higher the UI on the provider, the more likely it is that the VMs will experience QoS degradation. Note that for optimal operation, the UI on a provider should not go into double digits. In the above example, if the PM has a UI of 16 or more, the VMs are very likely to suffer QoS degradation.

<table>
<thead>
<tr>
<th>VM Turbo Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilization Index</td>
<td>A measure of the risk to Quality of Service (QoS) that a consumer will experience. The higher the UI on a provider, the more risk to QoS for any consumer of that provider’s services. For example, a physical machine provides host services to one or more VMs. The higher the UI on the provider, the more likely it is that the VMs will experience QoS degradation. Note that for optimal operation, the UI on a provider should not go into double digits. In the above example, if the PM has a UI of 16 or more, the VMs are very likely to suffer QoS degradation.</td>
</tr>
<tr>
<td>Service</td>
<td>A functioning commodities group such as a physical machine, a VM, or an application.</td>
</tr>
<tr>
<td>Utilization</td>
<td>The percentage over time that a commodity is used, where 100% is utilization of the full capacity.</td>
</tr>
<tr>
<td>VM Group</td>
<td>The collection of VMs running on a given physical machine. Because an environment can have many VMs, the user interface shows VM groups as a way to simplify and organize their presentation.</td>
</tr>
</tbody>
</table>
The Operations Manager User Interface

To use Operations Manager, you open a web browser to the IP address of your product installation. Operations Manager serves the user interface to your browser, where you can observe, analyze, and manage your environment. The following figure shows the user interface opened to the Home tab.

Figure 3-1. The Operations Manager User Interface — Home Tab
Tool Bar and Display Tools

The Operations Manager tool bar provides the following:

- **Reports**
  The reports tool opens a new web page that presents all the Reports that are defined for your installation of Operations Manager. It generates reports in PDF that you can view or send to specific e-mail addresses. You can also save reports in the Microsoft Excel XML format. Operations Manager presents a standard set of reports, and you can also define custom reports. Reports are not available until Operations Manager has been running for 24 hours.

- **Search**
  The search tool opens a dialog box you can use to search for components or services by name. As you type a Search Expression, the dialog box lists all the items that match your string. When you select an item and click OK, Operations Manager opens a new tab to show information about that item. You can select multiple items. Use Shift-Click to extend the selection, or use Ctrl-Click to select discontinuous items.

- **Help**
  Click this tool to open help to its main page. You can also right-click on different panels of the user interface to open help at the discussion for that item.

- **Support**
  This tool opens the VMturbo Knowledge and Support Center in your Web browser.

- **Logout**
  Use this tool to log out of your Operations Manager session.

The Display tools specify the following:

- **Collapse**
  This button collapses all the entries in the Navigation panel.

- **Refresh**
  The Refresh button causes Operations Manager to update the data it displays. Auto-Refresh causes Operations Manager to update the data at regular periods. Specify the Refresh Interval in seconds. For example, to auto-refresh every ten minutes, enter “600”.

Tab Bar

Operations Manager presents tabs for the different activities you can perform.

You can also open tabs to show information about specific components. For example, when you search for a specific virtual machine (see Search in Tool Bar and Display Tools - page 19), Operations Manager opens a new tab for that VM. That tab includes a navigation panel and information panels that list only information about the given VM. When you are through with this kind of tab, click the tab’s close box to discard it.
Operations Manager provides tabs for the following features:

- **The Home Tab** - page 46 — See dashboards that focus on assuring service performance, maintaining efficient allocation of resources, and projecting future resource requirements for clusters.

- **The Inventory Tab** - page 46 — See real-time and historical information about the various resources, services, and components in your environment.

- **The Plan Tab** - page 85 — Run what-if scenarios to investigate how to change your infrastructure to achieve optimal performance.

- **The Optimize Tab** - page 130 — Execute recommended actions to proactively identify problems and implement the optimal response. Operations Manager can perform many actions automatically.

- **The Admin Tab** - page 135 — Attach Operations Manager to specific hypervisors, create user accounts, specify data retention policies, and perform other maintenance activities.

- **The Policy Tab** - page 150 — Define groups and make settings to define workload placement, analysis, and other policies.

**Navigation Panel**

The Home tab includes a navigation panel that lists available dashboards, as well as controls to create or delete custom dashboards. The Inventory and Optimize tabs include a navigation panel that shows hierarchical trees of resources, services, and components in your environment. For example, the following figure shows the navigation panels for the Inventory tab.
Figure 3-2. Navigation Panels for the Inventory Tab

This figure shows the Inventory tree and the Groups tree. You can navigate these trees to see what each item contains. The Inventory tree shows a hierarchy of items in your environment. The Groups tree shows the groups that are standard with Operations Manager, as well as custom groups you have defined (see Group Management - page 155). When you select an item, the information panels on the right display data about the selected item.
Navigation Tree Hierarchies

The navigation tree shows the hierarchy of services and commodities Operations Manager has discovered in your environment. The Inventory tree groups these according to the supply chain — Virtual Applications, Applications, Virtual Machines, Physical Machines, Storage, etc. The Groups tree displays the items in groups defined by Operations Manager, as well as other groups that you define.

A tree branch for a given service (a named VM or named storage, for example) can include the following:

- **Composed Of** — The constituent parts that make up the service; for example, a physical machine might include four CPUs in the Composed Of list, but only show one Processor entry in the Commodities list.
- **Consumes** — The service providing commodities that the parent service consumes; for example, a VM consumes a Host and a data store.
- **Hosts** — For a physical machine, the VMs hosted on that PM.

For example, the following figure shows a selected virtual machine named vm-005b. This VM uses three CPUs on its host. One of those CPUs is selected, and the information panel shows the properties of that commodity.

![Inventory Tree Showing an Offered Commodity](image)

**Figure 3-3. Inventory Tree Showing an Offered Commodity**

Resource Icons

The Navigation Panel displays icons for the different resources Operations Manager handles. These icons indicate:

- Resource type
- Hypervisor type
- Resource State
Standard Panel Controls

Chart panels include a number of controls you can use to display more details, or to customize how the charts show data. These controls include:

- **Tooltips** - page 23
- **Chart Legend Pulldowns** - page 24
- **Chart Display Radio Buttons** - page 24
- **Maximize/Minimize** - page 25
- **Export to XML** - page 25
- **Customize Heatmap** - page 25
- **Chart Zoom and Date Ranges** - page 27

**Tooltips**

To show extra details about an item in the information panels, hover the pointer over the item until a tooltip appears. The tooltip displays extra information such as the actual value of a data point or the resource it is charting.

Most lists and tables also display tooltips. If a data filed in a list or table is not large enough, use the tooltip to display the complete information.
Figure 3-4. Displaying a Tooltip

Chart Legend Pulldowns

To save space, many charts show their legends on a pulldown.

Figure 3-5. Displaying a Pulldown Legend

Chart Display Radio Buttons

Many charts include radio buttons you can use to determine which metrics to plot. If the chart panel is too small to display all the radio buttons, you can scroll them to the left or right.
Choose which metric to plot | Click to scroll radio buttons

Figure 3-6. Choosing the Metrics to Plot

Maximize/Minimize

Information panels include Maximize and Minimize icons ( ) you can click to show or hide the panels, or to expand them to a full view. As you minimize panels, the remaining panels expand to fill in the information display area.

Export to XML

Many panels have an Export to XML icon ( ). These panels display data that can be represented in a table or spreadsheet. When you click the icon, you can navigate to a directory and export the panel data to an XML file. You can then open that XML in a spreadsheet.

Customize Heatmap

Heatmap panels include a customize icon ( ) to specify which columns to show, and the scope of the chart. When you click the icon, the panel displays the Customize control board, with Columns and Scope accordions to display the specific controls.
When you set the scope of a panel, you limit the number of resources it will display. This reduces the number of rows that will display in the panel.

Figure 3-7. Choosing the Columns to Display
NOTE: To restore default views, click on the Customize tool and choose Reset.

Chart Zoom and Date Ranges

Bar chart panels include buttons ( ) to show/hide extra controls. With these controls you can:

- Specify the date for the data (show current data, or show data from a previous time)
- Zoom in on a specific set of devices (for example, show only the most utilized physical machines)
- Control what type of data the panel displays (for example, change from showing the Utilization Percentage of specific metrics to showing the Utilization Index)
Click the **Down** arrow to show the controls, and click the **Up** arrow to hide them.

**Figure 3-9. Controlling a Panel’s Display**

Note that to set the zoom, you can also drag across the chart to select the devices you want to zoom in on. When you reset the zoom, the chart shows data for all the devices that it monitors.

**Information Panels**

As you select a dashboard or an item in the navigation panel, you can see information about that item in panels to the right. These panels show different charts and listings of properties, depending on the item you select.

The panels have standard controls you can use to modify their display (see **Standard Panel Controls** - page 23).

**Summary Panels**

In the Inventory tab, the Inventory tree begins with a **Summary** entry. When you select this entry, Operations Manager shows summary information about your environment. The information displays in Summary panels for Applications, VMs, Physical Machines, and Storage. The user interface also shows recommended actions, a Problem Log, and a Savings summary. The following figure shows a VM summary panel.
Figure 3-10. Panels Showing the Virtual Machine Summary

The summary panel displays a heatmap with colored cells to show utilization of resources, as well as the Utilization Index. By default, heatmaps only show the Utilization Index, but you can customize them to show other values (see Customize Heatmap - page 25). To get more details about an item, click on the colored entry. The figure above shows the details panel for utilization on a cluster of virtual machines.

Clicking a named entry in the Summary panel opens a new tab for that named item. When you are finished with this tab, discard it by clicking the tab’s close box.

Utilization Charts

When you select a named service or group in the Inventory tree, Operations Manager displays panels for that item. One of the panels is the Utilization Chart. This chart shows utilization percentage and utilization index for the selected item. If the item represents a group of resources, the panel displays a bar chart showing utilization values for each resource. To show utilization history of a single service, click the corresponding bar in the chart.

NOTE: The default user interface shows up to one hour’s worth of data. You can install licenses to enable the display of more historical data.

You can zoom in on a bar chart to show a smaller number of commodities. Either move the zoom markers, or click and drag over the region you want to zoom in on. To return to the full view, click **Reset Zoom**. For more information, see **Chart Zoom and Date Ranges** - page 27.

The following figure shows utilization for the data stores in the current environment. It also shows the latency of a single data store. You can hover over a data point to display its tooltip, or click the data point to display a chart.
Figure 3-11. Panels Showing the Utilization

Dashboard Panels

In the Home tab, you select the dashboard you want, and Operations Manager displays system data in the associated dashboard panels. These panels include a To Do list, various charts, and expanding tables.
Device Charts

Figure 3-12. Expanding Table

Some dashboard charts include the option to choose which type of device to plot. Choose the type from the drop-down menu.
Expanding Tables

Expand entries to show more information

Click an entry for a To Do list and details on the item

![Virtual Machine Efficiency Table]

Figure 3-13. Expanding Table

Some dashboard tables include items that expand to show more data. You can quickly browse to the item you want to inspect, then expand it to see more information. Often, you can click the main entry to open a window that shows charts and details for that item.

Utilization History

When you select an entry for a specific device in the Inventory tree or Groups tree, the corresponding Utilization panel displays metrics for that device. By default, the panel displays metrics for the last two hours. Depending on the license you have installed, you can view up to 48 days of data in this panel.
Figure 3-14. Viewing historical data in the Utilization chart

You drag a slider to set the range to view. Note that Operations Manager has to have been running long enough to display the range of data you want. For example, if it has only been running for 30 days, you cannot view more than 30 days of data.
Logging In to Operations Manager

To get started, you open a web browser to your Operations Manager installation. Operations Manager serves the user interface to your browser, where you can use it to observe your environment. In this way, you can access the unique capabilities of Operations Manager from any internet connection. Before you can log in, an Operations Manager virtual appliance must be installed in your environment. To get a virtual appliance, contact VMTurbo — you can register online at http://www.vmturbo.com.

To log in to Operations Manager:

1. **Navigate your Web browser to the Operations Manager virtual appliance**
   For the URL, provide the IP address or machine name for the appliance. This URL opens the VMTurbo Operations Manager Login page. You should bookmark this URL for future use.

   ![Login Screen](image)

   **Figure 5-1. Login Screen**

2. **Provide the user name and password for your account**
   Your system administrator creates user accounts. Contact your system administrator for login information.

   After you log in, the browser opens to the The Home Tab - page 46. This tab displays information about your virtual environment.
To display this information, Operations Manager communicates with *target platforms* such as hypervisors, load balancers, and cloud stacks. Note that your Operations Manager administrator sets up the target configuration. For more information, see **Target Configuration** - page 137.
The Inventory Tab

The Inventory Tab is where you go to observe your full virtual infrastructure. Here you can see the health of your entire virtual environment from a single tab. You can identify bottlenecks and other resource and performance anomalies, and assess your overall workload balancing. You can also see recommended actions to improve performance in your environment, and direct Operations Manager to execute various actions.

If your current licensing supports the retention of historical data, panels in the Inventory Tab can show up to 48 days of utilization on specific devices. For more information, see Utilization History - page 32.

In the Inventory Tab, the Navigation panel shows all the resources, services, and commodities Operations Manager has discovered for your environment. As you browse the navigation tree, the information panels display charts and tables to describe the items you select.
Chart panels in the Inventory tab include tools you can use to:

- Maximize/minimize
- Customize display
- Export content to XML
- Show/hide controls to set date range or zoom
- Display a legend
- Display tooltips

For more information, see **Standard Panel Controls** - page 23.

Chart panels can display historical data. For more information, see **Utilization History** - page 32.

The Inventory view includes To Do lists that show recommended actions. For more information, see **To Do Lists—Maintaining QoS** - page 34.

The following sections describe the information you see as you select the different Navigation items:

- **Summary** - page 47
- **Virtual Applications** - page 50
- **Applications** - page 53
- **Virtual Machines** - page 56
- **Physical Machines** - page 61
- **Storage** - page 65
- **Provider Virtual Data Centers** - page 69
- **Organization Virtual Data Centers** - page 72
- **Data Centers** - page 67

## Summary

When you select **Summary** in the Inventory tree, the Inventory View displays its summary panels. These panels show summaries of your Applications, Virtual Machines, Physical Machines, and Data Stores to give you an overview of the environment’s status.

Each of these panels shows a heatmap for the items in a level in the supply chain. For each item the panel shows the status of its resources and the item’s utilization Index. The status indicators are color-coded, as follows:

<table>
<thead>
<tr>
<th>Utilization Legend</th>
<th>Critically Underutilized</th>
<th>Underutilized</th>
<th>Normal</th>
<th>Overutilized</th>
<th>Critically Overutilized</th>
</tr>
</thead>
</table>

Chapter 6: The Inventory Tab
As Operations Manager monitors and analyzes your environment, it uses specified constraints to identify the status of a resource. You specify these constraints in the Policy tab. Changes to these settings can affect the status display in the summary panels. For more information about policy settings, see Policy Categories - page 155.

You can get additional information for the items in these panels as follows:

- To display tool tips that show actual values, hover the mouse over the colored indicators
- To display a chart that shows details about a specific item, click the colored indicator
- To display a separate tab for an item, click the item’s name
- To display the Risks/Opportunities for a specific item, click its severity icon

In addition to information panels, the Summary display includes a To Do panel — This panel toggles between a To Do list of recommended actions and a list of risks and efficiency opportunities. You can execute the recommended actions to maintain optimal performance in your environment. The risks/opportunities describe the issues that drive action recommendations. For more information, see To Do Lists—Maintaining QoS - page 34.

Figure 6-2. Summary Panels

Summary Reports

If you have installed a license for reporting, you can launch summary reports from the Inventory tab. To launch a report, click the Reports icon next to the given entry in the Navigation tree.
You can launch a report for all the items in a tree item, or you can expand the item and launch a report for a single item. For example, you can launch a report for all virtual machines on a host, or you can expand the tree and launch a report for a single virtual machine.

For more information about reporting, see Reports - page 75.

**Severity Icons in Summary Panels**

The panels in the summary view show a severity icon for each entry. You can click the icons to display the Risks/Opportunities Log to help track issues for the given item. For information about executing recommended actions and using the problem log, see To Do Lists—Maintaining QoS - page 34.
NOTE: The heatmap does not directly correspond with the existence of risks to QoS. The heatmap might show red, but Operations Manager doesn’t show a risk. Conversely, the heatmap might show greens and blues, but Operations Manager recognizes a risk and a corrective action to take. For example, if there is no fix for overconsumption in the heatmap, Operations Manager does not list the risk. On the other hand, if Operations Manager recognizes a fix that can improve utilization for a device, it lists that as a risk or opportunity.

Virtual Applications

A virtual application is the logical application server (sometimes called a vserver) that a load balancer uses to marshal access to load-balanced applications. For a full definition, see Virtual Application - page 7 in Introducing Operations Manager - page 3.

Each virtual application has one or more running applications bound to it. The load balancer passes requests to these bound applications. Note that Operations Manager discovers running applications, but you must bind these to the virtual applications that are in a load balancer. For more information, see Applications - page 53 and Application Discovery - page 170.

NOTE: Operations Manager uses Microsoft Windows Management Integration (WMI) to discover and manage application processes. With the exception of Guest Load, all managed applications run on Windows machines (for more information, see Guest Load - page 56).
When you select **Virtual Applications** in the Inventory tree, the Inventory view displays the following panels:

- **Virtual Applications Utilization Chart**
  The percentage of allocated transaction capacity the virtual applications are using. To see a history of usage for a virtual application, click the associated bar.
  
  To see the utilization index for your virtual applications, display the customizing controls and edit the chart. Utilization index shows a measure of the utilization of resources. The more equal the utilization indexes are for your applications, the more evenly balanced their loads.

- **Virtual Applications Utilization Trend**
  The percentage of maximum and average transactions over time.

- **To Do list — Recommended actions for Virtual Applications**

- **Usage for Virtual Applications**
  A tabular display of the percentage of transaction capacity for each virtual application.

Figure 6-5. Virtual Applications Summary
In the Inventory tree, the Applications branch includes a hierarchy similar to the following figure.

![Applications Hierarchy](image)

**Figure 6-6. Applications Hierarchy**

Underneath Virtual Applications, the list shows the application service types. These service types are defined on the load balancer — Operations Manager discovers the service types through each load balancer that is registered as a target. For each service type, the panels show charts for the current service type:

- **Virtual Applications Utilization Chart**
  The percentage of transaction capacity used by virtual applications of this service type. To see a history of usage, click the associated bar.
- **Virtual Applications Utilization Trend**
  The percentage of maximum and average transactions over time.
- **Virtual Applications To Do list**
- **Usage for Virtual Applications**
  A tabular display of the percentage of transaction capacity for virtual applications of this service type.

When you expand a Service Type item, the Inventory tree lists the individual virtual applications within that service type. Each virtual application consumes the running applications that are managed by the load balancer.
Applications

Operations Manager discovers and monitors applications running on VMs in your environment. By default, Operations Manager discovers the following applications:

<table>
<thead>
<tr>
<th>Application Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSASS</td>
<td>Microsoft Active Directory services</td>
</tr>
<tr>
<td>IIS</td>
<td>Microsoft Internet Information Services</td>
</tr>
<tr>
<td>XenDesktop</td>
<td>Citrix XenDesktop</td>
</tr>
<tr>
<td>VMView</td>
<td>VMWare View</td>
</tr>
<tr>
<td>MSSQL</td>
<td>Microsoft SQL Server</td>
</tr>
<tr>
<td>SharePoint</td>
<td>Microsoft Sharepoint Server</td>
</tr>
<tr>
<td>Guest Load</td>
<td>The resources that Operations Manager has not assigned to any specific application (for more information, see Guest Load - page 56)</td>
</tr>
</tbody>
</table>

In addition, your installation of Operations Manager might be configured to discover other applications running in your environment. For more information, see Application Discovery - page 170.

**NOTE:** Operations Manager uses Microsoft Windows Management Integration (WMI) to discover and manage application processes. With the exception of Guest Load, all managed applications run on Windows machines (for more information, see Guest Load - page 56).

When you select **Applications** or an applications group in the Inventory tree, the Inventory view displays the following panels:

- **Applications Utilization Chart**
  The percentage of VMEM, VCPU and transaction capacity the applications are using. To see a history of usage for an application, click the associated bar.
  
  To see the utilization index for your applications, display the customizing controls and edit the chart. Utilization index shows a measure of the utilization of resources. The more equal the utilization indexes are for your applications, the more evenly balanced their loads.

- **Applications Utilization Trend**
  The consumption of commodities over time. Click the radio buttons to choose which statistics to show in the chart. You can show averages for all resources, or average and max for individual resources.

- **Recommended Actions for Applications**
- **Usage for Applications**
  A tabular display of VCPU and VMEM usage for the VMs that support your applications.
Figure 6-7. Applications Summary
In the Inventory tree, the Applications branch includes a hierarchy similar to the following figure.

![Applications Hierarchy](image)

**Figure 6-8. Applications Hierarchy**

When you expand an Applications item, the Inventory tree lists application groups and individual applications within each group. If you select an application group, the view displays a set of panels showing information about all the applications in that group. If you select an individual application, the view displays a set of panels devoted to the specific application.

These panels show:

- **Application Utilization Chart**
  The percentage of VMEM, VCPU and transaction capacity the application uses.

- **Application Utilization Trend**
  The consumption of commodities over time for this application. Click the radio buttons to choose which statistics to show in the chart. You can show averages for all resources, or average and max for individual resources.

- **Recommended Actions for the Application**

- **Usage for the Application**
  A tabular display of VCPU and VMEM usage for the VMs that support your applications.
The Apps_GuestLoad item is a special entry in the Applications hierarchy. This item tracks the resources that Operations Manager has not assigned to any specific application. This can occur for the following reasons:

- You do not have the licences required to support Application monitoring
  In this case, Operations Manager lists all the consumed VM resources in the Apps_GuestLoad entry—this is the only entry under Applications.
- Operations Manager fails to discover some applications
  In this case, Operations Manager displays entries for the applications it has discovered, and lists the VM resources that are not accounted for under Apps_GuestLoad.
- VM resources are devoted to infrastructure, and not part of any application
  Operations Manager lists these resources under Apps_GuestLoad, and provides entries for the applications it has discovered.

Virtual Machines

When you select Virtual Machines in the Inventory tree, the Inventory view displays information about groups of virtual machines. The virtual machines are grouped by the physical machines they run on. The view lists VMs in these groups because the number of VMs in your environment can be very large. Grouping them by their physical machines makes the amount of data in each panel easier to view and understand.
For the Virtual Machines item, the Inventory view displays the following panels:

- **Virtual Machines Utilization Chart**
  The percentage of CPU and memory capacity used by groups of virtual machines. To see a history of usage for a group, click the associated bar.
  
  To see the utilization index for your VMs, display the customizing controls 📊 ‪ ‪ ‪ ‪ ‪ and edit the chart 🖊 ‪ . Utilization index shows a measure of the utilization of resources. The more equal the utilization indexes are for your VMs, the more evenly balanced their loads.

- **Virtual Machines Utilization Trend**
  The consumption of commodities over time. Click the radio buttons to show CPU or memory statistics.

- **Recommended actions for Virtual Machines**

- **Usage for Virtual Machines**
  A tabular display of usage of resources such as CPU and memory for the VMs in your environment.

![Virtual Machines Utilization Chart](image1)

![Virtual Machines Utilization Trend](image2)

![Virtual Machines To Do](image3)

![Usage for Virtual Machines](image4)

**Figure 6-10. Virtual Machines**

In the Inventory tree, the Virtual Machines branch includes a hierarchy similar to the following figure.
When you expand the Virtual Machines item, the Index tree lists the individual VM Groups by the names of their physical machines. If you select an individual VM group, the view displays a set of panels similar to the following figure. Note that the Utilization bar chart shows bars for each VM in the group.
When you expand a VM group, the Index tree lists the individual VMs. If you select an individual VM, the view displays a set of panels similar to the following.

Figure 6-12. Virtual Machines — One Group of VMs
The Data Store Utilization panel shows metrics for the utilization of the data stores that are available to this VM. Beneath that, the Physical Machine Utilization panel shows the VM's resource utilization on the hosting PM, including CPU, memory and CPU ready queue utilization.

The Virtual Machine Consumption panel shows metrics for the utilization of physical resources by the selected VM. The title bar of the chart shows the VM name. You can see the name of that VM's physical host in the Navigation Tree. The table lists the utilization of each resource, compared to the overall capacity on the physical machine. Next to the utilization percent column, the table lists the actual resource used and the full available capacity, in the following units of measurement:

- Ballooning - KBytes
- CPU - MHz
- CPU Ready Queues - ms of wait time
- IO Throughput - KBytes/sec
- IOPS - Storage access operations per second
- Latency - ms (milliseconds)
- Memory - KBytes
- Net Throughput - KBytes/sec
- Storage Amount - KBytes
- Swapping - KBytes
From the Navigation Tree you can expand each VM to show the following:

- Commodities
- Commodities Bought
- Composed Of
- Consumes

**Physical Machines**

When you select Physical Machines in the Inventory tree, the Inventory view displays the following panels:

- **Physical Machines Utilization Chart**
  The percentage of physical machine CPU and memory commodities that are used within your environment. To see a history of usage per machine, click the associated bar.

  To see the utilization index for your PMs, display the customizing controls and edit the chart. Utilization index shows a measure of the utilization of resources. The more equal the utilization indexes are for your PMs, the more evenly balanced their loads.

- **Physical Machines Utilization Trend**
  The consumption of commodities over time. Click the radio buttons to show memory, CPU, IO, or network throughput statistics.

- **Recommended actions for Physical Machines**

- **Usage for Physical Machines**
  A tabular display of resource usage for the physical machines in your environment.

![Physical Machines Utilization Chart](image1)

![Physical Machines Utilization Trend](image2)

![Physical Machines To Do](image3)

![Usage for Physical Machines](image4)

**Figure 6-14. Physical Machines**
Usage Metrics

When you select physical machines, data stores, or VM groups in the Navigation Tree, the Inventory view displays a table of usage metrics for the selected devices. To control the display of these metrics you can:

- Show all or filter by the top 10 or bottom 10 instances
- Sort the table by column
- Show the current metrics, or show values for a historic sample (say, three days ago)

![Usage Table for Physical Machines](image)

Choose how to filter the metrics
Click to sort by column
Drag for historical metric data

Figure 6-15. Usage Table for Physical Machines

In the Inventory tree, the Physical Machines branch includes a hierarchy similar to the following figure.
Figure 6-16. Physical Machines Hierarchy
When you expand the Physical Machines item, the Inventory tree lists the individual physical machines in your environment. If you select an individual machine, the view displays a set of panels similar to the following.

The physical machine Resources panel shows metrics for the consumption of physical resources by the hosted VMs. The table lists the utilization of each resource, compared to the overall capacity on the physical machine, in the following units of measurement:

- Ballooning - KBytes
- CPU - MHz
- CPU Ready Queues - ms of wait time
- IO Throughput - KBytes/sec
- IOPS - Storage access operations per second
- Latency - ms (milliseconds)
- Memory - KBytes
- Net Throughput - KBytes/sec
- Storage Amount - KBytes
- Swapping - KBytes

You can expand each physical machine to show the following:

- Composed Of
- Consumes
- Hosts
Storage

The Storage item shows statistics for storage devices such as disks or disk arrays. When you select Storage in the Inventory tree, the Inventory view displays the following panels:

- **Storage Utilization Chart**
  The percentage of storage amount and storage IOPS capacity that are used in the environment. To see a history of usage per storage device, click the associated bar.
  
  To see the utilization index for your storage, display the customizing controls and edit the chart.

  Utilization index shows a measure of the utilization of resources. The more equal the utilization indexes are for your storage, the more evenly balanced their loads.

- **Storage Utilization Trend**
  The consumption of commodities over time.

- **Recommended actions for Storage**

- **Usage for Storage**
  A tabular display of storage amount and storage IOPS and other usage for the storage devices in your environment.

![Storage Utilization Chart](image)

**Figure 6-18. Storage**

In the Inventory tree, the Storage branch includes a hierarchy similar to the following figure.
When you expand the Storage entry, the Inventory tree lists the individual datastores in your environment. If you select an individual datastore, the Inventory view displays a set of panels similar to the following.
When you expand a data store item, the view shows the following:

- Consumes

**Data Centers**

When you select Data Centers in the Inventory tree, the view displays the following panels:

- Data Centers Utilization Chart
  The percentages of Space, Power, and Cooling capacity that are used within your environment. To see a history of usage per data center, click the associated bar.

  To see the utilization index for your data centers, display the customizing controls and edit the chart. Utilization index shows a measure of the utilization of resources. The more equal the utilization indexes are for your data centers, the more evenly balanced their loads.

- Physical Machines by Data Center Utilization Trend
  The consumption of commodities over time. Click the radio buttons to show Space, Power, or Cooling statistics.

- Recommended actions for Data Centers

- Usage for Physical Machines by Data Center
  A tabular display of usage for the data centers in your environment.
Figure 6-21. Data Centers

In the Inventory tree, the Datacenters branch includes a hierarchy similar to the following figure.
When you expand the Data Centers item, the Inventory tree lists the individual data centers in your environment. If you select an individual data center, the data display is similar to the above figure, but for that single data center. For each individual data center, the Inventory tree shows the following:

- Consists Of
- Hosts

**Provider Virtual Data Centers**

Provider Virtual Data Centers expose the resources that you will deliver to customer organizations. Virtual Data Centers are managed by vCloud Director. Note that you must have installed the Cloud Operations Manager license to access this feature.

When you select Provider Virtual Data Centers in the Inventory tree, the Inventory view displays the following panels:

- Provider Virtual Data Centers Utilization Chart
  The percentage of allocated memory, CPU, and storage resources that are used by your provider vDCs. To see a history of usage per data center, click the associated bar.

  To see the utilization index for your data centers, display the customizing controls and edit the chart. Utilization index shows a measure of the utilization of resources. The more equal the utilization indexes are for your data centers, the more evenly balanced their loads.

- Provider Virtual Data Centers Utilization Trend
  The consumption of allocated commodities over time. Click the radio buttons to show memory, CPU, or storage statistics.
• Recommended actions for Provider Virtual Data Centers
• Usage for Provider Virtual Data Center
  A tabular display of usage for the data centers in your environment.

Figure 6-23. Provider Virtual Data Centers

In the Inventory tree, the Provider Virtual Datacenters branch includes a hierarchy similar to the following figure.
When you expand the Provider Virtual Datacenters item, the Inventory tree lists the individual Provider vDCs in your environment. If you select an individual Provider vDC, the Inventory view displays a set of panels similar to the following.
These panels show:

- **Provider vDC Utilization Chart**
  The percentage utilization over time of memory, CPU, and storage commodities that are allocated to this vDC.
- **Provider Physical Machine Utilization**
  The percentage utilization of resources on the physical machines that host this vDC.
- **Provider Datastore Utilization**
  The percentage utilization of resources on the datastores that service this vDC.
- **Recommended Actions for the Provider vDC**
- **Provider vDC Consumed Resources**
  A tabular display of the utilization of resources, compared to the capacity that has been allocated to the vDC.
- **Organization Virtual Data Center Utilization**
  The percentage of resource capacity on the Provider vDC that is utilized by the hosted Organization vDCs.

If you expand an individual Provider vDC, the Inventory view shows the following:

- **Hosts** — The Organization vDCs that are hosted by this Provider vDC

---

**Organization Virtual Data Centers**

Organization Virtual Data Centers expose the physical resources that are allocated to specific customer organizations. Virtual Data Centers are managed by vCloud Director. Note that you must have installed the Cloud Operations Manager license to access this feature.

When you select Organization Virtual Data Centers in the Inventory tree, the Inventory view displays the following panels:

- **Organization Virtual Data Centers Utilization Chart**
  The percentage of allocated memory, CPU, and storage resources that are used by your organization vDCs. To see a history of usage per data center, click the associated bar.

  To see the utilization index for your data centers, display the customizing controls and edit the chart. Utilization index shows a measure of the utilization of resources. The more equal the utilization indexes are for your data centers, the more evenly balanced their loads.

- **Organization Virtual Data Centers Utilization Trend**
  The consumption of allocated commodities over time. Click the radio buttons to show memory, CPU, or storage statistics.

- **Recommended actions for Organization Virtual Data Centers**
- **Usage for Organization Virtual Data Center**
  A tabular display of usage for the data centers in your environment.
In the Inventory tree, the Organization Virtual Datacenters branch includes a hierarchy similar to the following figure.

**Figure 6-26. Organization Virtual Data Centers**

**Figure 6-27. Provider Virtual Datacenters Hierarchy**
When you expand the Organization Virtual Datacenters item, the Inventory tree lists the individual Organization vDCs in your environment. If you select an individual Organization vDC, the Inventory view displays a set of panels similar to the following.

Figure 6-28. Individual Provider Virtual Data Center

These panels show:

- **Organization vDC Utilization Chart**
  The percentage utilization over time of memory, CPU, and storage commodities that are allocated to this vDC.
- **VMs on Organization vDC**
  For each VM on this vDC, the percentage utilization of resources.
- **Provider Virtual Datacenter Utilization**
  The percentage of the host Provider vDC resources that are utilized by this Organization vDC.
- **Recommended Actions for the Organization vDC**
- **Organization vDC Consumed Resources**
  A tabular display of the utilization of resources, compared to the capacity that has been allocated to the vDC.

If you expand an individual Organization vDC, the Inventory list shows the following:

- **Consumes** — The Provider vDC that hosts this Organization vDC
Reports

The Operations Manager Reporter gives you selective snapshots of the state of your environment.

- **Host reporting** provides comprehensive customizable reports to track, analyze and trend your physical and virtual infrastructure operations.
- **Storage reporting** provides reports to track, analyze and trend the storage resources in your environment.

**Reporter** comes with a set of already defined reports, and you can also design your own custom reports.

Standard reports are in PDF format, and you can also export XML versions to view as Microsoft Excel spreadsheets. Operations Manager generates standard reports every day at a determined time (2:00 am on the Operations Manager system clock). With these reports you can see historical information about the state of your environment. Note that reports are historical, in contrast to the current state you can see by using Inventory (see The Inventory Tab - page 46).

You can view these reports in your web browser, or you can send them to a specified e-mail address. You can also add lists of subscribers to each report, including e-mail and reporting interval (daily or weekly). In this way, you can use Operations Manager reports to keep a specific group of people informed about the state of your environment.

**NOTE:** Operations Manager must run for at least 24 hours before the it can generate standard reports.

When you create custom reports, Operations Manager generates them per your request. These reports can display five-minute data, hourly data, or data that is consolidated daily. The Reports page displays a customized report as HTML — you can print it or save it as PDF, CSV, or XML. You can send custom reports to a specified address and set up subscriptions.

When you click the Reports tool (_reports) or a report icon for an inventory item (_report), VMTurbo opens a new web page that provides access to the reporting products you are currently licensed to use.

**NOTE:** The first time you launch the reporting page, you must provide login credentials. Use the same credentials that you provided to log into Operations Manager.
In the Reports GUI, the **Management Panel** provides access to individual reports, and any tools you need to show or edit reports. This panel displays different tools, depending on the Report Tab you are using. Operations Manager maintains categories of reports, and you open or close accordion buttons to show/hide each category.

The **View Panel** shows whichever report you choose to view. When you create or edit a custom report, the **Edit Panel** displays in this location.

The Reports page includes three tabs that present the following capabilities:

- **Standard Reports** - page 76 — Use this tab to view the standard reports that Operations Manager generates. The reports that appear in this list are determined by settings in the VMTurbo Admin tab (see Report Configuration - page 144).
- **Custom Reports** - page 78 — Use this tab to create custom reports, and show only the information you want.
- **Manage Subscriptions** - page 83 — Use this tab to see at a glance who is subscribed to your reports, and add or remove subscriptions.

### Standard Reports

This tab presents all the standard reports that Operations Manager generates. These reports include tabular data and charts to present the information. Each report heading in the Management Panel includes an icon to indicate the types of charts it includes.

The Standard Reports include categories such as:

- Capacity Management for Hosts — Available and utilized PM resource capacity
- Capacity Management for Storage — Available and utilized storage capacity
- Capacity Management for VMs — Available and utilized VM resource capacity

---

**Figure 7-1. The Reports GUI**

In the Reports GUI
• Workload Balancing — Resource utilization for physical and virtual machines
• Machine and Data Store Summaries — Summarizes physical and virtual machines, generated on request
• Group and Cluster Summaries — Summarizes PM and VM groups, generated on request

To view a report, choose the creation date you want. Then click:
• PDF to view the report as PDF in the View panel
• Excel to generate the report in the Excel XML format and either save it to disk or view it in Microsoft Excel

To send a report to one or more people, click Send, and provide a comma-separated list of e-mail addresses.

**Subscribing to Standard Reports**

Operations Manager provides subscription, so that Operations Manager will send reports to given e-mail addresses at regular intervals. Note that there are two types of standard reports:
• Fixed reports - generated for a predetermined set of entities, such as all hosts, or all data stores
• On-demand reports - generated for the set of entities that you specify

When you create a subscription, you specify:
• The recipient’s e-mail address.
• The reporting period - how often to send the report.
• For On-demand reports, the set of entities to include in the report subscription. Operations Manager generates a separate report for each entity.

**Fixed Reports Subscriptions**

To create a subscription, click the Subscribe link that is in the report’s entry.

In the form that appears, provide the e-mail address and reporting period, then click Save.

To edit this subscription (for example, to change the reporting period), use the Manage Subscriptions tab (see Manage Subscriptions - page 83).

**On-Demand Report Subscriptions**

To create a subscription, click the Edit Subscriptions link that is in the report’s entry.

In the form that appears, provide the e-mail address and reporting period, choose the set of entities for the report, then click Save. To edit subscriptions, click the link and modify the table of subscriptions.
"Hosting Summary by Host Group"

Subscriptions

Existing

<table>
<thead>
<tr>
<th>Delete</th>
<th>Edit</th>
<th>Send to E-Mail</th>
<th>Period</th>
<th>Day Type</th>
<th>Run Report For</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><a href="mailto:jane_smith@mycc.com">jane_smith@mycc.com</a></td>
<td>Weekly</td>
<td>Sun</td>
<td>PMS_Development41\Cluster-1</td>
</tr>
</tbody>
</table>

Add New Subscriptions

- **Send to E-Mail**: john_doe@myco.com
- **Period**: Monthly
- **Day Type**: None
- **Run Report For**:
  - HP Physical Machines
  - PMS_Development41
  - PMS_Development41\Cluster-1
  - PMS_Development41\Cluster-2

For example, this figure shows an existing subscription for Jane Smith. The form is prepared to create 4 separate subscriptions for John Doe. When the user clicks **Save**, those reports will appear in the table.

Custom Reports

Custom reports show tabular data for the fields you specify. The Operations Manager database stores historical data in five-minute data records. At specified intervals, the database consolidates the five-minute data into hourly records, and it consolidates the hourly records into daily records. The Operations Manager administrator uses Retention Configuration - page 179 to manage how Operations Manager performs this consolidation.

To view, send, or subscribe to a custom report, click the associated link next to that report.

To edit a report, click **Edit** and make your changes. See Edit Custom Reports - page 79.

To create a report, click **Add New** at the bottom of the Management Panel. See Adding New Custom Reports - page 79.
Adding New Custom Reports

When you create a new report, you first choose what type of report to create.

To create a new Custom Report:

1. **Display the Custom Reports tab.**
2. **Click Add New.**
   
   The New Custom Report page displays.
3. **Either click Select to begin by selecting the type of report, or click Copy to base your work on a copy of an existing report.**
   
   When you create a new report, you can either select from a list of report types, or you can choose to base your new report on a copy of an existing report.
   
   The report type determines the time range for the individual data records, as well as a focus on utilization or capacity data. For information about the time represented by each record, see [Custom Reports](#) - page 78 and [Retention Configuration](#) - page 179.
   
   To create a new report that is based on a report type, click **Select** for the report type you want to use. The New Custom Report page lists all the report types you can use for your report, with descriptions of each.
   
   To create a new report based on a copy of an existing custom report, click **Copy** for the report you want to copy. At the bottom of the New Custom Report page you will find a list of the existing custom reports, along with their descriptions.

When you click **Select** or **Copy**, the [Edit Custom Reports](#) - page 79 page appears. You make changes in this page to define the new report.

**NOTE:** The easiest way to learn how to create a custom report is to use a copy of an existing report. Reporter ships with a number of reports you can use as examples.

Edit Custom Reports

This page presents the tools to add fields to your custom report, specify sort order of the report table, and specify conditions that you can use to filter the table by field values. Changes you make on this page automatically apply to the current report — except for the **Basic Properties** form (report title, category, description, etc.), you do not need to apply any changes.

When you are finished specifying your report, click **Done Editing**. This takes you to the initial page of the Custom Reports tab, and displays the current report category.

If you no longer want the report in your collection, click **Delete This Report**. Note that if you’re creating a new report, that report exists in the collection even if you have made no changes whatsoever. If you change your mind and don’t want to create this report, click **Delete This Report**.

To create or edit a report, you perform the following tasks:

- **Setting Basic Properties** - page 80 — Provide information that describes the report, and specify the maximum number of records.
- **Choosing Query Fields** - page 80 — From the list of available fields for this report type, move fields into the Query Fields list. Each item in the Query Fields list will create a column in your report.
- **Specifying Query Field Conditions** - page 81 (optional) — For each field in the Query Fields list, you can specify conditions to filter the report by that field.
- **Sorting Report Columns** - page 82 (optional) — For each field in the Query Fields list, you can specify ascending or descending sort. You can also specify sort order — which column to sort first, then second, and so on.
NOTE: The easiest way to learn how to edit a custom report is to use a copy of an existing report. Reporter ships with a number of reports you can use as examples.

### Setting Basic Properties

The **Basic Properties** form provides a description of the report, and also limits the number of records the report will contain.

![Figure 7-2. Basic Properties for a Custom Report](image)

**NOTE:** When you make changes to the **Basic Properties** form, you must click **Apply Form Changes** to assign these changes to the report.

The **Basic Properties** form includes the following information. Make your settings and then click **Apply Form Changes**:

- **Report Type** — This shows the report type that is the basis for this report.
- **Title** — Provide your own descriptive report title.
- **Category** — Provide any name for a category. If you use an existing category name, this report will be a member. If you provide an new name, you will create a new report category. You should use a descriptive name that can apply to multiple custom reports. When you open the Custom Reports tab, the Management Panel will include an accordion button for each report category you create.
- **Short Description** — The short description appears in the report as a tool tip when you hover over the title.
- **Long Description** — The long description appears in the report, and also in the list of custom reports you can copy when you create new reports (see **Adding New Custom Reports** - page 79).
- **Max Records** — The default is 500. You should specify a reasonable number of records for your report. Too many records make your report difficult to read. Generating a report with a very large number of records can monopolize Operations Manager resources.

### Choosing Query Fields

The fields that you add to the **Query Fields** list will appear in the report’s table. To add an **Available Field** to the list, click the arrow for that available field.

Each field creates a column in the table — to move the column position to the left, click the query field’s up arrow. Use these arrows to arrange the layout of your report’s table.

To remove a field from the **Query Fields** list and return it to **Available Fields**, click the field’s **Remove** button.
Specifying Query Field Conditions

You can optionally specify a query condition for a given query field. In this way, you can filter the report to only show specific data. For example, the following figure shows an existing query for the `instance_name` field that limits it to the storage device named “iSCSISharedDisk1”. The figure also shows a new condition that gets storage latency data from the `property_type` field.

To add a condition, click the plus (+) icon. To remove an existing condition, click its minus (-) icon.

To specify a condition:
- Choose a Field Name — You can choose from the fields that are available for this report.
- Choose an operation — For example, to match a string, choose “equal”.
- Specify a value — You can provide a literal string or integer, or you can provide an SQL expression that returns a value. For example, in the above figure the new condition will have the following expression for its value: 
  \[ \text{date(date_sub(now(), interval 1 day))} \].

As you specify a condition for a field, it is useful to know what values are available in the database for a given field. The `Value` text box includes a `Show Choices` link that displays the Field Values Reference list. This list shows values for the database fields. This list shows live values that it gets from the database. For example, the list of values for the `instance_name` field shows the names of every entity that Operations Manager has discovered for your environment.
To see a list of values for a field, click the arrow next to that field.

To use a value, you can copy it from the list and paste it in the Condition Value text field. For example, you could make a condition such as instance_name = datastore3 to limit your report to information about the entity named datastore3.

This Field Value Reference does not show values for calculated fields. The following is a table of these fields, and how the values are treated:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Value Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>utilization</td>
<td>A percentage, where 0.5 = 50%</td>
</tr>
<tr>
<td>stddev_property_value</td>
<td>A raw number, where the units of measure depend on the resource this field represents.</td>
</tr>
<tr>
<td>avg_property_value</td>
<td></td>
</tr>
<tr>
<td>min_property_value</td>
<td></td>
</tr>
<tr>
<td>max_property_value</td>
<td></td>
</tr>
<tr>
<td>used_capacity</td>
<td></td>
</tr>
<tr>
<td>available_capacity</td>
<td></td>
</tr>
<tr>
<td>capacity</td>
<td></td>
</tr>
</tbody>
</table>

**Sorting Report Columns**

For any field in the Query Fields list, you can specify sort direction and sort order. When you generate a report, it will sort the columns of data according to the settings you make.
Sorting

<table>
<thead>
<tr>
<th>Sort Order</th>
<th>Field Name</th>
<th>Sort</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>class_name</td>
<td>ASC</td>
</tr>
<tr>
<td>↑ 2</td>
<td>instance_name</td>
<td>ASC</td>
</tr>
<tr>
<td>↑ 3</td>
<td>property_type</td>
<td>ASC</td>
</tr>
<tr>
<td></td>
<td>capacity</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>utilization</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>used_capacity</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>available_capacity</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>recorded_on</td>
<td>-</td>
</tr>
</tbody>
</table>

Figure 7-6. Specifying Sort

By default, the query fields do not sort. To define sorting for a field, click the hyphen character in the Sort column. This changes the specification to ASC, for ascending sort. For a descending sort, click the Sort field again (click ASC) — this changes the specification to DSC. Click the field again to turn off sorting and change the specification to a hyphen character.

To specify sort order, click the Up Arrow to move the entry up in the list. The Sort Order column indicates the ordering of each field.

Manage Subscriptions

This tab shows you at a glance all the subscriptions to your standard and customized reports. The tab divides the listing by category, and gives you the tools to add or delete subscriptions for each report. The following figure shows that John Doe is subscribed to two daily reports, and Jane Smith is subscribed to one weekly report.

Figure 7-7. Manage Subscriptions
To add a subscriber, click the **PLUS** button, and specify the following information:

- **e-mail Address** — The address of the report subscriber
- **Period** — One of Daily, Weekly, or Monthly, to specify how often the subscriber receives the report
- **Day of Week** — For a weekly period, the day of the week to send the report

Do delete a subscriber, click the **MINUS** button.

**NOTE:** You can specify the **From** address for emails to report subscribers. By default, Operations Manager uses the email address that is associated with the installed Operations Manager license. You can specify a **From** address as part of your current Email Notification policy. For more information, see *Email Notification* - page 176.
The Plan Tab

The Planner gives you the tools to create what-if scenarios that explore possibilities such as:

- Load balancing of current resources
- Projected system requirements
- Adding new and more powerful hardware
- Impact of downsizing, or removing resources

Operations Manager runs these scenarios and displays target results that give you optimum utilization indexes for your proposed environment. A scenario shows a summary of your target environment, utilization charts for your resources, as well as recommended actions you can perform to achieve the target results.

For example, assume you run a plan that adds virtual machines to a cluster. The summary might show that you gain a lower and more evenly spread utilization index if you add more virtual machines to a smaller number of physical hosts. The recommended actions would then indicate which hosts you can take offline, and how to distribute your virtual machines among the remaining hosts.

To use the Planner, click the Plan tab, then create and run plans. The following figure shows the Planner user interface, with these features:

- The summary shows that the target utilization index has been evened out across all the host machines. The green plot is the target index, while the bars on the chart indicate the current utilization index. You can display charts for utilization index, memory consumption, CPU percentage, IO utilization, and network utilization.
- The summary also shows that this scenario suggests you add two new hosts to support the 20 new VMs.
- There are a number of suggested actions you can perform to achieve this target. To see individual recommendations, you can expand the different categories.
Choose the type of plan to run

Planner toolbar

Choose the type of plan to run

Planner toolbar

Choose the type of plan to run

Planner toolbar

Actions you can take to achieve target results

Compare current state to target results. Green plot shows target.

Summary of plan parameters

Figure 8-1. The Planner GUI
Use Cases

Chapter 8: The Plan Tab

The Planner tool bar includes the following:

- **View**
- **Scope**
- **Merge and Run**
- **Run**
- **Stop**
- **Plan**

Display the different Planner views:
- **Summary View** - page 90
- **Physical Machine Utilization View** - page 92
- **Storage Utilization View** - page 92
- **Physical Machine and Storage Detailed Utilization View** - page 92

Limit the physical devices that are included in the planning scenario—such as, limit to a given cluster. See **Setting Plan Scope** - page 98.

Specify workload parameters for the plan—such as, add or remove VMs, PM, and data stores to change load or capacity. See **Specifying the Plan Load** - page 103.

Specify baseline utilization statistics (current or historic) for the plan. See **Selecting the Plan Baseline** - page 100.

Restrict planning to the current hardware inventory (don’t add new hardware).

**Note:** If you have specified a value for **Target Utilization** - page 166, you should not restrict to the current hardware. Otherwise, the plan results may not be satisfactory.

Specify advanced parameters for utilization, VM Constraints, and Workload Placement. See **Setting Advanced Options** - page 111.

Run the plan. The plan can recognize existing constraints (clusters, network/storage constraints, and workload placement policies), or it can disable the constraints before running (merge and run).

While a plan is running, the **Stop** button appears. You can stop a running plan if necessary. See **Running Plans** - page 93.

Create, save, load, or delete plans. See **Creating Plans** - page 96.

Use Cases

The Planner is especially useful for system architects and system administrators.

System architects can use Planner to investigate how to expand the physical and virtual inventory to the best effect. Planner can indicate how much new hardware to add, how to distribute VMs among clusters of hosts, and whether components of the proposed network will be over- or under-utilized.

System administrators can use Planner to answer immediate questions. If you expect a surge in utilization or demand, you can use Planner to explore how to deploy new VMs that perform specific functions.

The following sections show example scenarios that can address these use cases.

Increasing Virtual Load under Existing Constraints

Assume you want to determine the load distribution if you add more VMs to your environment. To do this, you would create a Workload Distribution scenario that adds the new load, and then determines the best way to spread it among your physical hosts and data stores.

Your environment already has its physical systems assigned to clusters and resource pools. As you add VMs to the environment, you want to respect these constraints. When thinking about this scenario, imagine asking, “What would happen if I add ten VMs running Web servers, and ten VMs running database servers? How can I optimally deploy these VMs in my current environment?”

To plan out the best way to add these VMs to your inventory, you create a Workload Distribution scenario that:

- Identifies how many VMs to add
- Uses an existing Web server VM as a model for your new Web server VMs
- Uses an existing database VM as a model for your new database VMs
The following steps show how to create such a scenario in the Plan tab.

1. **Display the Workload Distribution tab in the Planner.**

   ![Image of Workload Distribution tab]

   Click to display **Workload Distribution**

2. **Choose New from the Plan popup menu.**

   ![Image of Plan popup menu]

   This clears the Planner so you can specify a new plan.

3. **Edit the load for your plan.**

   For this plan you will add 20 VMs to your environment.
   - Click the Load icon ( ) to open the Edit Load dialog box
   - Specify the properties of the VMs that you will add
     For this scenario, you will add copies of existing VMs to your load. Copying existing VMs is one way to pick up the properties of your new VMs.
     To add copies of a specific VM, expand the VM group to select the VM you want, then click **ADD**. In the following image, the dialog box is set up to add 10 copies of a VM named Fedora 12:
- Now select another VM to copy, and add 10 more VMs to your load
  Be sure to click **ADD** after you have selected the new VM to copy.

- Now that you have defined the new load, click **Close and Run**
  Alternatively, you can just click **Close** and make other settings before running the planner scenario. For example, to plan for a recurring peak load you can run the scenario against a load that occurred in the past. Or you can specify the scope of the scenario. For example, you can specify that the scenario will only run on a specific group of physical hosts. After making these other changes, you can click **Run** to execute the plan.
- When Operations Manager is finished running the plan, verify that the process completed with success
  The Plan Details show the current status of the plan:
After a successful run, you can review the results in the Plan tab. To view the results, you choose a view category from the View dropdown menu. Each category displays different panels of information.

The following sections describe the view categories:

- **Summary View** - page 90
- **Physical Machine Utilization View** - page 92
- **Storage Utilization View** - page 92
- **Physical Machine and Storage Detailed Utilization View** - page 92
- **Action Plan** - page 92

### Summary View

This view shows an overview comparison of the current and target configurations. It includes the following panes:

**Summary Pane**

The Summary pane shows charts that compare the current environment to the target in terms of utilization index, memory utilization, CPU utilization, IO utilization, network utilization, and VMs per host. To see actual values, hover over the data points and display tooltips.
After running the above scenario, these charts quickly show you that the new scenario removes a number of physical hosts. For UI, Mem, CPU and IO the target significantly increases the utilization of one host, and for the remaining hosts the utilization expectations are roughly the same. Of course, the values for VMs per host have changed.

**Plan Summary Pane**

This pane shows the overall results of your proposed changes as they compare to your current environment. It presents a table showing changes to the number of physical hosts and VMs, as well as an estimate of total savings or cost.

After running this scenario, the table shows a target of 37 hosts, compared to the current environment that uses 35. It also shows that the target supports 206 VMs, to account for the 20 VMs we added in the scenario setup. Finally, VMTurbo Planner suggests you add two physical hosts.

<table>
<thead>
<tr>
<th>Plan Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Investment:</strong> $18000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Current</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Hosts</td>
<td>35</td>
<td>37</td>
</tr>
<tr>
<td>Number of VMs</td>
<td>186</td>
<td>206</td>
</tr>
<tr>
<td>Suggested Number of Hosts to Add</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Suggested Number of Hosts to Suspe</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
This pane displays the status of the current scenario:

- Name
- Scope
- Baseline (utilization statistics from this date form the basis of running the plan)

**Figure 8-2. Summary of VMs Per Host, and Cost Savings**

**Physical Machine Utilization View**

These charts show current and target utilization for the physical machines that support your VMs. With them you can easily compare the current and target states. For example, the following figure shows that the current deployment taxes two hosts with nearly 90% CPU utilization, while the target evenly distributes CPU utilization across five hosts.

**Figure 8-3. Physical Machine Utilization Charts**

**Storage Utilization View**

This view is similar to Physical Machine Utilization View, except it shows storage amount, IOPS, and latency. For this scenario, we have not made any changes that would affect storage.

**Physical Machine and Storage Detailed Utilization View**

This view shows tables of utilization metrics for your physical machines and storage devices. The tables show current and target metrics. Note that the values here are the same as the values shown in the various bar charts, but they are in tabular form.

The following image shows the target utilization for physical machines.

<table>
<thead>
<tr>
<th>Target PhysicalMachines (37 rows)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>del3.corp.vmtdisco.corporation</td>
</tr>
<tr>
<td>del4.corp.vmtdisco.corporation</td>
</tr>
<tr>
<td>hp-dl581.corp.vmtdisco</td>
</tr>
<tr>
<td>hp-dl582.corp.vmtdisco</td>
</tr>
</tbody>
</table>

**Action Plan**

After running a scenario, Operations Manager posts actions that it recommends you take to achieve the target configuration. You can browse these actions and perform them as appropriate.
Running Plans

The Planner uses plans to compare hypothetical conditions against the current conditions of your environment. You can modify a plan by setting conditions such as:

- Adding or removing VMs
- Using historical load conditions
- Respecting or ignoring constraints such as clusters or workload placement policies
- Adding hardware or restricting the plan to the current inventory

**NOTE:** By default, a new and untitled plan mirrors your current environment. You can run the Planner against such a scenario, and it will give you results for your current environment. For example, to check the workload balance of your current environment you simply run a new and untitled plan.

The Planner can run scenarios to calculate three types of results:

- **Workload Distribution**
  The Planner calculates the configuration of your environment that will best distribute the planned load across your devices. You can run the plan with no modifications to balance the current load on your environment, or you can create a plan that specifies a different load. For more information, see [Workload Distribution - page 114](#).

- **Workload Projection**
  The Planner uses historical resource consumption data to calculate the future consumption you can expect under the plan’s conditions. Run a plan with no modifications to see how your current configuration will hold up into the future. Or you can run a projection with plan conditions that test how the environment would respond in the future to a different load. For more information, see [Workload Projection - page 117](#).

- **Hardware Replace**
  Use templates for hosts or data stores to plan the effects you will see if you change the capacity of the physical devices in your environment. For more information, see [Hardware Replace - page 121](#).
By default, a plan incorporates all the constraints (cluster, storage, and network) and workload placement policies that are in effect. You can run a plan in two modes with respect to these constraints:

- **Normal mode:**
  The plan incorporates all the constraints. For example, in this mode the plan will not give resources from one cluster to a VM that is constrained to another cluster.

- **Merge mode:**
  The plan disables all the constraints before running. For example, in this mode the plan results can include:
  - Moving VMs to hardware that is in a different cluster
  - Moving VMs to hardware that uses different storage
  - Changes that violate enabled workload placement policies

When you run a plan, you can control whether the plan results assume you will add new hosts, or you will support the planned conditions with your current host inventory. Click the Enable Host Provisioning tool to enable or disable the addition of new hosts in your environment.

**NOTE:** The results of running a plan are incremental — if you run the same plan twice, the summary compares the first plan’s results to the second plan’s target results. For example, assume you click Run to run a plan that respects all the constraints in your environment, and it suggests suspending a host — for example, from a current inventory of 15 hosts, to a target inventory of 14 hosts. The Summary panel will show a bar chart for 15 hosts in your current environment, compared to a target result with 14 hosts. Then if you click Merge and Run to disable constraints, the Summary panel will show a bar chart for 14 hosts in your current environment, compared to the new target results.

To ensure clean results that are easy to understand, you should not run the same plan successively. Instead, you should load a new plan, or reload a saved plan before clicking Run or Merge and Run. For information about loading plans, see the procedure below, or see Managing Plan Files - page 97.

To run a plan:

1. **Display the plan type you want:** Workload Distribution, Workload Projection, or Hardware Replace.

2. **Either load a saved plan, or clear the current plan to create a new and untitled plan.**

   - To clear the plan, choose **New**. To load a plan, choose **Open**, and then pick the plan you want to load.
3. **Click** to decide whether to run without adding new hosts.

This tool determines how the planner manages hosts. As it calculates the new workloads in the plan, Operations Manager can recommend that you add new hosts to support increased load. However, if you turn on this option, the planner results will not include the addition of any new hardware.

**Note:** If you have specified a value for **Target Utilization** - page 166, you should not restrict to the current hardware. Otherwise, the plan results may not be satisfactory.

4. **Make any special settings you need for the type of planning scenario you want to run.**

If you are running a **Workload Projection**, set the projection parameters. The projection parameters determine:

- The range of time for the projection’s base
  - The projection will perform a linear interpolation based on historical workload data. As you set a time range, the dialog box charts the CPU and memory statistics for that range.
- Period: how far into the future to project the workload
  - Using the base time range, the Planner will project the workload this far into the future.

You can only set these parameters if you are in the **Workload Projection** tab. In this tab, the Utilization Chart includes controls to set the projection’s base and period. After you run the plan, this chart will show the projection data.

For more information, see **Workload Projection** - page 117.

If you are replacing hardware, set the scope of the hardware you will replace, and choose templates to describe the new hardware. For more information, see **Hardware Replace** - page 121.
Creating Plans

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5. **Run the plan**

Run the plan in Normal or Merge mode.

Note that Run icon changes to Stop (Stop) while a plan is running. You can stop a running plan if necessary.

After running a plan, you can review the results according to the type of plan you have run. For more information, see Workload Distribution - page 114 and Workload Projection - page 117.

**Creating Plans**

A plan defines the workload, resources, and rules that you want to use when calculating results. You can think of a plan as a description of your desired environment. Operations Manager then calculates the results that can come from the planned changes.

**NOTE:** When you create a new and untitled plan, it is a description of your current environment. You can run the Planner against such a plan, and it will give you results for your current environment. For example, to check the workload balance of your current environment you simply run a new and untitled plan.

To create a plan, you specify its properties and then save it. After saving a plan you can open it, run it, edit it, or delete it.

The following sections describe the steps for plan creation:

- Managing Plan Files - page 97
- Tracking Plan Modifications - page 97
- Setting Plan Scope - page 98
- Selecting the Plan Baseline - page 100
- Specifying the Plan Load - page 103
- Setting Advanced Options - page 111
Managing Plan Files

The Plan dropdown menu (Plan) provides the following commands:

- **New**
  Clear the current plan, and load a new, untitled plan. The properties of this new plan are the same as your current environment.

- **Open**
  Choose a saved plan to open.

- **Save**
  Saves any changes you made to the current plan.

- **Save As**
  Opens the Save As dialog box, where you can name and save the current plan.

- **Delete Saved Plan**
  You can delete plans you saved, or shared plans.

- **Show Plan Report**
  Opens a report for the current plan in a new browser tab.

**Tracking Plan Modifications**

As you make changes to the loaded plan, the Summary Grid pane displays a running log of your modifications. In this way you can track the progress of your edits. For example, the following image shows that the plan has been changed to remove one host from the environment (among other changes to the plan).
Note that if you want to start over after making many changes, you can reload the plan, or save your changes as a new plan.

### Setting Plan Scope

Plan scope determines which devices in the environment will be affected by the plan. For example, you can specify that a plan will only run on your Development cluster of PMs. In that case, the current environment for your plan would only include PMs in the Development cluster, the VMs hosted by those machines, and data stores that support those machines. Likewise, the target results would only correspond to those machines.

Scope is determined differently if you select VMs or physical hosts:

- **Scope by VM**
  
  When you set scope by VMs, Operations Manager limits the plan to the physical hosts that those VMs are allowed to run on. Likewise, the plan includes all the data stores that are available to the VMs in your scope.

- **Scope by PM**
  
  When you set scope by PM, Operations Manager limits the plan to those physical hosts. For data stores, Operations Manager identifies all the VMs that can run on the hosts in your scope, and identifies all the data stores that are available for those VMs.

**NOTE:** When setting scope for a plan, you can choose multiple groups. However, you should be sure to choose groups of the same type. For example, you should not scope by PM and VM groups for the same plan.

To set the current plan’s scope, click the **Scope** icon ( ). This opens the **Define User Scope** dialog box.
Ctrl-click to select multiple items in the list. When you click OK, Operations Manager sets that scope to the current plan. You can see the scope for the current plan in the Plan Details table.
Selecting the Plan Baseline

The plan baseline is the set of utilization statistics that the Planner uses to calculate target or projected results. You can use the current statistics, or you can choose statistics from a past period. For example, if utilization typically peaks at a certain time of the day, or a certain day of the week, you can choose that moment as your baseline.

To set the baseline, click the Set Baseline icon ( ). In the dialog box that appears, click a data point to choose the moment you want. You can set the baseline for Workload Distribution and Hardware Replace scenarios.
After you click a data point, the dialog box displays the statistics for loads on the environment’s physical hosts.
When you are satisfied with the baseline settings, click **Confirm**. You can see the plan’s current baseline in the **Plan Details** table.
Specifying the Plan Load

The plan load is determined by the set of VMs that are deployed in your environment, compared to the PMs and Data Stores that provide resources to them. The more VMs you have for a given number of PMs and data stores, the greater the load will be on these physical devices. With a plan you can add or remove VMs, PMs, and Data Stores to see what the target or projected results would be. For example, you can define a plan that adds VMs to the same set of PMs and Data Stores. Or you can upgrade your physical hosts so they have more CPU or memory resources, and see how that would affect the way your environment supports the current crop of VMs.

To set the plan’s load, click the Edit Load icon ( ). The dialog box that appears displays a list of the load modifications you can specify.
The dialog box gives you actions to perform on VMs, physical hosts, and data stores. The actions you can perform are similar for all three types; examples will show performing these actions for VMs.

The actions you can perform are:

- **Add** - page 105
  Add one or more devices to the environment.

- **Add Using Template** - page 106
  Use a template to specify the properties of the devices you want to add.

- **Replace Using Template** - page 106
  Use a template to specify properties, and replace existing devices with these new devices. For example, use this to upgrade a physical host with more memory or CPU resources.

- **Remove** - page 107
  Select the devices you will remove.

- **Change Resource Utilization** - page 108 (for VMs, only)
  Increase or decrease the load on selected VMs by a given percentage point.

You can also create templates for add and remove operations. For more information, see **Creating Templates** - page 109.
**Add**

Select a device to serve as a model of what you want to add, then specify how many copies of that device you want to add to the environment.

1. Choose the Add action.
2. Navigate the list of items to choose which item to add.
3. Specify the number of copies to add, then click **Add**.

The list of items will include folder called New Entities. You can expand that folder to see these items you have added.

You can repeat these steps — select another item to copy, specify the number of copies, then click **Add**. New additions will appear in the New Entities folder.
4. **When you have finished adding items to the plan's load, close the dialog box.**
   
   Click **Close** to close the dialog box. Use this option if you want to make more changes to the plan, or if you want to save the plan before you run it.
   
   Click **Close and Run** to close the dialog box and run the plan immediately.

**Add Using Template**

Select a template to serve as a model of what you want to add, then specify how many copies of that templated device you want to add to the environment. You can also choose to create a new template or edit an existing template (see **Creating Templates** - page 109).

![Choose the template you want to use](image)

1. **Choose the Add Using Template action.**
2. **Choose the template you want to use.**
3. **Specify the number of copies to add, then click Add.**
   
   The list of items will include a folder called New Entities. You can expand that folder to see these items you have added. You can add other items, and this folder will update to show the new items.
4. **When you have finished adding items to the plan's load, close the dialog box.**
   
   Click **Close** to close the dialog box. Use this option if you want to make more changes to the plan, or if you want to save the plan before you run it.
   
   Click **Close and Run** to close the dialog box and run the plan immediately.

**Replace Using Template**

Select the items you want to change, then select a template to serve as a model for what you will replace the devices with. You can also choose to create a new template or edit an existing template (see **Creating Templates** - page 109).
1. Choose the Replace Using Template action.
2. Navigate the list of items to choose which items you will change. You can select individual items, or groups of items.
3. Choose the template you want to use.
4. Click Replace.
   The list of items will include folder called New Entities. You can expand that folder to see these items you have added. You can replace other items, and this folder will update to show the new items.
5. When you have finished replacing items to the plan's load, close the dialog box.
   Click Close to close the dialog box. Use this option if you want to make more changes to the plan, or if you want to save the plan before you run it.
   Click Close and Run to close the dialog box and run the plan immediately.

Remove

Select the items you want to remove from your environment.
1. Choose the Remove action.

2. Navigate the list of items to choose which items you will remove. You can select individual items, or groups of items.

3. Click Remove.

4. When you have finished removing items in the plan’s load, close the dialog box.
   - Click **Close** to close the dialog box. Use this option if you want to make more changes to the plan, or if you want to save the plan before you run it.
   - Click **Close and Run** to close the dialog box and run the plan immediately.

**Change Resource Utilization**

This option is for VMs, only. Select the VMs you want to reallocate, and raise or lower the resource utilization by percentage points.

1. Choose the Change Resource Utilization action.

2. Navigate the list of VMs to choose which ones you will change. You can select individual VMs, or groups of VMs.
   - Ctrl-click to select multiple items.

3. Click Change Load.

4. When you have finished changing VMs in the plan’s load, close the dialog box.

5. Click Close to close the dialog box. Use this option if you want to make more changes to the plan, or if you want to save the plan before you run it.
   - Click **Close and Run** to close the dialog box and run the plan immediately.
Creating Templates

When you specify the load for a plan, you can use templates to define the items you will add to the load.

To create a new template:

1. Click the Edit Load icon ( ) to open the Modify Load dialog box.
2. Select either of the template actions:
   - Add Using Template
   - Replace Using Template
3. When you choose a template to use, scroll the dropdown list to select Add New Template.
4. Specify your template settings and click Create Profile.

To edit an existing template:

1. Click the Edit Load icon ( ) to open the Modify Load dialog box.
2. Select either of the template actions:
   - Add Using Template
   - Replace Using Template
3. Choose a template to use.
4. Click the Edit icon for that template. If you want to delete the template, click the Delete icon.
5. Change your template settings and click Update Profile.

When you create a new template or edit a template, the Modify Load dialog box expands to display the template settings. The settings you can make are different, depending on the type of item the template is for.

Template Settings for VMs

These settings identify a VM type, and specify the resources that VM type will consume.

For VCPU, Operations Manager assigns 75% of the physical CPU resources to the VM. For example, if you specify 1 VCPU for this VM type, Operations Manager assigns 75% capacity of a CPU on the machine that hosts the VM. This ensures that the host machine has CPU capacity to perform infrastructure tasks.

For VMEM and VStorage, Operations Manager assigns 100% of the physical resources that you specify here.
Template Settings for PMs

These settings identify a PM type, and specify the resources it can provide. The **Planner uses the Price** entry to calculate costs or savings when adding or removing host machines.
Template Settings for Data Stores

These settings identify a type of data store, and specify the resources it can provide.

<table>
<thead>
<tr>
<th>Choose template name:</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage capacity [GB]:</td>
<td>2048</td>
</tr>
<tr>
<td>IOPS:</td>
<td>20000</td>
</tr>
</tbody>
</table>

Setting Advanced Options

For a given plan, you can make the following advanced settings:

- **Utilization** - page 111 (for Physical Hosts and Data Stores)
- **VM Constraints** - page 112
- **Workload Placement** - page 113

Utilization

Utilization specifies the percentage of a physical resource that you want to make available in the given plan. By default, hosts and data stores have utilization set to 100%. For a given plan, you can set the utilization to a lower value.

For example, assume you have one data store that you want to share evenly for two clusters of VMs. Also assume that you are creating a plan for one of those clusters. In that case, you can set the data stores to 50% utilization. This saves storage resources for the other cluster that will use this storage.
To set utilization:

1. Click the Advanced Options icon ( ) to open the advanced Planning Options dialog box.
2. Display the Set Utilization tab.
3. Choose which type of device to modify:
   - Set Max Host Utilization
   - Set Max Storage Utilization
4. Navigate the list to select the device you want to modify.
5. Specify the percentage you want, then click Set Max Level.

**VM Constraints**

By default, VMs are constrained to the cluster, network group, or storage group that their hosts belong to. When you run a plan, Operations Manager does not consider moving VMs to physical hosts outside of the current cluster if they are constrained by cluster. But if you disable the Cluster constraint for a VM, then Planner can evaluate the results of hosting that VM on any other physical machine in your environment. If the best results come from adding that VM to a different cluster, then Planner will show that result.
Creating Plans

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To set constraints:

1. Click the Advanced Options icon ( ) to open the advanced Planning Options dialog box.
2. Display the VM Constraints tab.
3. Navigate the list to select the VMs you want to modify.
4. Choose the types of constraints to set:
   - All
   - Cluster
   - Network
   - Storage
5. Specify whether to enable or disable the constraints.
6. Click Apply.

Workload Placement

In this tab you can enable or disable DRS rules or Operations Manager Segment policies for the VMs in your plan. The tab shows the workload placement policies that are currently defined for your environment. You can also click the Plus or Minus icons to create new Operations Manager Segments from this tab. For more information about these policies and how to manage them, see Workload Placement - page 160 on the Policy tab.

Click the Plus or Minus icons to create or delete Operations Manager Segments.
To set enable or disable placement policies:

1. Click the Advanced Options icon to open the advanced Planning Options dialog box.
2. Display the Workload Placement tab.
3. Navigate the list to select the policies you want to enable, then click Enable Rule.

Workload Distribution

Workload Distribution scenarios show you the optimal distribution of VMs across hosts and data stores for the given plan. The view compares your current distribution with target results. The view includes an Action Plan that displays a list of actions you can take to achieve the target results.

To see distribution data, display the Workload Distribution tab.
Workload Distribution

Chapter 8: The Plan Tab

To see different views of the workload distribution data, choose from the View dropdown menu. A Workload Distribution plan displays the following views:

- **Summary View** - page 115
- **Physical Machine Utilization** - page 116
- **Storage Utilization** - page 116
- **Physical Machine and Storage Detailed Utilization Data** - page 117

**Summary View**

This view provides an overview of the current distribution and target results.

The Summary pane charts the current results. You can view charts for the different resource types (utilization index, memory, CPU utilization, input/output, network utilization, and VMs per host). The target results display as a green plot. The plot is laid over a bar chart of the current resource distribution. If a bar is grayed, that means the Planner recommends you suspend that device. If the chart shows no bar to correspond with a target result data point, this indicates a new device to be added in the target results.

The Plan Summary pane shows the current target numbers of VMs and hosts. It includes a total savings/cost at the top of the pane. This value is calculated from the costs you assign to resources. For example, you can assign a cost when you create a host template (see Creating Templates - page 109).

This view also includes a Summary Grid, that describes the currently loaded plan. For example, you can see the scope of this plan, or the date for the baseline data. (For more information, see Creating Plans - page 96).
Physical Machine Utilization

This view focuses on the physical machines in your environment. It shows charts for the current PM utilization, compared with the target utilization. You can hover over data points to display tooltips.

Storage Utilization

This view focuses on the data stores in your environment. It shows charts for the current storage utilization, compared with the target utilization. You can hover over data points to display tooltips.
Physical Machine and Storage Detailed Utilization Data

This view provides data grids of current and target utilization distribution for hosts and data stores.

Workload Projection

Workload Projection estimates the VM consumption of VCPU and VMem resource, projected to a given time in the future. The Planner uses past utilization data to make its calculations. To run a projection, you provide the following:

- **Plan**
  You choose the plan to use and load it into the Workload Projection. If you use a new and unnamed plan, the Planner calculates a projection for your current environment.

- **Historical date range**
  In the Summary View, you specify the start and end dates for the data that you want the Planner to use when calculating the projection.

- **Projection period**
  How many days, weeks, or months into the future you want to extend the projection.

To see projection data, display the Workload Projection tab.
After you run a projection, you can display different views to see the results in detail. To see different views of the workload projection data, choose from the View dropdown menu.

A Workload Distribution plan displays the following views:

- **Summary View** - page 115 (Use this to specify historical dates and projection period)
- **Physical Machine Utilization** - page 116
- **Storage Utilization** - page 116
- **Physical Machine and Storage Detailed Utilization Data** - page 117

**Summary View**

The Summary view serves two purposes:

- Specify the projection parameters
- Display an overview of projection results

When you first display the Workload Projection tab, the Summary View is ready for you to provide projection parameters.
To specify the projection parameters, make your settings in the Utilization Chart:

The projection parameters determine:

- The range of time for the projection’s base
  The projection will perform a linear interpolation based on historical workload data. As you set a time range, the dialog box charts the CPU and memory statistics for that range.
- Period: how far into the future to project the workload
  Using the base time range, the Planner will project the workload this far into the future.

As you drag to set the time range, the chart updates to show you the historical values. When you are satisfied with your settings, click Run.

After the projection runs, the Summary View updates to show you the results:
The Utilization Chart shows the projected values for CPU and memory utilization. If you want to see different results, you can change the projection parameters (historical range or projection period) and run the projection again.

In the above image, the projection begins where the Memory and CPU plots change colors. For example, the Memory plot changes from green to blue.

The Plan Summary pane shows the current target numbers of VMs and hosts. It includes a total savings/cost at the top of the pane. This value is calculated from the costs you assign to resources. For example, you can assign a cost when you create a host template (see Creating Templates - page 109).

This view also includes a Summary Grid, that describes the currently loaded plan. For example, you can see the scope of this plan, or the date for the baseline data. (For more information, see Creating Plans - page 96).

Physical Machine Utilization

This view focuses on the physical machines in your environment. It shows charts for the current PM utilization, compared with the target utilization. You can hover over data points to display tooltips.

Storage Utilization

This view focuses on the data stores in your environment. It shows charts for the current storage utilization, compared with the target utilization. You can hover over data points to display tooltips.
Physical Machine and Storage Detailed Utilization Data

This view provides data grids of current and target utilization distribution for hosts and data stores.

Hardware Replace

Hardware Replace scenarios calculate the optimal performance you can achieve after replacing existing PMs or data stores with other equipment. To create a new Hardware Replace scenario, you provide the following:

- **Scope**
  You set the scope to determine which physical devices the plan will run against. For example, you can select a single cluster, or a specific data center. The plan will consider only on the physical devices that are within the specified scope.

- **Hardware type**
  A single plan can calculate replacement results for hosts, for data stores, or both.

- **Hardware template**
  Templates specify the capacity and cost of the replacement hardware. You can use existing templates, or create and save your own.
• Hardware to replace

After choosing the hardware template, you then choose the hardware you want to replace. You choose from devices that are within the plan's scope. For example, if the current scope includes a set of 10 hosts and two data stores, you can choose to replace any of those devices with a templated device.

To see projection data, display the Hardware Replace tab.

After you run a Hardware Replace plan, you can display different views to see the results in detail.

A Hardware Replace plan displays the following views:

- Summary View - page 115 (Use this to specify historical dates and projection period)
- Physical Machine Utilization - page 116
- Storage Utilization - page 116
- Physical Machine and Storage Detailed Utilization Data - page 117

Defining Replace Parameters

To plan hardware replacement, you must specify which hardware you will replace, and what you will replace it with. When you create the plan scenario, you can make the same settings that you make for any other plan. For example, you can set the baseline to past conditions, or you can add more VMs to the workload. For more information, see Creating Plans - page 96.

The following sections describe settings you make that are special for hardware replacement:

- Scope - page 123 (You set scope for any plan, but the effect is slightly different for hardware replacement.)
- Hardware Type - page 123
- Template - page 123
- Hardware to be Replaced - page 124
Scope

Plan scope determines which devices in the environment will be affected by the plan. For example, if you set the scope to a cluster, then replacement planning will only affect the physical devices in that cluster. Note that you can set the scope to groups of VMs or to Virtual Data Centers. In this case, hardware replacement will affect only the physical machines that provide resources to these virtual entities.

To set the current plan’s scope, click the Scope icon ( ). This opens the Define User Scope dialog box where you can navigate the inventory tree and set the plan scope. For more information, see Setting Plan Scope - page 98.

Hardware Type

Hardware Replace plans support Hosts and Data Stores. The type you choose determines which templates you can select, and which hardware you can replace.

One plan scenario can be devoted to replacing hosts or storage, or you can define a single scenario that replaces both hosts and data stores.

Template

The template you choose describes the new hardware for your plan. Operations Manager ships with pre-defined templates, and you can create your own templates to describe specific hardware that you have in mind.

To create a new template, select Add New Template, and then click Edit Template. Note that as you define your own templates, they are stored with Operations Manager installation, and are available to anybody else who uses the planner on the same installation.

The templates you use here are also available when specifying workloads for a planning scenario. For more information, see Creating Templates - page 109.
You can make the following settings in a template:

- **User Information**
  - Template Name
  - Vendor
  - Description

- **Price**: Operations Manager uses this price to calculate replacement costs or savings

- **Capacity Data**: Values Operations Manager uses to calculate capacity and utilization
  - CPU Cores and Speed
  - Memory
  - Network Throughput
  - IO Throughput

When you run a plan, Operations Manager uses the template's pricing and capacity data to calculate the plan results. For example, if you replace your current hosts with less powerful models to address under utilization, Operations Manager will use the template to recalculate the optimal workload distribution. You might see that workload is more evenly distributed across the smaller machines, giving you a saving in actual cost.

### Hardware to be Replaced

Once you have specified the plan scope, hardware type, and the template you want for the scenario, you can specify which hardware you will target for replacement. You can specify individual devices, or you can select groups of devices to replace.
When you expand items in this dialog box, the physical devices you can select are limited by the scope you have set for this scenario. For example, assume you selected a cluster of VMs that are restricted to PMs in Cluster-1. In that case, then you browse for hosts to replace, you will only see the hosts in that cluster.

After you select the hardware to replace, Operations Manager commits your parameters to the current scenario. The Plan Modification Log shows the replace actions you have specified for this scenario.
Once you have made settings for Host, you can then add in settings to replace data stores as well.

After you have made the settings you want, you can then run the plan, save it, or start a new plan to discard your changes.

**Summary View**

This view provides an overview of the current hardware, and the target hardware replace results.

The Summary pane charts the results. You can view charts for the different resource types (utilization index, memory, CPU utilization, input/output, network utilization, and VMs per host). The target results display as a green plot. The plot is laid over a bar chart of the current resource distribution.

Assume a Hardware Replace scenario that will replace three of four hosts. In the figure below, notice that the target plot is laid over the one host that is not replaced. The target plots a lower utilization than the host currently exhibits. The other three data points for the target show utilization for the replacement hosts. On the right, the chart shows bars for the replaced hosts so you can compare target to current values.

The Plan Summary pane shows the current target numbers of VMs and hosts. It includes a total savings/cost at the top of the pane. This value is calculated from the costs you assign to resources. For example, you can assign a cost when you create a host template (see Creating Templates - page 109 and Template - page 123).

This view also includes a Summary Grid, that describes the currently loaded plan. For example, you can see the scope of this plan, or the date for the baseline data. (For more information, see Creating Plans - page 96).
Physical Machine Utilization

This view focuses on the physical machines in your environment. It shows charts for the current PM utilization, compared with the target utilization. You can hover over data points to display tooltips.

Storage Utilization

This view focuses on the data stores in your environment. It shows charts for the current storage utilization, compared with the target utilization. You can hover over data points to display tooltips.
Physical Machine and Storage Detailed Utilization Data

This view provides data grids of current and target utilization distribution for hosts and data stores.

Recommended Actions

Planner lists actions you can perform to achieve the target utilization metrics. These recommendations can range from adding more storage or physical machines to your environment, or moving or changing the configuration of virtual machines. Each action includes a tooltip that displays a full description of the suggested action.

Operations Manager provides the following categories of suggestions:

- **Capacity Management** — Adjusting the physical capacity of your inventory. For example, adding physical machines to reduce critical memory utilization.
- **Workload Balancer** — Distributing processes among your physical machines. For example, moving virtual machines to different physical hosts.
- **Green IT** — Opportunities to reduce costs and energy consumption. For example, suspending under-utilized machines.
### Recommended Actions (20 rows)

<table>
<thead>
<tr>
<th>Category</th>
<th>Suggestions</th>
<th>Type</th>
<th>Target</th>
<th>Source</th>
<th>Destination</th>
</tr>
</thead>
</table>

Hover to display the tooltip.
The Optimize Tab

The Optimizer analyzes the current status of your infrastructure, looking for utilization patterns that indicate opportunities to achieve optimal performance and reduce operational risk. Using this analysis, it displays utilization charts and tables in a Summary panel. These summaries show metrics for your current configuration, as well as target metrics — the metrics you can achieve by performing the recommended actions to optimize system deployment.

Beneath the Summary panel, Operations Manager shows a To Do list of recommended actions (see To Do Lists—Maintaining QoS - page 34 for more information).

You can use the Optimizer to analyze and proactively address problems related to workload and resource distribution among physical hosts and storage devices. Further, Optimizer can automatically perform most recommended actions that do not include changes to physical configurations of hosts or storage.

Once you execute a recommended action, the environment changes. Operations Manager performs its analysis again and presents further actions you can perform to optimize your deployment. In this way, you can iteratively change your configuration and workload distribution to improve overall performance.

As Operations Manager monitors and analyzes your environment, it uses specified thresholds to identify risks and opportunities that it will consider for planning and optimization. You specify these thresholds in the Policy tab. For more information, see Utilization Thresholds - page 165.

Optimizer User Interface

The Optimize tab displays the following panels:

- **Navigation Panel - Optimize Tab** - page 131 — Lists the physical devices in your inventory. Use this to set the scope of the tab's display.
- **Utilization Summary Panel** - page 131 — Charts and tables that show utilization metrics for the current deployment, and target metrics that you can achieve by resolving the identified problems.
- **To Do Panel** - page 134 — Actions you can take to achieve the target results.
Navigation Panel - Optimize Tab

For Optimizer, the Navigation Panel limits the scope of the data it displays. For example, if you select **Summary** in the Inventory tree, it shows data for all the physical and virtual devices in your inventory. If you select Physical Machines, then it only shows data for physical machines. (For general information about navigation, see Navigation Panel - page 20.)

You can also use the Groups tree to focus on specific segments of your environment. For example, you can use a pre-defined group to focus only on the physical machines in your production environment. You can also use custom groups to set your own scope. (For more information about groups, see Group Management - page 155).

Utilization Summary Panel

The Summary panel shows the current and target metrics for your inventory. The scope of display for this panel changes depending on the selections you make in the Navigation panel (see Navigation Panel - Optimize Tab - page 131).
Utilization Charts

These bar charts display utilization metrics for physical machines and storage devices. To see more information about each plot, hover over a bar to display its tooltip. The chart legend shows which metrics are plotted in the chart. In the following figures you can see charts for target metrics.

**Figure 9-2. Optimizer Utilization Charts**

Customizing Charts

You can specify whether the chart shows utilization metrics or Utilization Index. For charts that show utilization metrics, you can specify which metrics the chart shows.

To customize a chart, click its **Customize** button and make settings in the dialog box that appears. For more information, see **Standard Panel Controls** - page 23.
Utilization Grids

Utilization grids present current and target metrics in tabular form. You can see the actual values, and sort the tables by a given metric. For example, the following figure shows target metrics sorted by Utilization Index.

![Utilization Grid Chart](image)

**Figure 9-3. A Price Index Utilization Chart**

**Figure 9-4. An Optimizer Utilization Table**
To Do Panel

This panel displays actions you can execute to maintain optimal operating conditions. You can toggle the panel between a To Do list and a list of current risks to service performance. For a complete description of To Do panels, see To Do Lists—Maintaining QoS - page 34. This will show you how to:

- View recommended actions or risks to QoS and efficiency opportunities
- Execute recommended actions
- Understand action and risk categories

Note that as you make selections in the Navigation panel, the To Do list changes to show actions for the items you select.
The Admin Tab

The Admin tab provides settings to manage Operations Manager sessions and perform other administrative tasks. In this tab you assign the instances of any hypervisors Operations Manager will connect to as it manages your environment. You can also use the Admin tab to manage user accounts on Operations Manager, manage how Operations Manager retains system metrics and other data, manage custom groups, and perform maintenance tasks such as managing configuration files or refresh intervals.

The Configuration panel of the Admin tab includes the following accordion buttons for specific administrative tasks:

- **License Configuration** - page 136
  Apply license keys to activate VMTurbo Operations Manager features.

- **Target Configuration** - page 137
  Use these tools to specify the list of VMware Virtual Center servers Operations Manager will connect to as it monitors your environment.

- **User Authentication Configuration** - page 142
  Create and manage user accounts for the Operations Manager.

- **Report Configuration** - page 144
  Specify which reports Operations Manager will generate daily.

- **Maintenance** - page 145
  Perform general tasks such as managing configuration files or refresh intervals.

The Admin tab also includes the **Notifications Panel** - page 146, A panel to display notifications for any issues Operations Manager encounters during normal processing.
License Configuration

Operations Manager provides a range of capabilities, from observing your environment, to planning resource management, to the automation of load balancing. The user interface presents these capabilities via different tabs and tools. The following table lists the main Operations Manager features for each edition of the product. The Community Edition features do not require licensing, but all other features do.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure Performance Visibility</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Capacity and Performance Alerting</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Management Reporting</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Capacity Planning</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Resource Optimization &amp; Tuning</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Problem Prevention</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Automated Recommendations</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Multi-hypervisor Management</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Multi-tenant Management</td>
<td></td>
<td></td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Cloud-scale Management</td>
<td></td>
<td></td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Cloud Architecture Integration (vCD/CloudStack)</td>
<td>☑</td>
<td></td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>API Integration &amp; Support</td>
<td></td>
<td></td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Application Performance Visibility</td>
<td>☑</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application Discovery and Policy</td>
<td></td>
<td></td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td>Application Load Balancing Integration</td>
<td></td>
<td></td>
<td>☑</td>
<td></td>
</tr>
</tbody>
</table>

To activate features outside of the Community Edition, you must purchase licenses from VMTurbo. When you purchase a new product, VMTurbo sends the license key to you in an e-mail message.

To activate a license, Click License Configuration to display the form. Copy the license key and paste it into the text box, and then click Save.
**Target Configuration**

**Target Configuration** determines which Virtual Management servers Operations Manager will monitor. To use Operations Manager, you must install it in a network that has access to these servers. Then you can add the management servers as targets to your Operations Manager installation.

Target Configuration displays an Environment Summary panel and a list of current target servers. The environment summary charts the numbers of PMs, VMs, data stores, DataCenters, and network nodes in your environment.

The list of targets displays all the target servers Operations Manager currently monitors. Operations Manager currently supports:

- **Hypervisors**
  - VMware vCenter
  - Microsoft Hyper-V
  - Citrix XenServer
- **Cloud Managers**
  - VMware vCloud Director
  - CloudStack
- **Load Balancers**
  - Citrix NetScaler
Adding and Removing Target Virtual Management Servers

The target servers your Operations Manager installation will manage appear in the Target Configuration list. You can add, remove, and edit entries in this list. Note that the target server’s account must be configured with privileges that support the Operations Manager activities you want to perform. For example, the following list shows how vCenter privileges correspond to activities Operations Manager can perform:

- **VCenter Administrator** — Enables Operations Manager monitoring, simulation (what-if scenarios), and automation functions
- **Read Only** — Enables Operations Manager monitoring and simulation (what-if scenarios) only
- **Enable Datastore Browse** — Enabling this property for the account gives Operations Manager the privileges it needs to enable its storage management functionality

To add a target server, click the **Add** button to open the **Target Configuration** dialog box. Provide the following information, then click **save**:

- **Target Type** — Choose among the supported VM Management technologies (Hypervisor, Cloud Management, or Load Balancer)
  After you choose the technology, then choose the specific target type for that technology. You may see a different target types, depending on your current license.
- **Hostname or IP address** — The address of the target server you want to add
- **User Name** — A valid account username for the target server
- **Password** — A password for the target server account
• VC user name and password — Optional credentials for vCloud Director (if you do not provide these values, Operations Manager will use the User Name and Password you provide for the server account) For vCloud Director, Operations Manager discovers the virtual datacenters that are managed by that target. However, in order to discover and manage these vDCs, Operations Manager needs logon credentials for each one. If your vDCs use the same credentials as the vCloud Director server, then you do not need to provide VC Username and VC Password. However, if the vDCs use different credentials, then you must provide them in addition to the vCloud Director credentials.

![Target Configuration Form](image)

Figure 10-3. Adding a Load Balancer Target

To edit a target server entry, select the entry in the list and then click **Edit**. The **Target Configuration Form** opens, where you can make your changes.

To remove a target server, select the entry in the list and then click **Delete**.

### Adding Hyper-V Servers as Targets

To add a Hyper-V server as a target, you must provide `domain\username` in the **User Name** field. In addition, the user that you specify must be one of the server’s WBEM Scripting Locator owners.

Each Hyper-V server requires specific permissions to allow management via WMI. These permissions are set in the host’s WBEM Scripting Locator registry key. To set the permissions, you edit the registry key to add owners and grant them full control.

To add an owner to the Hyper-V server’s registry key:

1. Launch regedit on that machine as Administrator
2. Find the following registry key:
   ```plaintext
   HKEY_CLASSES_ROOT\CLSID\{76A64158-CB41-11D1-8B02-00600806D9B6}\n   ```
3. Right click the key and choose **Permissions**
4. Click **Advanced** and display the **Owner** tab
5. In the owners list, add the user you want to allow to connect to the machine
6. Click **Ok**
7. Highlight the user and grant **Full Control**
Once you have done this you can specify the Hyper-V server as an Operations Manager target, using credentials for an owner that has Full Control privileges.

Adding vCloud Director Servers as Targets

If you have installed the Cloud Operations Manager license, you can add vCloud Director (VCD) servers as targets. To add a VCD server, you specify the login address and credentials for the VCD machine, as well as user name and password for the vCenter hypervisors managed by this VCD server.

![Target Configuration](image)

For a VCD target, Operations Manager discovers the virtual datacenters (VDCs) that are managed by that target. To discover all the resources in these VDCs, Operations Manager must access the vCenter hypervisors that manage them. However, in order to discover and manage these vCenter hypervisors, Operations Manager needs logon credentials for each one. Operations Manager uses **VC Username** and **VC Password** to access these vCenter servers.

**VC Username** is an optional field. If you do not provide this value, Operations Manager will obtain the VC username that is specified in the vCloud Director's configuration. Even if you leave this field blank, you must provide a valid password for the obtained username.

When specifying VC credentials, you should consider the following:

- Operations Manager uses the same credentials for all vCenter servers associated with this vCloud Director target. Operations Manager adds all these vCenter servers to the targets list.
- If the credentials are not valid for a vCenter Server, Operations Manager shows it in the list of targets, but it has a Target Status of **Not Valid**. (All the targets in the following figure are valid.)
Adding Load Balancers as Targets

To add a load balancer as a target, you specify the IP address and credentials for the load balancer. Operations Manager discovers the service types that are assigned to that load balancer. These service types appear in the Operations Manager supply chain as virtual applications. To enable discovery of virtual applications, you must configure load balancer discovery.

Configuring Load Balancer Discovery

After you add a load balancer as a target, you must configure Operations Manager to discover the virtual applications that load balancer manages. The steps to do this are:

1. **Specify discovery for the applications the load balancer will manage**
   The load balancer manages workload across instances of running applications in your environment. Operations Manager must be configured to discover and manage these running applications before it can recognize that they are managed by the load balancer. To specify discovery of a specific application, you define its application signature and then provide WMI credentials that Operations Manager can use to access the VMs that host the application. For more information, see Application Discovery - page 170.
2. **Assign application signatures to specific virtual applications**

Operations Manager discovers the virtual applications that the load balancer uses to manage applications. After you have specified signatures and discovery for the applications you want the load balancer to manage, you can then assign those application signatures to specific virtual applications. For more information, see [Load Balancer Discovery](#) - page 174.

For example, assume the load balancer uses virtual applications named `web` and `sql` to manage web servers and SQL databases. Also assume that you have defined an application signature named `IIS` for IIS Web Server applications, and another signature named `SQL` for Microsoft SQL Server applications. In that case, you need to map the `IIS` signature to the `web` virtual application, and `SQL` to the `sql` virtual application. Now Operations Manager can discover these applications and represent them as the running components within the load balancer.

### User Authentication Configuration

As an Operations Manager administrator, you can specify user accounts that grant specific access to Operations Manager. You assign a role to each account which determines the kind of access that user will have.

Operations Manager supports Active Directory user authentication as well as local authentication. For local authentication, each user account is configured on Operations Manager. For Active Directory authentication, you specify the name of the Active Directory server that maintains the user database.

#### Specifying an Active Directory Server

To specify an Active Directory server to use for authentication, provide the Active Directory server’s name, then click **Apply** to set the URI for this Operations Manager installation to use.

You can name the Active Directory server in the following ways:

- By IP address
- By the FQDN: `x.x.x.x`
- By full domain name (e.g. `mydc.mydomain.com`)
When creating a user account that is managed by Active Directory, you must specify the user name and the Active Directory domain. You can use the following formats for a user name:

- `mydomain\theuser`
- `theuser@mydomain.com`

When the user logs in, he or she must use the same format that you specified for the account. For this reason, we suggest that you use the same format for all user accounts that are managed by Active Directory.

### Managing User Accounts

To create a new user account, click **Add new user**, and provide the following information. When you’re finished, click **Create**.

- **Username and Password** — The credentials the user must supply to log in.
- **Role** — A profile that determines the user’s access privileges. The supported roles are:
  - **observer** — Can use Operations Manager Observe functions; the most restricted user role. You can specify a scope to limit this user’s view of the environment (see Setting Scope for a User Account - page 143).
  - **advisor** — Can use Operations Manager Observe and Plan functions; can use more functions, but cannot use Operations Manager to change the environment.
  - **automator** — Can use all the Operations Manager environment management functions, but cannot perform administration tasks.
  - **administrator** — Can use all Operations Manager functions.
- **Local** — When enabled, this user’s authentication is performed by Operations Manager
- **Active Directory** — When enabled, this user’s authentication is performed by the assigned Active Directory service.

![Figure 10-8. Specifying User Credentials](image)

To edit or delete a user account, select the user in the list. Then make changes and click **Update**, or to remove the user you can click **Delete**.

### Setting Scope for a User Account

When creating an account, you can define a scope for that user. The scope limits what the user can monitor. For example, assume you have created a group that contains only the physical machines that support this user’s VMs or applications. You can then set the user’s scope to that group. When the user logs in, Operations Manager will only display information about those machines, and resources associated with them such as hosted VMs and data storage that
they use. In the figure below, the scope is set to a specific virtual datacenter. The user’s account can only access resources associated with that datacenter. Dedicated customers can work with physical resources, but shared customers are restricted from working with the physical infrastructure.

**Figure 10-9. Setting the User’s Scope**

<table>
<thead>
<tr>
<th>Define user scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Username: john doe</td>
</tr>
<tr>
<td>Password: **********</td>
</tr>
<tr>
<td>Role: observer</td>
</tr>
<tr>
<td>Scope: Define Scope</td>
</tr>
<tr>
<td>Type: Local, Active Directory</td>
</tr>
</tbody>
</table>

**NOTE:** If you want to use custom groups to set the scope, you must create the groups first, and then assign them to the user account. For more information, see Group Management - page 155.

---

**Report Configuration**

Operations Manager generates standard reports every day at a determined time (2:00 am). As the Operations Manager administrator, you can limit report generation and specify exactly which standard reports to generate. Limiting report generation reduces the processing time spent on reports, and also reduces clutter in GUI when users want to review the reports. Changes you make in report configuration take effect for the next report generation cycle.

To configure report generation, expand the categories and set the check boxes for the reports you want. When you have made your settings, click **Submit**.

---

Chapter 10: The Admin Tab
Chapter 10: The Admin Tab

Maintenance

The Maintenance panel provides tools to load configuration files onto your Operations Manager installation, set up the monitoring interval, export data for technical support, and check for Operations Manager updates. These tools are for advanced users. You should verify with VMTurbo technical support before you use them:

- The configuration file controls load specific configuration files onto your Operations Manager installation. For example, a support engineer might send you fresh configuration files as part of a solution to an issue. You would then load these files as instructed by the engineer.
- Interval configuration specifies how often Operations Manager sweeps through your system to collect and analyze metrics. Depending on your environment, a support engineer might suggest that you change this value.
- With the SMTP Relay section you can enable e-mailing VMTurbo reports to subscribers through your e-mail SMTP relay -- Click to enable SMTP and enter the address of your SMTP relay.
- If you are experiencing problems with Operations Manager, your support engineer might request that you export diagnostic data. The engineer will help you specify the correct data in the text box.
- You can check to see whether VMTurbo has released updates to the Operations Manager software, and apply them when appropriate.

Figure 10-10. Specifying Standard Reports
About Administration

The About Administration panel provides a brief description of Operations Manager administration.

Notifications Panel

The VMturbo Notifications panel displays notifications of any issues Operations Manager encountered during normal processing. For example, if Operations Manager discovery process finds two devices with the same UUID, it will post a notification here.

Figure 10-12. Notifications Panel
Extra Configuration Tasks

You may find it necessary to perform the following configuration tasks:

**P2V — Planning Migration from Physical to Virtual**

To migrate your physical environment to a virtual environment, you will identify how many virtual machines to deploy, and what hardware you need to serve the virtual environment. You can perform your own analysis to build up such a listing, or you can use existing services and utilities to generate a listing.

Once you have a list of the devices you need in your environment, you can use Operations Manager to plan out the distribution of workload and resources that will give you optimal performance. The Planner suggests deployments that assure QoS while making sure to utilize system resources as fully and efficiently as possible.

When you execute P2V, the planner creates a planning scenario that contains only the devices in your listing. It then uses the Economic Scheduling Engine to calculate the best placement of VMs among the physical hosts and datastores. The Planner generates a To Do list of recommended actions to achieve this target deployment. When it’s completed, you can view the results:

- As an XML listing of recommended actions
- As a PDF report
- As a plan in the Plan tab of Operations Manager

**Running a P2V Plan**

To run a P2V plan:

1. **Generate a CSV listing of virtual and physical devices**
   You can generate the listing in a number of ways. You can turn to a vendor to analyze your current physical environment and generate a listing for you. Or you can perform your own analysis to generate the listing.
   Once you have a list of physical and virtual devices, plus their capacities and resource requirements, you must convert that data into a CSV file with the appropriate fields for each device. For a listing of the required fields and field order, see CSV Field Order - page 148.

2. **Load the listing and run the plan**
   To access P2V planning, navigate your browser to the following URL:
   `<Operations ManagerAddress>/plan.html`
   This opens the P2V page where you can provide the following:

**VMTurbo P2V**

```
P2V Planning

Specify the username and password to authorize the offline update!
Username: user  Password: [redacted]

Select the P2V csv file!
C:\VMTurbo\P2V\p2v.csv  Browse

Username and password for the account that will run this plan
Path to the P2V CSV file
```

The login credentials you give must be for a user account with a role that has access to run the Planner. To run the plan, click **Plan P2V**.
3. **View the results**
   After running the plan, the web page displays two links:
   - View Action Plan
     Display the list of recommended actions as XML.
   - Generate Report
     Direct Operations Manager to generate a PDF report outlining the plan results.
   To return to the original P2V page, click the browser’s **Back** button.
   To view results in the Plan tab of Operations Manager, log into Operations Manager with the same credentials you used to run the P2V plan, then navigate to the Plan tab.

**CSV Field Order**

The following table lists the fields in the CSV file. For each type of device you will add, some fields are mandatory, while the others are optional. The table lists the mandatory fields for each device type with an X. You can provide values for the unmarked fields, but they are not mandatory.

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>VM</th>
<th>PM</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Type</td>
<td>The type of device — Can be one of VirtualMachine, PhysicalMachine, or Storage</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2 Instances</td>
<td>Number of instances to create</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 DataCenter</td>
<td>Name of the datacenter that houses the device</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Cluster</td>
<td>Name of the cluster the device belongs to</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5 Network</td>
<td>Name of the network the device runs on</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>6 Datastore</td>
<td>Name of the datastore that services the device</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>7 Host</td>
<td>For a VM, the host physical machine</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>8 System Name</td>
<td>The name for this device.</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Vendor</td>
<td>The vendor name for this device</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>10 Model</td>
<td>The model for this device</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>11 Description</td>
<td>A string describing this device</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Price</td>
<td>The price for this hardware device</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>13 VCPU Count</td>
<td>The number of cores on the physical machine</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>14 Speed (Mhz)</td>
<td>Core speed for this physical machine</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>15 vMem Size (MB)</td>
<td>The memory installed on this physical machine</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>16 Storage Size (GB)</td>
<td>Size of the datastore</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>17 Network Interface Count</td>
<td>The number of networks the device is connected to</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 Network Speed</td>
<td>The bandwidth of the network serving this device</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 Network throughput</td>
<td>The network throughput for the interface(s) on this physical machine (KBytes/sec)</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Field</td>
<td>Description</td>
<td>VM</td>
<td>PM</td>
<td>Storage</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>----</td>
<td>----</td>
<td>---------</td>
</tr>
<tr>
<td>20 Speed (MB/sec)</td>
<td>??</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 I/O speed (MB/sec)</td>
<td>I/O speed for this device (KBytes/sec)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 I/O Throughput Size</td>
<td>I/O throughput bandwidth for this physical machine</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>23 Rack Units</td>
<td>Number of rack slots this physical device takes up</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 Weight (lbs)</td>
<td>Weight of this physical device</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 Power (W)</td>
<td>Power consumption of this physical device</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 Thermal (BTU/hr)</td>
<td>Heat generated by this physical device</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27 % CPU Used</td>
<td>Percentage of CPU capacity granted to this VM instance</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28 Queue/CPU</td>
<td>Percentage of CPU wait time capacity granted to this VM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29 % Mem Used</td>
<td>Percentage of memory capacity granted to this VM instance</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 FileSys Cache (MB)</td>
<td>File system cache space capacity for this device</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 Page File%</td>
<td>Percentage of paging capacity granted to this device</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 Paging (Pg/sec)</td>
<td>Storage access speed</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>33 I/O (Trans/sec)</td>
<td>Percentage of IOps capacity granted to this VM instance</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34 I/O (MB/sec)</td>
<td>I/O speed for this VM instance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35 % IO</td>
<td>Percentage of I/O capacity granted to this VM instance</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36 % Storage</td>
<td>Percentage of storage capacity granted to this VM instance</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37 Traffic (MB/sec)</td>
<td>Network speed for this VM instance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38 % Network</td>
<td>Percentage of network capacity granted to this VM instance</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Policy Tab

The Policy tab provides settings to control how the Operations Manager analyzes resource allocation, how it displays resource status, and how it recommends or performs actions. This tab opens the Policy Editor that you can use to:

- Navigate to policy categories
- Specify the scope of your settings
  You can make global settings, or make settings for groups of machines or applications
- Enter setting values and apply your changes

![Figure 11-1. Policy Editor](image-url)
To set a policy, you first select a category, and then navigate the Scope tree to set the scope of the policy change. The editor then displays the settings you can make. To edit a field you click in it and enter a value. When you have made the settings you want, be sure to click **Apply Setting Changes**.

For example, you can direct Operations Manager to automatically resize all VMs on a specific cluster. To do this, you would make a selection similar to the following figure, set the Resize value, and apply the change.

![Policy Scope Set to VMs By Storage](image)

**Figure 11-2. Policy Scope Set to VMs By Storage**

Before you make policy settings, you should understand the scope of these settings, and how Operations Manager chooses among competing settings. For more information, see **Policy Scope** - page 151.

For information about policy categories, and the effects of their individual settings, see **Policy Categories** - page 155.

### Policy Scope

Policy scope determines which resources will be affected by the settings you make. Scope can be either:

- **Global Settings** - page 151: Base settings for each category that apply by default to all resources
- **Group Overrides** - page 152: Settings you apply to specific groups of resources

### Global Settings

To make global settings, select a category, and if necessary select a resource type. The following image shows global settings for actions on Hosts.
Figure 11-3. Global Policy Settings

These are the base settings for all the resources in your inventory. The settings you make on groups and individual resources will override these global settings.

Group Overrides

You can make settings to groups of resources that override the global settings for the resource type. (For information about defining custom groups, see Group Management - page 155.) As you make these settings, you should be aware of issues that can arise with:

- Conflicting Settings - page 153
- Top-level Groups - page 154
Conflicting Settings

You can set overrides on any groups listed in the Profiles tab. However, it's possible that individual machines or applications are in more than one group (see the following illustration).

![Policy Scope](image)

**Figure 11-4. Same VM in Two Groups**

In this case, you could set different overrides for the two groups, which can then conflict with each other in the same resource instance. For example, assume the following settings for **VM Resizing**:

- The Global setting is *Manual*
- The override for VMs_Beta\Cluster-1 (in Virtual Machines by Cluster) is *Automated*
- The override for VMs_dv VM Network (in Virtual Machines by Network) is *Recommend*

In this case, two different settings will be associated with the VM named Fedora 12. In all such conflicts, Operations Manager uses a tie-breaker to resolves the conflict. In the case of actions, the tie-breaker uses the most conservative setting. Following this example, any Resize actions for Fedora 12 will be of type *Recommend*, because that is the most conservative of the settings for this VM.

The documentation for each policy category describes the tie-breaker for that category.

**NOTE:** Tie-breakers only apply among override settings. For example, even if a global action setting is more conservative than its override, the override takes precedence. But among two or more overrides for the same setting, the tie-breaker comes into effect.

You can navigate to any instance in the scope tree, see its effective setting, and also see where that has been set. For example, the following figure shows that the action mode for Resize on Fedora 12 is *Recommend*, and it was set in the VMs_dv VM Network group.
**Scope:** VirtualMachine

**Parameter:** Fedora 12

**Action Mode Settings**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
<th>Defined In</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>Manual</td>
<td>Global</td>
</tr>
<tr>
<td>Move</td>
<td>Manual</td>
<td>Global</td>
</tr>
<tr>
<td>Suspend</td>
<td>Manual</td>
<td>Global</td>
</tr>
<tr>
<td>Terminate</td>
<td></td>
<td>Global</td>
</tr>
<tr>
<td>Add Provider</td>
<td>Recommend</td>
<td>Global</td>
</tr>
<tr>
<td>Change</td>
<td>Recommend</td>
<td>Global</td>
</tr>
<tr>
<td>Remove Provider</td>
<td>Recommend</td>
<td>Global</td>
</tr>
<tr>
<td>Reconfigure</td>
<td>Recommend</td>
<td>Global</td>
</tr>
</tbody>
</table>

**Figure 11-5. Viewing the Effective Setting for a VM**

**Top-level Groups**

Within each policy category, the editor displays resources in groups. The following figure shows groups for actions on Host and VM.

**Figure 11-6. Top-level Groups for Actions**
Notice that each category has top-level groups. For example, the Action category sets policies for actions on VMs, hosts, datastores, and virtual datacenters. For VM actions the scope tree shows:

- Virtual Machines
- Virtual Machines by Cluster
- Virtual Machines by Network
- Virtual Machines by Storage

Each of these is a top-level group. Beneath each top level you can see the individual groups that contain the resources. It’s likely that most individual resources belong to all of the top-level groups. For example, it’s likely that a single VM belongs to Virtual Machines by Cluster and to Virtual Machines by Datacenter.

You should not make settings to the top-level groups. You could make a top-level setting that always wins a tie-breaker, and so all the lower-level settings would never take effect. If you set overrides to a top-level group after lower-level settings were already made, you could inadvertently make all the lower-level settings ineffective.

**NOTE:** If you want to make settings to all resources (all PMs or all VMs, for example), then you should make global settings (see Global Settings - page 151). You should not make settings in a top-level group.

---

**Policy Categories**

You can specify the following categories of policies on this installation of Operations Manager:

- **Group Management** - page 155: Custom groups you define to manage resources—You can use groups to manage how Operations Manager uses policy settings
- **Workload Placement** - page 160: DRS rules and segments that restrict how Operations Manager calculates workload placement
- **Analysis** - page 162 — Constraints that Operations Manager can use to determine whether a resource is operating optimally
- **Action Modes** - page 167 — How Operations Manager handles the execution of actions in the To Do list (automatic, manual, recommend, or disable)
- **Application Priority** - page 169 — Mission critical or normal
- **Discovery Policies** - page 170 — How to discover Windows applications, and how to recognize vCenter tags
- **Email Notification** - page 176 — Notification policies for Operations Manager events
- **Retention Configuration** - page 179 — Policies to retain historical data

**Group Management**

Groups assemble collections of resources for Operations Manager to monitor and manage. When using the Navigation Panel, or when or setting scope, you can select groups to focus on those specific resources. For example, if you have a number of VMs devoted to a single customer, you can create a group of just those VMs. When running a Planner scenario you can set the scope to affect just that group.

Operations Manager ships with some groups already defined. With Group Management you can also create your own groups. Operations Manager supports two custom-grouping methods:

- **By criteria** — You create dynamic groups that are defined by specific search criteria. You can group services according to naming conventions (all VM names that start with “ny”), resource characteristics (all physical machines with four CPUs), or other criteria such as time zone or number of CPUs. These groups are dynamic because Operations Manager updates the group as conditions changes.
- **By manual selection** — You create static groups by selecting the specific group members.
Figure 11-7. Editing Groups

In the **Groups Configuration** panel you can:

- Collapse the groups tree — click the **Collapse** button
- Refresh the Operations Manager session — You should refresh your session after you make changes to groups. The Refresh button causes Operations Manager to update the data it displays.
- Create new groups — click the **PLUS** icon
- Edit an existing group — select a group and make changes to its properties
- Delete an existing group — select a group and click the **X** icon
Creating a Group

When you click the PLUS icon, the **Create New Group** dialog box appears. To create a group:

1. **Name the group.**

![Create New Group Dialog Box](image)

2. To specify the grouping criteria, display the Members tab.
Choose a grouping method: 
- Group entities by criteria
- Manually select entities to group

Define the group members:

Search for:
- Physical Machines ▼
- by name

Physical Machine whose name matches the regular expression:

hp.*

When manually selecting entities, drag found entities to add them to the custom group

Figure 11-9. Specifying Group Content

3. **Choose a grouping method.**
   If you group by criteria, the group will contain all the items that match your search criteria. As Operations Manager discovers new entities that match your criteria, it will add the entities to the group. To manually select entities, you search for items and add specific matches to the Custom group content list.

4. **Define the group members**
   You set up searches to find the group items. For search criteria, you choose the type of entity to search for. When you choose an item in the Search criteria list, the search field updates to accept the appropriate input. The search field accepts regular expressions. For help on regular expression syntax, click the QUESTION MARK button.
   When you have entered your search criteria, click Find matches to see what entities your search specifies. If you enabled the Group By Criteria grouping method, these items will be the members of your group. If you enabled the Manually Select grouping method, you can drag items from the match list to the Custom group content list.
5. **Click Create Group.**

   Before you create the group, you can make settings for that group, including whether to enable or disable reports for that group (see **Group Settings** - page 159, below). You can always return to a group and edit it to change these settings at any time. Also, you can specify these settings directly, choosing groups to limit the scope of your changes. For more information, see **Policy Scope** - page 151.

   You can also use the Segment tab to see a listing of workload placement policies that include this group in their definitions (see **Workload Placement** - page 160).

### Group Settings

As you create a group, you can specify the settings that apply to that group. You can also edit these settings at any time. The settings for a group depend on the type of resource in the group. For example, in a group of PMs you cannot set constraints that apply to storage devices. For a listing of the settings you can apply to a group, see:

- **Analysis** - page 162
- **Action Modes** - page 167
- **Application Priority** - page 169
- **Discovery Policies** - page 170

For each group, you can also enable or disable reports. Reports are enabled by default — if you want to exclude a group from reports, make the setting in the group definition.

### Group Management

![My Groups](image)

**HP Hosts: Group Configuration**

<table>
<thead>
<tr>
<th>Properties</th>
<th>Members</th>
<th>Settings</th>
<th>Segments</th>
</tr>
</thead>
</table>

**Reports**

<table>
<thead>
<tr>
<th>Override</th>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enable group reports</td>
<td></td>
</tr>
</tbody>
</table>

**Operational Constraints**

- **Target Utilization**
- **Heatmap Critical Utilization [%]**
- **Utilization Thresholds [%]**

**Action Mode Settings**

<table>
<thead>
<tr>
<th>Override</th>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start</td>
<td>Manual</td>
</tr>
<tr>
<td></td>
<td>Suspend</td>
<td>Manual</td>
</tr>
<tr>
<td></td>
<td>Terminate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Provision</td>
<td>Recommend</td>
</tr>
</tbody>
</table>

![Apply Settings Change](image)

**Figure 11-10. Disabling Reports for a Group**
Workload Placement

For planning and optimization, Operations Manager makes recommendations to move VMs, and can execute these moves automatically. When calculating VM moves, Operations Manager respects cluster boundaries, networks, and provisioned data stores. For planning, you can also specify the explicit scope of a scenario as you create it (see The Plan Tab - page 85).

Workload placement policies provide you with finer control over how Operations Manager calculates these moves. From this tab you can:

- Enable/disable DRS Rules that are specified in your VCenter environment
- Create segment policies that restrict workload placement according to specific rules

Imported Workload Placement Policies

Operations Manager can monitor an environment associated with one or more VCenter servers (see Target Configuration - page 137). These VCenter servers can include Distributed Resource Scheduler (DRS) rules that determine placement of VMs among physical hosts.

For each DRS rule, you can specify whether to enable or disable it in Operations Manager. By default, Operations Manager disables DRS rules.

To see the list of DRS rules for your environment, expand the Imported Placement Policies folder.

To enable or disable a policy, select it in the list and modify its settings.

Figure 11-11. Enabling a DRS Rule

Operations Manager Segments

You can create Operations Manager Segment policies to further control how Operations Manager calculates the placement of VMs among your physical hosts and data stores. You can create policies that have these and other effects:

- Restrict the number of VMs that can use a given data store
- Limit VM mobility by restricting a collection of VMs to a specified cluster or group of hosts
- Implement system redundancy by specifying that certain VMs always run on different hosts
For the VMs in a selected group, you can create rules of the following types:

- **VMs must not run on the same Host**
  No more than the specified number of VMs can run on the same host.

- **VMs must not run on the same Host, out of the given PM group**
  For hosts from a specified PM group, no more than the specified number of VMs can run on the same host.

- **VMs must not be connected to the same Storage device**
  No more than the specified number of VMs can use the same storage device.

- **VMs must not be connected to the same Storage, out of the given group of Storage devices**
  For storage devices from a specified group, no more than the specified number of VMs can use the same device.

To create a segment rule, click the Plus icon (+) to display the Policy Builder. In the Policy Builder:

- Name the segment rule
- Choose the workload - select a VM group to determine the placement of these group members
  Click the PLUS icon to open a group browser, and double-click the group you want to choose.
- Choose the placement - select a group of physical devices to determine how the VMs can be placed on these members
  Click the PLUS icon to open a group browser, and double-click the group you want to choose.
- Enable the rule to limit the workload to the target placement group
- Specify the number of VMs to place on each physical device
- Click Create Rule

For example, the following figure shows a policy for placing VMs devoted to databases. For all the VMs in the cluster set in the **Choose Workload** list, the policy limits placement to one VM per physical host in the custom group, **DB_Hosts**.

![Policy Builder](image-url)

**Figure 11-12. Workload Policy Builder**
Analysis

As Operations Manager gathers metrics, it compares the metric values against specified constraint and capacity settings to determine whether a metric exhibits a problem, how to recommend a problem resolution, and so on. Operations Manager maintains analysis settings for Host and Storage devices.

The following figure shows override settings for all NAS storage devices. To make settings for all storage devices in the environment, you should make global settings for Analysis > Host or Analysis > Storage (see Global Settings - page 151).

Tie-break Results

When the same resource instance has conflicting settings, the most conservative setting wins:

<table>
<thead>
<tr>
<th>Setting type</th>
<th>Most conservative is</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilization, throughput, and upper bounds</td>
<td>Lowest value</td>
</tr>
<tr>
<td>Latency and lower bounds</td>
<td>Highest value</td>
</tr>
</tbody>
</table>

How Operations Manager Responds to Analysis Settings

Operations Manager compares utilization metrics in your environment to the operational constraints you specify. It uses that comparison to trigger problem notifications and to classify the problems. The values you set here specify maximum values for each metric. Based on those settings, Operations Manager classifies these metrics as follows:

<table>
<thead>
<tr>
<th>If the value is</th>
<th>The classification is</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 80% of the constraint setting</td>
<td>Critically overutilized</td>
</tr>
<tr>
<td>More than 60% and less than 80% of setting</td>
<td>Overutilized</td>
</tr>
<tr>
<td>Less than 10% and more than 5% of setting</td>
<td>Under utilized</td>
</tr>
</tbody>
</table>
### Load Balancer Settings

To manage load balancers, Operations Manager tracks transactions that occur on the virtual applications (vservers) each load balancer manages. You can set the capacity of transactions per second as a policy for virtual applications. Operations Manager will list transaction utilization as a percentage of the capacity you set:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual Application Transaction Capacity</td>
<td>1000</td>
</tr>
</tbody>
</table>

### Operational Settings

#### Hardware Costs

For planning and reporting, Operations Manager uses these values to estimate the cost of changes to your hardware inventory. The following table shows the default settings for hardware cost:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host Hardware Cost</td>
<td>9000</td>
</tr>
<tr>
<td>Cost of CPU per unit</td>
<td>200</td>
</tr>
<tr>
<td>Cost of memory per GB</td>
<td>50</td>
</tr>
<tr>
<td>Cost of storage per TB</td>
<td>50</td>
</tr>
</tbody>
</table>

#### Heatmap Critical Utilization

Operations Manager compares utilization metrics in your environment to the operational constraints you specify (see Utilization Thresholds - page 165 and Storage Settings - page 166). It uses that comparison to set colored notifications in heatmaps, trigger problem notifications, and to classify the problems it finds. The values you set here define what Operations Manager considers critical violations for different metrics.

For example, assume you define critical as 80% for a metric. Based on the settings you make for the monitored metrics, Operations Manager then classifies these metrics as follows:

<table>
<thead>
<tr>
<th>If the value is:</th>
<th>The classification is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 80% of the constraint setting</td>
<td>Critically overutilized</td>
</tr>
<tr>
<td>More than 60% and less than 80% of setting</td>
<td>Overutilized</td>
</tr>
</tbody>
</table>

For under utilization, assume you define critical as 10% for a metric. Based on the settings you make for the monitored metrics, Operations Manager then classifies these metrics as follows:

<table>
<thead>
<tr>
<th>If the value is:</th>
<th>The classification is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 10% and more than 5% of setting</td>
<td>Under utilized</td>
</tr>
<tr>
<td>Less than 5% of analysis setting</td>
<td>Critically under utilized</td>
</tr>
</tbody>
</table>
The following table shows the default settings for critical utilization:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical Utilization Percent for IOPS</td>
<td>80</td>
</tr>
<tr>
<td>Critical Utilization Percent for CPU</td>
<td>80</td>
</tr>
<tr>
<td>Critical Utilization Percent for Memory</td>
<td>80</td>
</tr>
<tr>
<td>Critical Utilization Percent for IO Throughput</td>
<td>80</td>
</tr>
<tr>
<td>Critical Utilization Percent for Net Throughput</td>
<td>80</td>
</tr>
<tr>
<td>Critical Utilization Percent for Swapping</td>
<td>80</td>
</tr>
<tr>
<td>Critical Utilization Percent for Latency</td>
<td>80</td>
</tr>
<tr>
<td>Critical Utilization Percent for Storage Amount</td>
<td>80</td>
</tr>
</tbody>
</table>

**Reporting Upper and Lower Bounds**

The following table shows the default settings for operational constraints on virtual machines.

Upper bounds limit the amount of a physical resource that will be devoted to a VM consumer. For example, with a VMem upper bound of 85 Operations Manager will never devote more than 85% of physical memory to VMs running on a host. This ensures the host machine has enough physical memory to perform core operations.

Lower bounds identify the percentage utilization that Operations Manager will consider under utilized. For example, with a VMem lower bound of 10, if utilization falls below 10% Operations Manager will consider migrating consumers to another host and suspending the under utilized physical machine.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMem Utilization Upper Bound</td>
<td>85</td>
</tr>
<tr>
<td>VCPU Utilization Upper Bound</td>
<td>85</td>
</tr>
<tr>
<td>VMem Utilization Lower Bound</td>
<td>10</td>
</tr>
<tr>
<td>VCPU Utilization Lower Bound</td>
<td>10</td>
</tr>
<tr>
<td>VStorage Utilization Upper Bound</td>
<td>85</td>
</tr>
</tbody>
</table>

**Resize Recommendation Incrementing Constant**

As Operations Manager recommends changes to virtual resources, it raises or lowers the resource values by these increments.

**NOTE:** For VMem, you should not set the increment value below 1024. Virtual machines rely on VMem to start up and run. For a VM that is under utilized, Operations Manager will reduce VMem allocation by the increment amount, but it will not leave a VM with zero VMem. For example, if you set this to 512, then Operations Manager could reduce the memory for a VM to 512 Kb. It’s possible that if the increment is too low, then Operations Manager might allocate insufficient VMem for the machine to operate.
The following table shows the default settings for these increments:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increment constant for VMem user value [MB]</td>
<td>1024</td>
</tr>
<tr>
<td>Increment constant for VCPU user value [MHz]</td>
<td>1024</td>
</tr>
<tr>
<td>Increment constant for VStorage user value [GB]</td>
<td>0.5</td>
</tr>
</tbody>
</table>

**Utilization Thresholds**

Operations Manager uses the thresholds you set for specific metrics when it analyzes your environment and recommends changes that will achieve the optimal targets.

The following table shows the default settings for operational constraints on physical machines.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Storage IOPS Utilization</td>
<td>100</td>
</tr>
<tr>
<td>Max Storage Latency Utilization</td>
<td>100</td>
</tr>
<tr>
<td>Max Host CPU Utilization</td>
<td>100</td>
</tr>
<tr>
<td>Max Host Memory Utilization</td>
<td>100</td>
</tr>
<tr>
<td>Max Host IO Throughput</td>
<td>20</td>
</tr>
<tr>
<td>Max Host Net Throughput</td>
<td>20</td>
</tr>
<tr>
<td>Max Host Swapping Utilization</td>
<td>100</td>
</tr>
<tr>
<td>Max Storage Latency Utilization</td>
<td>100</td>
</tr>
</tbody>
</table>

**Advanced**

The advanced settings adjust the overall analysis performed by the economic scheduling engine. You can adjust how Operations Manager calculates recommended actions, as well as the optimal utilization Operations Manager will try to achieve for physical devices.

**Calculation Adjustments**

The Time Range Constant sets the number of days Operations Manager will look into the past when making recommendations to decrease the resources available to a VM or application. Operations Manager makes suggestions to reduce resources on a daily basis. (Note that Operations Manager can make recommendations to increase resources every 10-minute cycle. For these recommendations it looks back 24 hours.)

Weights for peaks and averages specify how much peak and average metric values will affect calculations. For example, a high weight for peaks means that peak metric values are highly significant when calculating over utilization. However, you might have an application that uses 100% CPU for very short transient events. To suppress the way Operations Manager responds to these transient events, you can set a lower value for **Weight for Peaks**.

The following table shows the default settings for overall Operations Manager settings.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Range Constant</td>
<td>100</td>
</tr>
</tbody>
</table>
Target Utilization

When you provide values, these settings specify the optimal target you want for utilization of system resources. Operations Manager will analyze current utilization and recommend or perform changes that seek to achieve the target you set here. Use these settings to specify the balance you want between performance (quality of service) and efficiency.

If you set the balance in favor of efficiency, Operations Manager tends to place more VMs on fewer physical hosts, and to give storage capacity from fewer data stores. As a result, high utilization can have more impact on QoS. With a balance in favor of performance, Operations Manager tends to spread virtual loads across more physical devices.

**NOTE:** The setting for Target Utilization can have an effect on plans that you run. If you restrict planning to the current hardware inventory (don’t add new hardware), then you should always set a value of zero for Target Utilization.

The default value for Target Utilization is 70, with a range of 10. When you provide a Target Utilization value, Operations Manager varies market calculations in an attempt to arrive at the zone you specify. Note that as you move the sliders, a tooltip displays the numerical value of the setting you make.

For example, assume you want utilization of your resources to center on 75%, with a tolerance of plus/minus 10%. In other words, you consider 65% to be under-utilization, 85% to be over-utilization, and 75% to be optimal utilization. To achieve that, you would specify:

- Target Utilization = 75
- Range for Target Utilization = 20

The following table shows the default settings for target utilization:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Utilization</td>
<td>70</td>
</tr>
<tr>
<td>Range for Target Utilization</td>
<td>10</td>
</tr>
</tbody>
</table>

Storage Settings

Storage settings are measured against the storage capacity. For capacity, you specify the IOPS (input operations per second) and latency in ms that your storage devices can support. Then the constraint settings identify what percentage of this capacity Operations Manager should consider when triggering problems. For example, assume IOPS Capacity of 500, and Latency of 1000 ms. If a storage device has 250 IOPS, then it is at 50% of capacity for that metric. Likewise, if the storage latency is 750 milliseconds, then the latency is at 75% of capacity.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOPS Capacity</td>
<td>500</td>
</tr>
<tr>
<td>Storage Latency</td>
<td>1000</td>
</tr>
</tbody>
</table>
### Action Modes

When Operations Manager uncovers bottlenecks, over provisioning, or other issues, it can then identify and perform actions that resolve those issues and restore optimal performance. You can specify how Operations Manager should handle the actions it identifies for hosts and VMs.

### Supported Actions

Operations Manager doesn’t automate the same actions equally for all hypervisors. For example, assume you set the Suspend action to be automated for all VMs. In that case, Operations Manager can automate suspension for VMs managed by vCenter and XenServer, but it cannot automatically suspend VMs managed by Hyper-V. Note that Operations Manager will perform automation for the VMs that it can, and recommend suspension for Hyper-V VMs.

The following table lists actions Operations Manager supports on each hypervisor, showing whether it can automate the actions, or only recommend them.

- ✓ indicates full automation support
- ✓ - indicates recommended-only actions

#### Host

<table>
<thead>
<tr>
<th>Action</th>
<th>vCenter</th>
<th>XenServer</th>
<th>Hyper-V</th>
<th>VCD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>✓</td>
<td>✓ -</td>
<td>✓ -</td>
<td>✓ -</td>
</tr>
<tr>
<td>Suspend</td>
<td>✓</td>
<td>✓ -</td>
<td>✓ -</td>
<td>✓ -</td>
</tr>
<tr>
<td>Remove (Terminate)</td>
<td>✓ -</td>
<td>✓ -</td>
<td>✓ -</td>
<td>✓ -</td>
</tr>
<tr>
<td>Provision</td>
<td>✓ -</td>
<td>✓ -</td>
<td>✓ -</td>
<td>✓ -</td>
</tr>
</tbody>
</table>

#### VM

<table>
<thead>
<tr>
<th>Action</th>
<th>vCenter</th>
<th>XenServer</th>
<th>Hyper-V</th>
<th>VCD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Move</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Suspend</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Remove (Terminate)</td>
<td>✓ -</td>
<td>✓ -</td>
<td>✓ -</td>
<td>✓ -</td>
</tr>
<tr>
<td>Change (Move to Different Storage)</td>
<td>✓ -</td>
<td>✓ -</td>
<td>✓ -</td>
<td>✓ -</td>
</tr>
</tbody>
</table>
Note that for VCloud Director datacenters Operations Manager only supports resize actions. However, it can automate actions for the underlying VMs and hosts because they are managed by vCenter.

**Action Mode Settings**

For each action Operations Manager can perform you can specify the action mode, or how it will handle the action. Operations Manager supports the following action modes:

- **Disabled** — Do not recommend or perform the action
- **Recommended** — Recommend the action so a user can perform it using the given hypervisor or by other means
- **Manual** — Recommend the action, and provide the option to perform that action through the VMTurbo Operations Manager user interface
- **Automated** — Operations Manager performs the action automatically

The following figure shows override settings for a group of Development hosts. In this case, Operations Manager will automatically start physical machines in this group. To set modes for all hosts in the environment, you should make global settings for Action (see Global Settings - page 151).

<table>
<thead>
<tr>
<th>Action</th>
<th>vCenter</th>
<th>XenServer</th>
<th>Hyper-V</th>
<th>VCD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add Storage</td>
<td>☑️</td>
<td>⬟</td>
<td>⬟</td>
<td>⬟</td>
</tr>
<tr>
<td>Remove Storage</td>
<td>☑️</td>
<td>⬟</td>
<td>⬟</td>
<td>⬟</td>
</tr>
<tr>
<td>Reconfigure</td>
<td>☑️</td>
<td>⬟</td>
<td>⬟</td>
<td>⬟</td>
</tr>
<tr>
<td>Resize</td>
<td>☑️</td>
<td>☑️</td>
<td>☑️</td>
<td>☑️</td>
</tr>
</tbody>
</table>

Figure 11-14. Setting Action Modes for a Group
**Tie-break Results**

When the same resource instance has conflicting settings, the most conservative setting wins. The following list is from most conservative to most aggressive:

- Disabled
- Recommended
- Manual
- Automated

**Application Priority**

Application priority determines the conditions under which Operations Manager recommends to suspend or terminate a VM. Suspending a VM means powering it down, but leaving it in the hypervisor’s list of managed VMs. Terminating a VM means removing it from the hypervisor. When Operations Manager recommends that you terminate a VM, this indicates that the VM is dormant, and no applications are running on it.

**NOTE:** Your environment may include some VMs that you never want to terminate. You might think that you can set all applications to Mission Critical as a way to direct that Operations Manager never recommends termination. In fact, Operations Manager can recommend that you terminate a dormant VM that has Mission Critical applications on it. If you want to never terminate, then you can disable the Terminate action for all VMs or for a group of VMs. For more information, see Action Modes - page 167.

Operations Manager monitors resource consumption, and works to keep Mission Critical applications running. If a Mission Critical application needs resources and none are immediately available, Operations Manager may recommend suspending non-critical VMs to free up resources and make them available to the critical application.

You can specify the priority for applications to be:

- **Mission Critical**
  The focus of Operations Manager is to keep the applications running. For example, it will never suggest suspending the VM that hosts a mission critical application.

- **Normal**
  Operations Manager may suggest suspending a VM that hosts normal applications to free up resources that a mission critical application might need.

- **Low**
  Operations Manager does not consider the needs of low priority applications when calculating the optimal operating zone for your environment.

You specify application priority to groups. The most important groups for application priority are:

- **Applications**
  Each group is named for a discovered application, and contains all the instances of that named application.

- **Physical Machines**
  For each physical machine, all the applications running on that machine.

If a VM has any Mission Critical applications on it, Operations Manager will always try to find resources for that VM, and will never recommend suspending it in order to free up resources. Operations Manager can recommend terminating a VM with Mission Critical applications, if the VM is truly dormant.

For a VM with all Normal applications, if the VM uses resources that are needed elsewhere, then Operations Manager may recommend suspending this VM. For a VM with Low-priority applications, it can recommend to terminate the VM to free up resources.

By default, all applications are **Mission Critical** (see the Global Setting for Application Priority).
NOTE: For each VM Operations Manager defines a Guest Load application. The Guest Load represents all consumption that Operations Manager cannot assign to a specific application. This includes processes for the VM’s operating system. Operations Manager ignores Guest Load priority when deciding how to free up resources. However, if a VM has only the Guest Load application on it, and that application is set to Low, then Operations Manager may recommend terminating that VM.

The following figure shows override settings for the applications hosted by use a specific physical machine. To set priority for all applications in the environment, you should make global settings for Application Priority (see Global Settings - page 151).

![Policy Editor](image)

**Figure 11-15. Setting Priority for the Applications on a Specific Host**

**Tie-break Results**

When the same resource instance has conflicting settings, the most conservative setting wins. The following list is from most conservative to most aggressive:

- Mission Critical
- Normal
- Low

**Discovery Policies**

Operations Manager sweeps through your environment to discover the inventory items (applications, VMs, hosts, data stores, etc.) in your environment. It performs initial discovery when you first start it and add target hypervisors, and events that can change the inventory trigger subsequent discovery. You can set policies to direct:

- Application Discovery - page 170 - Application Signatures (how Operations Manager recognizes application processes), and credentials to access the VMs that host the applications
- Load Balancer Discovery - page 174 - Mapping application signatures to virtual applications
- vCenter Annotation Grouping - page 175 - The vCenter tags to use for grouping

**Application Discovery**

For Operations Manager to perform application discovery, it needs Admin credentials on the VMs that host the applications. You can also specify application signatures it uses to associate multiple processes with a single application.
Default Application Discovery

By default, Operations Manager discovers the following applications:

<table>
<thead>
<tr>
<th>Application Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSASS</td>
<td>Microsoft Active Directory services</td>
</tr>
<tr>
<td>IIS</td>
<td>Microsoft Internet Information Services</td>
</tr>
<tr>
<td>XenDesktop</td>
<td>Citrix XenDesktop</td>
</tr>
<tr>
<td>VMView</td>
<td>VMWare View</td>
</tr>
<tr>
<td>MSSQL</td>
<td>Microsoft SQL Server</td>
</tr>
<tr>
<td>SharePoint</td>
<td>Microsoft Sharepoint Server</td>
</tr>
<tr>
<td>Guest Load</td>
<td>The resources that Operations Manager has not assigned to any specific application (for more information, see Guest Load - page 56)</td>
</tr>
</tbody>
</table>

**NOTE:** Operations Manager uses Microsoft Windows Management Integration (WMI) to discover and manage application processes. With the exception of Guest Load, all managed applications run on Windows machines.

Application Signatures

An application signature is a search string that matches process names. A single application may launch a number of processes to perform its job. Rather than tracking each process as a separate application, Operations Manager can group these processes and monitor the group as a single application.

Each process must have a unique name, but each process name typically includes part of the name of the main application, or some other text that identifies it as part of the overall application. This name that’s shared in all the process names is the application signature.

To specify an application signature:

1. **Select Application Discovery to display the editor.**
2. **Create a new application signature.**
3. **Provide an application name.**
   - Application names should be unique. If you provide a name that is identical to a default application name (as described in Default Application Discovery - page 171), then Operations Manager will use your custom application signature when grouping application processes.
4. **Enter regular expressions to identify the characters that must be in a Windows process name.**
   - You can also specify characters that must not be in the process name. Any process name that satisfies the application signature identifies a member of the given application.
   - For example, assume the following strings:
     - Match: `s . *`
     - No-match: `sq . *`
     - In this case, the signature would match all process names that begin with 's ', except those that begin with 'sq '.
VM Credentials

Operations Manager uses WMI to discover applications. You must provide valid credentials for any of the VMs that host applications you want to monitor. These VMs should be running Windows OS.

You select VM groups and set specific credentials for those VMs. You can select a top-level group to provide one set of credentials for all the VMs in the inventory, and then select lower-level groups to override the more general settings (for more information, see Policy Scope - page 151).

Note that you set credentials to groups of VMs, not to individual VMs. To discover applications on all the VMs in a group, all those VMs must honor the same credentials. If the VMs in default groupings don’t all have the same credentials, you can create custom groups to keep the same credentials together. For information about creating custom groups, see Group Management - page 155.

The settings to make are:
- Username: A user with admin rights on the machine
- Password: That user’s password
- Retry Interval: The minimum amount of time to wait before trying to log into a machine again

It’s common to configure machines so they will lock out any login attempts after a certain number of unsuccessful attempts. The lockout typically stays in effect for a given time (15 or 30 minutes, for example). Operations Manager logs in to poll for applications every 20 minutes. You should set the retry interval to a value larger than the lockout time that is specified for the machine. This will avoid unnecessary lockouts in case the credentials you provide here are incorrect. The default retry interval value is 60 minutes.

The following figure shows settings for the applications that run on VMs in a specific cluster. To set credentials for all VMs in the environment, you would select a top-level item in the Scope list.

![Figure 11-17. Setting Discovery Credentials for Applications in a Cluster](image)

Credentials are inherited. For example, you can select the top-level group **Virtual Machines** and provide one set of credentials. Then you can select lower-level groups and provide override credentials. The lowest-level credential specification wins.

The following image shows settings for all VMs (the top-level group). This means that by default Operations Manager will use these credentials when it performs application discovery on a VM:
The next image shows settings for a specific VM. You cannot make settings on individual VMs, but you can see the username, and you can also see which group setting is in effect. In this case, Operations Manager will use these credentials for application discovery on that VM.

![Image of settings for a specific VM]

Note that the Application Discovery table shows where this VM's credentials are set. In this case, they are set in the top-level group (Virtual Machines). It's possible for one VM to belong to many groups. If you need to change the credentials for this machine, you know where they are currently set. You can create another group to set different credentials for this VM.

### Load Balancer Discovery

Load balancers use virtual applications (sometimes called vServers) to marshall requests to a defined set of running applications. Virtual applications are divided by service type. Operations Manager discovers the service types that are defined for the load balancers in your environment.

To define which applications Operations Manager associates with load balancer service types, you assign an application signature to each service type. The application signatures should identify applications that are currently bound to specific load balancers. (Application binding to load balancers is part of the load balancer configuration.)

To assign signatures to a load balancer service type, you must first have defined appropriate signatures for the specific applications running in your environment. For information about defining application signatures, see Application Discovery - page 170. When you have the appropriate application signatures, you can then assign signatures to load balancer service types.

1. **Choose Discovery > Load Balancer in the Category list.**
   A list of load balancers appears. These are the load balancers you set up as targets in the Admin tab (see Adding Load Balancers as Targets - page 141).

2. **Assign application signatures to a load balancer’s service types.**
   Expand the load balancer you want and select a service type. Click in the right column to choose from the currently defined application signatures.
vCenter Annotation Grouping

vCenter Server annotations are a way for users to classify their VMs according to custom names. For example, the vCenter administrator may use tags for Department, Owner, and Team. Each one of these tags is a way to classify the VMs. The administrator can then assign values to each tag, which further classifies the VMs. For example, the VMs can be grouped into two departments as a way to distinguish VMs for Sales from VMs for Development.

Operations Manager can use these annotations to manage vCenter VMs in groups. The following figure shows two departmental groups. This corresponds to the VMs in vCenter that have been given either Demo or Engineering values for their Department annotations. Note that Operations Manager fully recognizes these groups. You can set scope (for user accounts or plans), generate reports, and use other group-related features.
Figure 11-19. Groups Created for VC Annotations

To specify how Operations Manager discovers annotations, display **VC Annotations** and enter a string. The string names each annotation, separated by an OR bar. Do not include spaces at either side of the separator.

Figure 11-20. Specifying Annotation Names

**Email Notification**

You can set up email notifications for problems that arise on VMs, hosts, or data stores. Operations Manager can send notifications when problems occur and when they’re cleared.
Message Format

You can define the content of notification messages, as well as the From address for each message. To make these settings, select the Email Notifications category and make Global settings.

**Table: Global Email Notifications**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>'From' Address</td>
<td><a href="mailto:dot94@vmturbo.com">dot94@vmturbo.com</a></td>
</tr>
<tr>
<td>Email content format - VM notifications</td>
<td>{6}: {5} \nHost: (8) \nDatastores: {9} \nTarget: {7} \nEvent: {0} - {4} \nCategory: {1} \nSeverity: {2}</td>
</tr>
<tr>
<td>Email content format - PM notifications</td>
<td>{6}: {5} \nDatastores: {9} \nTarget: {7} \nEvent: {0} - {4} \nCategory: {1} \nSeverity: {2}</td>
</tr>
</tbody>
</table>

Figure 11-21. Editing From Address and Message Content

The From address identifies the sender, and will be used for any replies to an email notification. If you leave this field blank, the From address will be the email address that is associated with the Operations Manager license installation.

**NOTE:** The From address also identifies the sender for report subscriptions. For more information about report subscriptions, see Manage Subscriptions - page 83.

When you define message content, you enter format variables and line breaks to determine what the message will include. For example, the following message format:

{6}: {5} \nDatastores: {9} \nTarget: {7} \nEvent: {0} - {4} \nCategory: {1} \nSeverity: {2}

Results in the following email message:

PhysicalMachine: myMachine.corp.mydomain.com  
Datastores: No value  
Target: 10.10.172.203  
Category: Workload Balancing  
Severity: MINOR  
State: NOTIFY
The message format variables for a message are:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>{0}</td>
<td>Event type - The problem name. For example, “WorkloadBalance”.</td>
</tr>
<tr>
<td>{1} Sub category - One of:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Performance Bottlenecks</td>
</tr>
<tr>
<td></td>
<td>• Storage Management</td>
</tr>
<tr>
<td></td>
<td>• Workload Balancing</td>
</tr>
<tr>
<td></td>
<td>• Green IT</td>
</tr>
<tr>
<td></td>
<td>• Configuration Management</td>
</tr>
<tr>
<td></td>
<td>• Over Provisioning</td>
</tr>
<tr>
<td></td>
<td>• Capacity Management</td>
</tr>
<tr>
<td>{2}</td>
<td>Severity - One of:</td>
</tr>
<tr>
<td></td>
<td>• Critical</td>
</tr>
<tr>
<td></td>
<td>• Major</td>
</tr>
<tr>
<td></td>
<td>• Minor</td>
</tr>
<tr>
<td>{3}</td>
<td>State - Can be NOTIFY or CLEAR.</td>
</tr>
<tr>
<td>{4}</td>
<td>Description - A full description of the problem.</td>
</tr>
<tr>
<td>{5}</td>
<td>Affected entity - The name of the VM, host, or datastore associated with the problem.</td>
</tr>
<tr>
<td>{6} Class name - The type of device that registers this problem. Can be one of:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• VirtualMachine</td>
</tr>
<tr>
<td></td>
<td>• PhysicalMachine</td>
</tr>
<tr>
<td></td>
<td>• DataStore</td>
</tr>
<tr>
<td>{7}</td>
<td>Target - The IP address or name of the hypervisor that manages the affected devices.</td>
</tr>
<tr>
<td>{8}</td>
<td>Host name - The name of the physical machine that hosts the affected VM. This variable only applies to VM problem notifications.</td>
</tr>
<tr>
<td>{9}</td>
<td>Datastore names - The names of the data stores that server the affected Host or VM. This variable only applies to VM and Host problem notifications.</td>
</tr>
</tbody>
</table>

**Notification Setup**

You can set up notification for all the devices in your environment, or you can select defined groups and set specific priorities for those devices. (For information about defining custom groups, see Group Management - page 155.) The following figure shows problem notification for all the hosts in the environment.
Figure 11-22. Setting Up Email Notifications for a Group

When you set up email notifications, you can choose from the following categories of events (click the cell in the Category column to make your choice):

- **Problem** - Issues Operations Manager identifies within your virtual environment
- **Discovery** - Issues that occur as Operations Manager performs discovery
- **Monitoring** - Issues that affect Operations Manager as it monitors your environment
- **Control** - Issues that affect Operations Manager as it performs recommended actions

**Retention Configuration**

Operations Manager gathers metrics from your environment, and stores them to provide historical reports. To optimize data storage, it consolidates the data into three groups — Hourly, Daily, and Monthly. Daily statistics consolidate Hourly data, and Monthly statistics consolidate Daily data.

Operations Manager also saves audit log entries, and it starts new server logs at regular periods.
Figure 11-23. Specifying Retention of Historical Records

The more time you specify to retain these data, the more storage Operations Manager requires. As you modify the time to retain data, Operations Manager estimates the storage you will need for the resulting database.

To change retention settings, edit the Value fields. When you’re satisfied with the settings, click Apply.

To return to the default settings, click Reset Defaults.