



HOL-2201-14-CMP  
Advanced Topics in  
vRealize Operations

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## Lab Overview - HOL-2201-14-CMP - Advanced Topics in vRealize Operations

### Lab Guidance

[2]

Note: It will take more than 90 minutes to complete this lab. You should expect to only finish 2-3 of the modules during your time. The modules are independent of each other so you can start at the beginning of any module and proceed from there. You can use the Table of Contents to access any module of your choosing.

The Table of Contents can be accessed in the upper right-hand corner of the Lab Manual.

This lab is a collection of feature-based modules that are designed to go into some depth in using several of the common components within vRealize Operations. The modules are all intended to be taken as stand-alone topics for people who want to become more familiar with using and getting value from vRealize Operations.

Lab Module List:

- Module 1 - Use Symptoms and Recommendations to Create Alerts (30 minutes) (Intermediate) Learn how to build a custom alert definition and how alerts can be used in our infrastructure.
- Module 2 - Creating and Modifying Views and Reports (45 minutes) (Intermediate) Learn how to create and modify several different types of custom views and reports.
- Module 3 - Creating and Managing Dashboards (30 minutes) (Intermediate) Learn how to import dashboards and other community content, create our own custom dashboards, as well as how to share dashboards through various methods.
- Module 4 - Managing Users and Roles (30 minutes) (Intermediate) Learn how to configure users, user groups, user roles and user permissions and how to share dashboards so certain users can see targeted content.
- Module 5 - Create Super Metrics Using the Super Metric Editor (45 minutes) (Intermediate) Learn about creating super metrics and how to use the super metrics editor.

Lab Captain:

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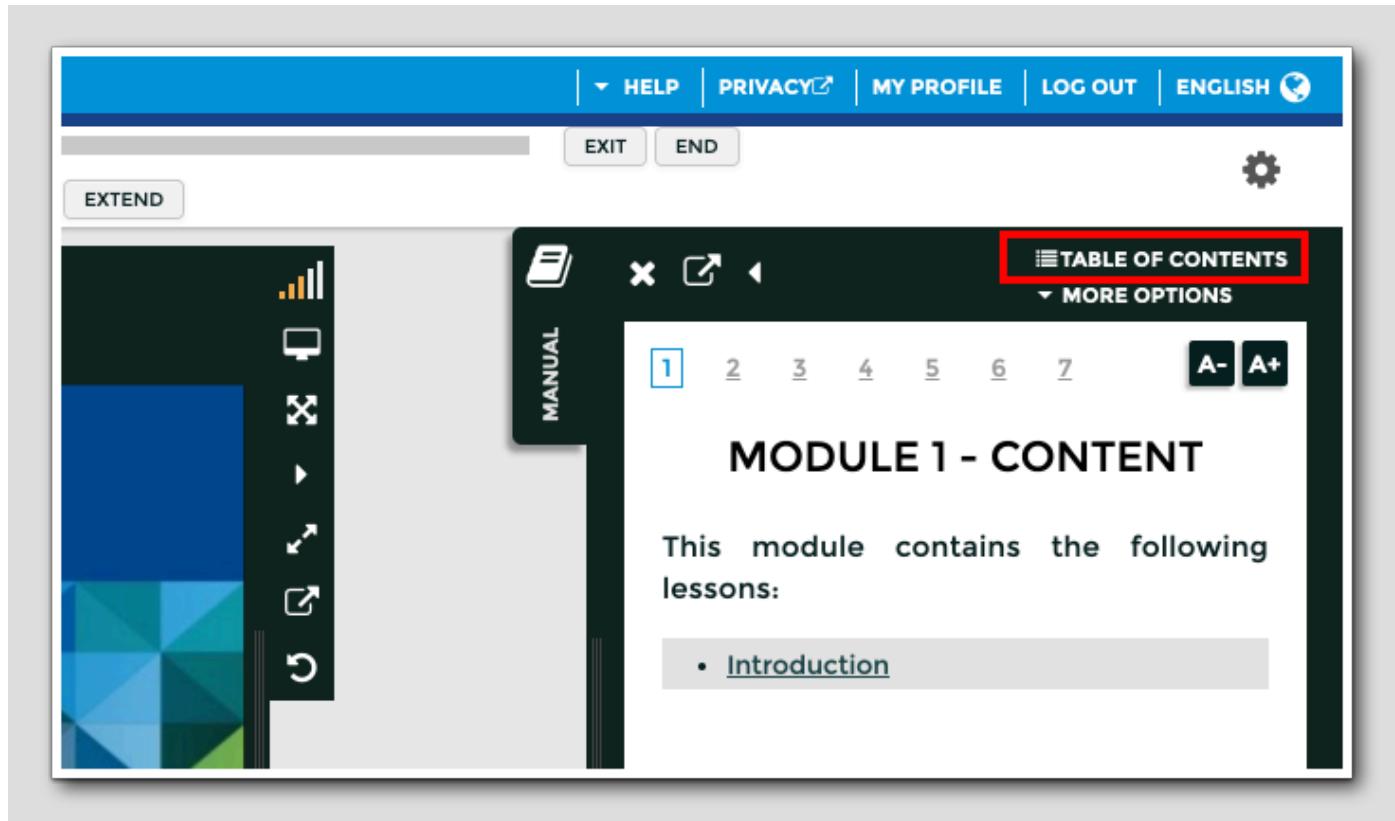
This lab manual can be downloaded from the Hands-on Labs Document site found here:

<http://docs.hol.vmware.com>

This lab may be available in other languages. To set your language preference and have a localized manual deployed with your lab, you may utilize this document to help guide you through the process:

<http://docs.hol.vmware.com/announcements/nee-default-language.pdf>

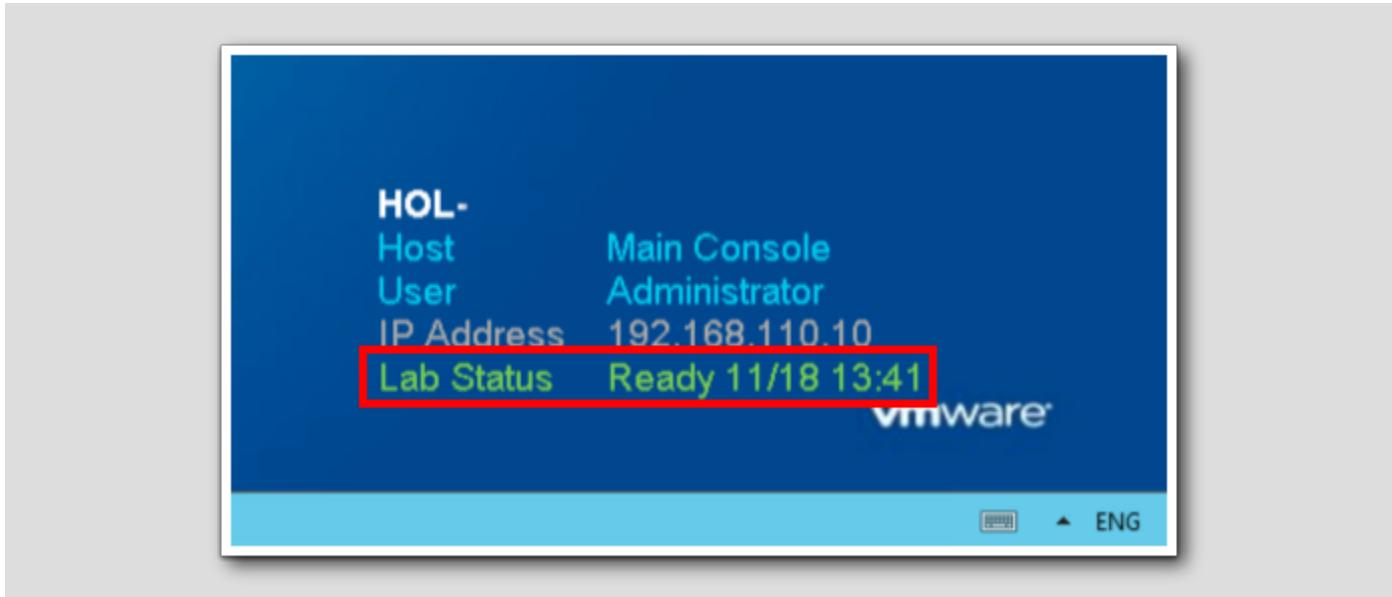
First time using Hands-on Labs?



Welcome! If this is your first time taking a lab navigate to the Appendix in the Table of Contents to review the interface and features before proceeding.

For returning users, feel free to start your lab by clicking next in the manual.

You are ready....is your lab?



Please verify that your lab has finished all the startup routines and is ready for you to start. If you see anything other than "Ready", please wait a few minutes. If after 5 minutes your lab has not changed to "Ready", please ask for assistance.

## Module 1 - Use Symptoms and Recommendations to Create Alerts (30 minutes)

### Introduction

[6]

Upon completing this lab, you will be able to:

- Understand Alerts, Symptoms, Recommendations and Actions
- Build a custom Alert Definition
- Simulate issues in the environment to demonstrate how to customize the alerts
- Utilize the different ways alerts can be used based on the critical nature or other characteristics of the monitored infrastructure

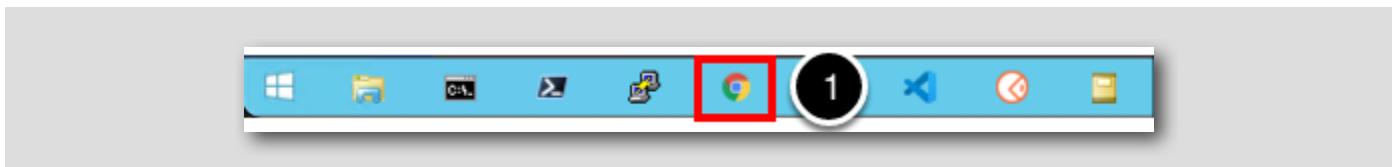
### Log in to vRealize Operations

[7]

To begin this exercise, we will log in to vRealize Operations. If you are not currently logged into any instance of vRealize Operations, continue to the next page, but if you are already logged into vRealize Operations, click [here](#) to skip ahead.

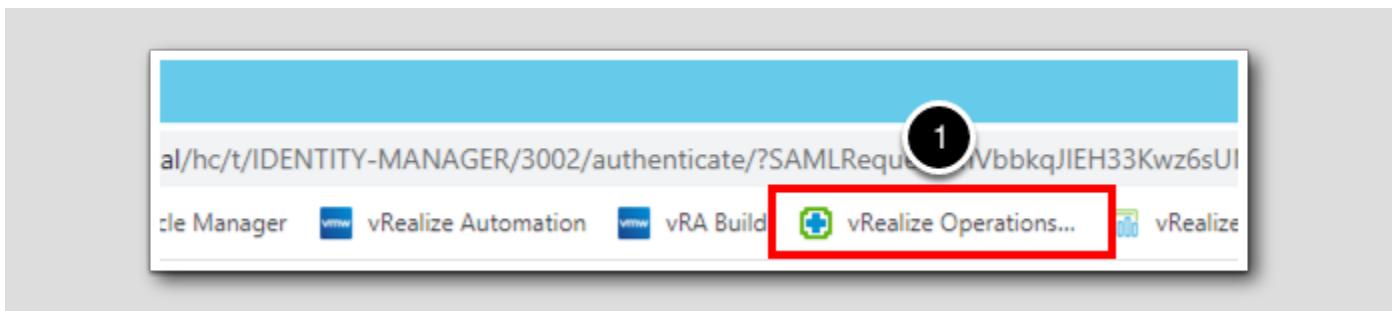
### Open the Chrome Browser from Windows Quick Launch Task Bar

[8]



If your browser isn't already open, launch Google Chrome

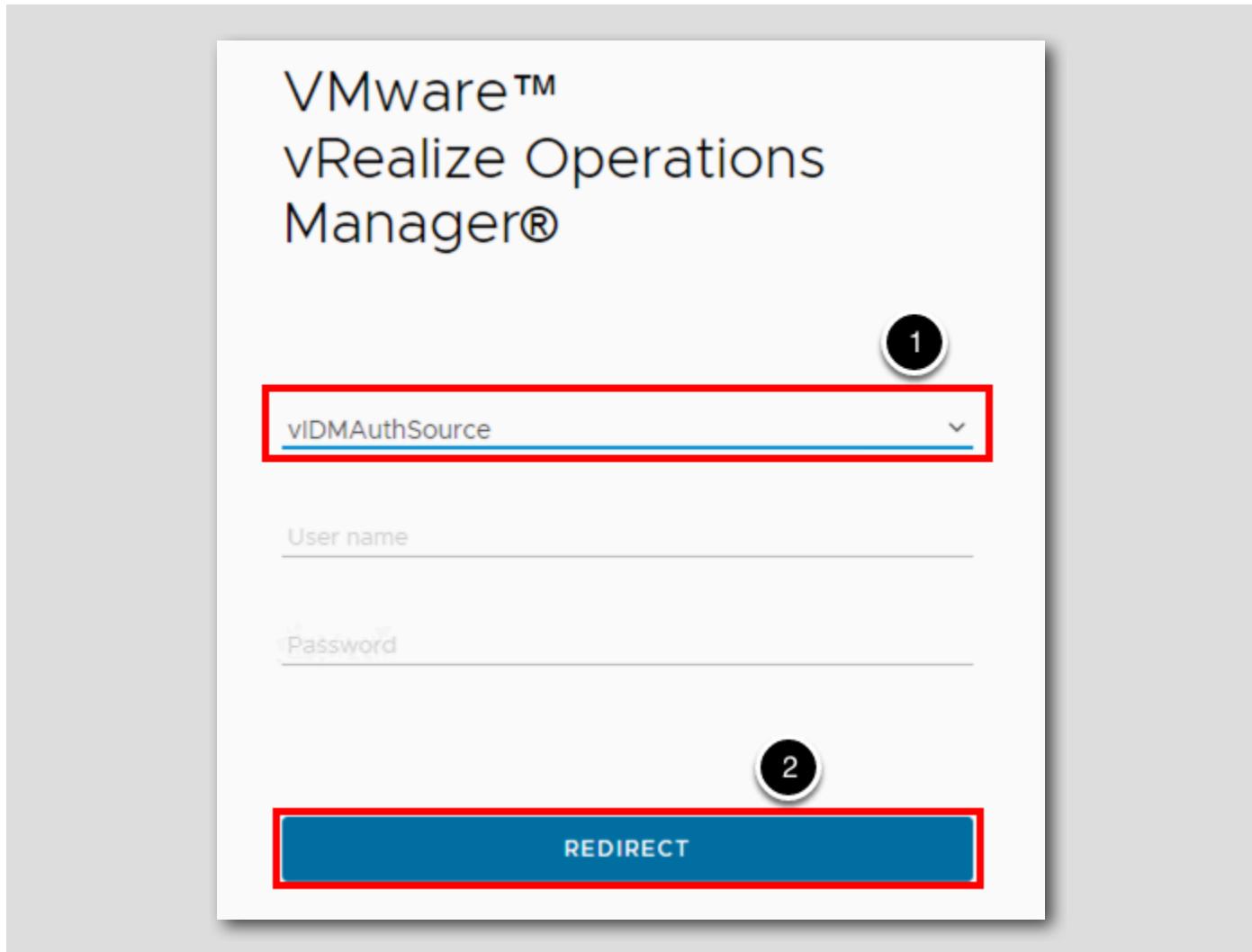
1. Click the Chrome icon on the Windows Quick Launch Task Bar



The browser Bookmarks Bar has links to the different applications that are running in the lab.

1. Click the vRealize Operations Bookmark

## Log in to vRealize Operations

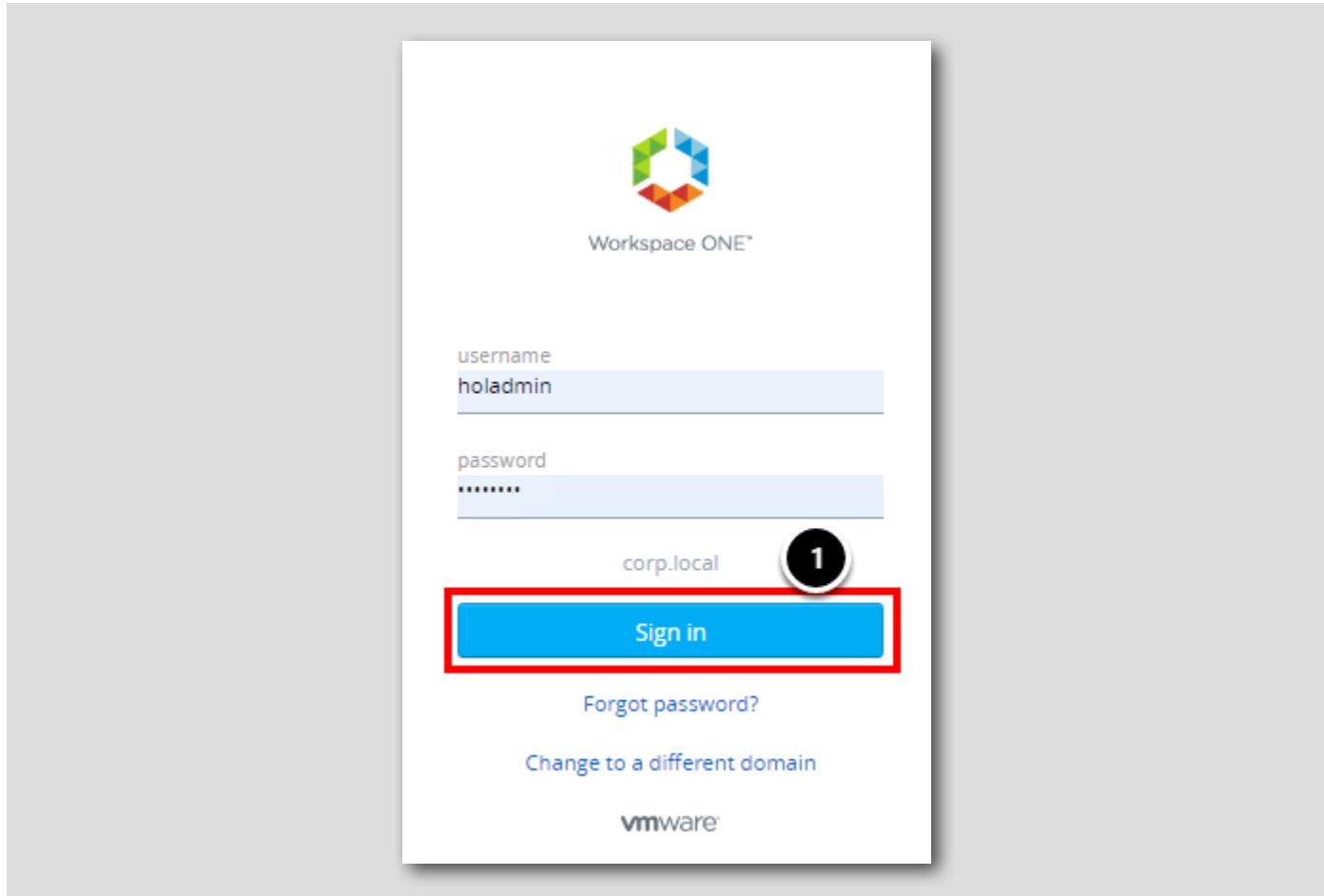


vRealize Operations is integrated with VMware Identity Manager which we will use for user authentication in this lab.

vIDMAuthSource (VMware Identity Manager) should be pre-selected as the identity source. However, if it is not selected you will choose it.

1. Click the drop-down arrow if vIDMAuthSource is not selected.
2. Click REDIRECT to be taken to the authentication page.

## VMware Identity Manager Login



At the Workspace ONE login screen, use these credentials:

username: holadmin

password: VMware1!

1. Click Sign in

## vRealize Operations Home Screen

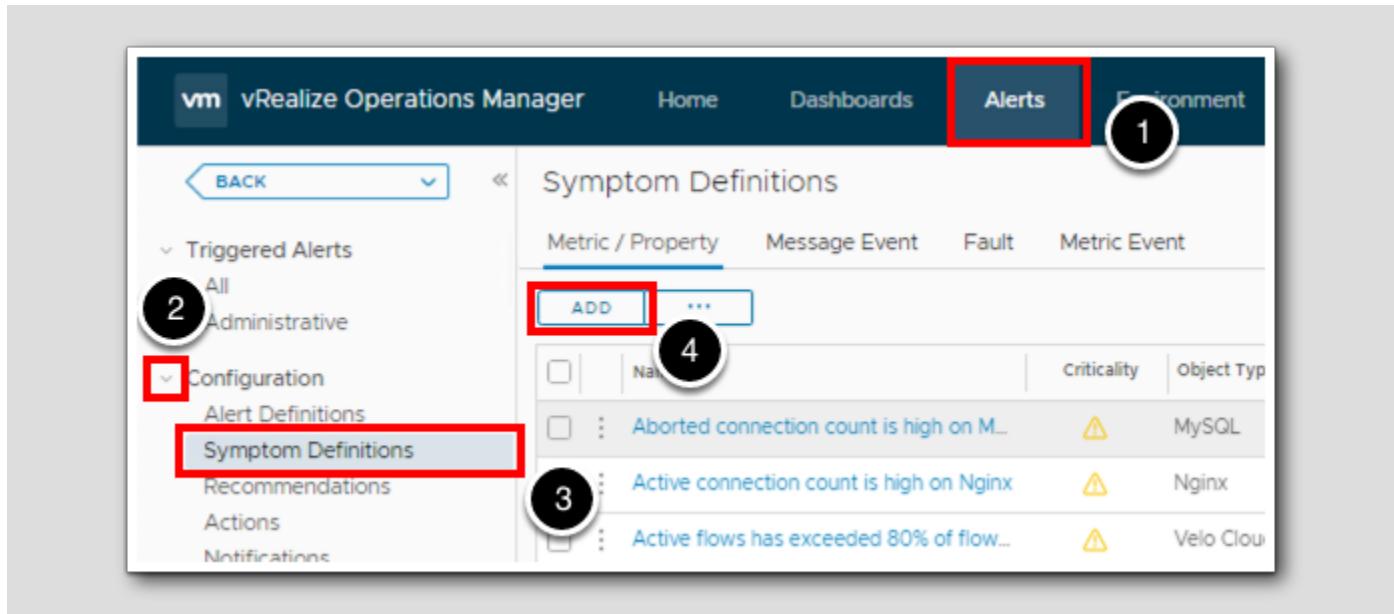
You should be at the vRealize Operations Home screen and ready to start the module.

## Using Symptoms and Alerts to Trigger Recommendations and Actions

vRealize Operations Alerts are similar to rules used for years in monitoring critical IT resources. However, previous rule-based systems tended to be static and difficult to build, deploy, and maintain. vRealize Operations leverages built-in analytics and pre-defined content to provide a dynamic, effective, and scalable approach for identifying and resolving issues in your environment.

For this lesson, we will start by creating a Symptom Definition. Symptom Definitions enable vRealize Operations to identify problems with objects in your environment. These Symptom Definitions will then trigger Alerts when conditions qualify as problems. In this scenario, the condition to monitor is the high CPU workload on the virtual machine "ubuntu-0003". Creating one or more of the Symptoms enables them to be added to an Alert Definition. When a symptom is triggered, vRealize Operations will then issue an alert. In this lesson, we'll go through this in more detail and we'll also show how you can automate certain actions to occur when an alert is triggered in vRealize Operations.

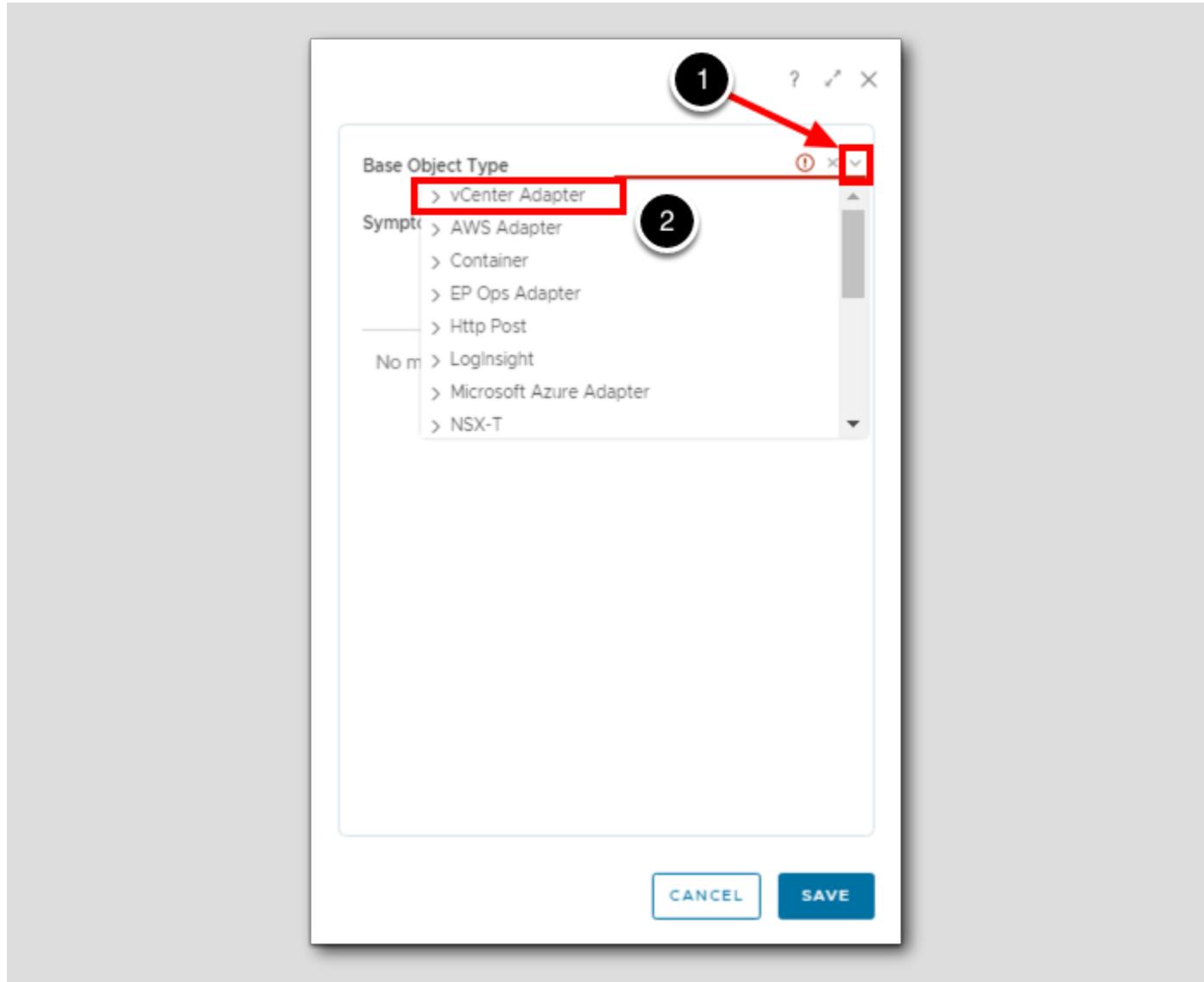
## Creating Custom Alerts



Symptom Definitions evaluate conditions in your environment that, if the conditions become true, trigger a symptom and can result in a generated alert. You can add symptom definitions that are based on metrics or super metrics, properties, message events, fault events, or metric events. You can create a symptom definition as you create an alert definition or as an individual item in the appropriate symptom definition list.

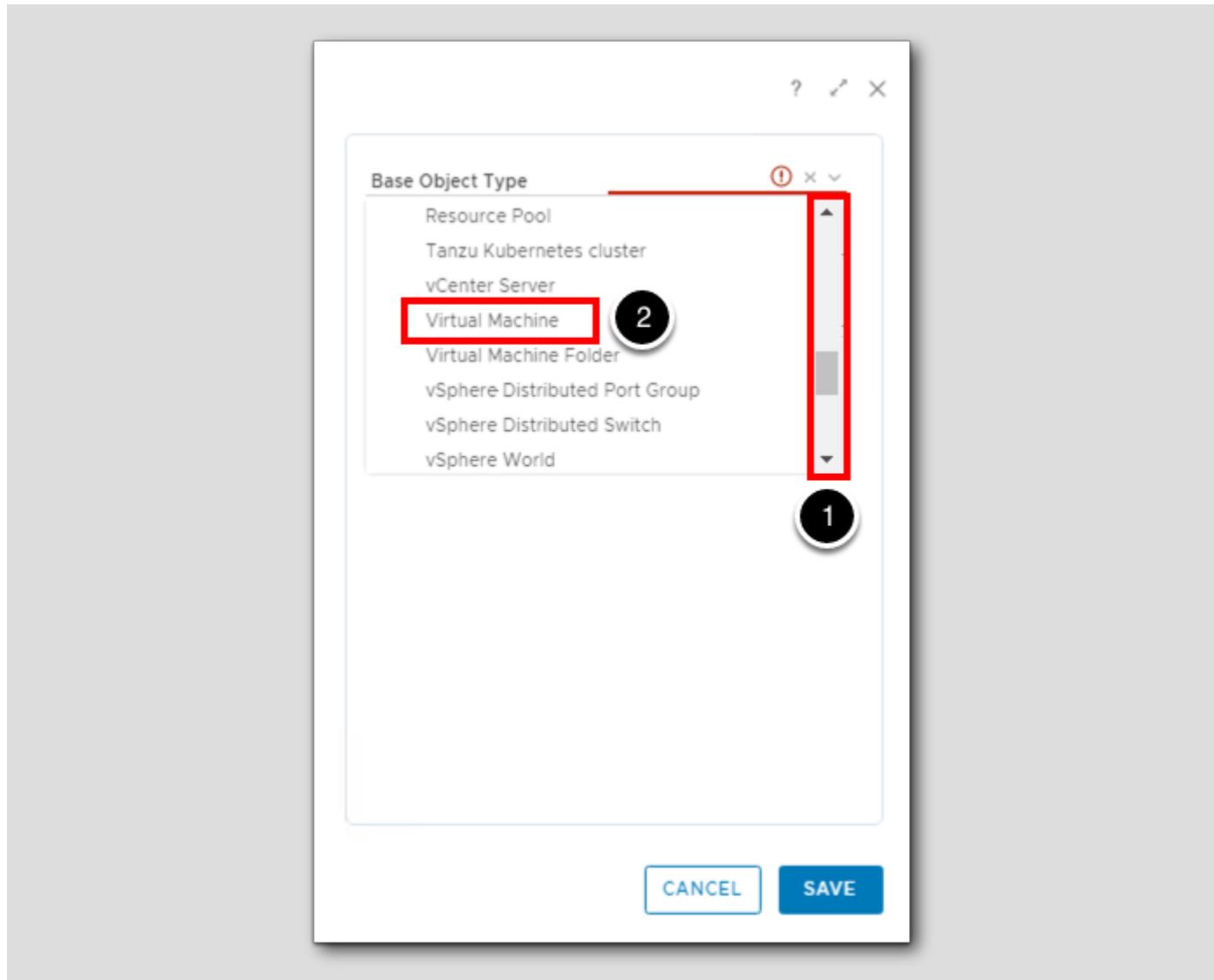
1. Click the **Alerts** tab.
2. Click the chevron to expand **Configuration** if needed to show the configuration options.
3. Click **Symptom Definitions**.
4. Click **ADD** to create a new Symptom Definition.

## Select vCenter Object



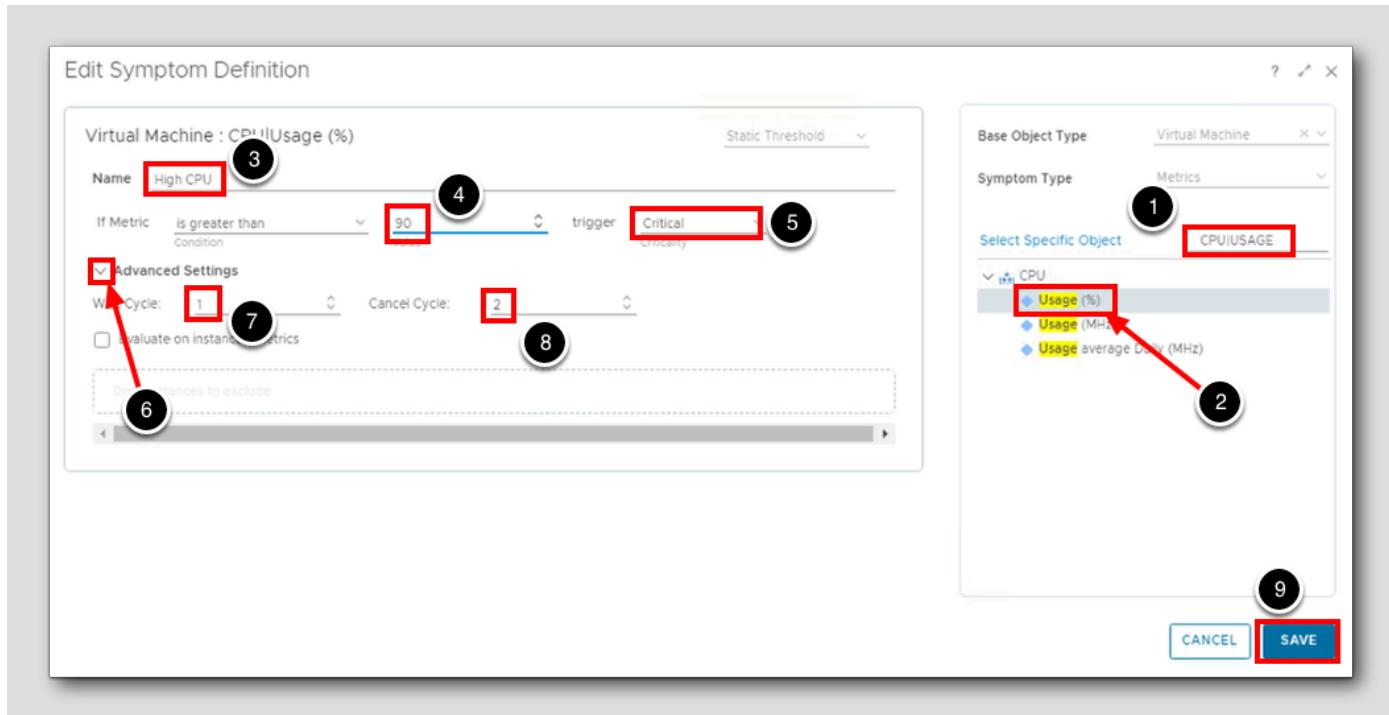
1. Click the chevron to show the list of Base Object Types.
2. Click **vCenter Adapter** which should be the first item in the drop-down list.

## Select Virtual Machine



1. Scroll down until you see Virtual Machine.
2. Select Virtual Machine.

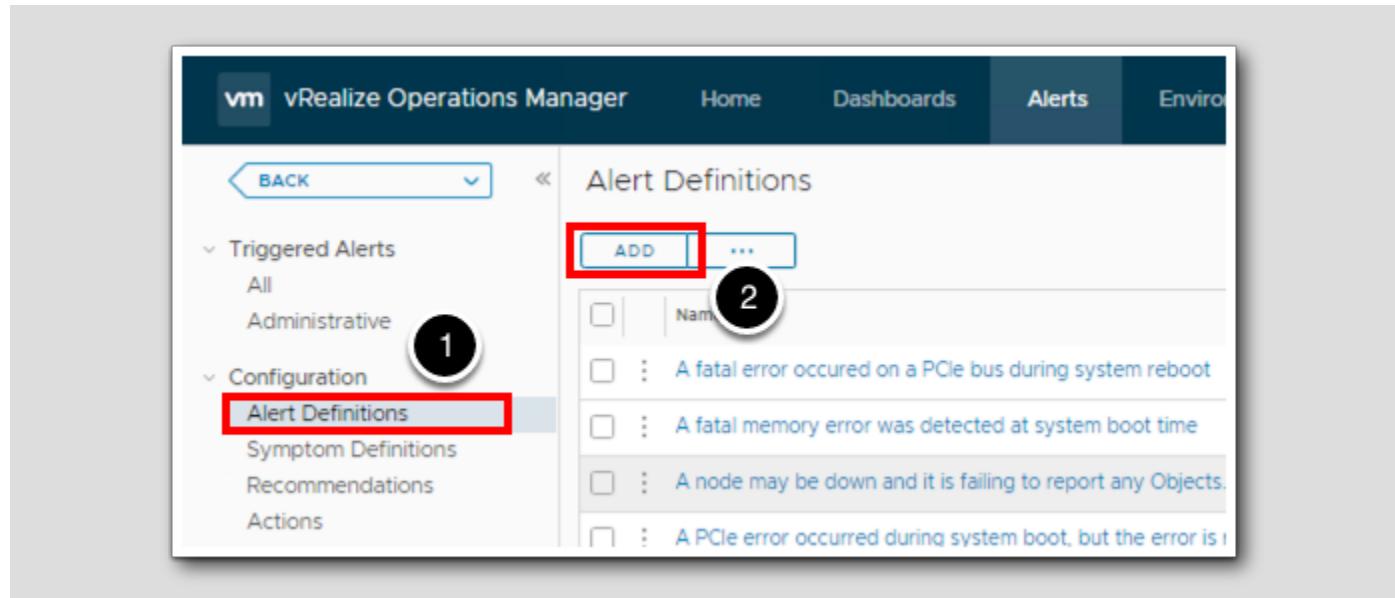
## CPU Usage Definition



Configure the Symptom Definition with the following parameters.

1. Type a metric filter of **CPU|USAGE** and hit Enter.
2. Double-click **Usage (%)**.
3. Type **High CPU** for the symptom name.
4. Type **90** as the value the symptom must exceed to be triggered.
5. Set the definition to **Critical**.
6. Click to expand the **Advanced** section.
7. Modify the **Wait Cycle** to 1.
  - The Wait Cycle field shows that the trigger condition should remain true for this number of collection cycles before the symptom is triggered. This means that the symptom is triggered in the same collection cycle when the condition became true.
8. Modify the **Cancel Cycle** to 2.
  - The Cancel Cycle field shows that the symptom after the trigger condition is false for this number of collection cycles, after which the symptom is canceled. This means that the symptom is canceled in the same cycle when the condition becomes false.
9. Click **SAVE**.

## Alert Definition

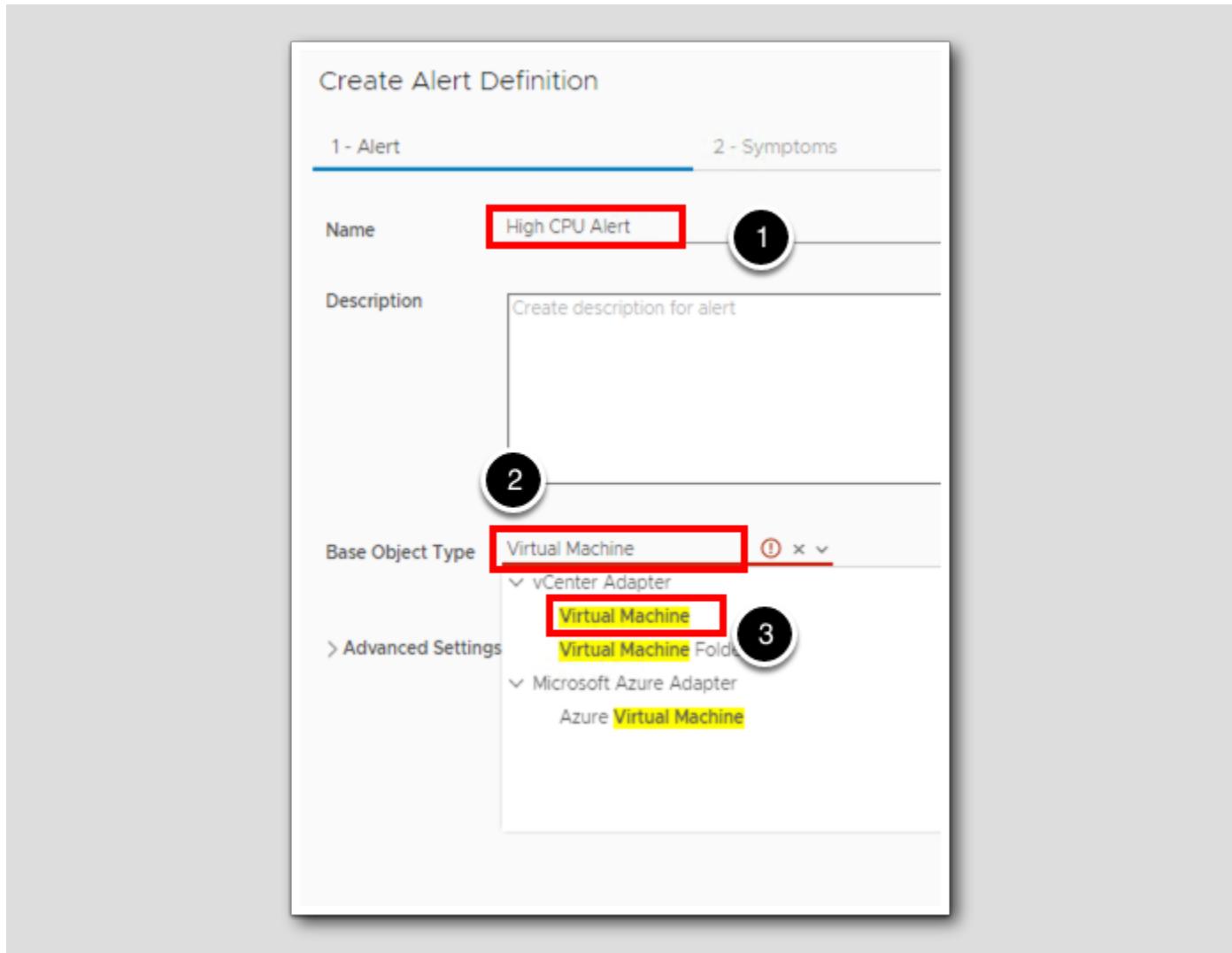


An alert definition is comprised of one or more symptom definitions, and the alert definition is associated with a set of recommendations and actions that help you resolve the problem. Alert definitions include triggering symptom definitions and actionable recommendations. You create the alert definitions so that the generated alerts tell you about problems in the monitored environment. You can then respond to the alerts with effective solutions that are provided in the recommendations.

To create Alert Definitions:

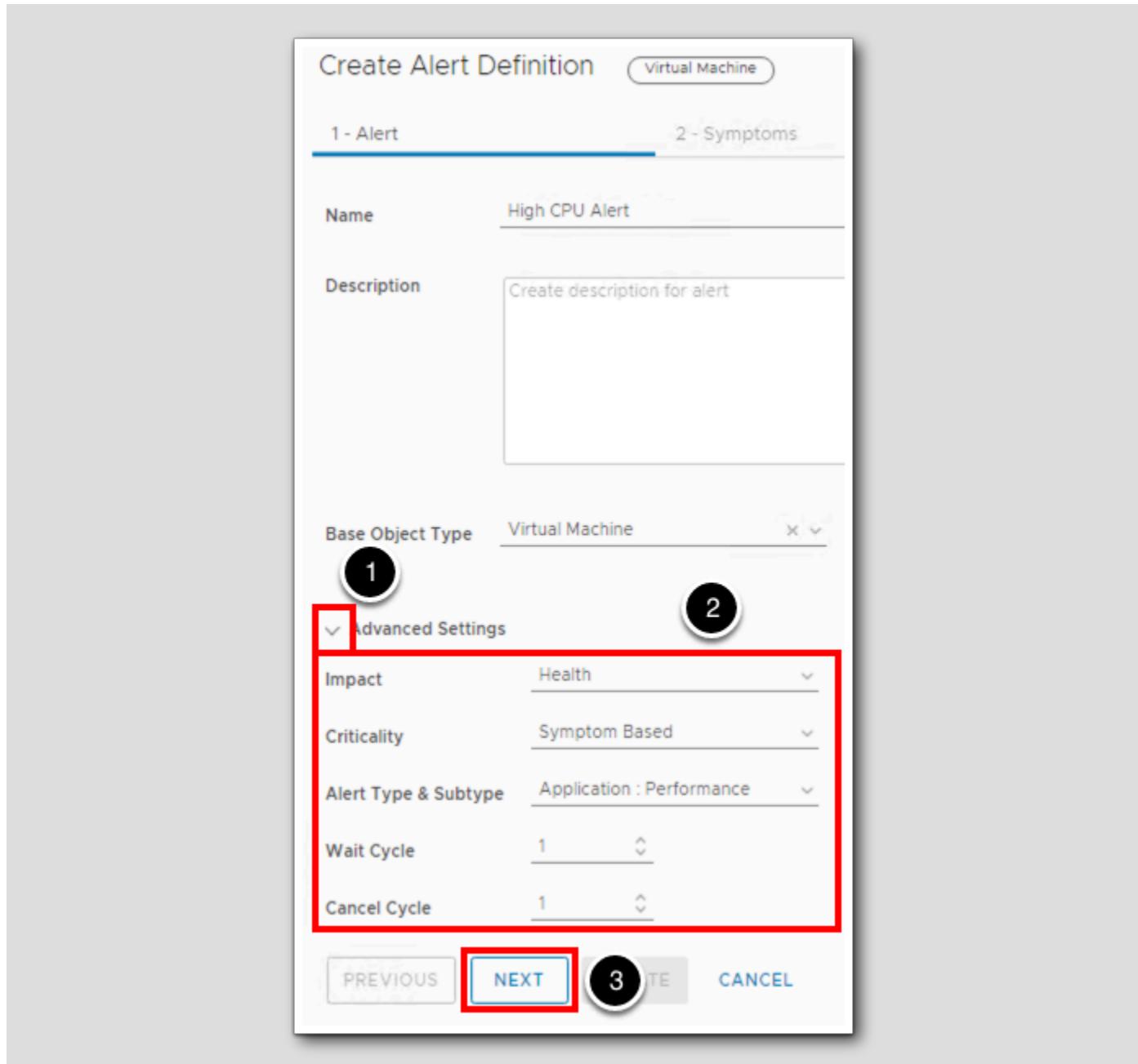
1. Click Alert Definitions.
2. Click ADD to create a new Alert Definition.

## Alert Name and Base Object Type



1. Type **High CPU Alert** for the alert name.
2. Click in the Base Object Type search field and type **Virtual Machine**.
3. Click **Virtual Machine**.

## Alert Impact Settings



## Alert Impact

Alert Impact settings and their definitions are shown below. These settings determine how your alert will be classified and triggered.  
Note: The default settings will be used in this scenario.

- The **Impact** field will categorize the alert as a health, risk, or efficiency problem
- The **Criticality** field shows how serious the problem is

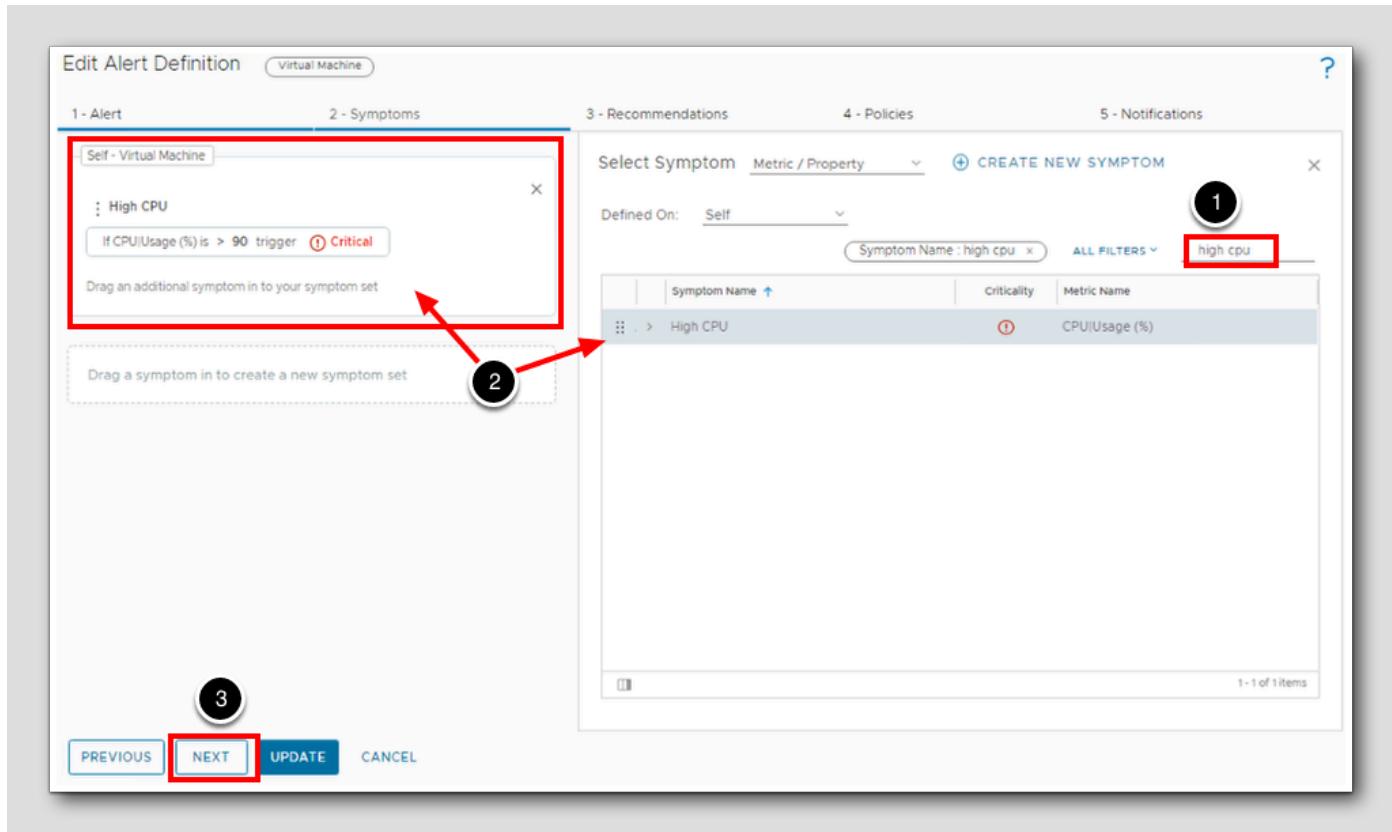
For Criticality, you can select one of the following values:

- Info (informational purposes only; does not affect badge colors)
- Warning (lowest level; displays yellow)
- Immediate (medium level; displays orange)
- Critical (highest level; displays red)
- The **Alert Type** and **Subtype** fields can be used to classify the alert; an example would be using these fields' information to route the alert to the appropriate personnel in your organization

Finally, choose settings for your cycle, which are data collection intervals.

- **Wait Cycle** indicates how many cycles should pass before triggering the alert
  - **Cancel Cycle** indicates how many cycles without symptoms should pass before the alert is canceled
1. Click the **chevron** to show the Advanced Settings.
  2. Review the **Alert Impact** Settings. We will be using the default settings, so no changes are needed.
  3. Click **NEXT**.

## Add Symptom to Alert Definition



1. Type **high cpu** in the filter field and press the Enter key to filter the Symptom Definitions to what we created in a previous step.
2. Drag High CPU to the Symptom Definition section on the left to the workspace as shown above.
3. Click **NEXT**.

## Add Recommendation

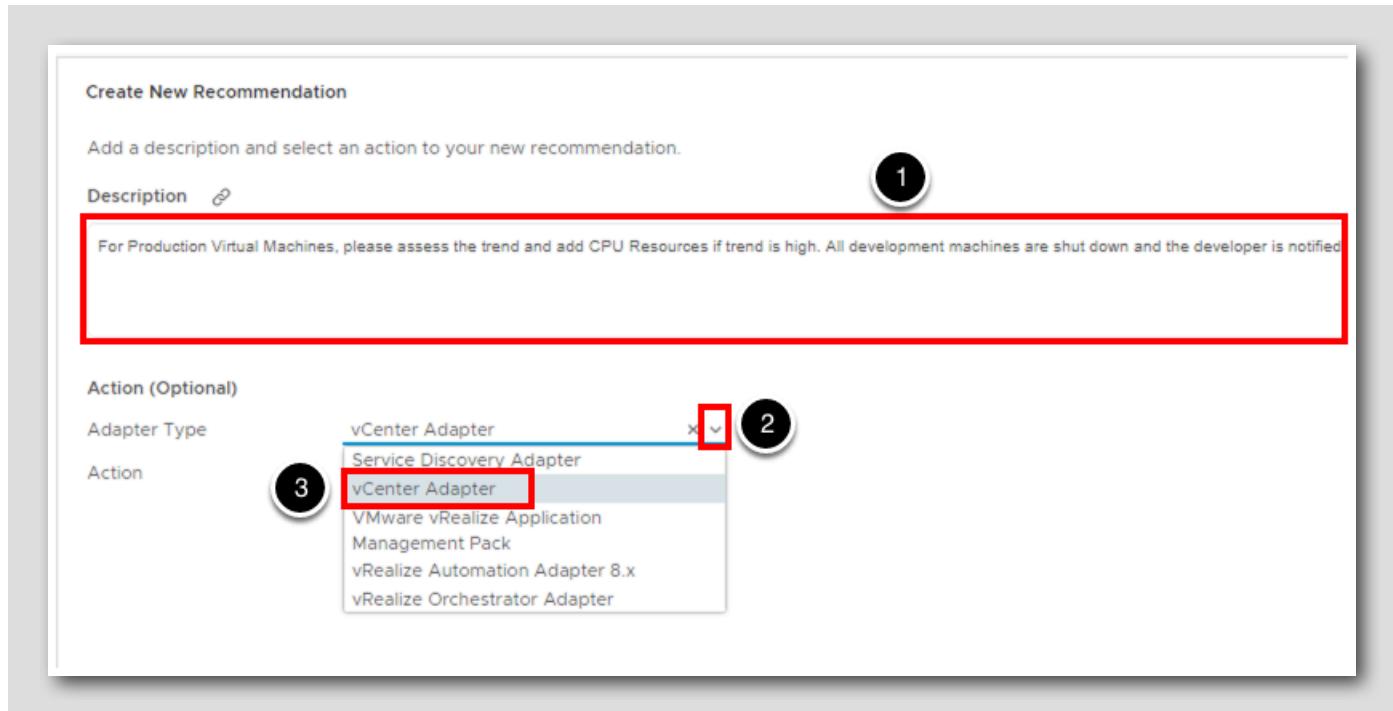
The screenshot shows the 'Add Recommendation' screen in the vRealize Operations Management Console. At the top, there are three tabs: '3 - Recommendations' (selected), '4 - Policies', and '5 - Notifications'. Below the tabs, there's a section to 'Drag recommendations into sets to define your alert.' followed by a table of existing recommendations. The table has columns for 'Description' (with a sort arrow), 'Action', and 'Defined By'. A red box highlights the '+ Create New Recommendation' button, which is circled with the number '1'.

Description ↑	Action	Defined By
... . A Soft Limit can be increased in certain cases. To know more about this so...		VMware Clo...
... . Activate the Velocloud Gateway.		VMware vR...
... . Add a new Host in VMC SDDC.		vRealize Ne...
... . Add a new virtual hard disk or expand the existing disk of the virtual machi...		vCenter Ad...
... . Add a new vRealize Operations Manager Node to the vRealize Operations...		vRealize On...

Recommendations are the remediation options that you provide to your users to resolve the problems that the generated alert indicates. Now, we will define a new Recommendation for our custom alert based on our organization's policies.

1. Click + Create New Recommendation.

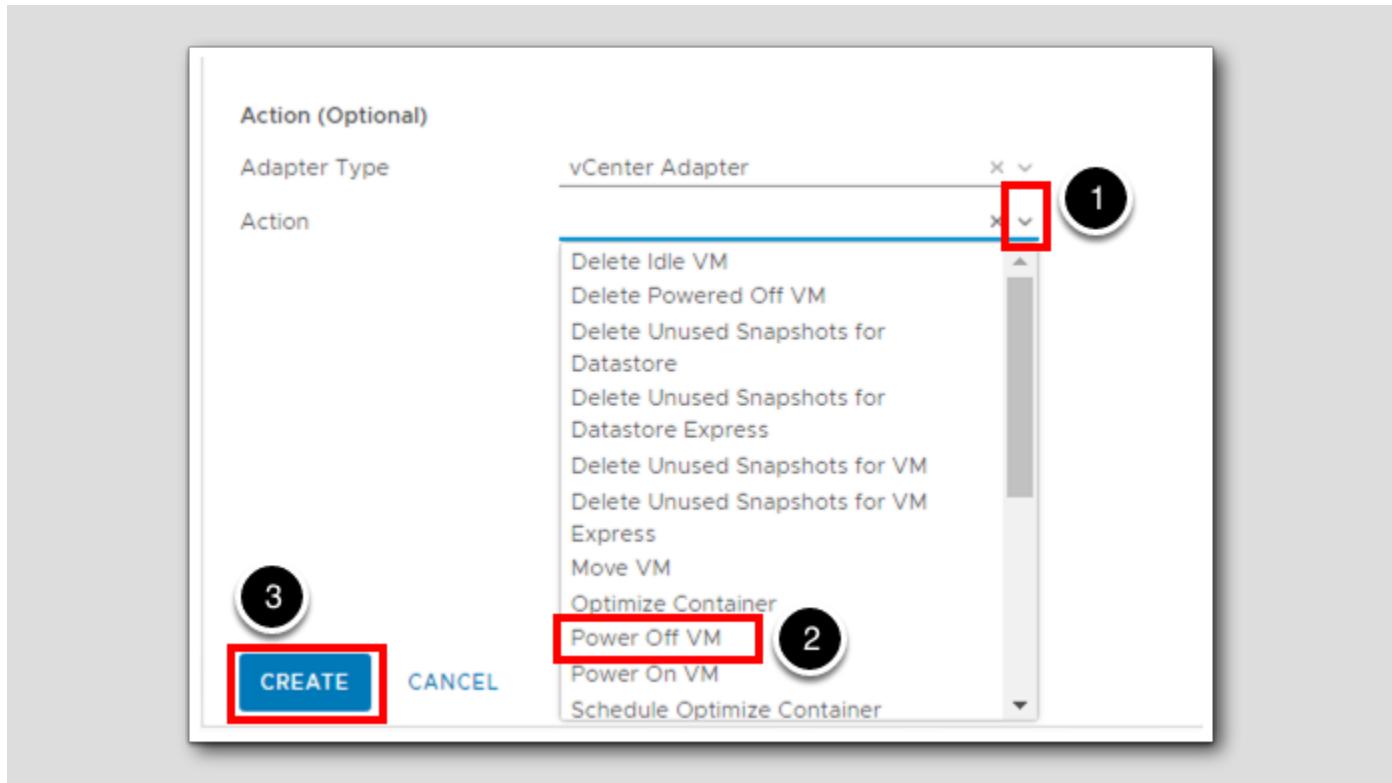
## Custom Recommendation



For Production Virtual Machines, please assess the trend and add CPU Resources if trend is high.  
All development machines are shut down and the developer is notified.

1. Paste the text shown above into the Recommendation Text area.
2. Click Adapter Type to show the adapter type options.
3. From the list shown, select vCenter Adapter.

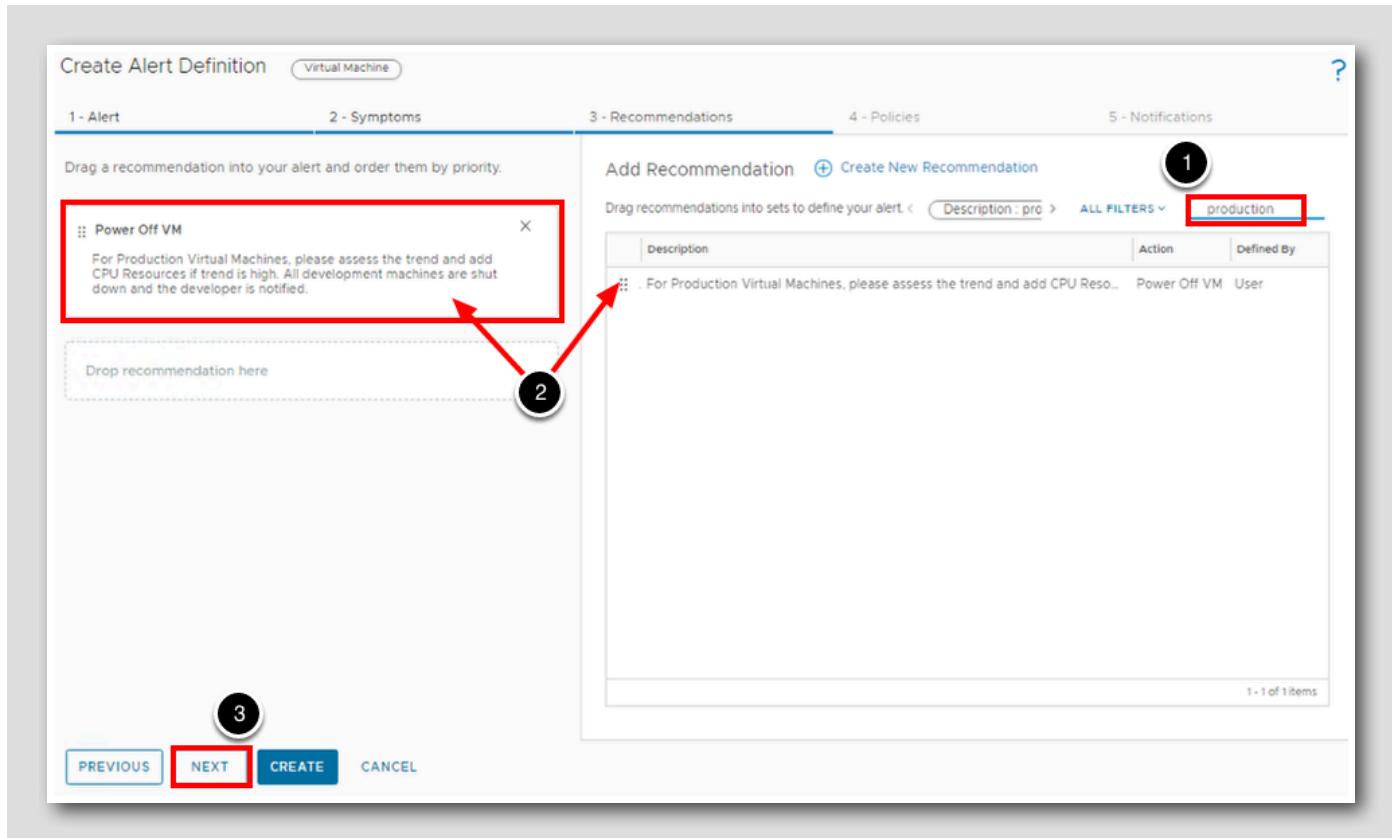
## Set Recommendation Action



Actions are accessible in several places inside of vRealize Operations. They can link to recommendations for the user to execute after review, or they can be fully automated to execute when the alert is triggered.

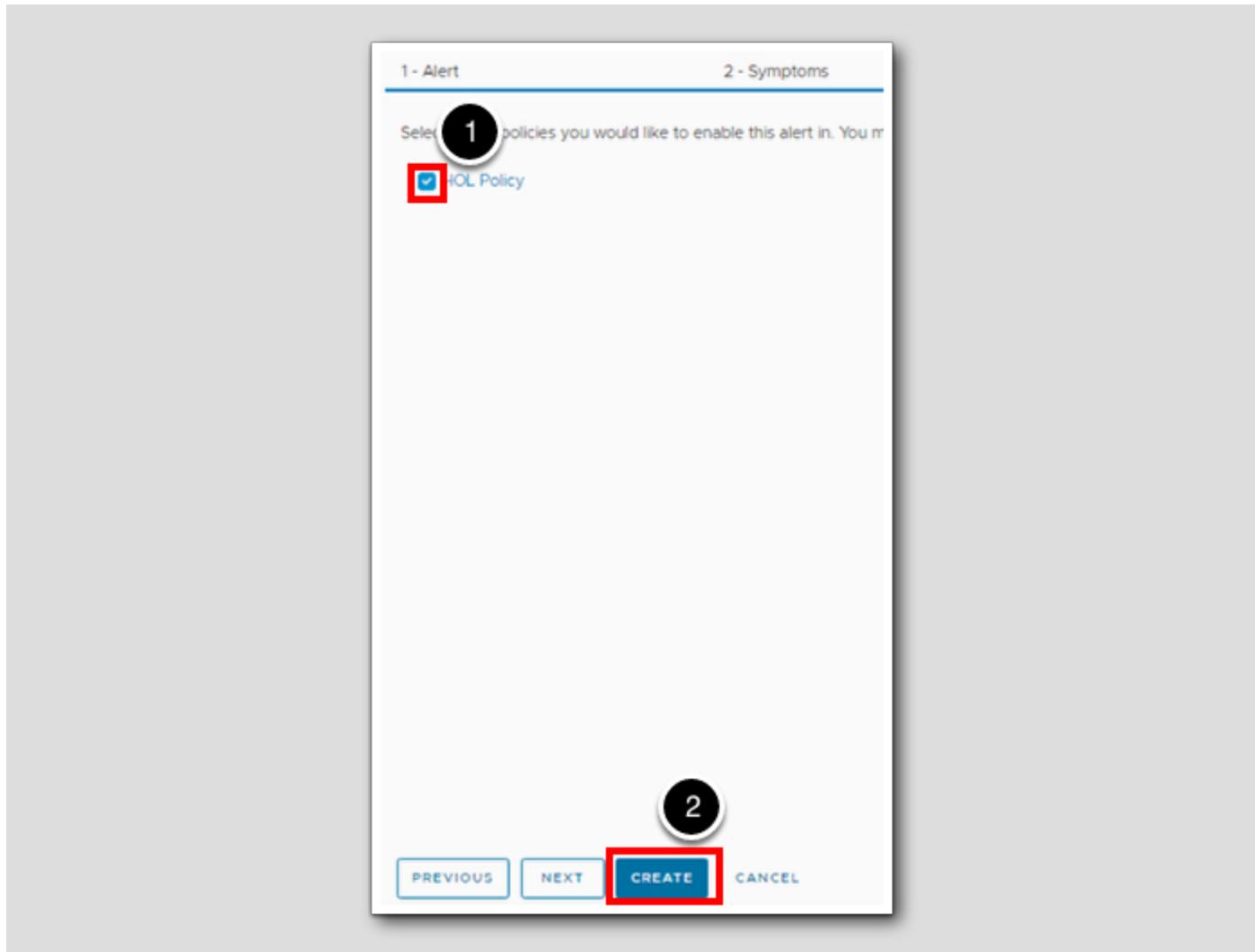
1. Click the down arrow on the Action Menu to show the action options.
2. Select Power Off VM.
3. Click CREATE.

## Save New Alert Definition



1. Type **production** in the filter field and hit Enter.
2. Drag your newly created custom recommendation onto the Alert Definition.
3. Click **NEXT** to go to the Policies tab.

## Set Effective Policy



1. Click the checkbox to select HOL Policy.
2. Click CREATE to create the new Alert Definition.

## Alert List

The screenshot shows the 'Alert Definitions' page in vRealize Operations. A search bar at the top right contains the text 'Name : High CPU'. Below it, a table lists several alert definitions. One row, 'High CPU Alert', is highlighted with a red box and has a circled '2' above it, indicating it is the selected item. Another row, 'Fully-automated DRS-enabled cluster has high CPU ...', also has a red box around its 'Name' column and a circled '1' above it.

Name	Adapter Type	Object Type	Alert Type	Alert Subtype	Criticality	Impact	Defined By	Last Modified	Modified By
Fully-automated DRS-enabled cluster has high CPU ...	vCenter Adapter	Cluster Co...	Virtualizatio...	Performance	<span style="color:red;">!</span>	<span style="color:green;">Health</span>	vCenter Adapter	5/14/2111:28 ...	admin
<b>High CPU Alert</b>	vCenter Adapter	Virtual Ma...	Application	Performance	<span style="color:red;">!</span>	<span style="color:green;">Health</span>	User	150 PM	holadmin@c...
vRNI-An NSX infrastructure VM is experiencing high ...	vCenter Adapter	Virtual Ma...	Virtualizatio...	Configuration	<span style="color:yellow;">!</span>	<span style="color:green;">Health</span>	vRealize Network...	5/14/2111:34 ...	admin

Verify that the Alert exists.

1. Type **High CPU** in the Alert Definitions quick filter and then press the Enter key to reduce the Alert Definition list.
2. We can verify that our new **High CPU Alert** has been created.

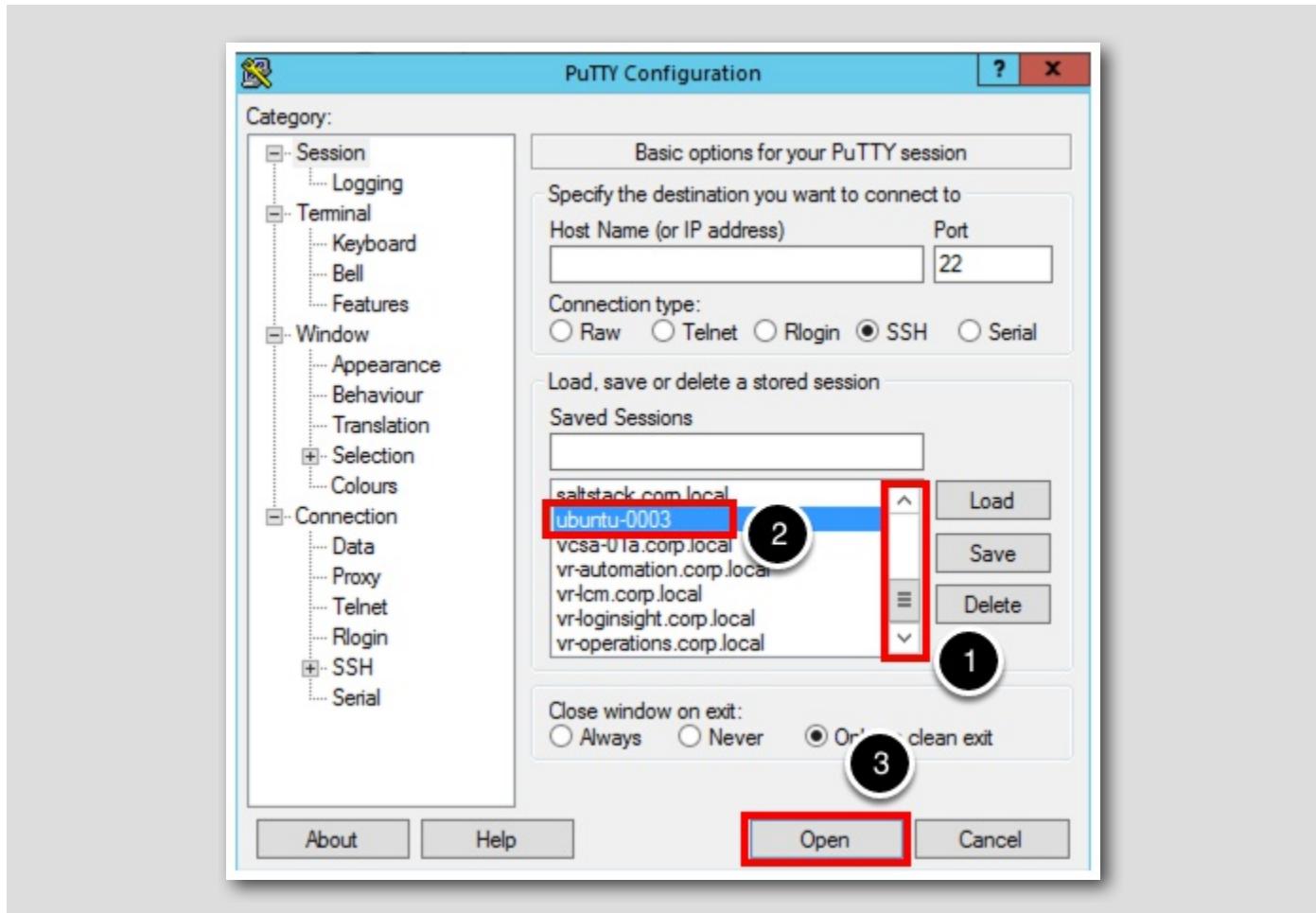
Now that our symptoms and alert has been configured, we're ready to test it out!

## PuTTY to ubuntu-0003 VM

The screenshot shows a Windows taskbar with several icons. The PuTTY icon, which is a blue square with a white terminal window and a connection line, is highlighted with a red box and has a circled '1' above it, indicating it is the selected item.

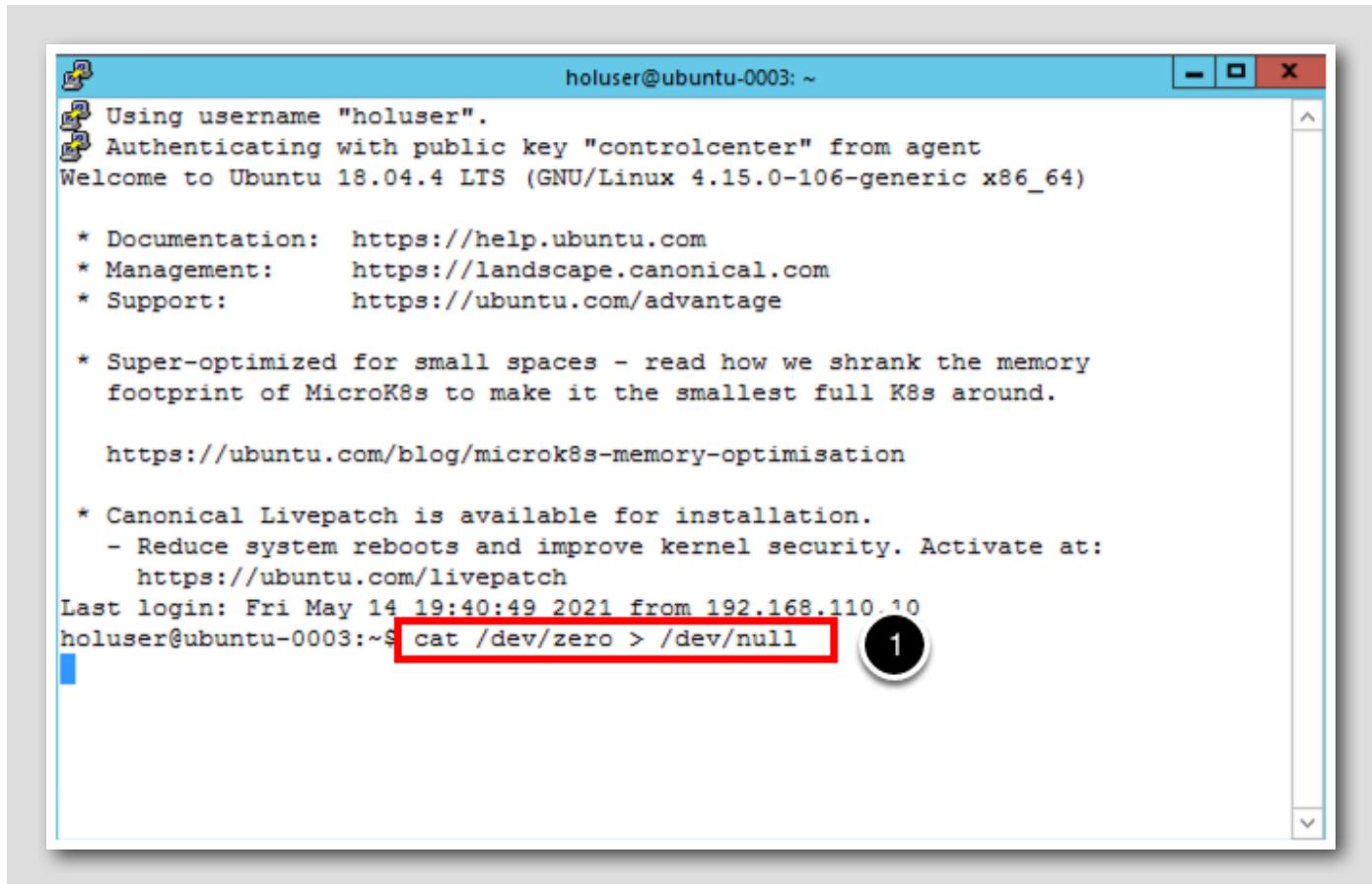
1. Click on the PuTTY icon in System tray.

## Start PuTTY Session



1. Scroll down to the bottom of the Saved Sessions list.
2. Click on ubuntu-0003.
3. Click Open to start the PuTTY session.

## Run CPU Load



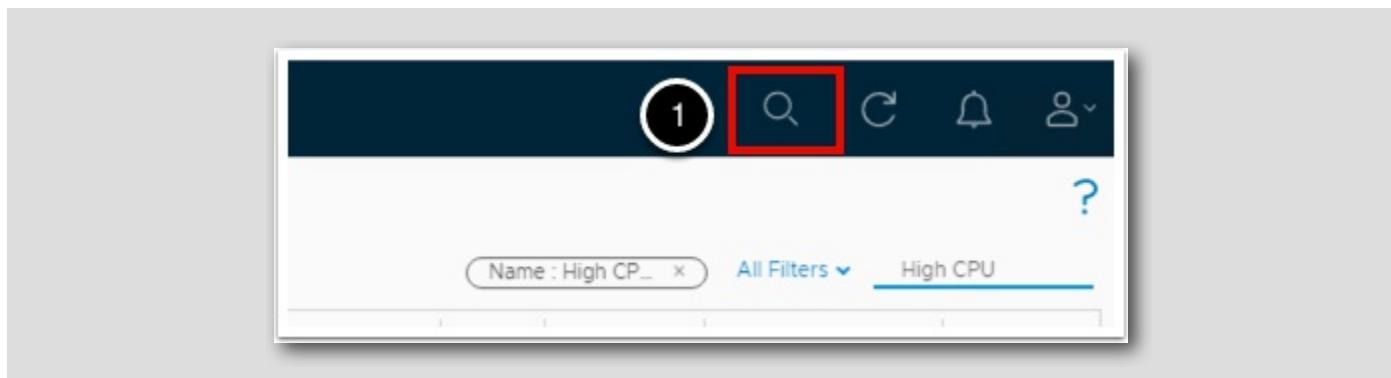
The screenshot shows a PuTTY terminal window titled "holuser@ubuntu-0003: ~". The session has established a connection using the username "holuser" and a public key "controlcenter". The terminal displays the standard Ubuntu 18.04.4 LTS welcome message, including links for documentation, management, support, and livepatch. The command "cat /dev/zero > /dev/null" is typed at the prompt, and the terminal window is highlighted with a red rectangle. A small circular icon with the number "1" is positioned in the bottom right corner of the terminal area.

We will now redirect dev/zero to dev/null to generate CPU load so that we can see the impact on the VM in vRealize Operations.

1. Type **cat /dev/zero > /dev/null** and press the **Enter** key to start the CPU load.

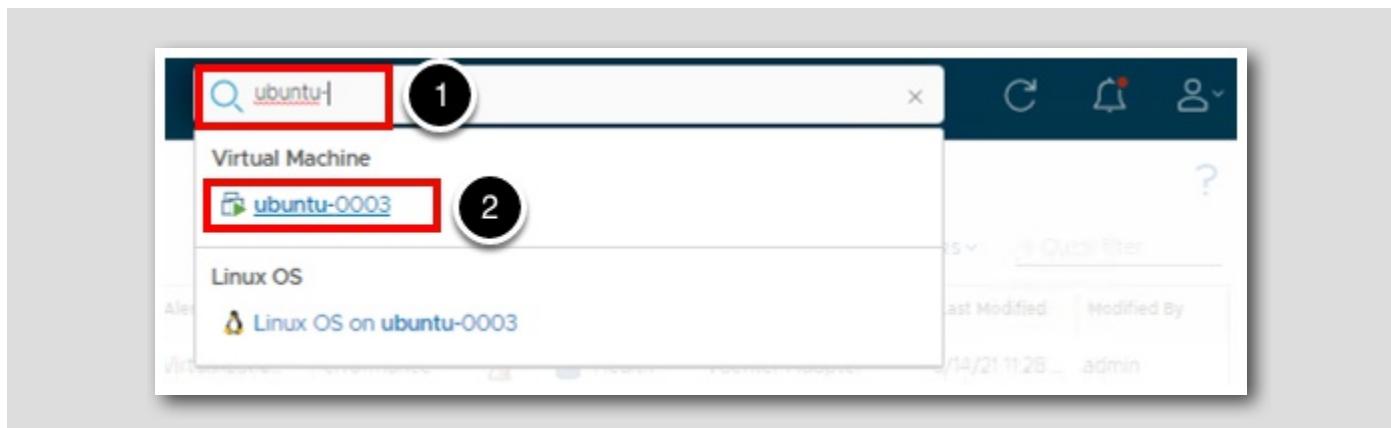
Leave this putty window open, we'll come back to this later in the lesson.

## Return to vRealize Operations



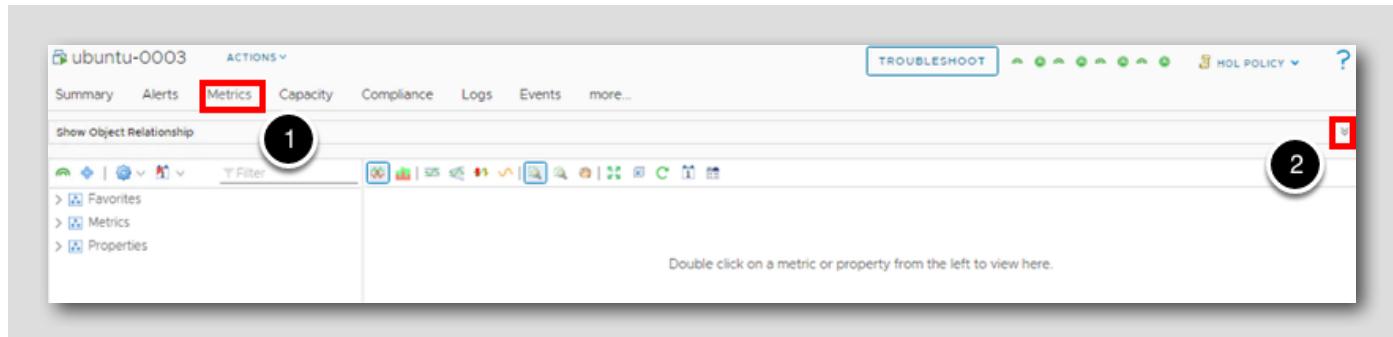
1. Back in vRealize Operations, click the Magnifying Glass Icon to start a search.

## Search for VM



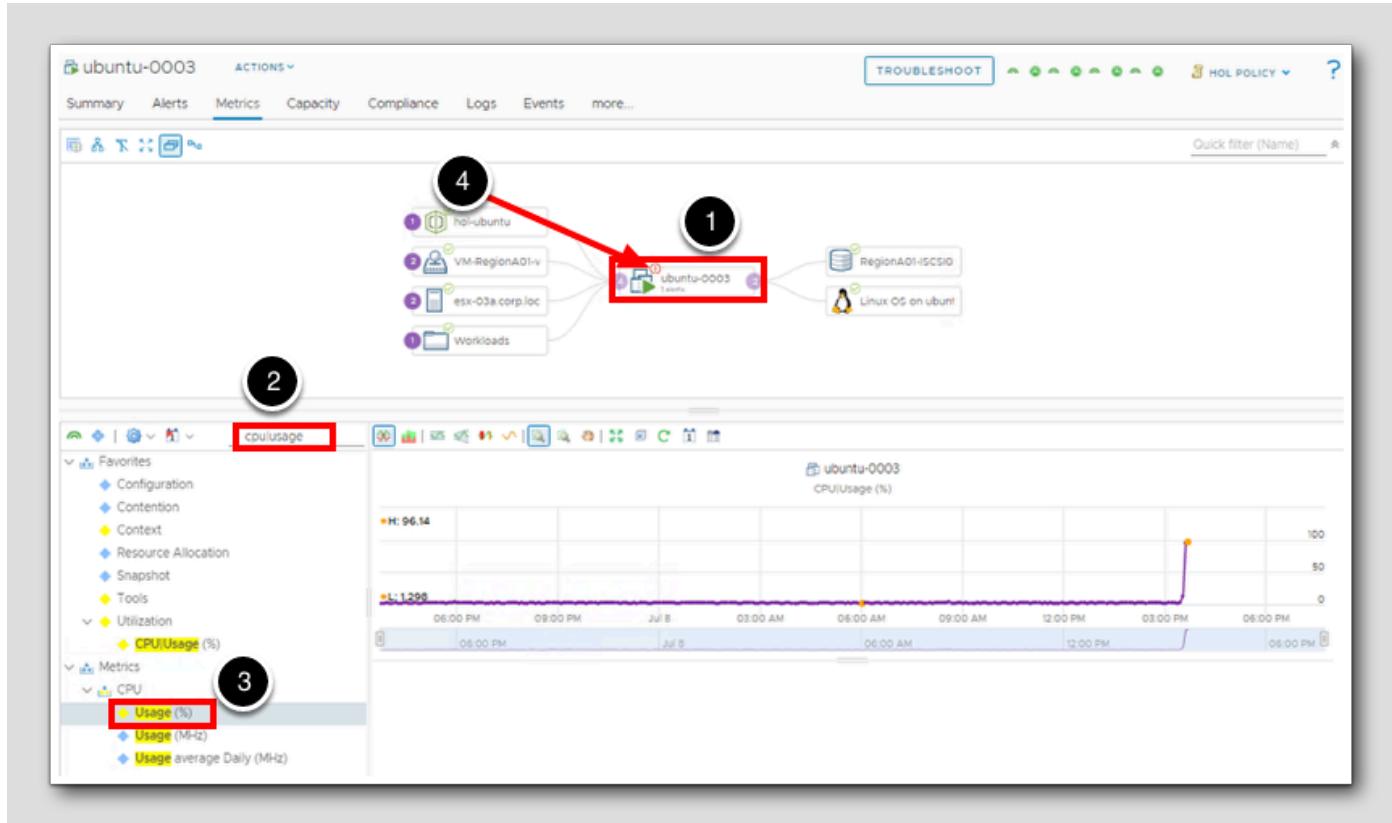
1. Type **ubuntu-** to search for objects beginning with "ubuntu-".
2. Click **ubuntu-0003** to go to the Summary page of this VM.

## Metrics and Object Relationships



1. Click Metrics to open the Metrics tab.
2. If the Object relationship window is not already visible, Click the chevrons to show the object relationships for the VM ubuntu-0003.

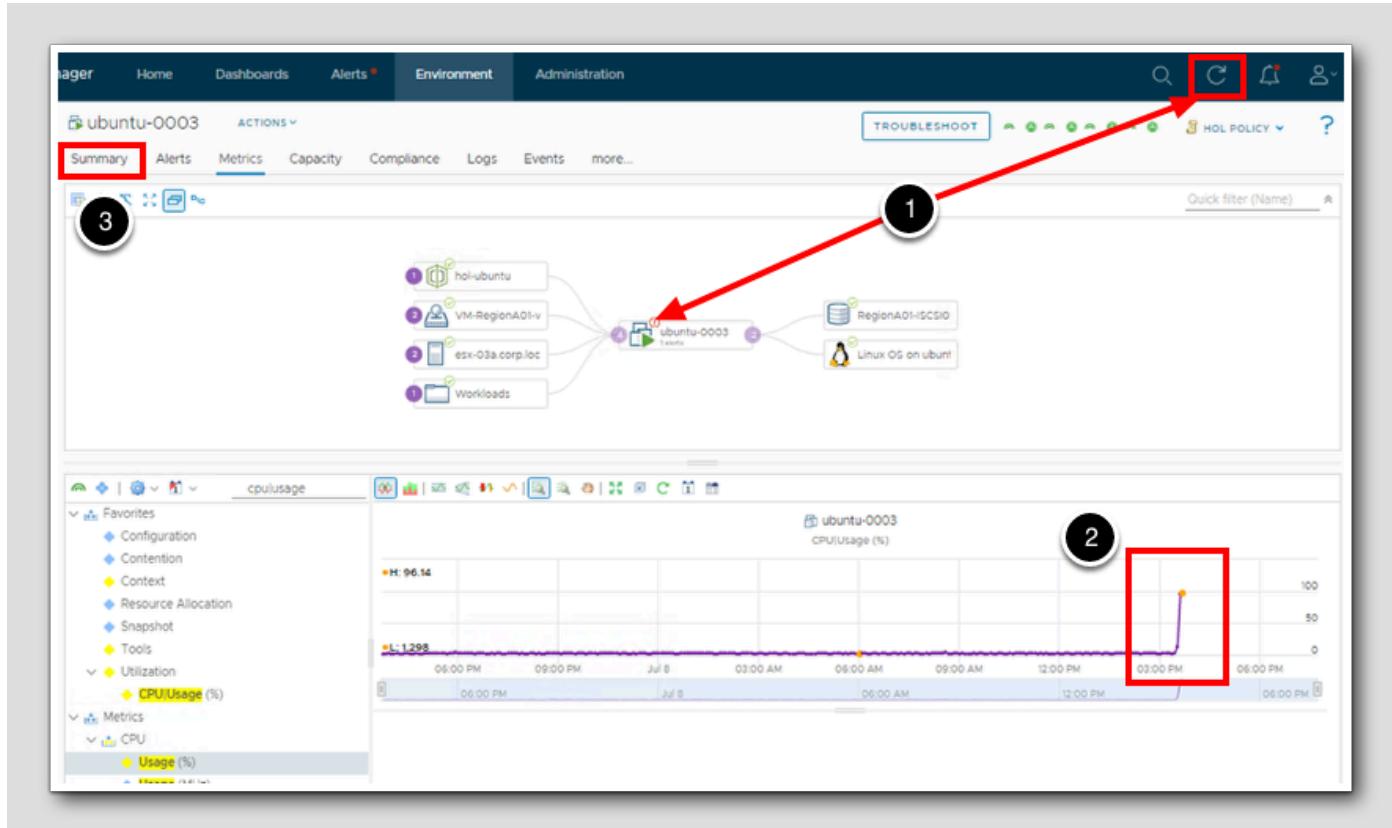
## Metrics Graphs



Set up the CPU graphs by completing the following:

1. Click **ubuntu-0003** so we can explore the Metrics on this object.
2. Type **cpu|usage** in the quick filter and then press the **Enter** key.
3. Double-click **Usage (%)** under Metrics / CPU to create a chart on the lower right hand side of the window.
4. In our example, the color of the VM Health badge will turn red once the alert we configured has been activated due to the high CPU Usage. However, the color can be green, yellow, orange, or red, depending on the status of the object and the severity of the alert.

## Refresh Metric Graphs



1. If the VM Health Badge is not yet red, then we may need to click Refresh.
  - The graph will eventually show the increase in CPU usage on the Metric chart. Once CPU usage is above 90%, an alert will be generated. (NOTE: It may take a few minutes for the VM Health Badge to turn red).
2. Notice the increased CPU usage on the graph.
3. Click Summary to move to the Summary page.

## Summary Page

The screenshot shows the vRealize Operations Management interface for a VM named 'ubuntu-0003'. The 'Alerts' tab is active, highlighted by a red box. In the 'Active Alerts' section, there is one critical alert. A circled '1' is positioned next to the alert count. A circled '2' points to the 'Powered On' status icon. Other tabs include 'Metrics', 'Capacity', 'Compliance', 'Logs', 'Events', and 'more...'. The top right features 'TROUBLESHOOT' and 'HOL POLICY' buttons. The left sidebar lists metrics like IP Address, Number of virtual CPUs, Memory, Disk Space, and VMware tools. The right sidebar shows performance metrics such as CPU Queue, CPU Context Switch Rate, and Disk Queue.

As shown here, we can see quite a bit of information about this particular object that we've selected.

1. Notice under Active Alerts, we can see that we have active Critical Alerts.
2. Click **Alerts** here to open the Alerts Tab.

## View Critical Alerts

The screenshot shows the vRealize Operations Management interface for a VM named 'ubuntu-0003'. The 'Alerts' tab is selected. The 'Alerts' sub-tab is also selected. A red box highlights the first alert in the list, which is a 'High CPU Alert' for the last hour. Another red box highlights the 'High CPU Alert' text itself. There are two numbered callouts: '1' points to the chevron icon next to the '1 Hour' entry, and '2' points to the 'High CPU Alert' text.

In the Alerts Tab, we see all of the alerts related to this vm ubuntu-0003.

1. Click the chevron beside 1 Hour to open the most recent alerts for the VM ubuntu-0003.
2. Click High CPU Alert in the Alert column for more details about the alert.

Note: You may see additional alerts for this VM as there are other alerts active within our environment. If it does not show as Critical, you may need to hit Refresh in the top right corner.

## Alert Details

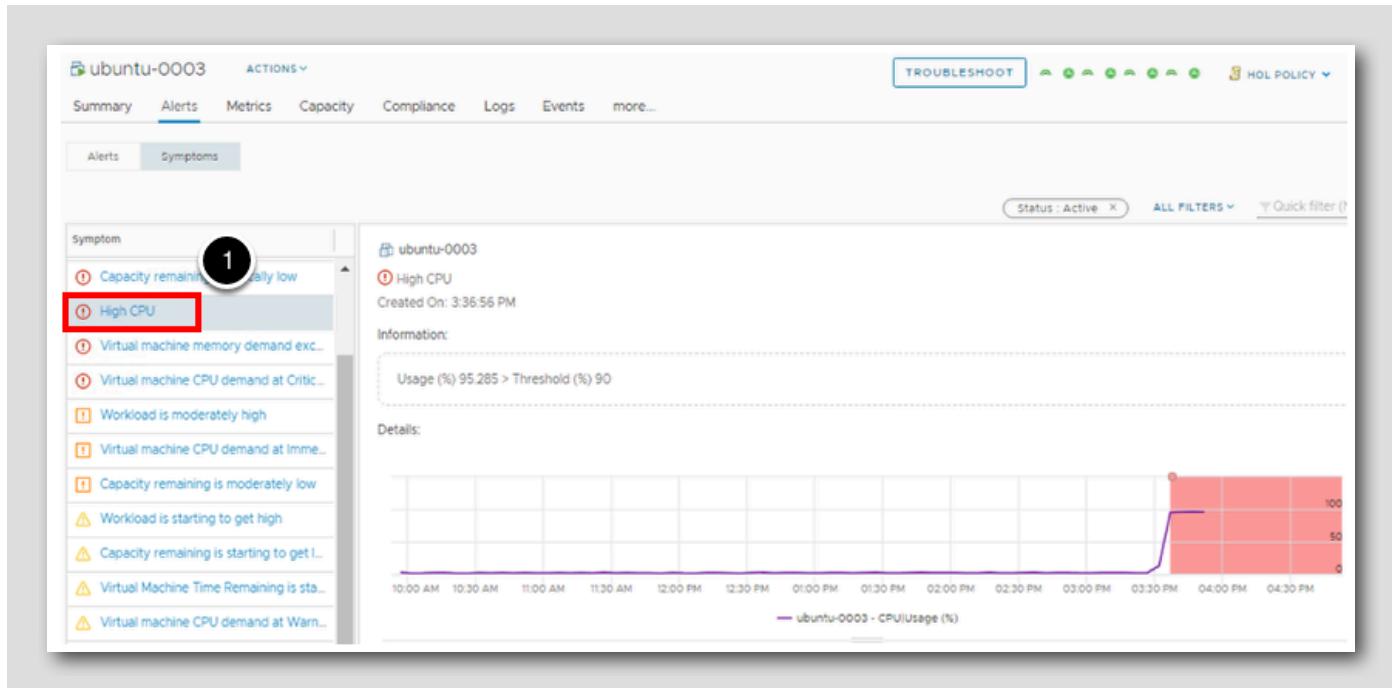
The screenshot shows the vRealize Operations Management interface. At the top, there's a navigation bar with tabs: Summary, Alerts (which is selected), Metrics, Capacity, Compliance, Logs, Events, and more... On the right side of the header are buttons for TROUBLESHOOT, HOL POLICY, and various icons. Below the header, there's a search bar with filters for Status: Active, ALL FILTERS, Application, and Performance.

In the main content area, there's a sidebar on the left with sections for Alerts (1 Hour, 4 Hours, Today) and Symptoms. The Symptoms section is highlighted with a red box and has a circled number 2 above it. The main pane displays an alert for "ubuntu-0003" with a red icon and the text "High CPU Alert". It shows the alert was started at 3:36:56 PM. Below this, there are tabs for Alert Details (selected), Related Alerts, and Potential Evidence. A large red box highlights the "Recommendations" section, which contains the text: "For Production Virtual Machines, please assess the trend and add CPU Resources if trend is high. All development machines are shut down and the developer is notified." Below this text is a blue button labeled "POWER OFF VM". A circled number 1 is above this section. At the bottom of the main pane, there's a "Symptoms" section with a single item: "ubuntu-0003 (Self) has symptom High CPU".

From this Alerts screen we can see details about the alert.

1. We can see our Recommendation text we entered earlier, and again we see the POWER OFF VM action button where we could manually kick off the action we configured earlier which was to shut down the VM.
2. Click Symptoms.

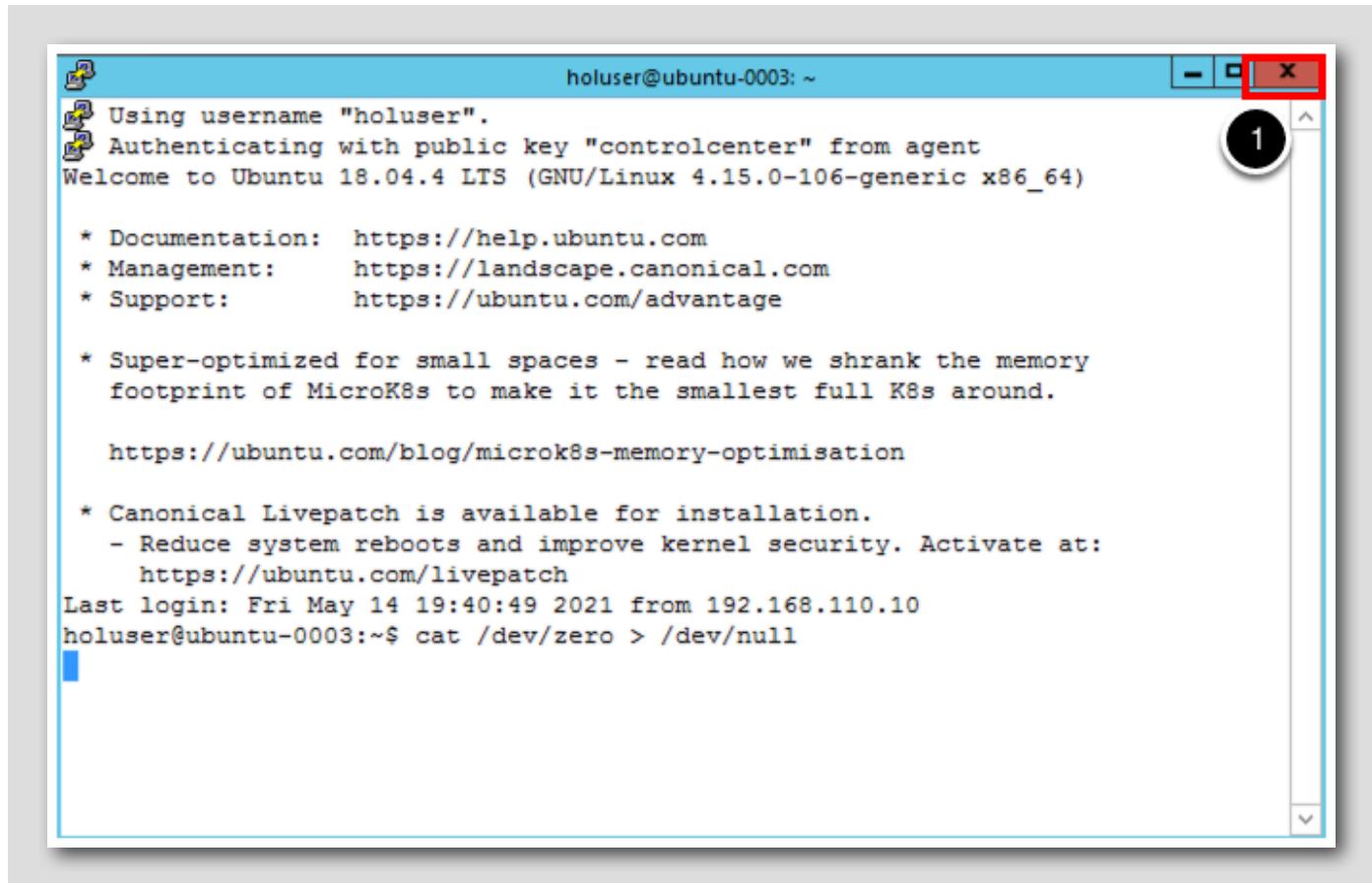
## Alert Symptom Details



1. Click on the High CPU Symptom.

From here we can see the CPU chart and we see the timing and details of this alert. We will now stop the CPU load so that we can complete some additional configuration to enable the automation of our configured recommendation for this High CPU alert.

## Stop CPU Load

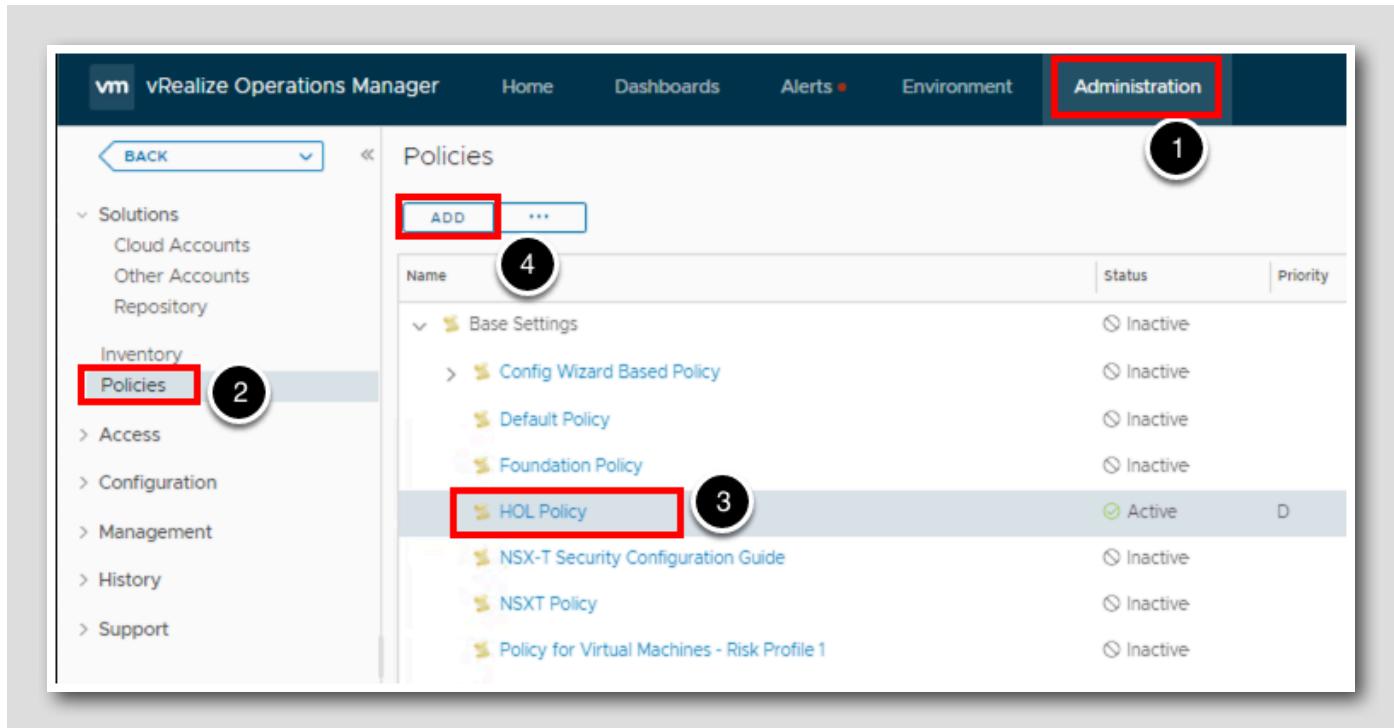


We've seen how we can manually create Alerts and Recommended Actions based on Symptom Definitions. Now let's end this part of the lesson and look at how we can automate these Recommended Actions by using the vRealize Operations Policies.

Return to your open PuTTY window. Closing this PuTTY session will end the CPU load command, and the alert will clear.

1. Click the X in the upper-right corner to close the PuTTY session.
2. Click OK in the PuTTY Exit Confirmation Pop-up Window (*Not Shown*).

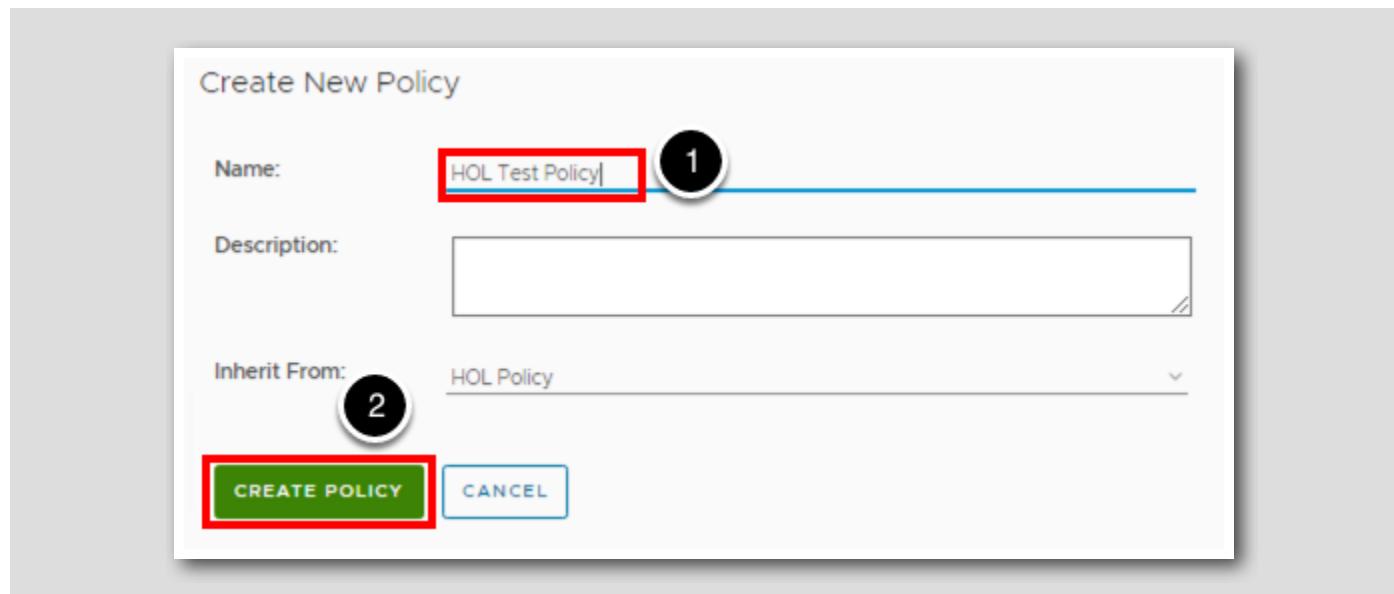
## Fully Automated Actions



Here, we will create a custom policy for test VMs to enable the system to act based on the VM's policy assignment. In this case, we will automatically power off test VMs that spike CPU usage to prevent them from causing resource constraints in the virtual environment. By using the HOL Policy, all settings in that policy will be applied if they are not explicitly set in our new policy.

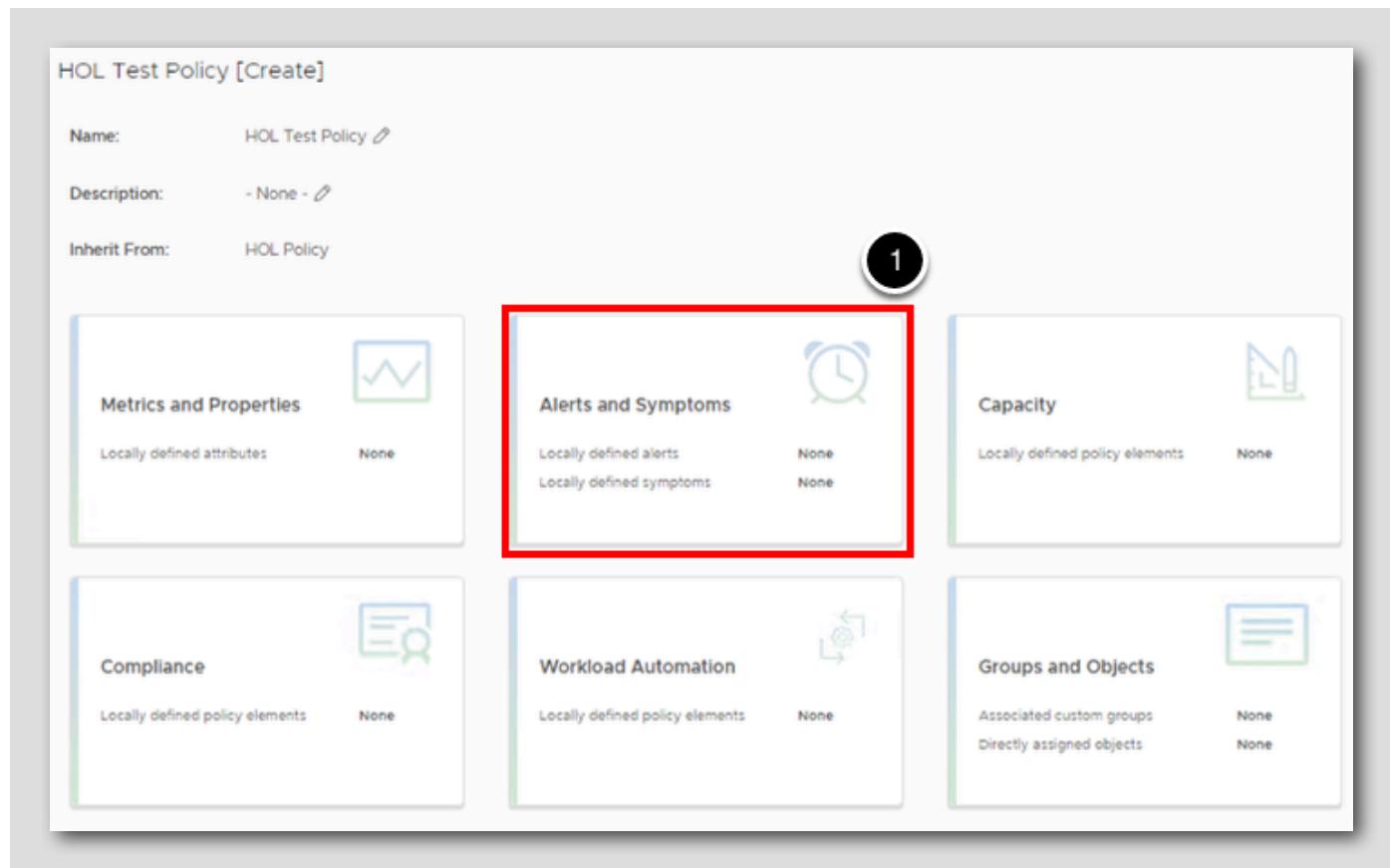
1. Click Administration.
2. Click Policies.
3. Click HOL Policy to highlight, this will enable this selected policy to be our beginning baseline.
4. Click ADD to create a new policy.

## Name the Policy



1. Enter **HOL Test Policy** in the Name field
2. Select CREATE POLICY.

## Policy Alerts and Symptoms



After creating the policy, we can now edit this Policy.

1. Select Alerts and Symptoms to edit this new policy.

## Edit Alert Definition Settings

HOL Test Policy [Create]

Alerts and Symptoms

Alert Definitions Symptom Definitions

Select Object Type: \_\_\_\_\_

Name : high cpu ALL FILTERS high cpu

Search for an Object Type x

ACTIONS Page Size: 20

Alert Definition	State	Automate	Symptom Definitions	Criticality
Fully-automated DRS-enabled cluster has high CPU w...	Enabled Inherited	Not Applicable	5	
High CPU Alert	Enabled Inherited	Inherited	1	
vRNI-An NSX infrastructure VM is experiencing high ...	Enabled Inherited	Enabled	1	

1  
2  
3  
4

SAVE CANCEL

The policy allows us to set the action to be run at the time of an alert.

1. Type **high cpu** in the filter box and hit **Enter**.
2. In the Alert Definitions Window, select our **High CPU Alert**
3. Click on **Enabled** (with the green checkmark to the left of it) in the drop-down list under the **Automate** column. Note that the action we assign in the alert is linked in the policy.
4. Click **SAVE**.

## Confirm Alert was Defined in the New Policy

The screenshot shows the 'HOL Test Policy [Create]' configuration screen. At the top, there are fields for 'Name' (HOL Test Policy), 'Description' (- None -), and 'Inherit From' (HOL Policy). Below these are four main sections:

- Metrics and Properties**: Contains a chart icon and a table with 'Locally defined attributes' (None).
- Alerts and Symptoms**: Contains a clock icon. A red box highlights the 'Locally defined alerts' row, which shows a value of 1. A black circle with the number 1 is positioned next to the alert count. The table also includes 'Locally defined symptoms' (None).
- Compliance**: Contains a magnifying glass icon.
- Workload Automation**: Contains a gear icon.

1. Now we can confirm that our new Policy "HOL Test Policy" was created, and under Alerts and Symptom we can see that we do have 1 Locally defined alert.

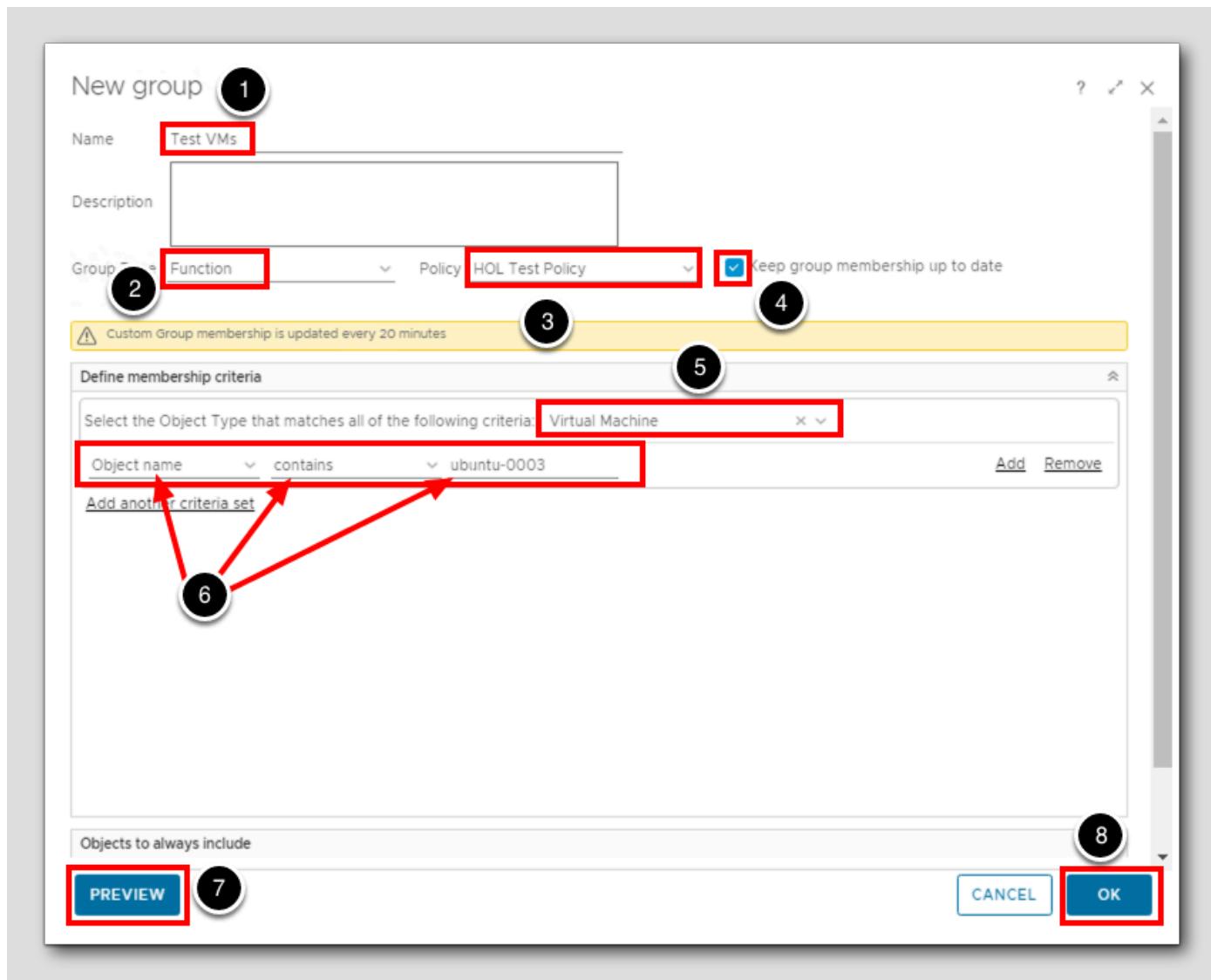
## Add VM to Test Group

The screenshot shows the vRealize Operations Manager interface. The top navigation bar has tabs for Home, Dashboards, Alerts, Environment (which is highlighted with a red box and circled with a black number 1), and Administration. Below the navigation is a breadcrumb trail with BACK, Environment Overview, and a sub-menu for Environment Overview, Custom Groups, Custom Datacenters, Cloud Zones, Applications, and Inventory. The main content area is titled 'Environment Overview' and shows a list of entities under 'Custom Groups'. A red box highlights the 'ADD' button, which is circled with a black number 2. The list includes entities like 'westus - 306a11a-668b-4250-8b8f-79cc18a62a6a', 'US West (N. California) - 260598382744', 'EU (Paris) - 260598382744', and 'groupb0420e2ea602311fa055b7487d3dd51a'. Each entity has a checkbox and a 'Health' status indicator.

We will now create a new group for test VMs and apply our HOL Test Policy to it. In this lab, we only have one test VM, but we will be able to configure the group to add additional machines dynamically and apply our policy.

1. Click on **Environment**.
2. Click **ADD** to create a new group.

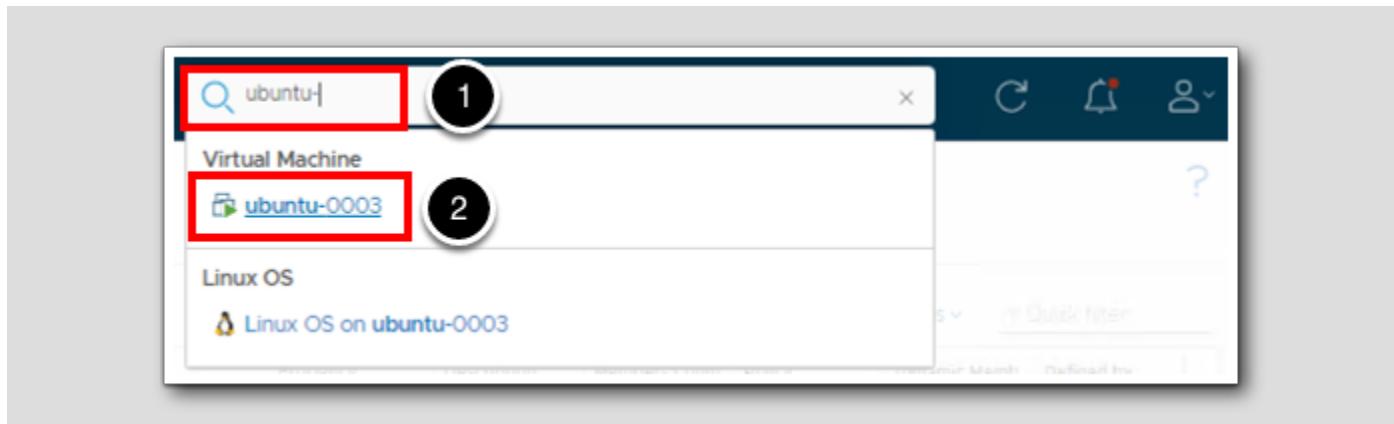
## Define the New Group



1. Enter **Test VMs** in the Name field.
2. Select **Function** for Group Type.
3. Select **HOL Test Policy**.
4. Click the check box to select **Keep group membership up to date**.
5. Select **Virtual Machine** under the vCenter Adapter for object type.
6. Under Object Name, select **contains** and then enter **ubuntu-0003** for the selection criteria.
7. Click **PREVIEW** to preview the machines that fit this search criteria and make sure only the VM **ubuntu-0003** shows up in the list.
  - Click **CLOSE** on the Preview Screen (not shown above).
8. Click **OK**.

## Check Policy

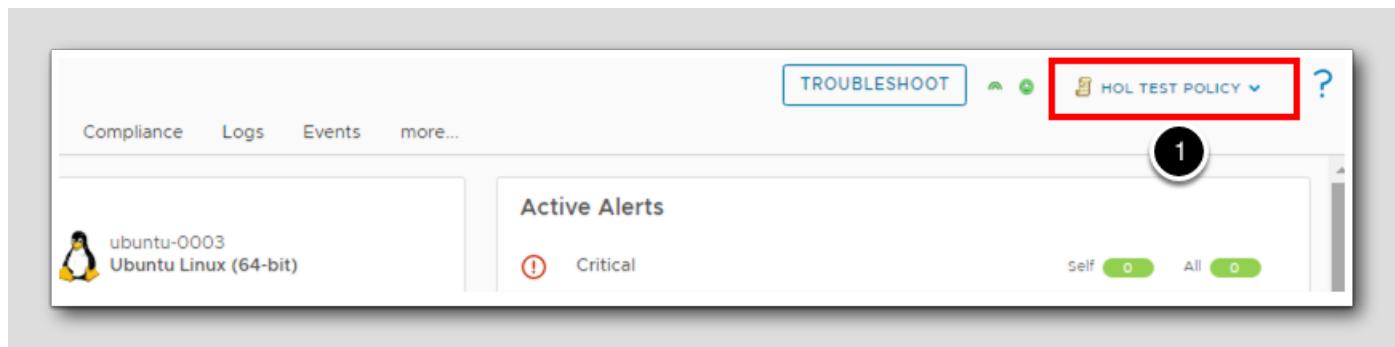
[47]



Verify our critical VM has the newly assigned policy.

1. Click the search magnifying glass at the top right corner of the screen and enter **ubuntu-**
2. Click the VM **ubuntu-0003**.

## Confirm HOL Test Policy



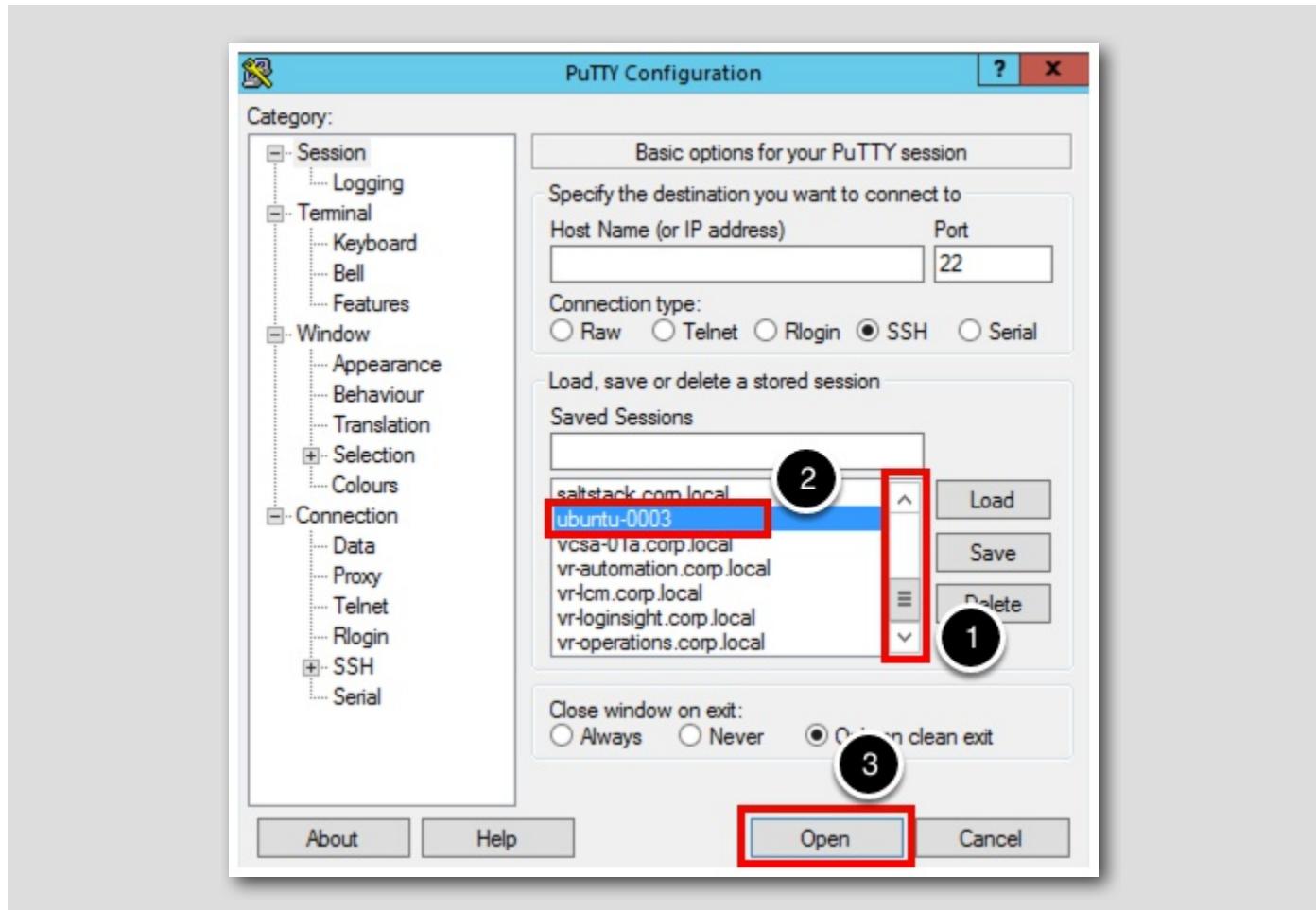
1. Verify that HOL Test Policy is now assigned to this VM.

## Open PuTTY Session



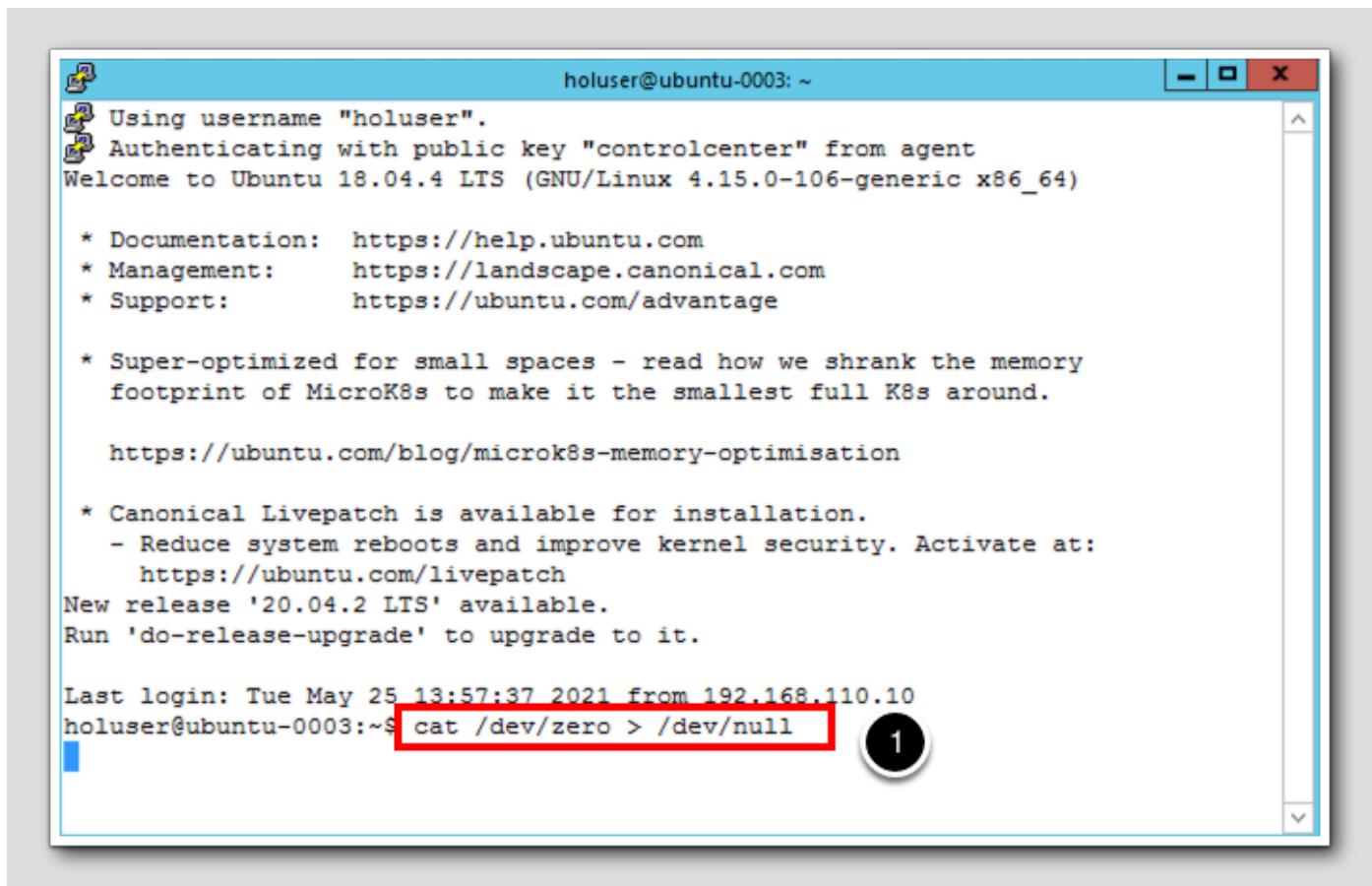
1. Click on PuTTY icon in System tray to view the PuTTY Configuration options.

## Open PuTTY Session



1. Scroll down to the bottom of the Saved Sessions list.
2. Click on **ubuntu-0003**.
3. Click **Open** to start the PuTTY session.

## Run CPU Load



```
holuser@ubuntu-0003: ~
Using username "holuser".
Authenticating with public key "controlcenter" from agent
Welcome to Ubuntu 18.04.4 LTS (GNU/Linux 4.15.0-106-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

 * Super-optimized for small spaces - read how we shrank the memory
   footprint of MicroK8s to make it the smallest full K8s around.

   https://ubuntu.com/blog/microk8s-memory-optimisation

 * Canonical Livepatch is available for installation.
   - Reduce system reboots and improve kernel security. Activate at:
     https://ubuntu.com/livepatch
New release '20.04.2 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Last login: Tue May 25 13:57:37 2021 from 192.168.110.10
holuser@ubuntu-0003:~$ cat /dev/zero > /dev/null
```

Redirect dev/zero to dev/null to generate CPU load again; this will trigger the alert and show how it behaves with the new policy.

1. Type `cat /dev/zero > /dev/null` and press the Enter key to start the CPU load.

Again, leave this PuTTY window open.

## Check for the Alert

The screenshot shows the vRealize Operations Manager interface. The top navigation bar includes 'vRealize Operations Manager', 'Home', 'Dashboards', 'Alerts' (which is highlighted with a red box and has a circled '1' above it), 'Environment', and 'Administration'. On the left, a sidebar lists 'Triggered Alerts' (with 'All' highlighted with a red box and circled '2'), 'Administrative', 'Configuration' (with 'Alert Definitions', 'Symptom Definitions', 'Recommendations', 'Actions', 'Notifications', and 'Payload Templates' listed), and a 'BACK' button. The main content area is titled 'All Alerts' and shows a table of alerts. The table has columns for 'Criticality', 'Alert', 'Triggered On', and 'Created On'. A filter bar above the table shows 'ACTIONS', 'Group By Time (1 Hour)', and a refresh icon. The first alert in the list, 'High CPU Alert' (criticality red, triggered on 'ubuntu-0003' at 4:11 PM), is highlighted with a red box and circled '4'.

Let the CPU load command run for a couple minutes, and then return to vRealize Operations and check the alerts from the Alerts screen.

Note, you may need to hit refresh in the upper right hand corner. The High CPU Alert will not show until the next collection cycle runs.

1. Click **Alerts**.
2. Click **All** to make sure you are seeing the full list of alerts.
3. Click the chevron beside **1 Hour** to show the most recent alerts.
4. Notice we do see our **High CPU Alert** has been triggered because of High CPU Usage.

We looked at the alert previously, so now we'll check the recent tasks and check the status of the action.

## Recent Task List

The screenshot shows the vRealize Operations Manager interface. The top navigation bar has tabs: Home, Dashboards, Alerts, Environment, and Administration (which is highlighted with a red box and a circled '1'). Below the navigation is a sidebar with a 'BACK' button and a list of categories: Solutions (Cloud Accounts, Other Accounts, Repository), Inventory, Policies, Access, Configuration, Management\*, History (Audit, Recent Tasks), and Support. The 'Recent Tasks' item under 'History' is highlighted with a red box and a circled '2'. A circled '3' points to the 'Recent Tasks' link in the sidebar. The main content area is titled 'Recent Tasks' and displays a table with one row:

Task	Status	Started Time	Completed Time	Automated	Object Name
Power Off VM	Completed	4:12 PM	4:12 PM	Yes	ubuntu-0003

1. Click Administration.
2. Click History to expand that menu item.
3. Click Recent Tasks.

## Inspect Power Off VM Task

The screenshot shows the 'Recent Tasks' section of the vRealize Operations Manager interface. A table lists a single task: 'Power Off VM'. The task is marked as 'Completed' at 4:12 PM on 4:12 PM. It was automated and applied to the object 'ubuntu-0003'. The 'Task' column for this row is highlighted with a red box and has a black circle with the number '1' over it.

Task	Status	Started Time	Completed Time	Automated	Object Name
Power Off VM	Completed	4:12 PM	4:12 PM	Yes	ubuntu-0003

1. Click the Power Off VM task. Additional details regarding the completed operations are displayed now at the bottom of the screen.

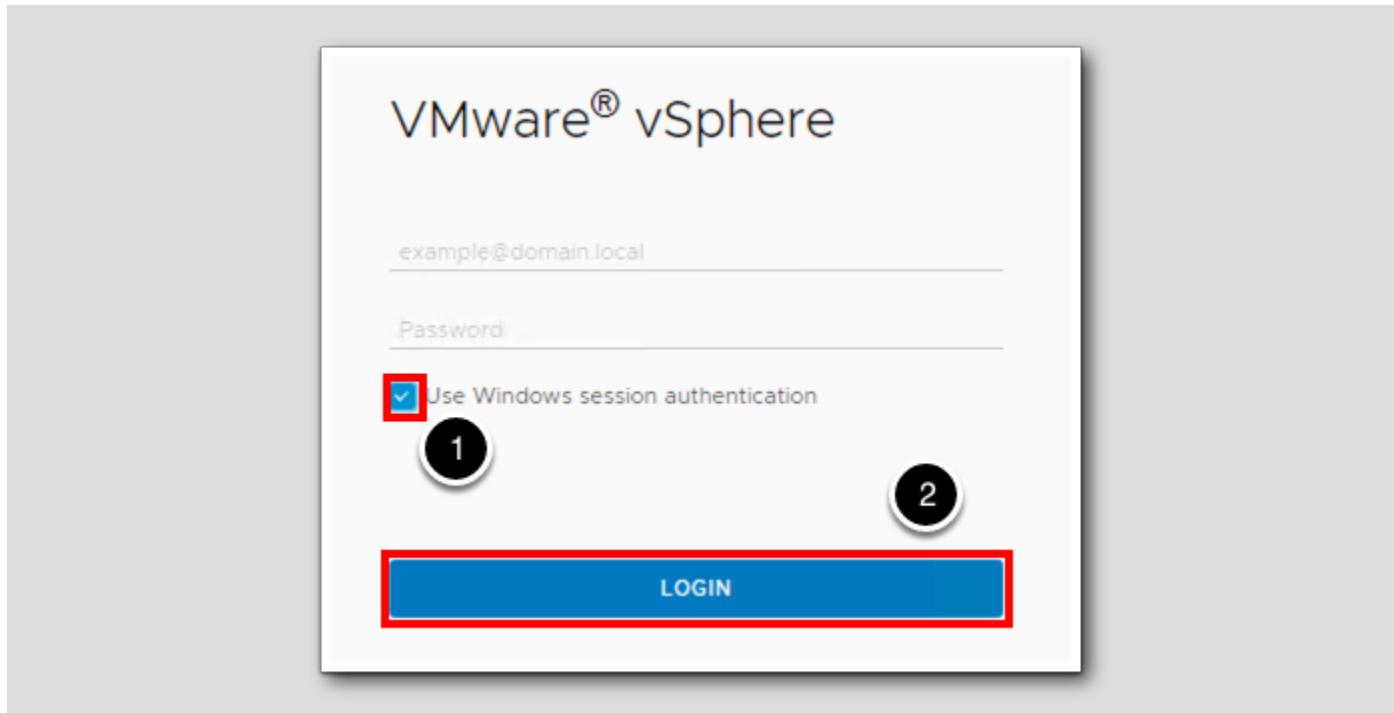
Let's take a look at the VM in the vSphere Client to ensure that the action has turned off our ubuntu-0003 VM.

## Open vSphere Client - Open a new Browser Tab

The screenshot shows a web browser window with the address bar containing 'vr-operations.corp.local/ui/index.action#/administration/t'. The bookmarks bar at the top includes links for 'vSphere Client' (highlighted with a red box and a black circle with '1'), 'vSphere Manager', 'Lifecycle Manager', and 'vRealize Automation'. The main navigation bar at the bottom includes 'vRealize Operations Manager' (selected), 'Home', 'Dashboards', and 'Alerts'. A new tab icon with a black circle and the number '1' is visible in the top right corner of the browser window.

1. Click the + to open a new Chrome Tab.
2. Click on the vSphere Client link in the bookmarks bar.

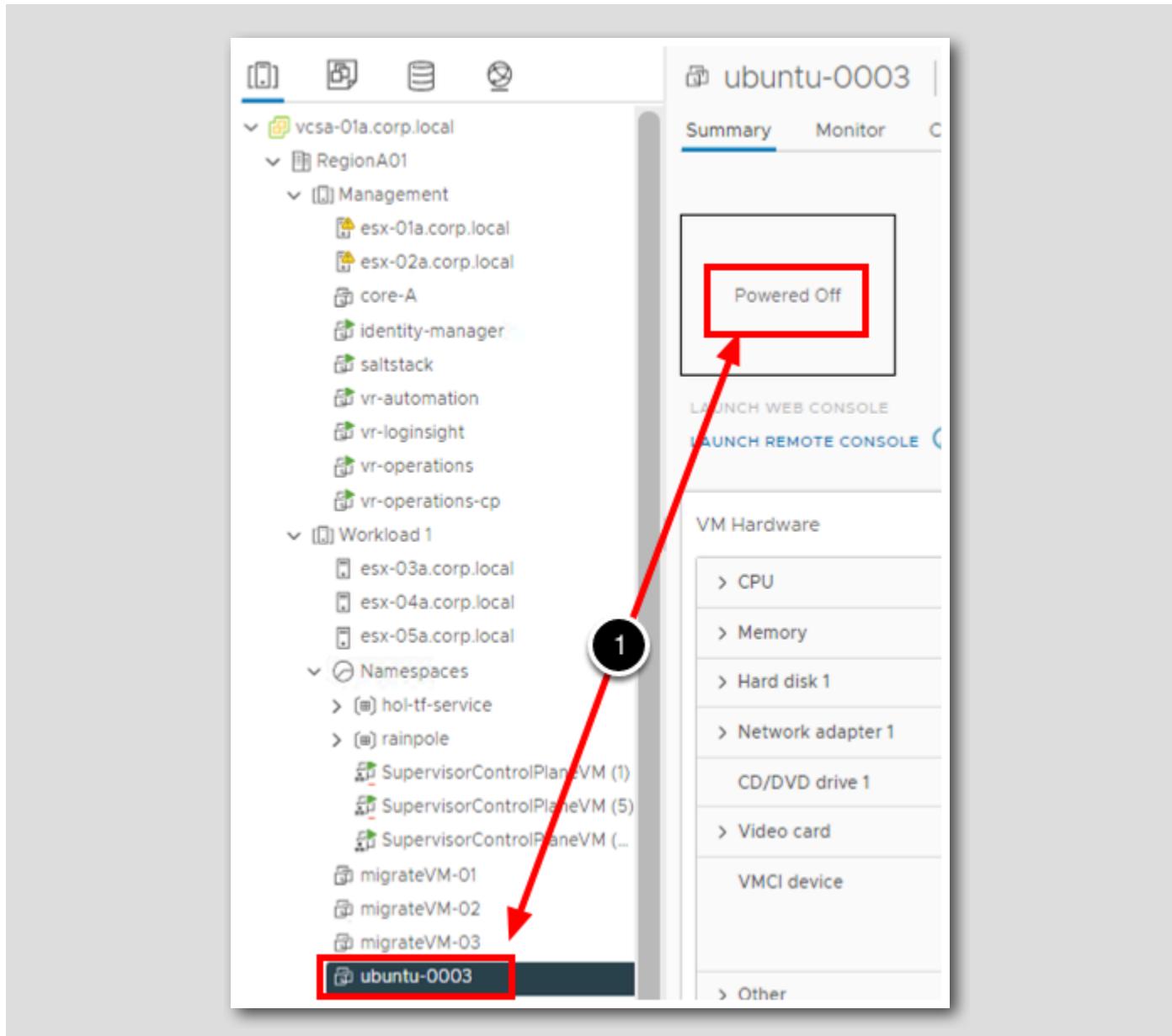
Login to vCenter



1. Click the checkbox to select Use Windows session authentication.

2. Click LOGIN.

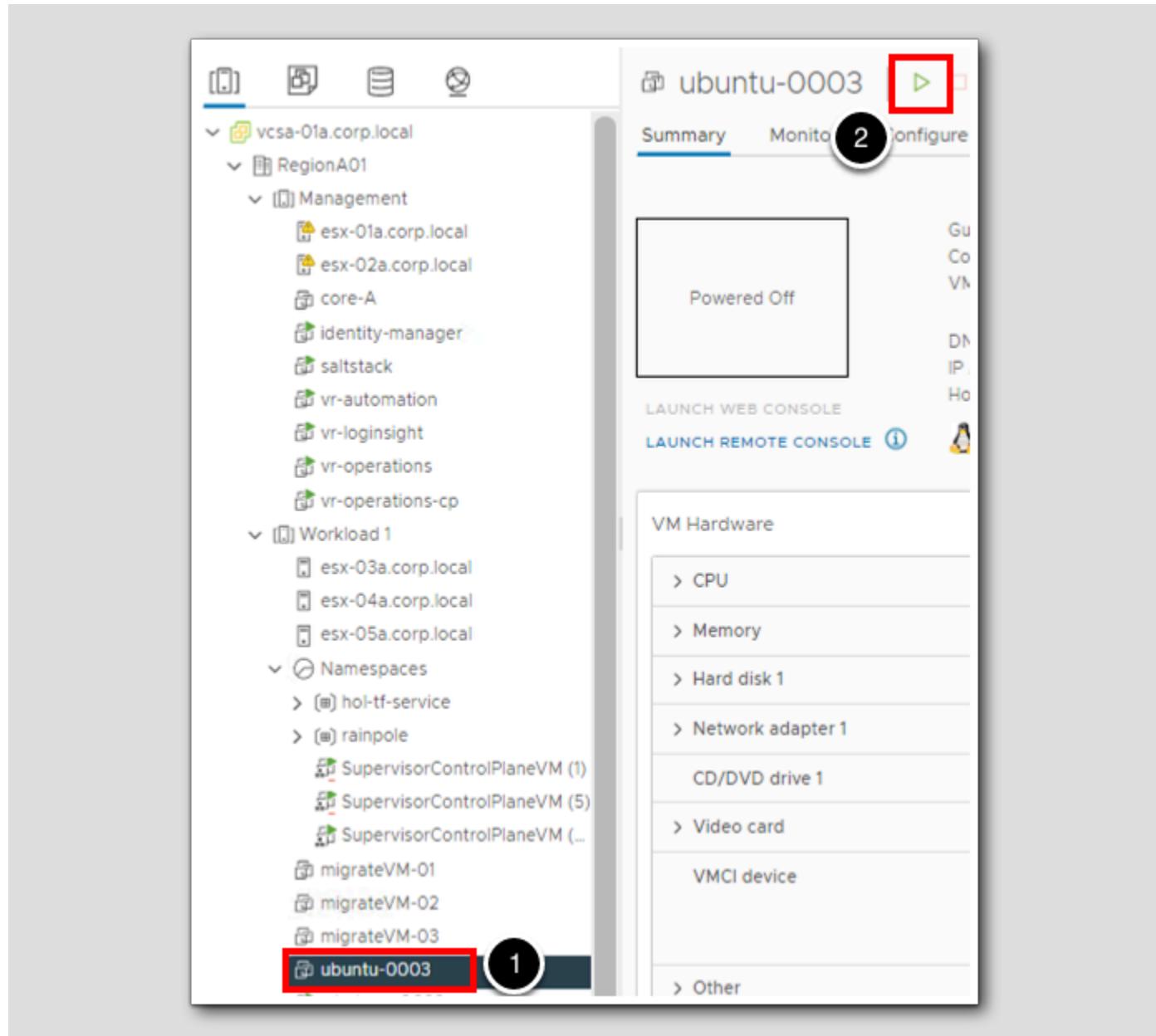
## Check the VM Status



1. In vCenter we can see that the **ubuntu-0003** VM has indeed been turned off by our automated action in vRealize Operations.

Automating actions in vRealize Operations is a key part of creating a Self Driving Datacenter!

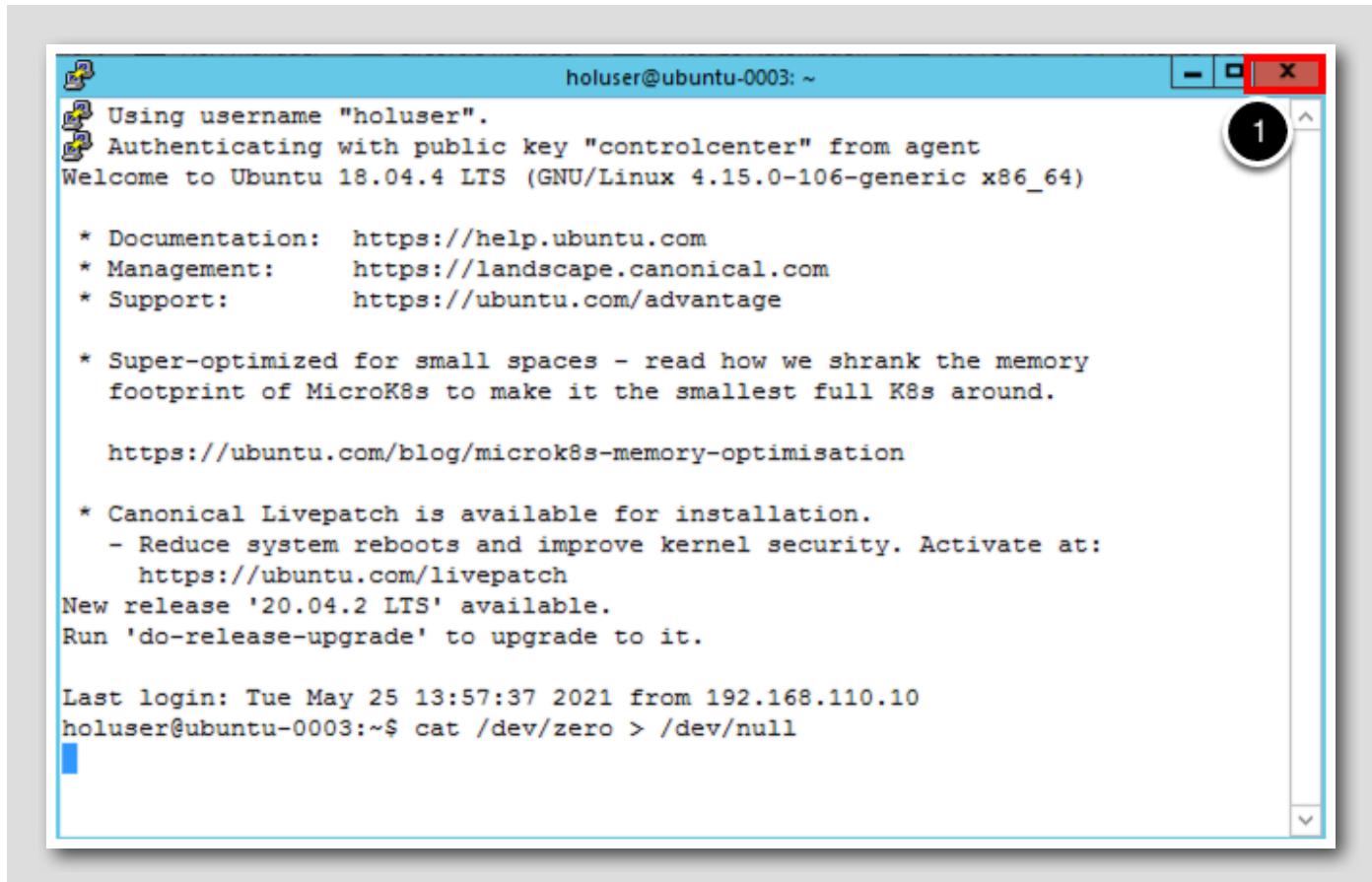
Restart the ubuntu-0003 VM



Let's restart the ubuntu-0003 VM as it will be needed in later lessons.

1. Click the VM ubuntu-0003.
2. Click the green start icon at the top of the VM summary page (or right-click and select Power On).

## Stop CPU Load



```
Using username "holuser".
Authenticating with public key "controlcenter" from agent
Welcome to Ubuntu 18.04.4 LTS (GNU/Linux 4.15.0-106-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

 * Super-optimized for small spaces - read how we shrank the memory
   footprint of MicroK8s to make it the smallest full K8s around.

   https://ubuntu.com/blog/microk8s-memory-optimisation

 * Canonical Livepatch is available for installation.
   - Reduce system reboots and improve kernel security. Activate at:
     https://ubuntu.com/livepatch
New release '20.04.2 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Last login: Tue May 25 13:57:37 2021 from 192.168.110.10
holuser@ubuntu-0003:~$ cat /dev/zero > /dev/null
```

Return to your open PuTTY window. Closing this PuTTY session will end the CPU load command.

1. Click the X in the upper-right corner to close the PuTTY session.
2. Click OK in the PuTTY Exit Confirmation Pop-up Window (*Not Shown*).

## Lesson End

This concludes the Using Symptoms and Alerts to Trigger Recommendations and Actions Lesson.

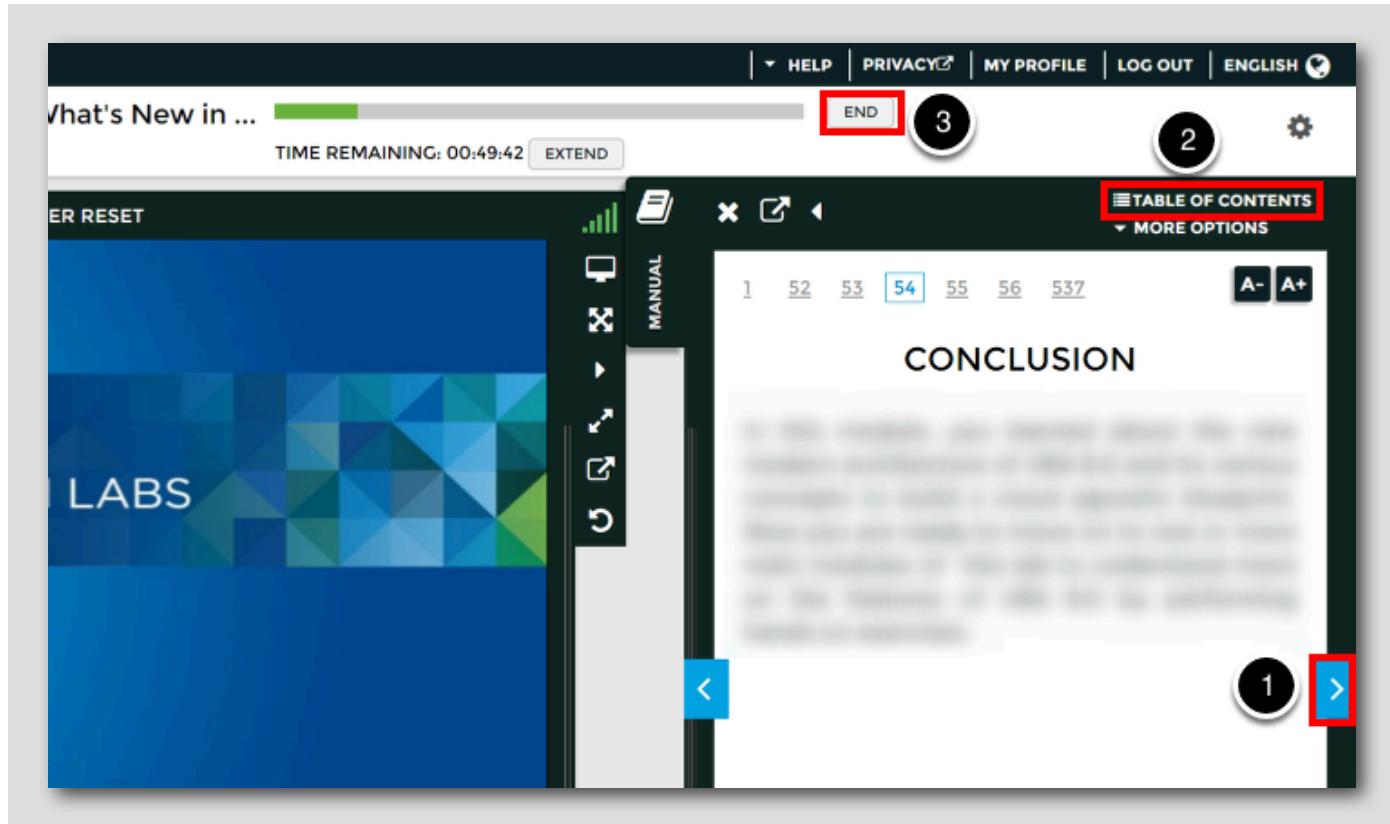
Thank You.

## Conclusion

Self-driving operations by VMware vRealize Operations automates and simplifies IT operations management and provides unified

visibility from applications to infrastructure across physical, virtual and cloud environments. We hope in this module you learned how Intelligent Remediation helps predict, prevent and even take actions to resolve issues upon detection. VMware vRealize Operations allows for faster troubleshoot with actionable insights correlating metrics and logs and unified visibility from applications to infrastructure.

You've finished Module 1



Congratulations on completing the lab module.

If you are looking for additional general information on vRealize Operations 8.4, try one of these:

- VMware Product Public Page - vRealize Operations: <https://www.vmware.com/products/vrealize-operations.html>
- vRealize Operations 8.4 - Release Notes: <https://docs.vmware.com/en/vRealize-Operations-Manager/8.4/rn/vRealize-Operations-Manager-84.html>
- vRealize Operations 8.4 - Documentation: <https://docs.vmware.com/en/vRealize-Operations-Manager/8.4/com.vmware.vcom.core.doc/GUID-7E6B5805-3D2F-41C4-ADFF-B7248386E7AC.html>
- VMware Cloud Management Blog - What's New in vRealize Operations 8.4 and Cloud: <https://blogs.vmware.com/management/2021/04/whats-new-in-vrealize-operations-8-4-and-cloud.html>

From here you can:

1. Click to advanced to the next page and continue with the next lab module
2. Open the **TABLE OF CONTENTS** to jump to any module or lesson in this lab manual
3. Click on the **END** button if you are done with the lab for now and want to exit

## Module 2 - Creating and Modifying Views and Reports (45 minutes)

### Introduction

[64]

This Module contains the following lessons:

- Create Customized View
- Simple View showing VM list with Metrics and Properties
- Create a View with Variable data
- Create a View with Trends
- Create a View with Distribution data
- Create Reports from Views and Dashboards

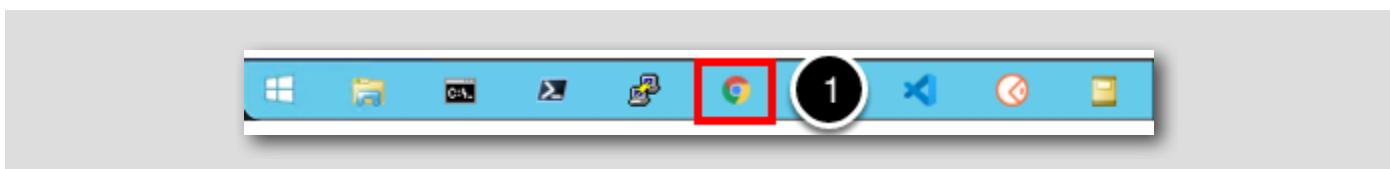
### Log in to vRealize Operations

[65]

To begin this exercise, we will log in to vRealize Operations. If you are not currently logged into any instance of vRealize Operations, continue to the next page, but if you are already logged into vRealize Operations, click [here](#) to skip ahead.

### Open the Chrome Browser from Windows Quick Launch Task Bar

[66]



If your browser isn't already open, launch Google Chrome

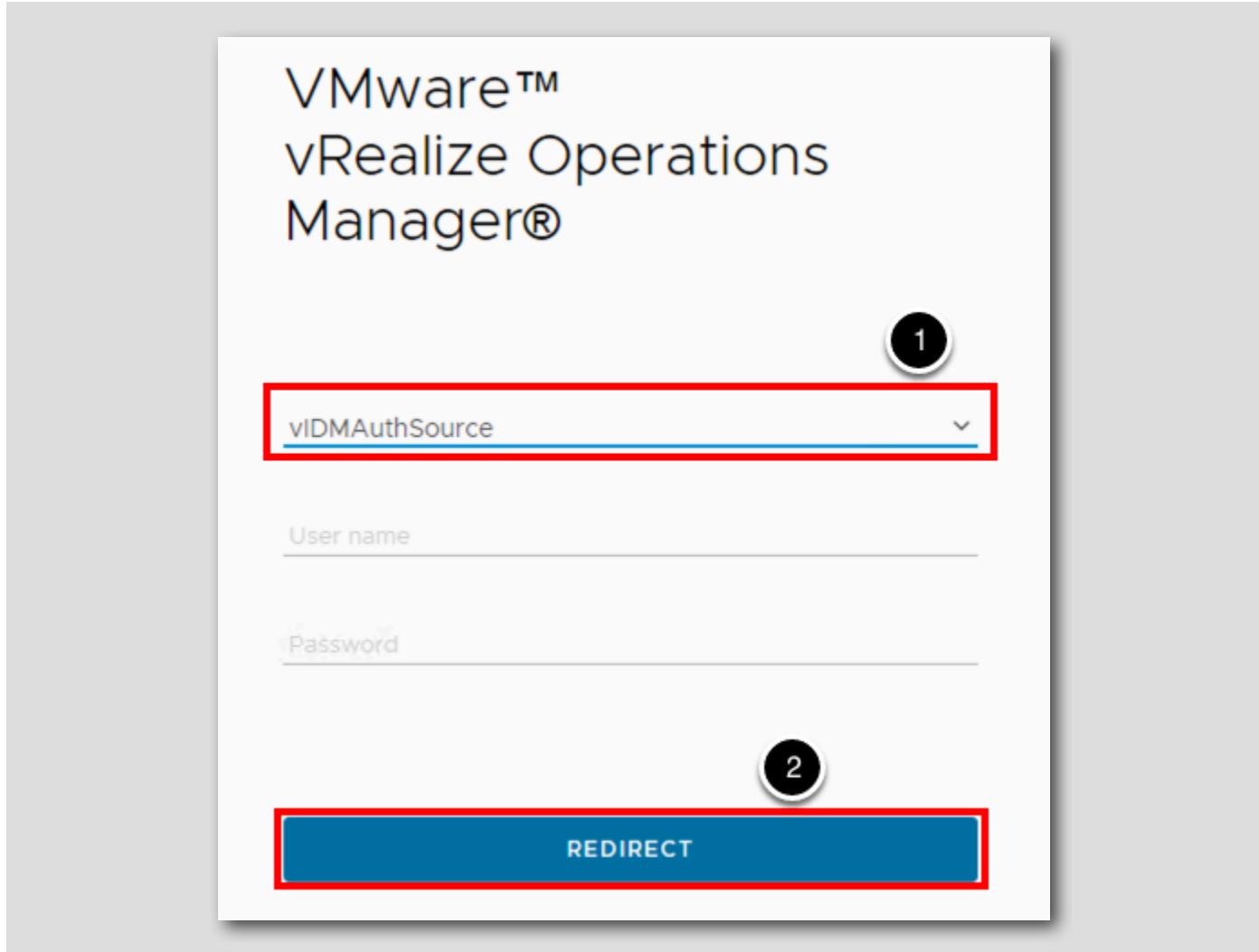
1. Click the Chrome icon on the Windows Quick Launch Task Bar



The browser Bookmarks Bar has links to the different applications that are running in the lab.

1. Click the vRealize Operations Bookmark

## Log in to vRealize Operations

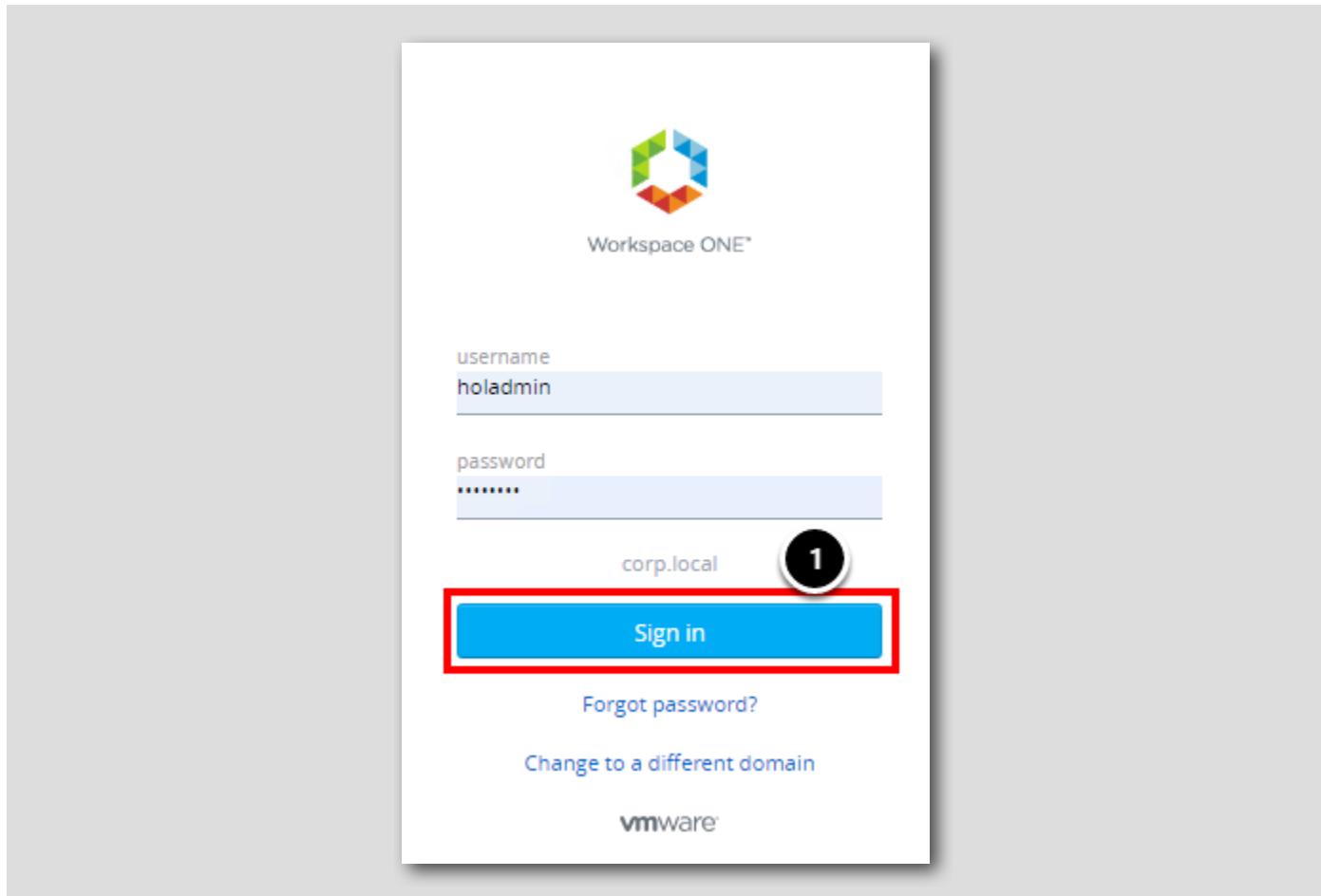


vRealize Operations is integrated with VMware Identity Manager which we will use for user authentication in this lab.

vIDMAuthSource (VMware Identity Manager) should be pre-selected as the identity source. However, if it is not you will choose it.

1. Click the drop-down arrow if vIDMAuthSource is not selected.
2. Click REDIRECT to be taken to the authentication page.

## VMware Identity Manager Login



At the Workspace ONE login screen, use these credentials:

username: holadmin

password: VMware1!

1. Click Sign in

## vRealize Operations Home Screen

You should be at the vRealize Operations Home screen and ready to start the module.

## Create Simple View showing VM list with Metrics and Properties

In this lesson, we will create a view. A view can be used in dashboards and reports. A view is also viewable as its own content in the Details section of the vRealize Operations interface.

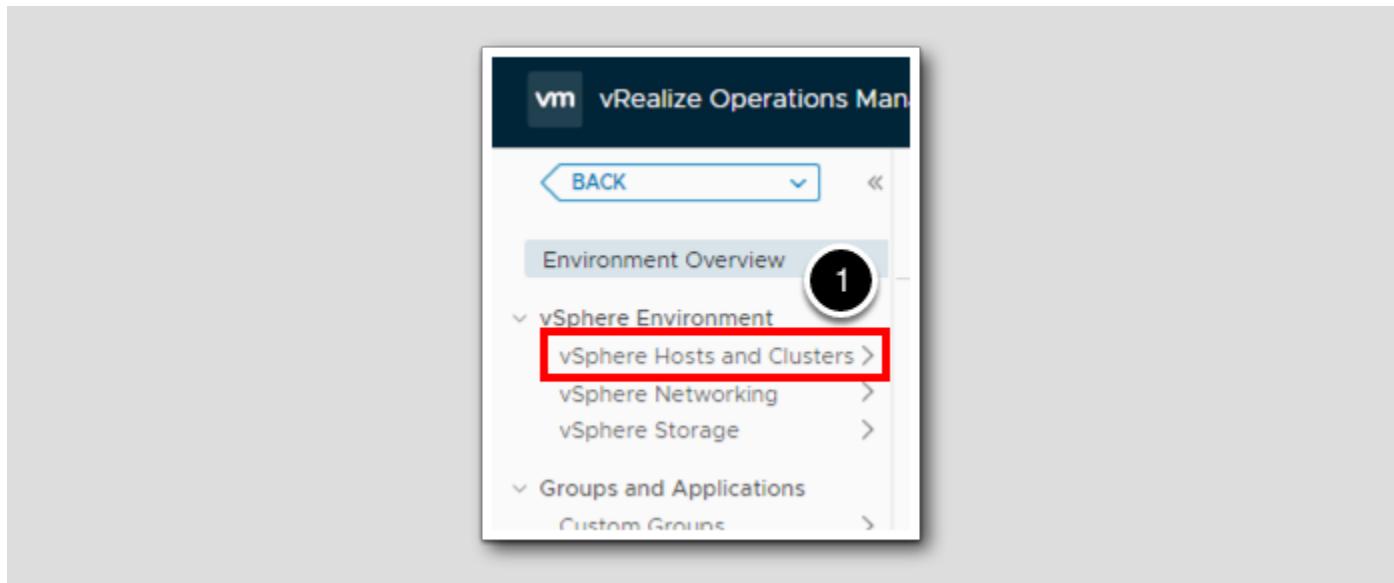
The view for this lesson is a starting point and intended to be a simple example to create. It will contain some basic metrics and properties for virtual machines.

### Go to Environment

1. Click on Environment.

## Hosts and Clusters

[72]



1. Click on vSphere Hosts and Clusters.

## Expand vSphere World

The screenshot shows the vRealize Operations Manager interface. The top navigation bar includes 'vRealize Operations Manager', 'Home', 'Dashboards', 'Alerts', 'Environment' (which is selected), and 'Administration'. Below the navigation is a breadcrumb trail: 'BACK' > 'vSphere Hosts and Clusters' > 'vSphere World' > 'Private Cloud'. A red box highlights the 'vSphere World' link. The main content area displays a summary for 'Private Cloud' with the following details:

Metric	Value
Cluster	2
ESXi Host	5
Virtual Machine	23
Datastore	6
Version	7.0.2-17694817

At the bottom right of the content area, there is a 'more...' button with a red box around it. Three numbered circles are overlaid on the interface: circle 1 points to the 'vSphere World' link, circle 2 points to the 'Private Cloud' link, and circle 3 points to the 'more...' button.

1. Expand vSphere World.
2. Select Private Cloud.
3. Click on more...

## Create a View

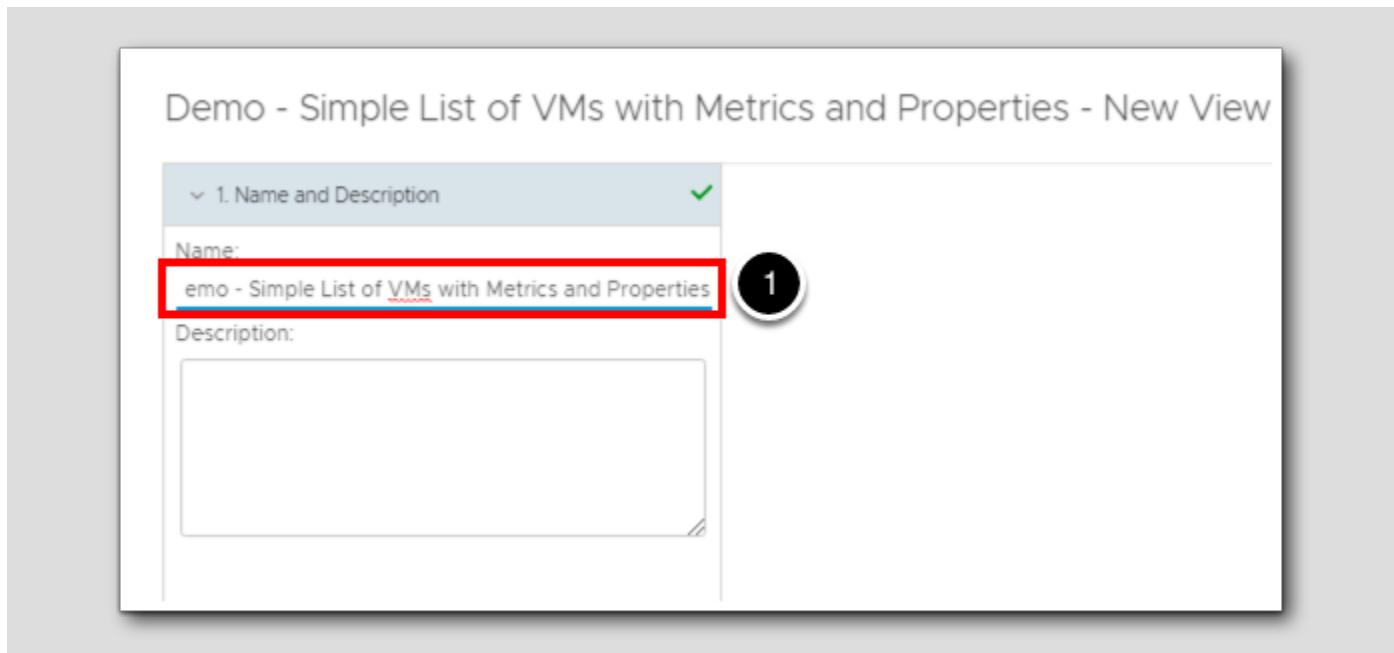
The screenshot shows the 'Private Cloud' view creation screen. The top navigation bar includes 'TROUBLESHOOT' and tabs for 'Summary', 'Alerts', 'Metrics', 'Capacity', 'Compliance', 'Logs', 'Events', 'Details' (which is selected), 'Environment', 'Reports', and 'less...'. Below the tabs is a toolbar with 'Views', 'Heatmaps', 'Workload', 'ADD', and '...'. A red box highlights the 'ADD' button. The main content area displays a table of view definitions:

Name	Type	Description	Subject
<input checked="" type="checkbox"/> Admission Control Enabled?	Distribution	vSphere Cluster Admission Control Enabled	Cluster Com
<input type="checkbox"/> Alerts that are currently active	List	Show alerts for the selected object and its des...	Alert

Three numbered circles are overlaid on the interface: circle 1 points to the 'Details' tab, circle 2 points to the 'ADD' button, and circle 3 points to the first row in the table.

1. Click on **Details**.
2. Click **ADD** to create a new view.

## View Name



The view creation wizard starts. Create a view with the following:

### Name and Description

1. Enter the name **Demo - Simple List of VMs with Metrics and Properties**.

## Presentation

Demo - Simple List of VMs with Metrics and Properties - New View

1. Name and Description ✓

2. Presentation ✓

1

2

List

Summary

Trend

Distribution

Text

Image

**List**

List views provide tabular data about specific objects in the monitored environment that correspond to the selected view.

**Configuration**

Items per page: 50 ▾

Top result count: ▾

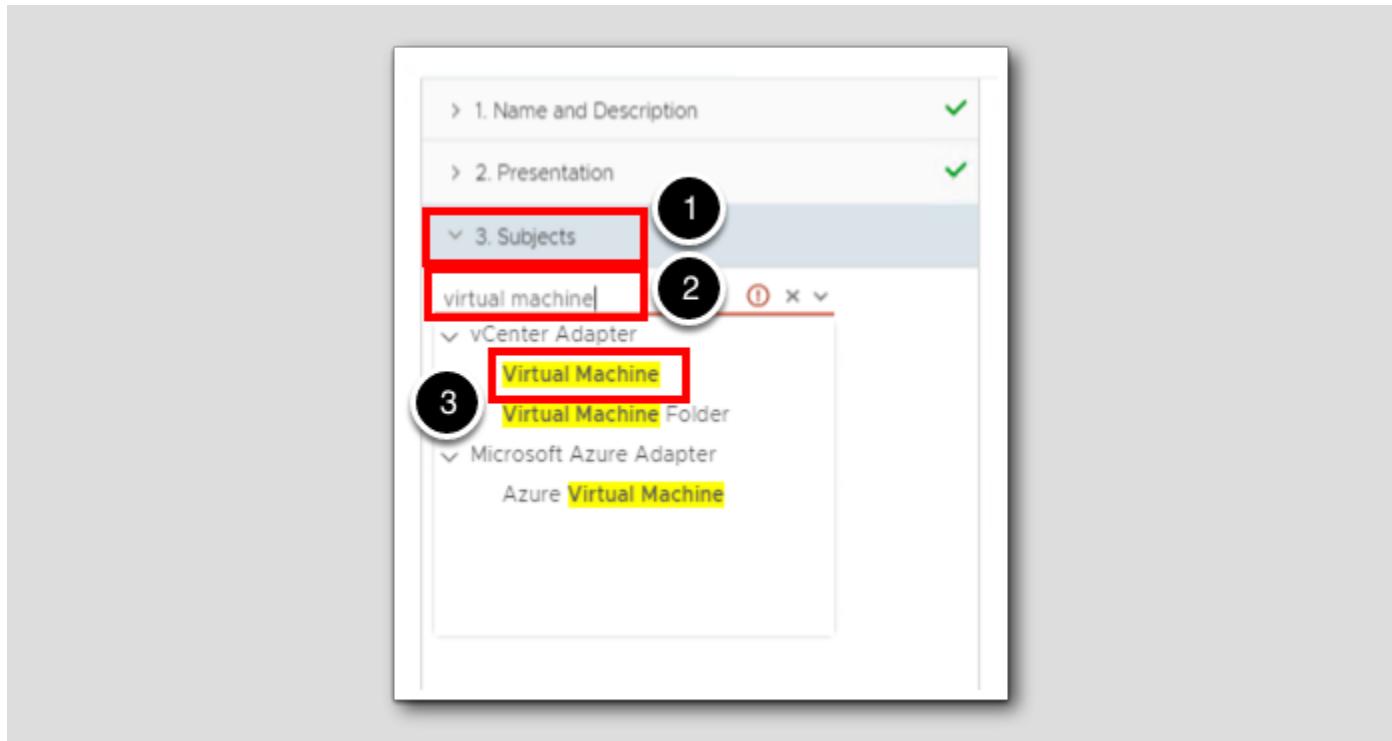
Preview source: Sample data

Object Name 3	Property Value 3	Value
VM-1	1234	Value
VM-2	1235	Value

1. Click on **Presentation**.

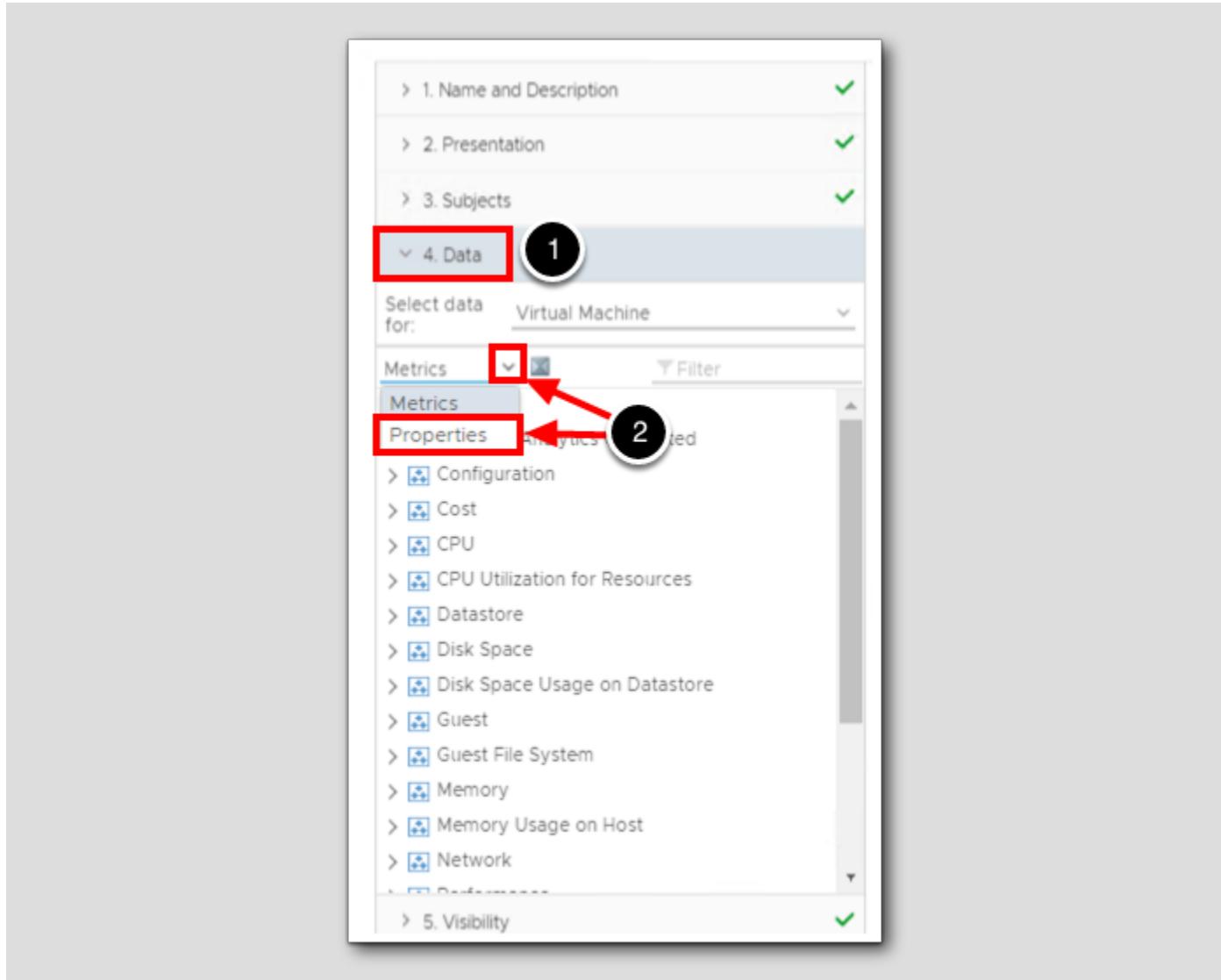
2. Select: **List**.

## Subjects



1. Click on Subjects.
2. Enter virtual machine (Begin typing and the list will populate with matched options).
3. Click on Virtual Machine.

## Data - Properties



1. Click on Data.
2. Switch from Metrics to Properties by clicking the chevron to show the drop-down options.

## Selected Properties

The screenshot shows the 'Selected Properties' view in the vRealize Operations Management interface. The left pane displays a hierarchical tree of objects. The right pane shows a table of properties for a selected object.

Numbered circles indicate specific steps:

1. Expands the 'Summary' node.
2. Double-clicks on 'Parent Cluster'.
3. Double-clicks on 'Parent Host'.
4. Double-clicks on 'Datastore(s)'.

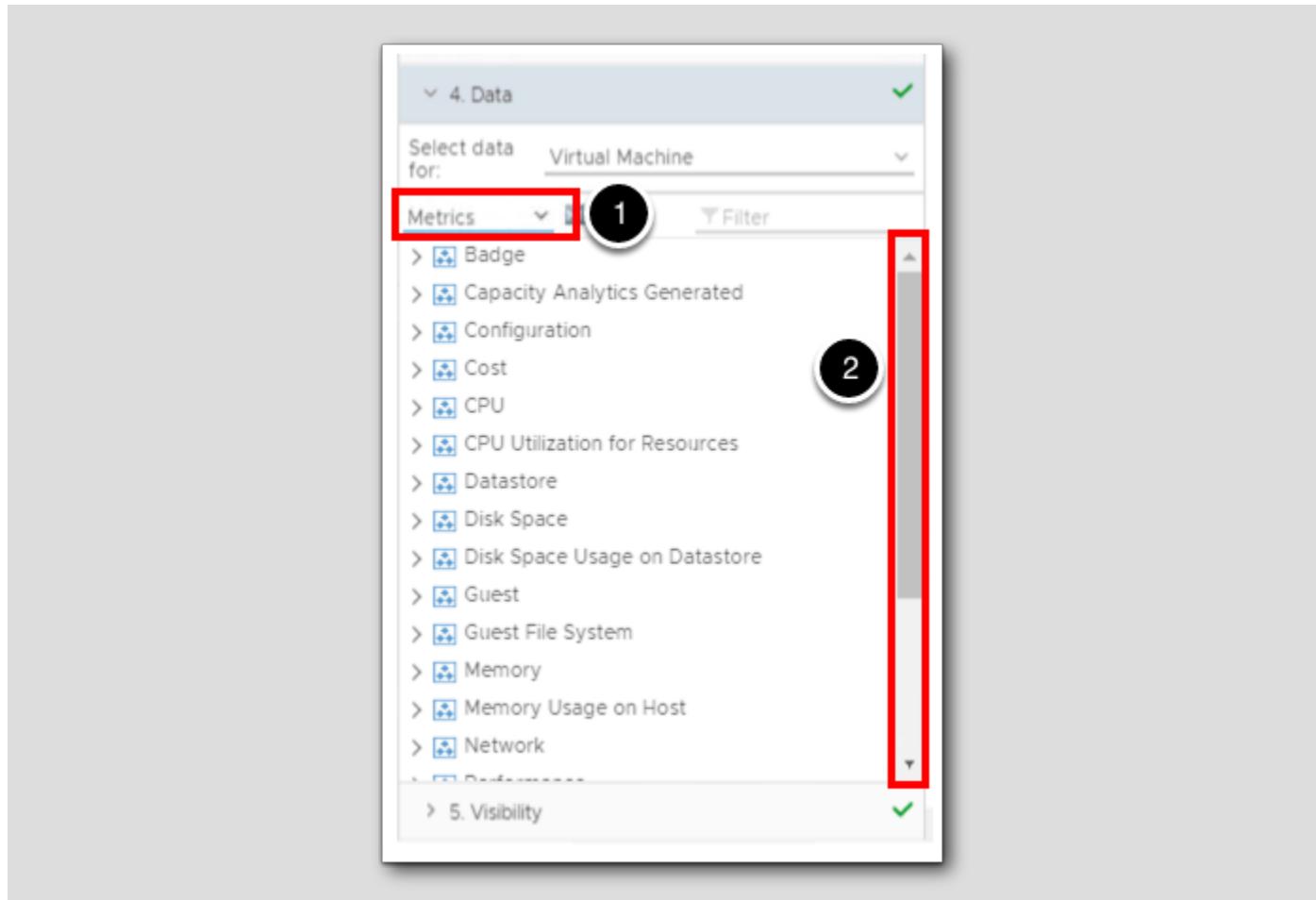
Red arrows point from the selected items in the tree to the corresponding rows in the 'Data' table. The 'Data' table has the following structure:

Object Name	Property Value	Value	Value 2
Object Name 5	Property Value 5	Value 5	Value 5

The 'Data' table includes tabs for Data, Time Settings, Breakdown by, Filter, and Summary, and a message at the bottom: "Drag the data to include in the view."

1. Expand **Summary** (Note: you may need to scroll down to see **Summary**).
2. Double-click on **Parent Cluster** (drag and drop the data to the center will work also).
3. Double-click on **Parent Host**.
4. Double-click on **Datastore(s)**.

## Data - Metrics



We've been working with Virtual Machine Properties, now we need to select Virtual Machine metrics.

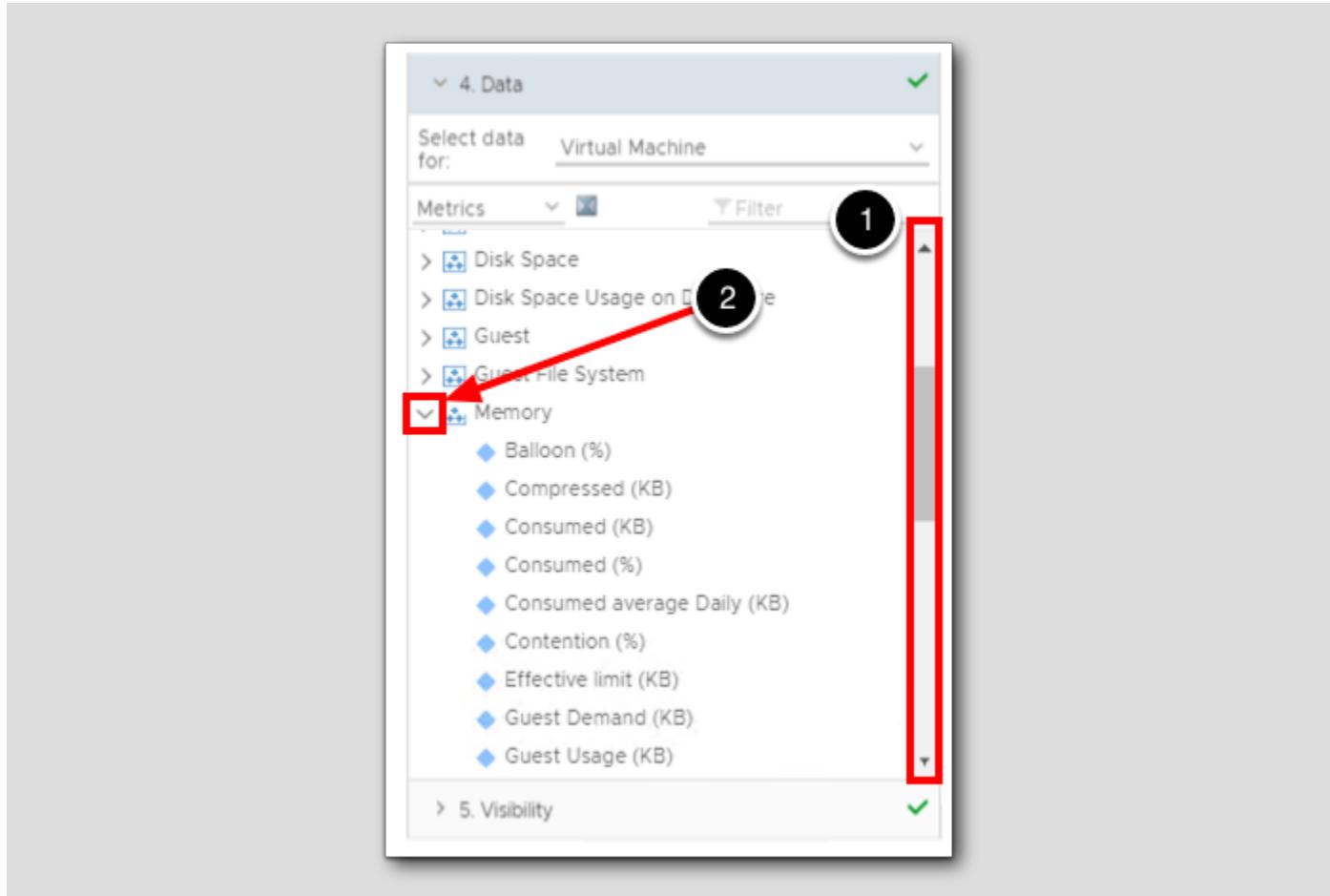
1. Switch from Properties back to **Metrics**.
2. Scroll back to the top of the list.

## Select Metrics

The screenshot shows the 'Select Metrics' interface in vRealize Operations. On the left, a tree view lists various metrics categories. A red box highlights the 'Configuration' category, with a red arrow pointing to it from the number 1. Another red box highlights the 'Hardware' category under 'Configuration', with a red arrow pointing to it from the number 2. A third red box highlights the 'Number of CPUs (vCPUs)' metric under 'Hardware', with a red arrow pointing to it from the number 3. To the right of the tree view is a table with columns 'Object Name', 'Property Value', and 'Value'. Below the table are tabs for 'Data', 'Time Settings', 'Breakdown by', and 'Filter'. A large red arrow points from the bottom of the tree view towards the transformation section at the bottom right. The transformation section shows a sequence of objects: 'Summary|Parent Cluster', 'Current', 'Summary|Parent Host', 'Current', 'Summary|Datastore(s)', 'Current', and 'Configuration|Hardware|Number of ... Current'. At the bottom right of this section is the text 'Drag the data to include in the view'.

1. Expand Configuration by clicking the chevron.
2. Expand Hardware.
3. Double-click Number of CPUs (vCPUs) to add it to the list of data to be included in the view.

## Memory Metrics



Scroll down and Expand Memory

1. Scroll down until you see the **Memory** category item.
2. Expand the **Memory** category by clicking the chevron.

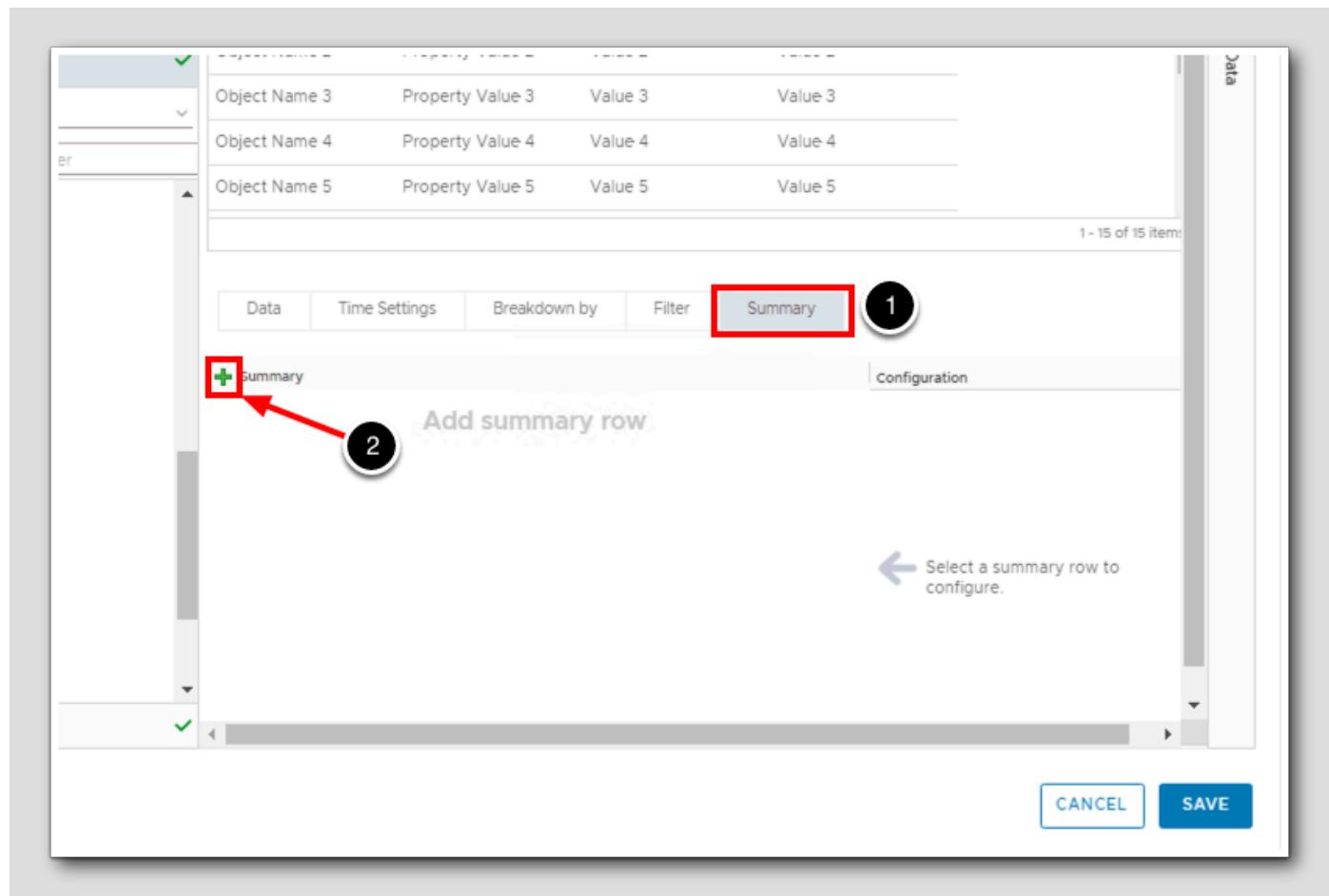
## Total Capacity

The screenshot shows the vRealize Operations Management Pack interface. On the left, a list of metrics is displayed, with 'Total Capacity (KB)' highlighted by a red box and circled with number 2. A vertical red bar highlights the scroll bar, with circle 1 indicating its position. On the right, a table shows data for various objects. The last row, 'Memory|Total Capacity', is highlighted by a red arrow and circled with number 2. A tooltip at the bottom right says 'Drag the data to include in the view'.

Object Name 4	Property Value 4	Value 4
Object Name 5	Property Value 5	Value 5
<b>Data</b> <b>Time Settings</b> <b>Breakdown by</b> <b>Filter</b>		
<b>Data</b>		<b>Transformation</b>
Summary Parent Cluster	Current	
Summary Parent Host	Current	
Summary Datastore(s)	Current	
Configuration Hardware Number of ...	Current	
Memory Total Capacity	Current	

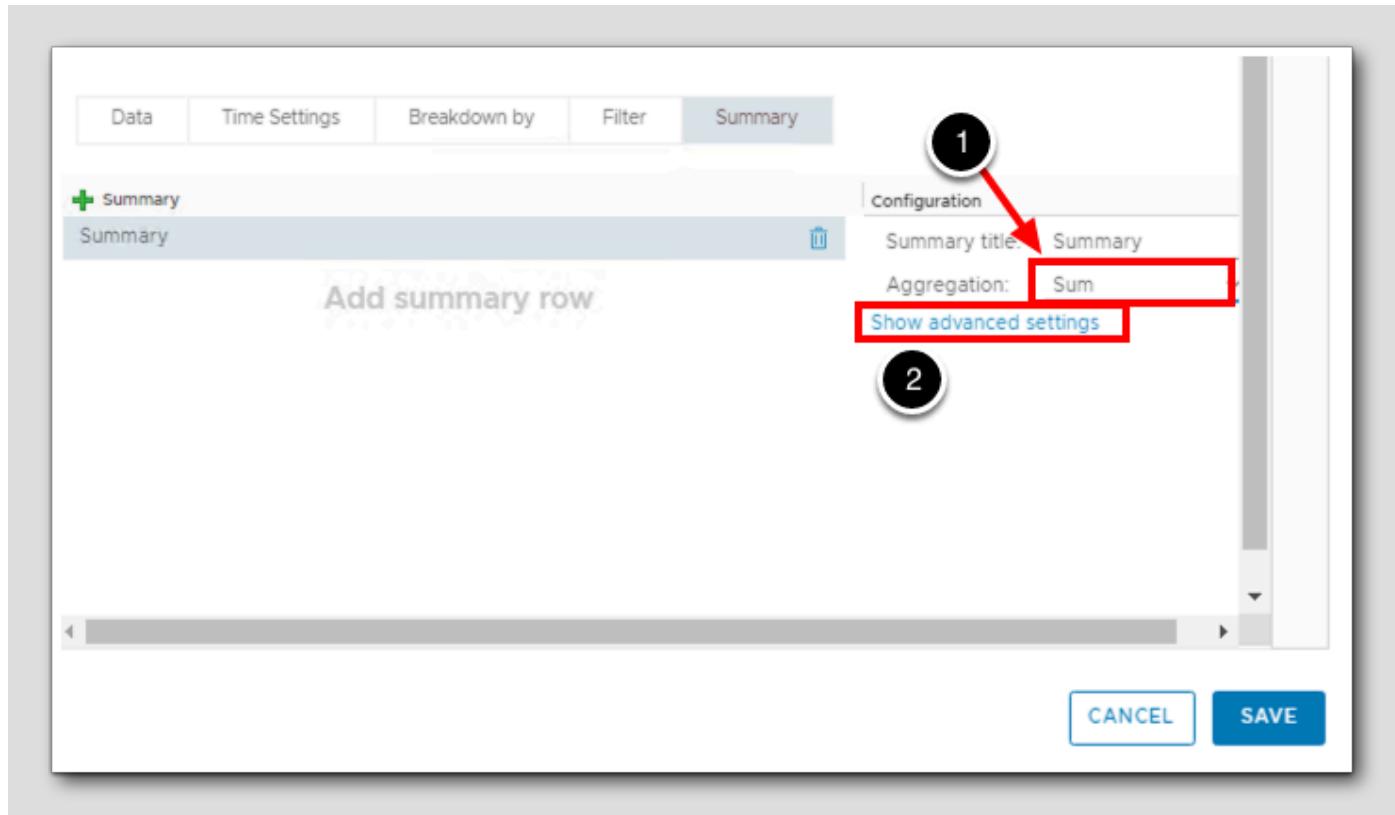
1. Scroll down to until you see the Total Capacity (KB) item.
2. Double-click on Total Capacity (KB) to add it to the view.

## Summary

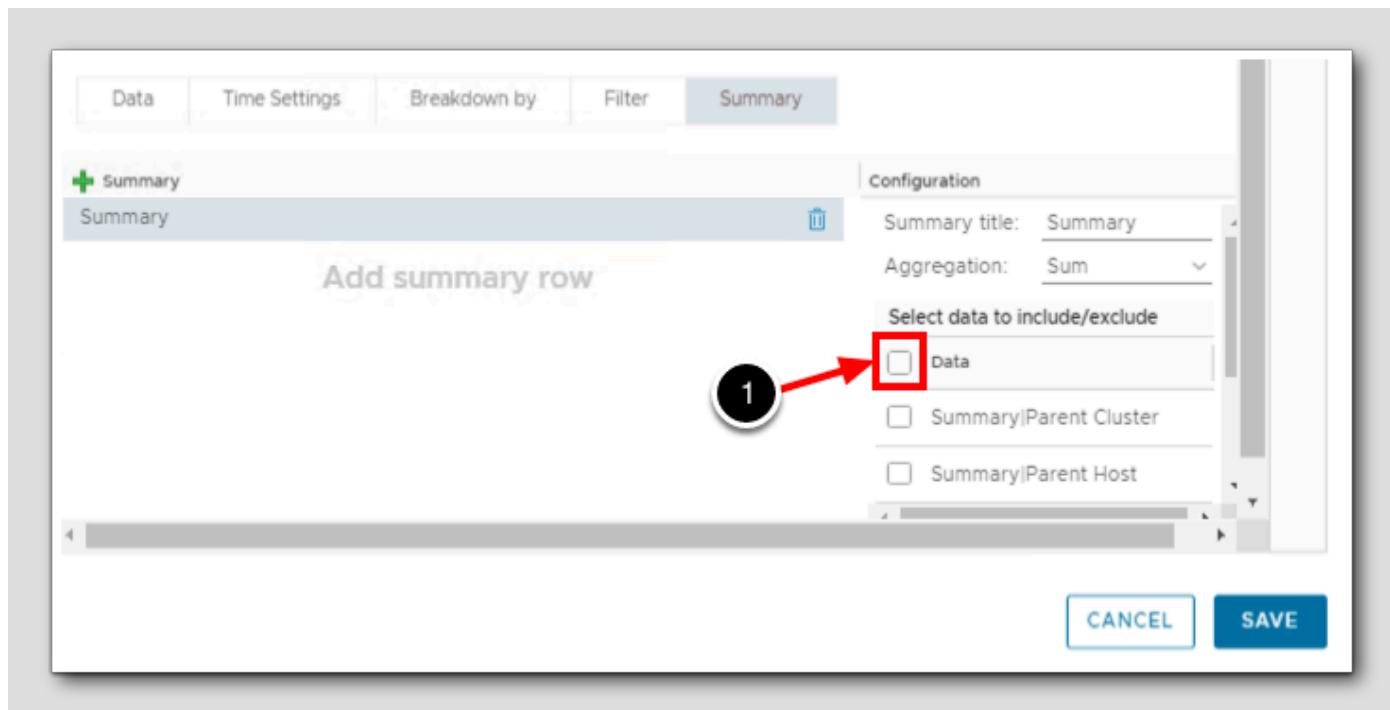


1. In the center of the screen, Click on Summary.
2. Click on the green plus sign to create a summary.

## Aggregation



1. Change aggregation to Sum by using the drop-down menu.
2. Click show advanced settings.

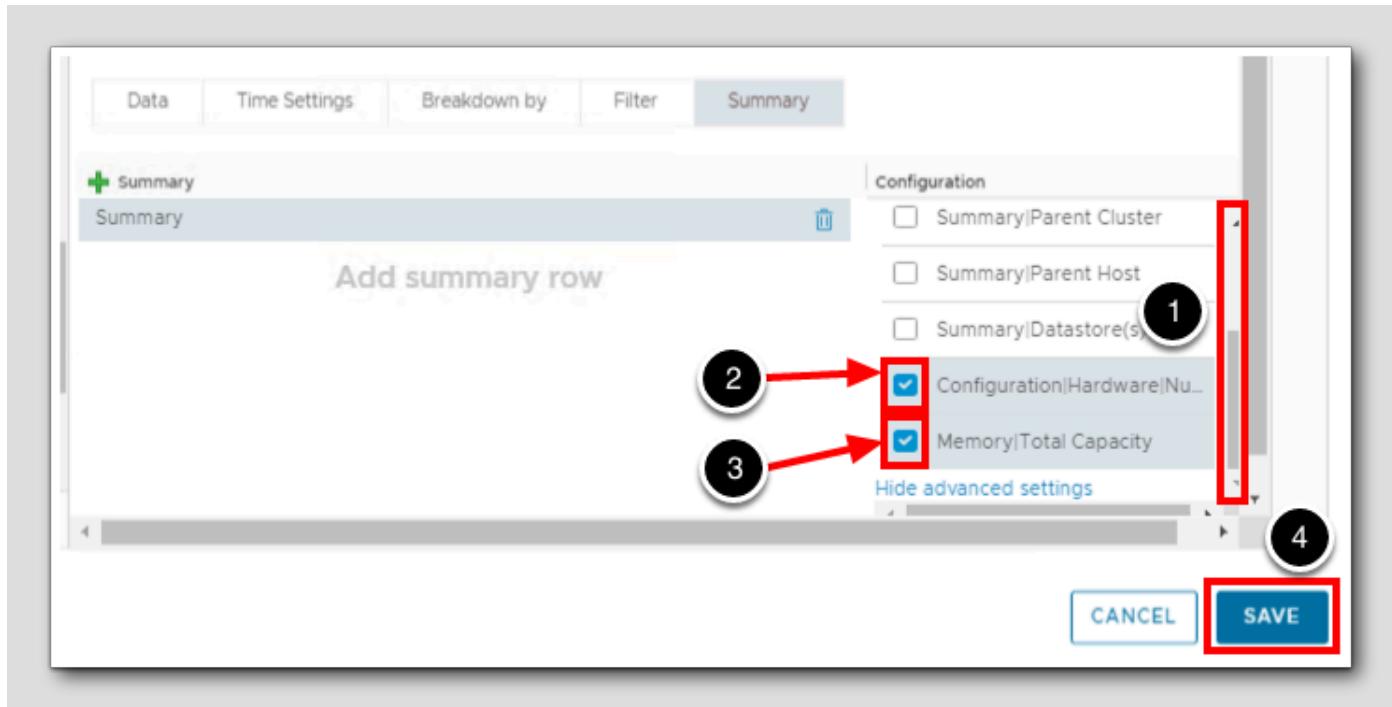
**Clear All**

1. Deselect all by clearing the check box next to Data.

Clicking the box will toggle 'Select all' and 'De-select All'.

Make sure your screen matches the image. Nothing should be selected at this point.

## Selected Sum



Scroll down to find the following:

1. Scroll down to find the following items.
2. Select Configuration|Hardware|Number of CPU(s) (vCPUs).
3. Select Memory|Total Capacity.
4. Click SAVE.

## Viewing the data

The screenshot shows the vRealize Operations Manager interface. At the top, there is a header with 'ADD' and '...' buttons. Below this is a table listing various views:

Name	Type	Description	Subject
... Datastore Utilization Summary	List	LIST OF all the Datastores with Average and Pe...	Datast...
... Datastore: Capacity	List	Lists the summary of different shared datasto...	Datast...
... Datastores with Wasted Disk Space	List	Following datastores have wasted disk space ...	Datast...
... DC cost List	List	Darwin	Datast...
<input checked="" type="checkbox"/> ... Demo - Simple List of VMs with Metrics and Pr...	List		Virtual
...			

Below the table, a section titled 'Demo - Simple List of VMs with Metrics and Properties' is displayed. It includes a toolbar with icons for refresh, search, and filters. A table lists the VM details:

Name	Summary Parent Cluster	Summary Parent Host	Summary Datastore(s)	Configuration Hardware ...	Memory Total Capacity
dev-project-control...	Workload 1	esx-04a.corp.local	RegionA01-ISCSI01-C...	2 vCPUs	4 GB
dev-project-workers...	Workload 1	esx-05a.corp.local	RegionA01-ISCSI01-C...	2 vCPUs	4 GB
identity-manager	Management	esx-02a.corp.local	local_esx-02a	6 vCPUs	10 GB
saltstack	Management	esx-02a.corp.local	local_esx-02a	8 vCPUs	16 GB
SupervisorControlPI...	Workload 1	esx-05a.corp.local	local_esx-05a	2 vCPUs	8 GB
...					

After clicking Save you will be in the view area again. The view we just created will be selected.

You should see the three properties and two metrics we selected. At this point, your view is created and saved.

## View the Sums

Demo - Simple List of VMs with Metrics and Properties

Name	Summary/Parent Cluster	Summary/Parent Host	Summary/Datastore(s)	Configuration/Hardware...	Memory/Total Capacity
vr-logininsight	Management	esx-02a.corp.local	local_esx-02a	4 vCPUs	8 GB
vr-operations	Management	esx-02a.corp.local	local_esx-02a	4 vCPUs	16 GB
vr-operations-cp	Management	esx-02a.corp.local	local_esx-02a	2 vCPUs	8 GB
windows-0602	Workload 1	esx-05a.corp.local	RegionA01-iSCSI01...	2 vCPUs	4 GB
windows2019	Management	esx-02a.corp.local	RegionA01-iSCSI01...	2 vCPUs	4 GB
<b>Summary</b>	-	-	-	<b>67 vCPUs</b>	<b>154.25 GB</b>

ALL FILTERS Quick filter (Name) 1 1 - 27 of 27 items

1. Scroll Down to the bottom of the results to see the summary for the total vCPUs and Total Memory.

The sum is for all the Virtual Machines contained in the view.

Because we used Virtual Machines as our subject matter, the view can be utilized for a single VM or anything that contains Virtual Machines like Hosts, Groups, Clusters, Datacenters, Applications, etc.

Feel free to navigate to a Host or any object that contains virtual machines to see the flexibility of a View.

## Lesson End

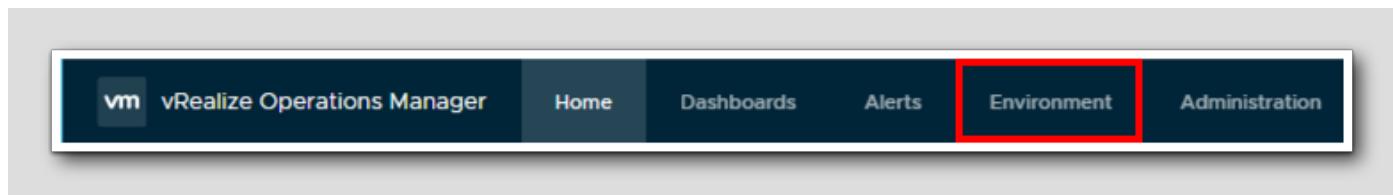
This completes the Simple View creation. In the next lesson, we will show how to create a view with variable data.

## Create a View with Variable Data

In this lesson, we are going to create a custom view. The view will concentrate on Virtual Machine data but can be applied to any resource collected in vRealize Operations.

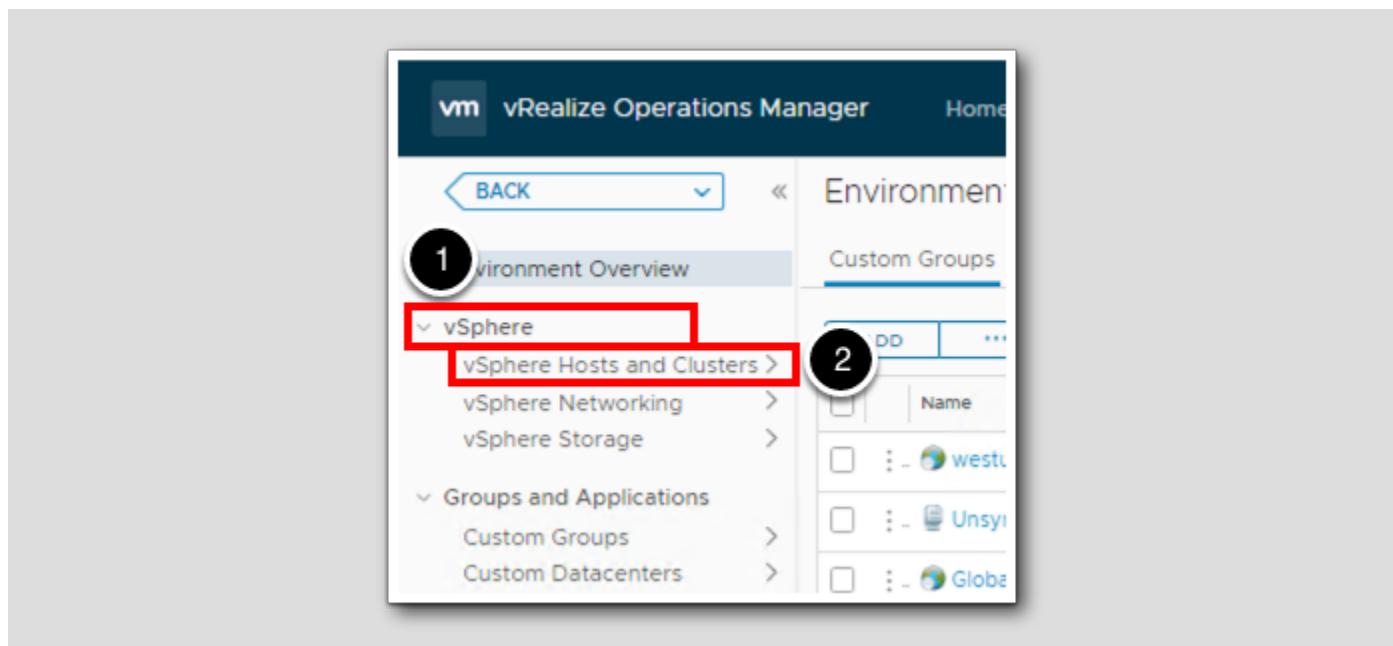
Views can be used within reports and dashboards. They also allow Users to see data within vRealize Operations.

## Go to Environment



1. Click on Environment.

## Hosts and Clusters



1. Expand vSphere Environment if needed.
2. Click on vSphere Hosts and clusters.

## Select a vCenter Server

The screenshot shows the vRealize Operations Manager interface. The top navigation bar includes Home, Dashboards, Alerts, Environment, and Administration. Below the navigation is a toolbar with BACK, ACTIONS, and various tabs like Summary, Alerts, Metrics, Capacity, Compliance, Logs, Events, and more... The main content area is titled "Private Cloud" and displays summary statistics:

Category	Value
Cluster	2
ESXi Host	5
Virtual Machine	23
Datastore	6
Version	7.0.2-17694817

Three numbered callouts point to specific elements: 1 points to the "vSphere World" node in the tree view; 2 points to the "Private Cloud" item under "vSphere World"; and 3 points to the "more..." button in the toolbar.

1. Expand vSphere World.
2. Select vCenter Server Private Cloud.
3. Click on more...

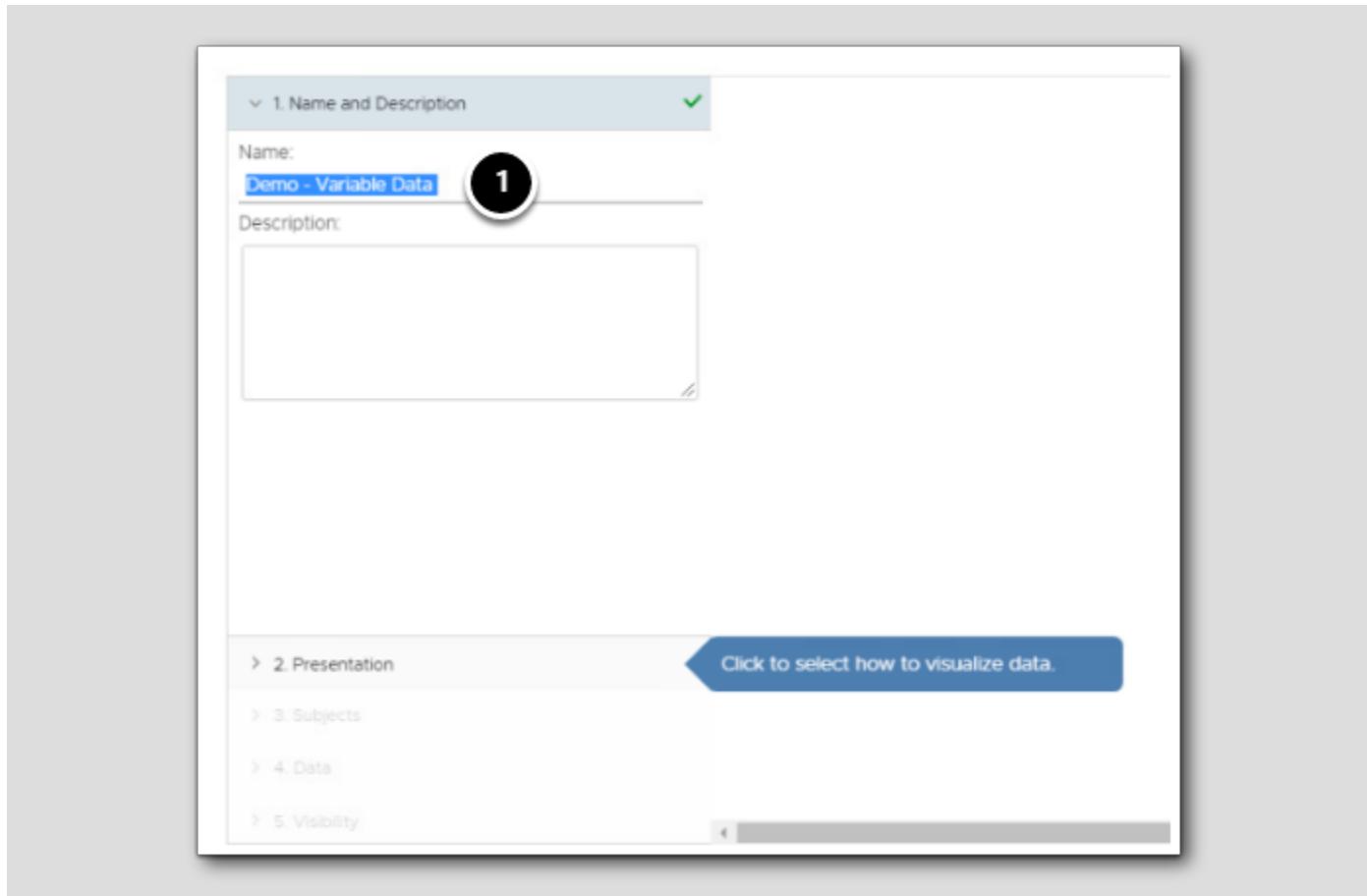
## Create a View

The screenshot shows the 'Private Cloud' view in the vRealize Operations Management Cloud interface. The 'Details' tab is highlighted with a red box and a circled '1'. The 'ADD' button in the top-left corner of the list area is also highlighted with a red box and a circled '2'. The list below shows two items: 'Admission Control Enabled?' (Type: Distribution) and 'Alerts that are currently active' (Type: List). The 'Description' column for the first item indicates it shows vSphere Cluster Admission Control Enabled.

	Name	Type	Description
<input type="checkbox"/>	Admission Control Enabled?	Distribution	vSphere Cluster Admission Control Enabled
<input type="checkbox"/>	Alerts that are currently active	List	Show alerts for the selected object and its children

1. Click on Details.
2. Click the ADD to create a new view.

## View Name

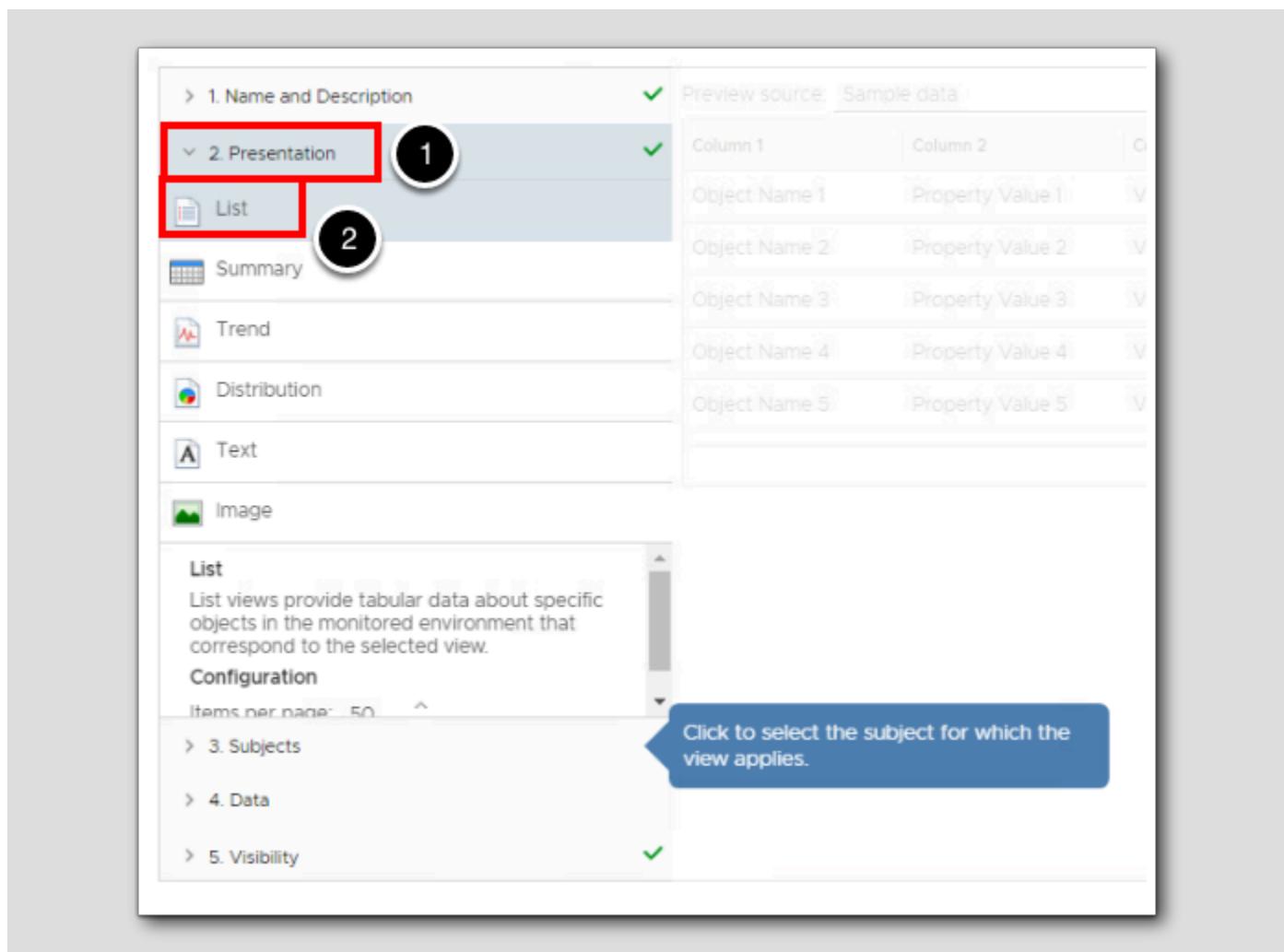


Create a view with the following data:

Section 1. Name

1. Enter Demo - Variable Data.

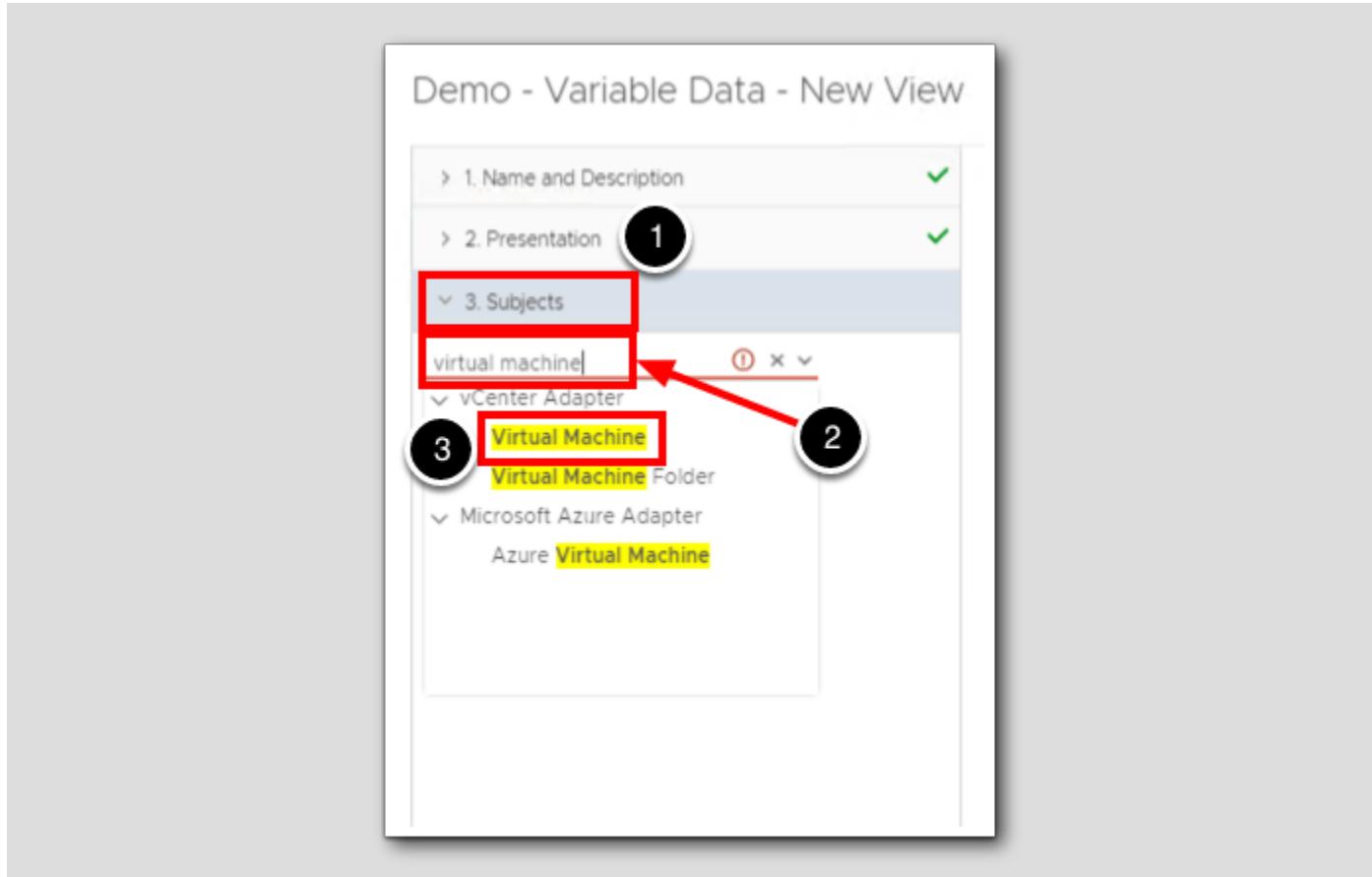
## View Presentation



1. Click on 2. Presentation.

2. Click on List.

## Subjects - Virtual Machine



1. Click on 3. Subjects.
2. Begin typing virtual machine (Start typing virtual and the list will show available resources that match).
3. Click on Virtual Machine.

## Data Metrics

The screenshot shows the 'Data Metrics' interface. On the left, there's a sidebar with a red box around '4. Data' (step 1) and a red circle with '2' over the 'CPU' section (step 2). A red arrow points from step 3 to the 'Demand (%)' item in the list. Another red arrow points from step 4 to the same item again. The main panel on the right shows a table with five rows of sample data and a 'Transformation' section with two entries, both highlighted with a red box (step 4). A tooltip says 'Drag the data to include in the view.'

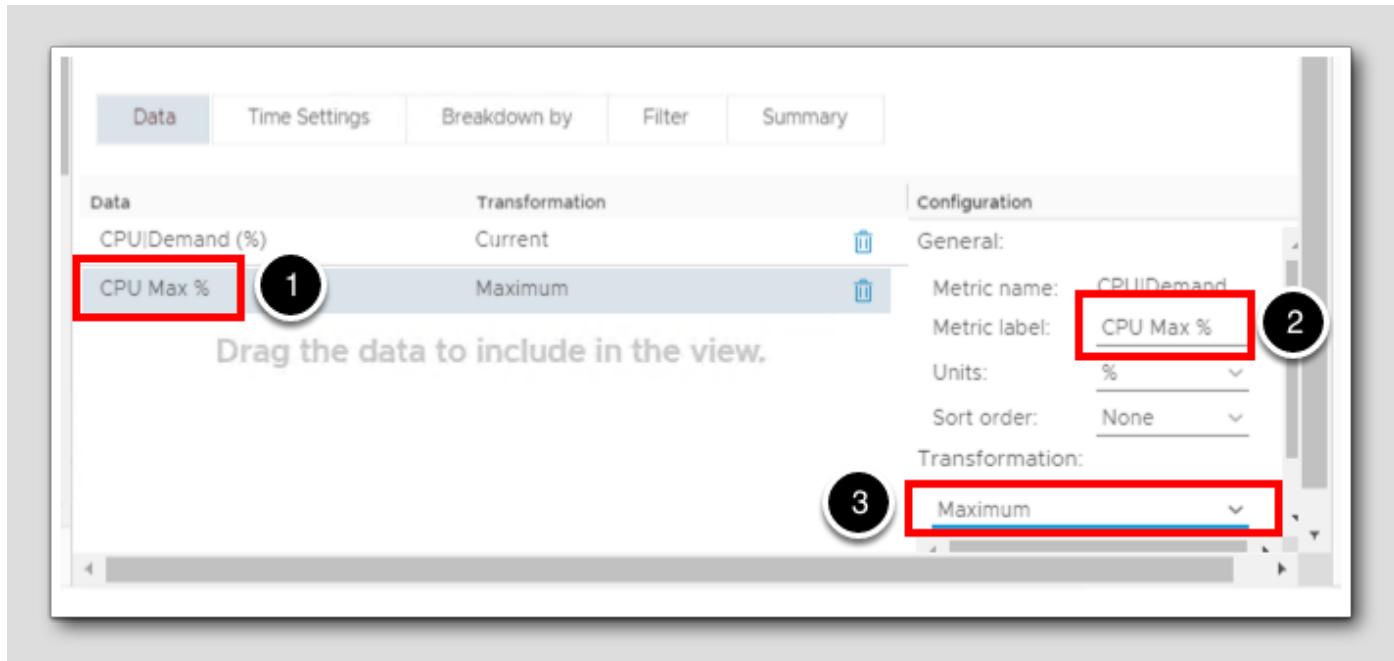
Object Name 2	Property Value 2	Value 2
Object Name 3	Property Value 3	Value 3
Object Name 4	Property Value 4	Value 4
Object Name 5	Property Value 5	Value 5

Data	Transformation
CPU Demand (%)	Current
CPU Demand (%)	Current

Drag the data to include in the view.

1. Click on 4. Data.
2. Expand CPU by clicking on the chevron to the left of CPU.
3. Double-Click Demand (%).
4. Double-Click Demand (%) again (It will be in the list on the right two times).

## Metric Transformation



1. After Demand (%) is in the list a second time, select the second instance with a single click.

◦ The screenshot was taken after the changes were made to the Metric label. The Data column will reflect what you type into the Metric label.

2. For Metric label: Enter "CPU Max %" (This will be our column header name in the final view).

3. For Transformation, Select Maximum in the drop down list.

Note: You may need to manipulate the screen by scrolling down in the configuration area.

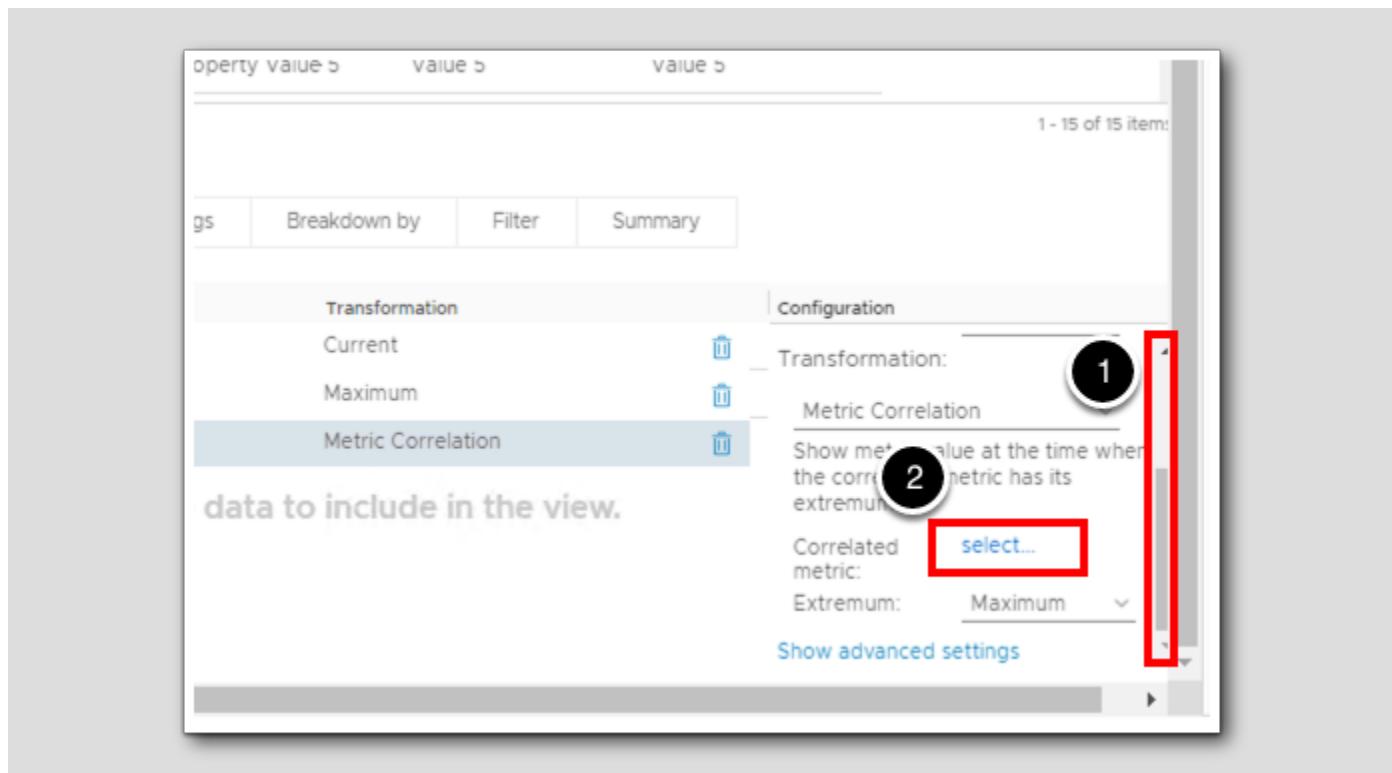
## CPU Ready

The screenshot shows the 'Metrics' configuration interface. On the left, a list of metrics is displayed, with 'Ready (%)' highlighted by a red box and circled with a number 1. In the center, a table shows the current configuration for the 'CPUReady (%)' metric. The 'Transformation' dropdown is set to 'Metric Correlation', which is also highlighted by a red box and circled with a number 2. The table includes columns for Data, Transformation, and Configuration.

Data	Transformation	Configuration
CPU Demand (%)	Current	Metric name: CPUReady (%) Metric label: CPUReady (%) Units: % Sort order: None
CPU Max %	Maximum	
<b>CPUReady (%)</b>	<b>Metric Correlation</b>	

1. Put Ready (%) into the data window with a double-click (or drag and drop). NOTE: You may need to scroll down a little to see the "Ready (%)" item.
2. Change Transformation to Metric Correlation in the drop down list.

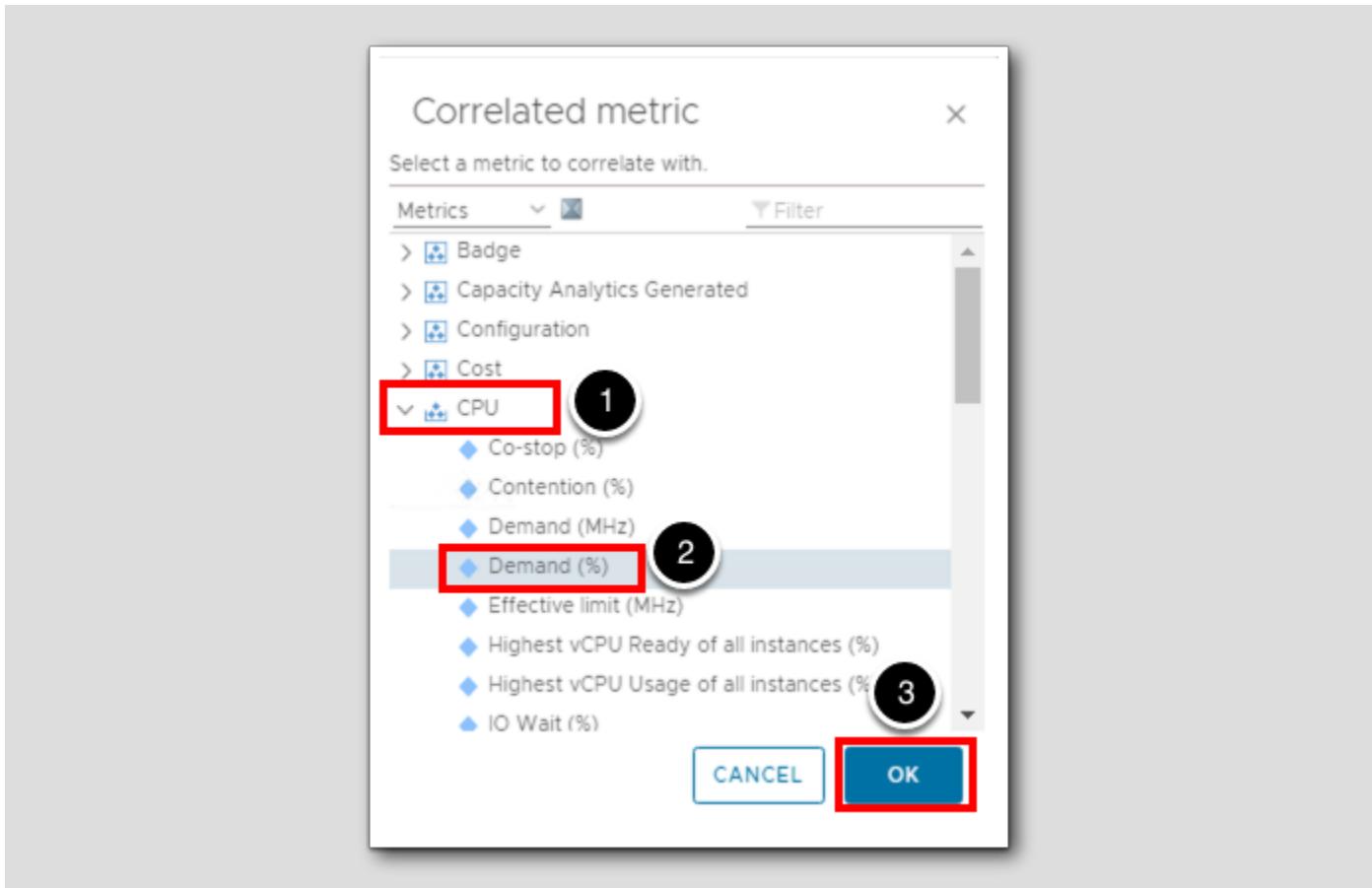
## Correlation



You may have to scroll down to see the metric correlation area. There will be a link to select the correlated metric.

1. Scroll down in this Configuration window so you can see the **Correlated Metric Item**.
2. Click **select...** beside Correlated Metric.

## Correlated Metric

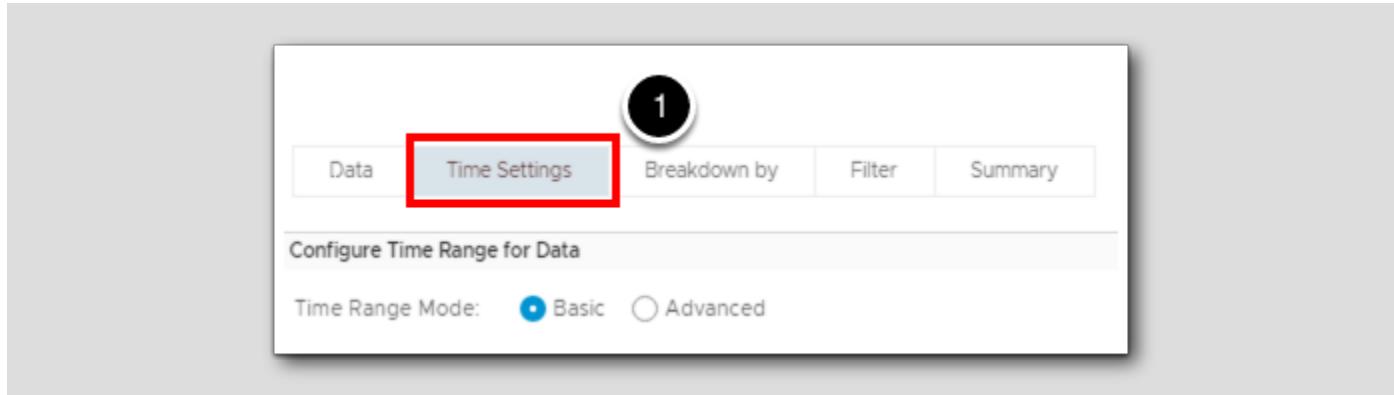


In the pop-up window:

1. Expand CPU
2. Select Demand (%)
3. Click OK

With this correlation, we are going to see the value of CPU Ready (%) when the CPU Demand (%) is at a maximum.

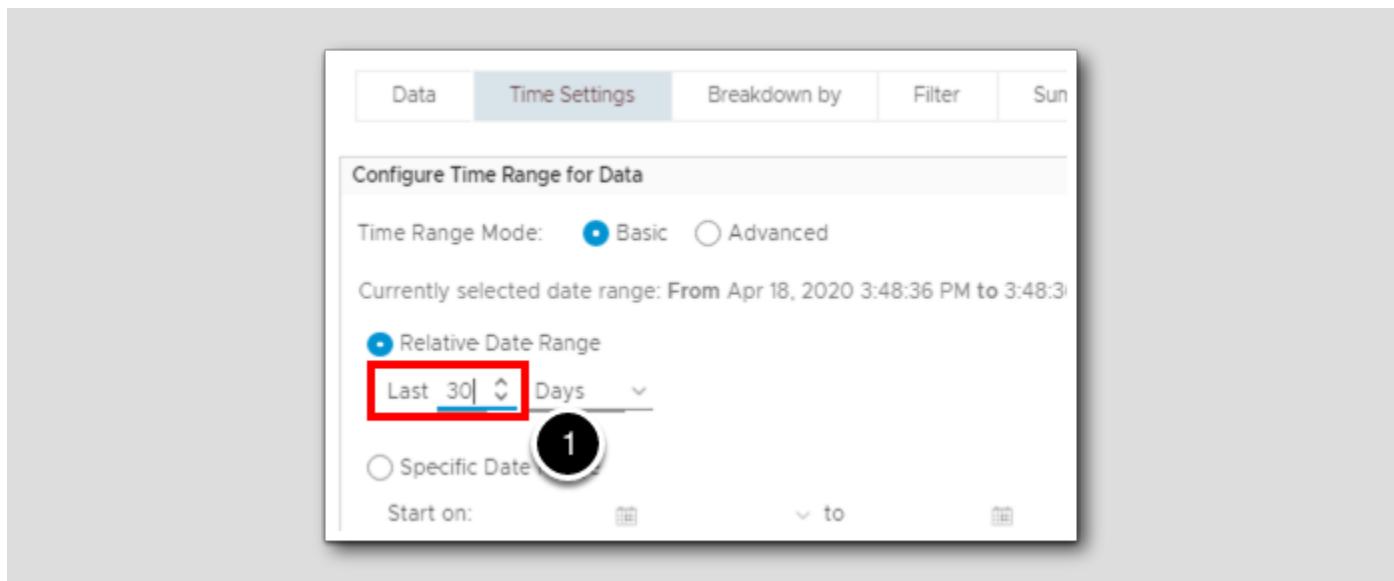
## Time Settings



In the center of the screen:

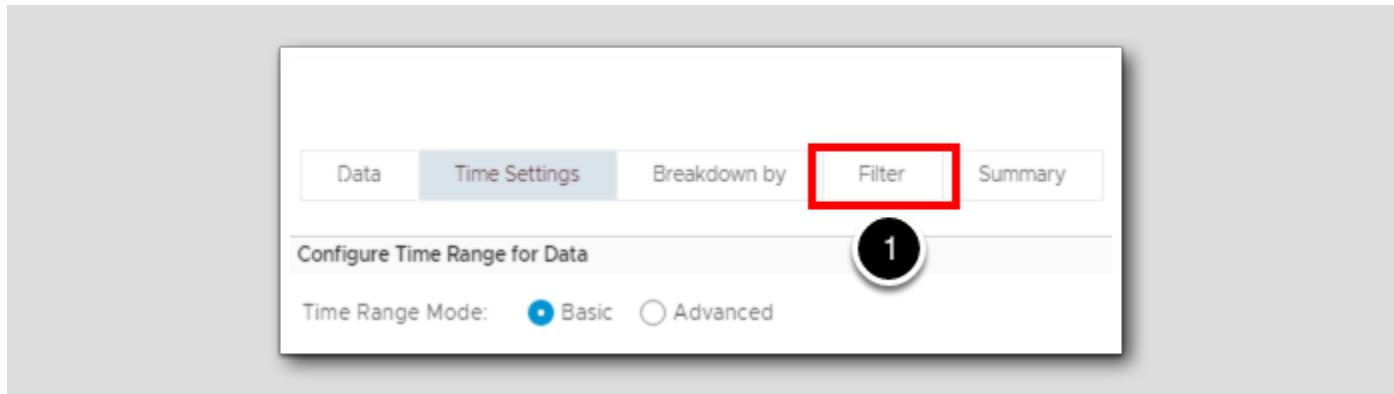
1. Click on Time Settings.

## Number of Days



1. Set the Relative Date Range to the Last 30 Days.

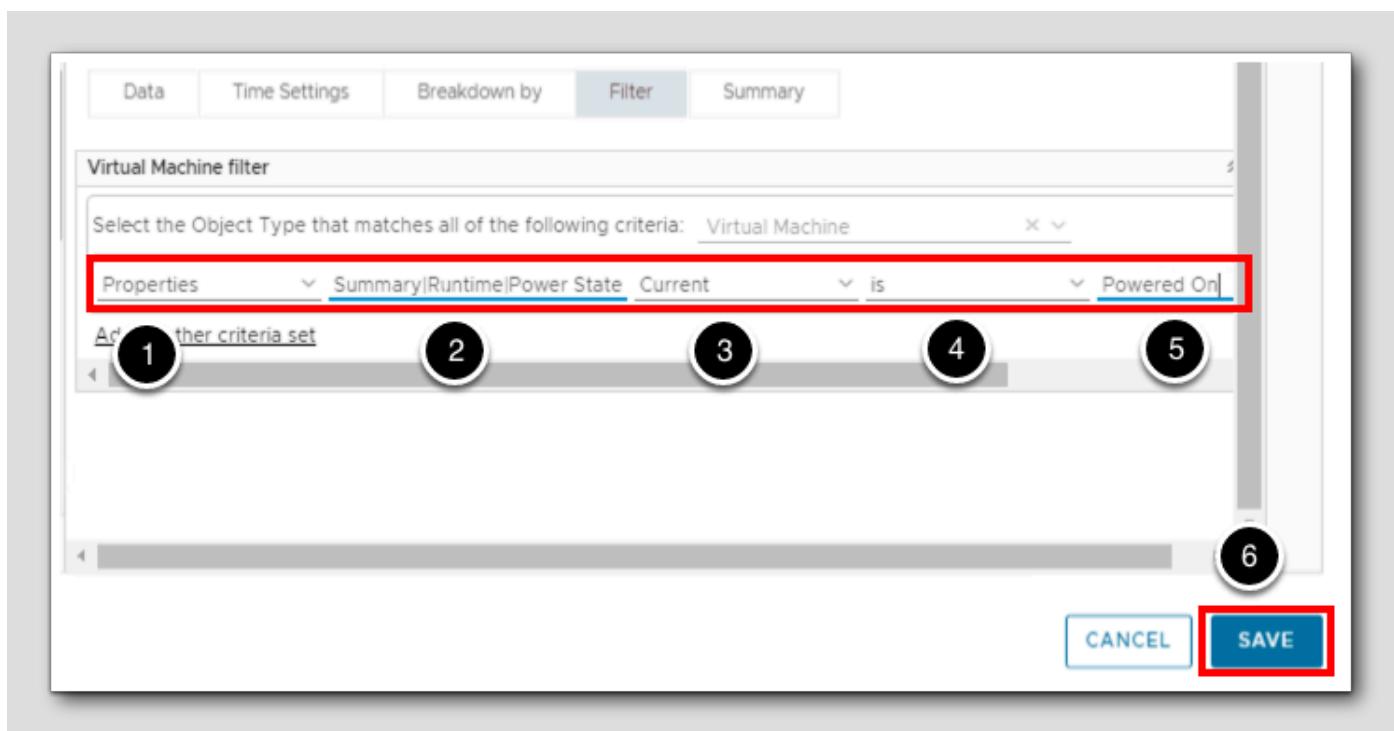
## Date Range



In the center of the screen:

1. Click on **Filter** to create a virtual machine filter.

## Filter



Switch from Metrics to Properties using the drop down lists for all of these properties.

1. Select **Properties**

2. In this dropdown, Expand **Summary**, under **Summary** expand **Runtime**, then Double-click 'Power State'.

3. Select **Current**.

4. Select: is

- Use the tab key to move into the property value field. You should see the available options of **Powered On** and **Powered Off**.

5. Select: **Powered On** from Property Value Menu.

6. Click **SAVE**.

## View Results

The screenshot shows the vRealize Operations Management interface with the 'Views' tab selected. A list of views is shown, with 'Demo - Variable Data' selected. Below the list, a detailed table displays CPU metrics for several virtual machines.

Name	CPU Demand (%)	CPU Max %	CPU Ready (%) (at CPU)...
dev-project-control...	59.79 %	98.49 %	19.23 %
dev-project-workers...	9.93 %	63.19 %	5.99 %
identity-manager	8.06 %	72.38 %	16.65 %
saltstack	4.56 %	52.9 %	9.14 %
SupervisorControlPI...	83.93 %	106.3 %	4.19 %

We now have a view that shows us the last CPU Demand collected for each Powered ON Virtual Machine. We also show the Maximum CPU Demand as a percentage for the last 30 days. The last value in our view shows us what the Ready % was when the demand was at maximum during the same 30 day period.

This is a very powerful feature of the product. While we are showing the ready % when the CPU is highly demanded, you may wish to see what disk latency looks like when network transmissions are high. You can correlate any two metrics that are being collected in vRealize Operations.

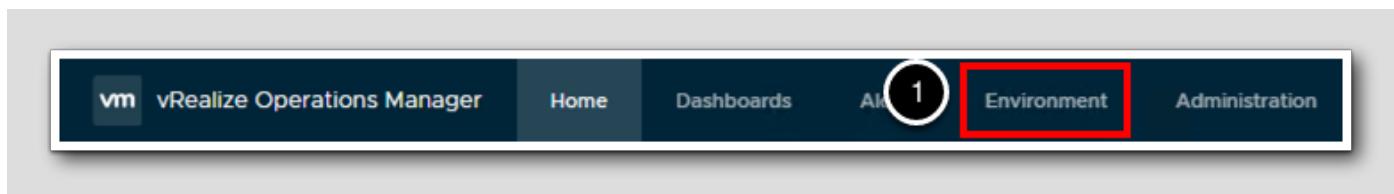
## Lesson End

This completes this lesson. In the next lesson, we will create a view with trended data.

## Create a View with Trends

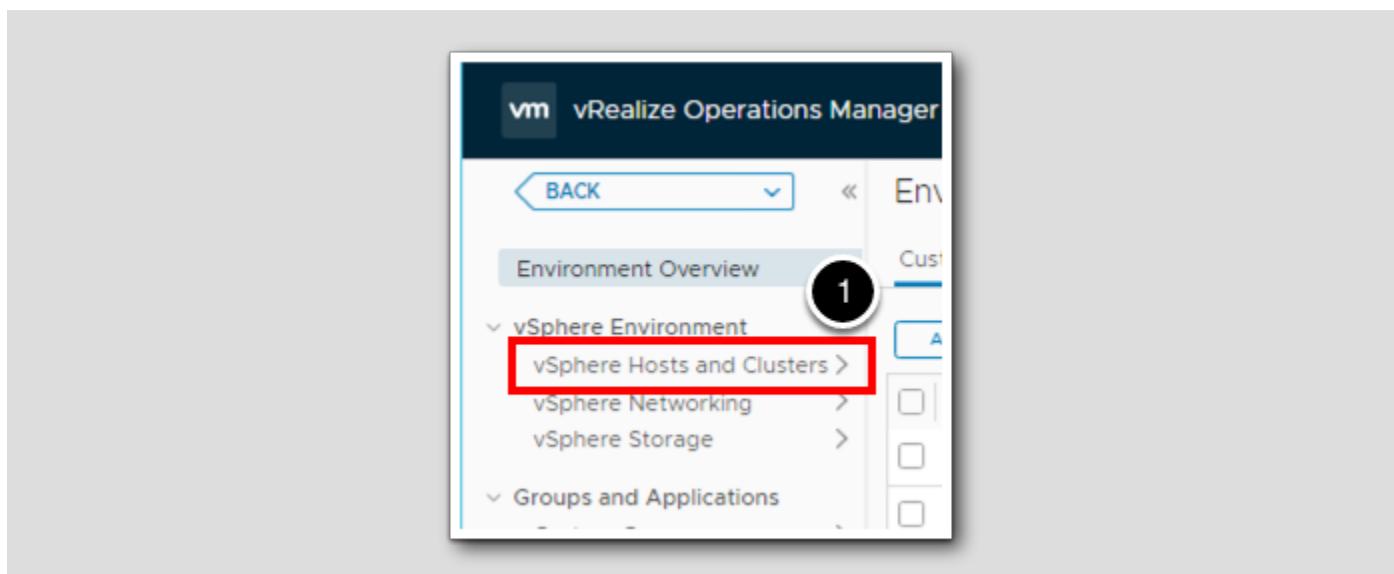
In this lesson, we continue the concept of creating custom views. This time, we will create a view with data that is trended over a period of time.

### Go to Environment



1. Click on Environment.

### Hosts and Clusters



1. Click on vSphere Hosts and Clusters.

## Select a vCenter Server

The screenshot shows the vRealize Operations Manager interface. The top navigation bar includes Home, Dashboards, Alerts (with a red dot), Environment (selected), and Administration. Below the navigation is a breadcrumb trail: BACK > Private Cloud. The main content area is titled "Private Cloud" and has tabs for Summary (selected), Alerts, Metrics, Capacity, Compliance, Logs, Events, and more... (highlighted with a red box). A sidebar on the left shows "Sphere Hosts and Clusters" with a dropdown menu expanded to show "vSphere World" and "Private Cloud" (also highlighted with a red box). Numbered callouts indicate the steps: 1 points to the "vSphere World" item, 2 points to the "Private Cloud" item, and 3 points to the "more..." link.

1. Expand vSphere World.
2. Select vCenter Server Private Cloud.
3. Click on more...

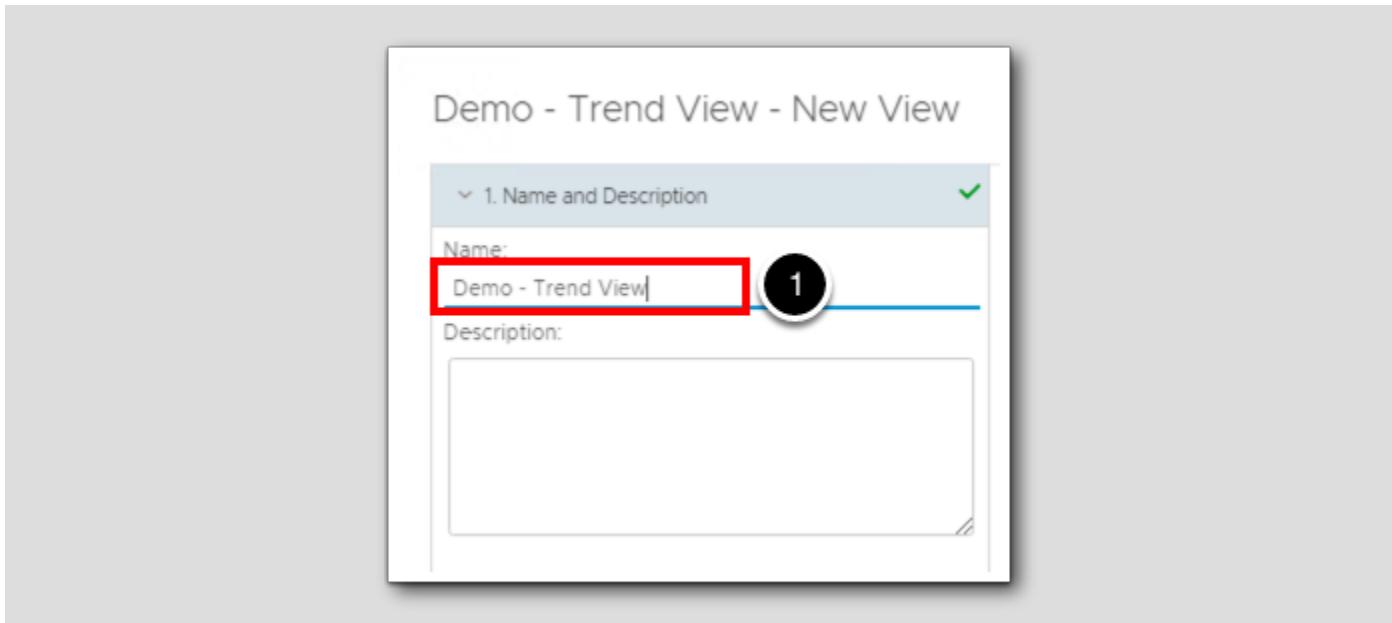
## Create a View

The screenshot shows the 'Private Cloud' view in vRealize Operations. The 'Details' tab is highlighted with a red box and a circled '1'. Below it, the 'View' tab is also highlighted with a circled '2'. The 'ADD' button is highlighted with a red box. A table below lists various views, with the first item checked.

	Name	Type	Description
<input checked="" type="checkbox"/>	Admission Control Enabled?	Distribution	vSphere Cluster Admission Co
<input type="checkbox"/>	Alerts that are currently active	List	Show alerts for the selected o
<input type="checkbox"/>	Availability   Cluster	List	List of clusters and their availa

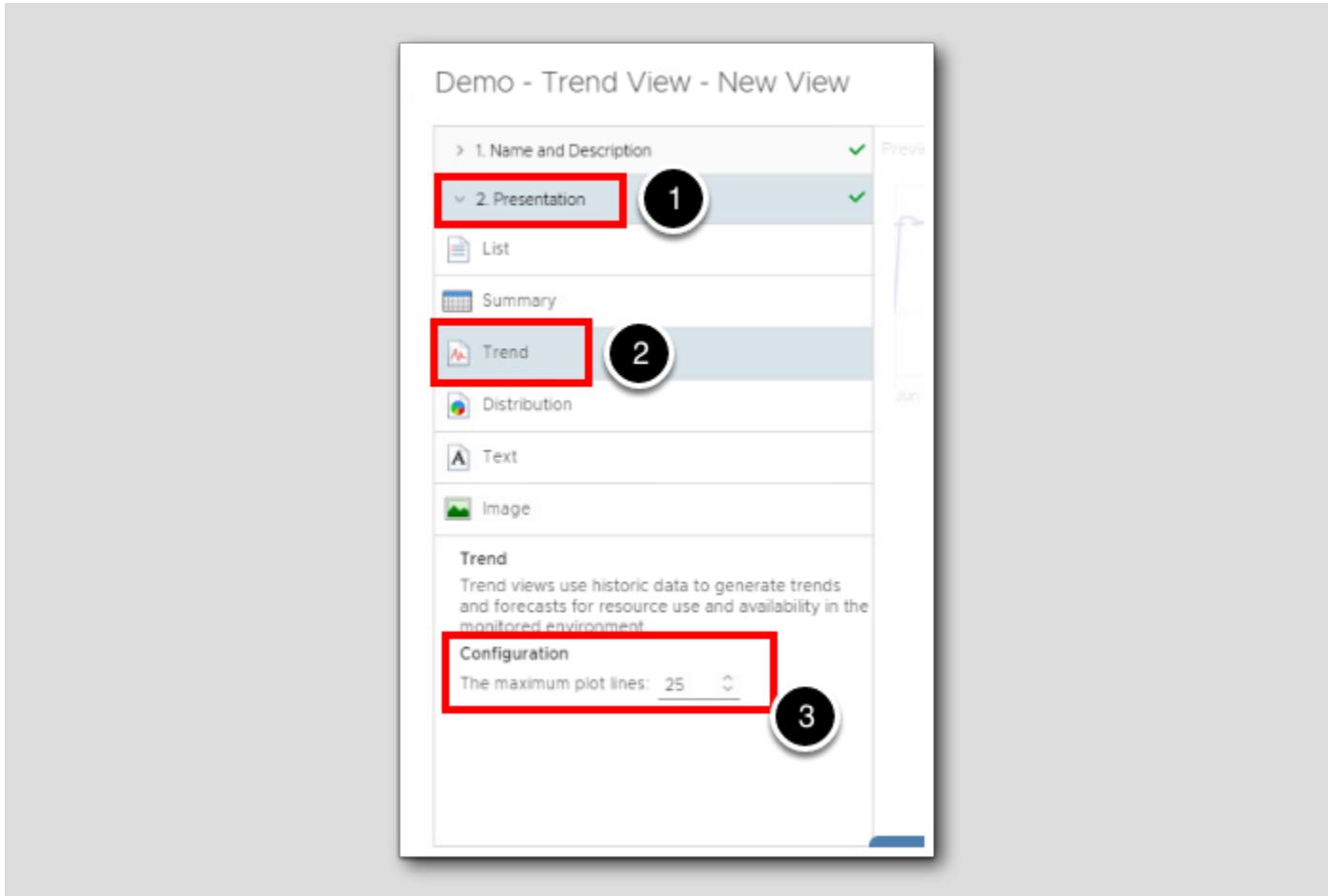
1. Click on Details.
2. Click ADD to create a new view.

## View Name



1. Enter the name: Demo - Trend View.

## Presentation Style



1. Click on 2. Presentation.

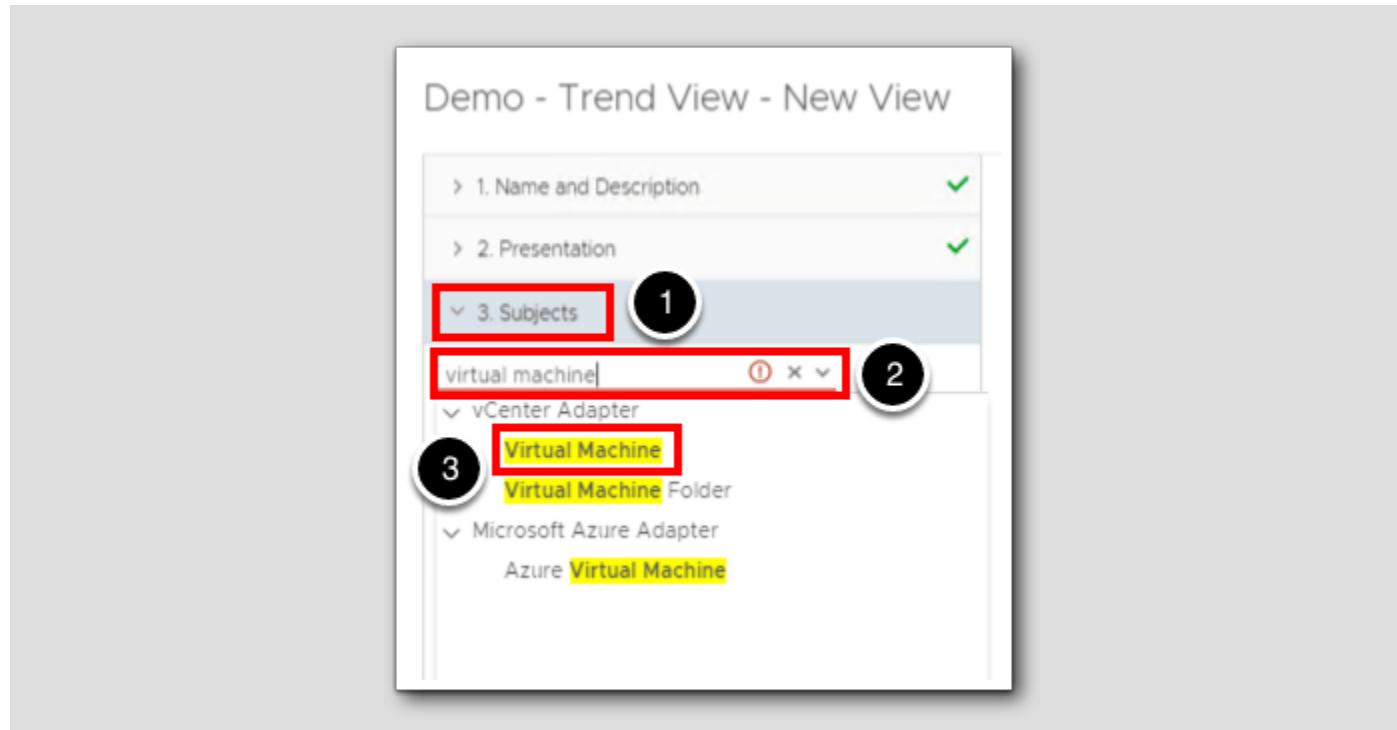
2. Select Trend.

3. When selecting a Trend presentation, notice the option to set The maximum plot lines. The default is 25.

- Since we are using Virtual Machines as our subject, If we select a cluster that has 25 or more virtual machines, the view we are creating will attempt to display 25 trend lines. It can be a crowded view. Be aware of that constraint when you are selecting the metrics to trend. You can always create multiple views to display different metrics trended.

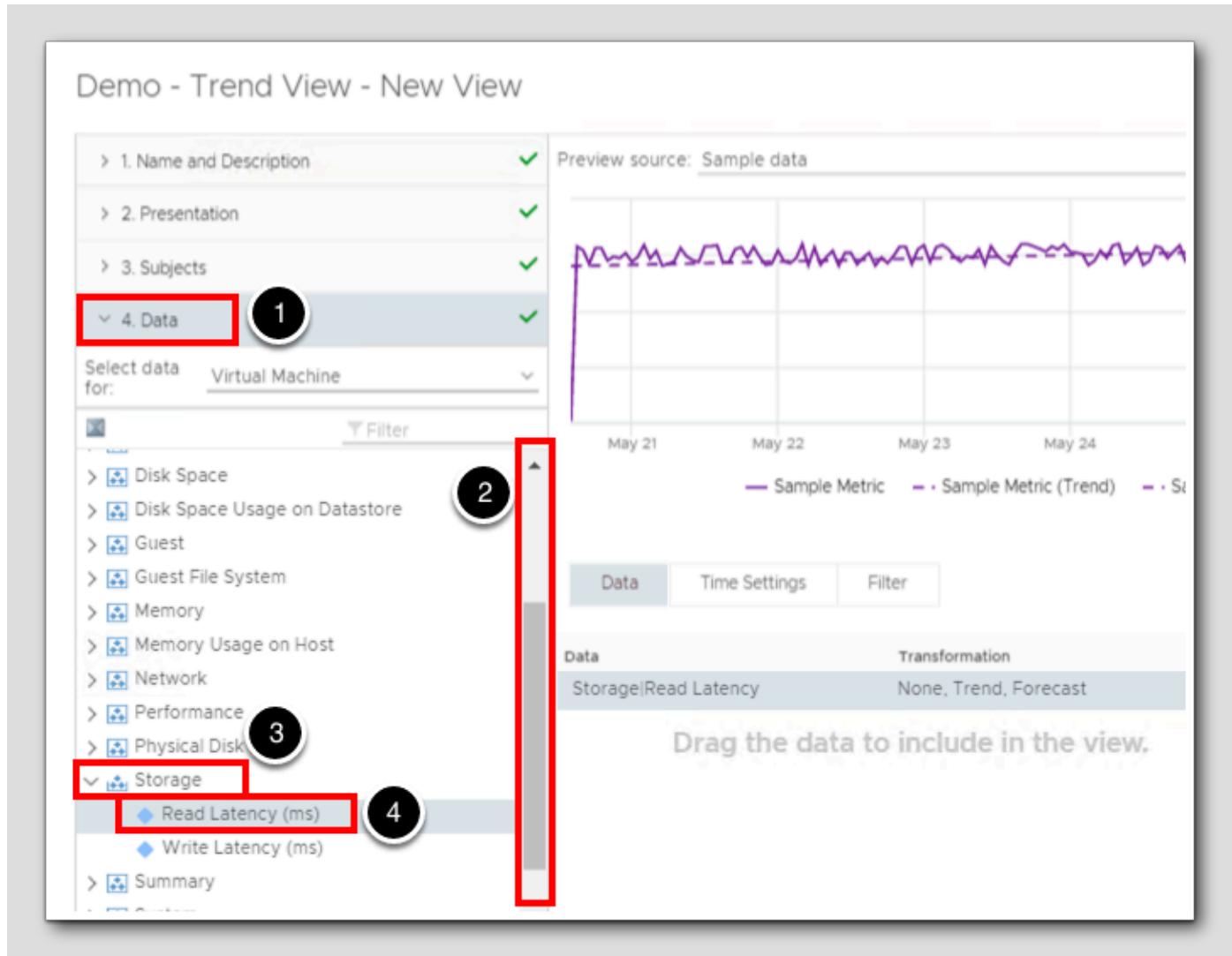
NOTE: Be aware that properties cannot be trended, only metrics.

## View Subjects



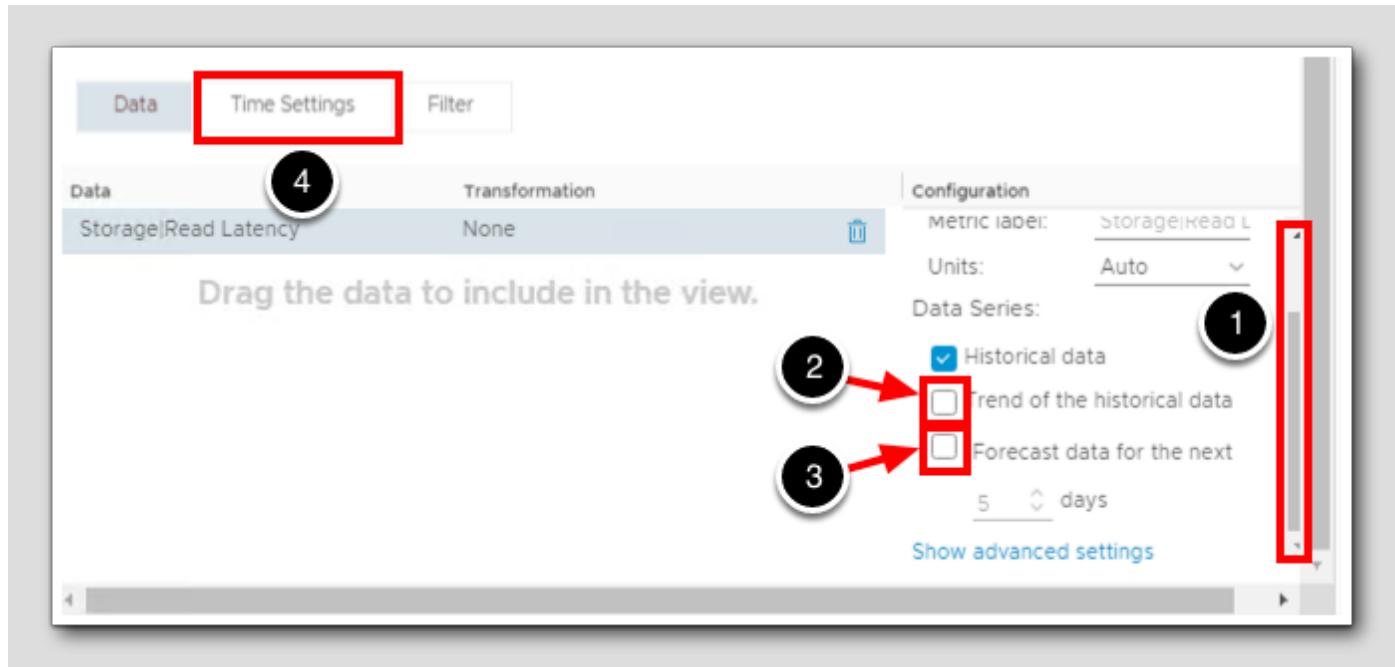
1. Click on 3. Subjects.
2. Type virtual machine in the search field and a filtered list will appear.
3. Click on Virtual Machine.

## View Data



1. Click on 4. Data.
2. Scroll down to the bottom of this page so you can see the Storage Item.
3. Expand Storage.
4. Double-click Read Latency (ms) (You may drag and drop the metric as well).

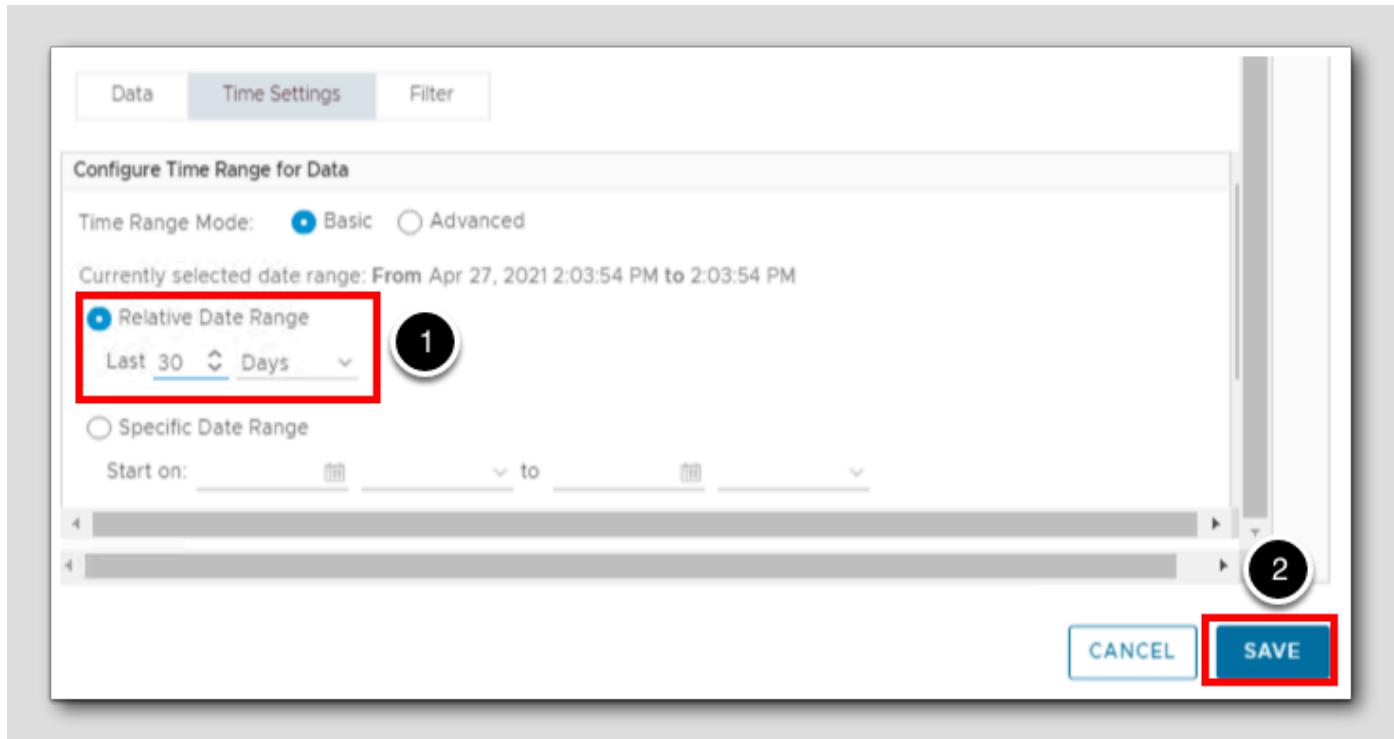
## Transform the Data



Once the metric is in the view, single-click on it and change the following:

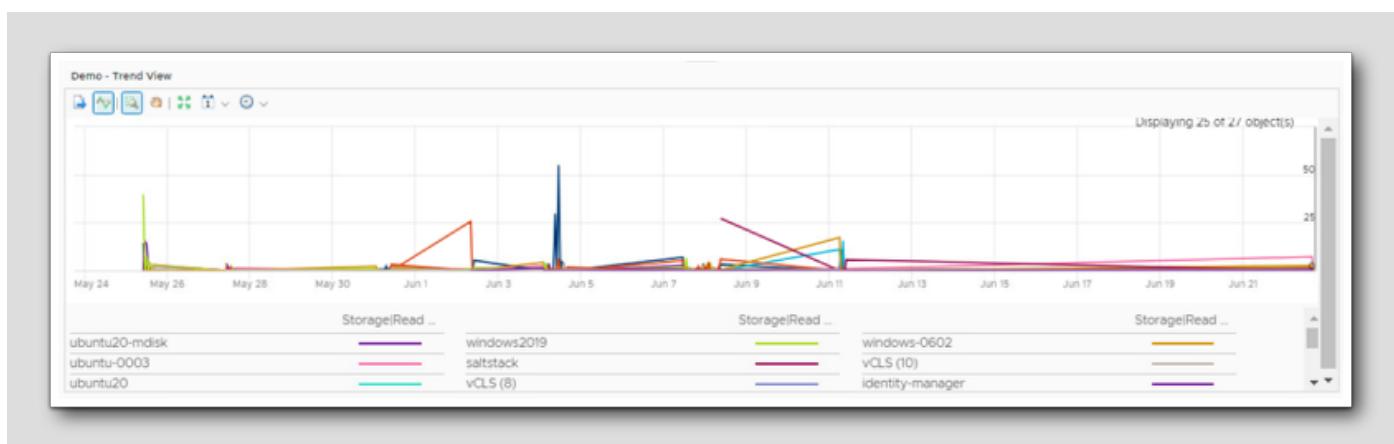
1. Scroll down the bottom of the Configuration window so we can see all the options.
2. Uncheck Trend of the historical data.
3. Uncheck Forecast data for the next.
4. In the center of the window, click on Time Settings.

## Time Range



1. Change the Relative Date Range to Last 30 Days.
2. Click SAVE.

## Summary



You now have a view that shows selected virtual machines read latency trended over the last 30 days. While we unchecked the forecast data option, leaving it checked would have trended the forecast of the selected metrics for up to a year.

## Lesson End

[122]

You have completed this lesson. The next lesson will show how to create a view with distribution data.

## Create a View that shows VM Growth

[123]

If you've completed the previous lessons in this module, we have created various views. In this lesson, we continue creating custom views with data transformation. With data transformation, we can represent the maximum value as well as expressions to show datacenter VM growth.

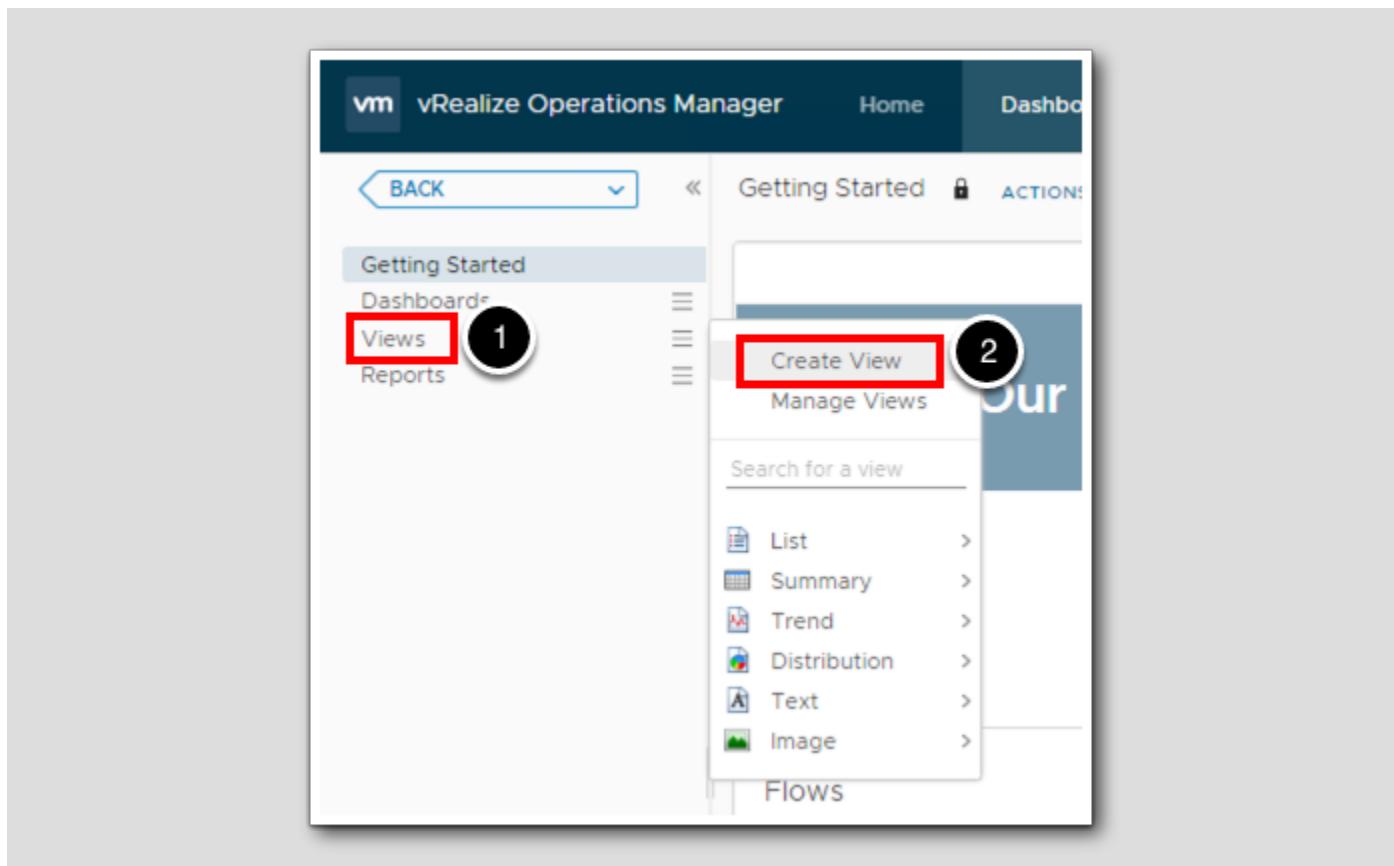
## Go to Dashboards

[124]



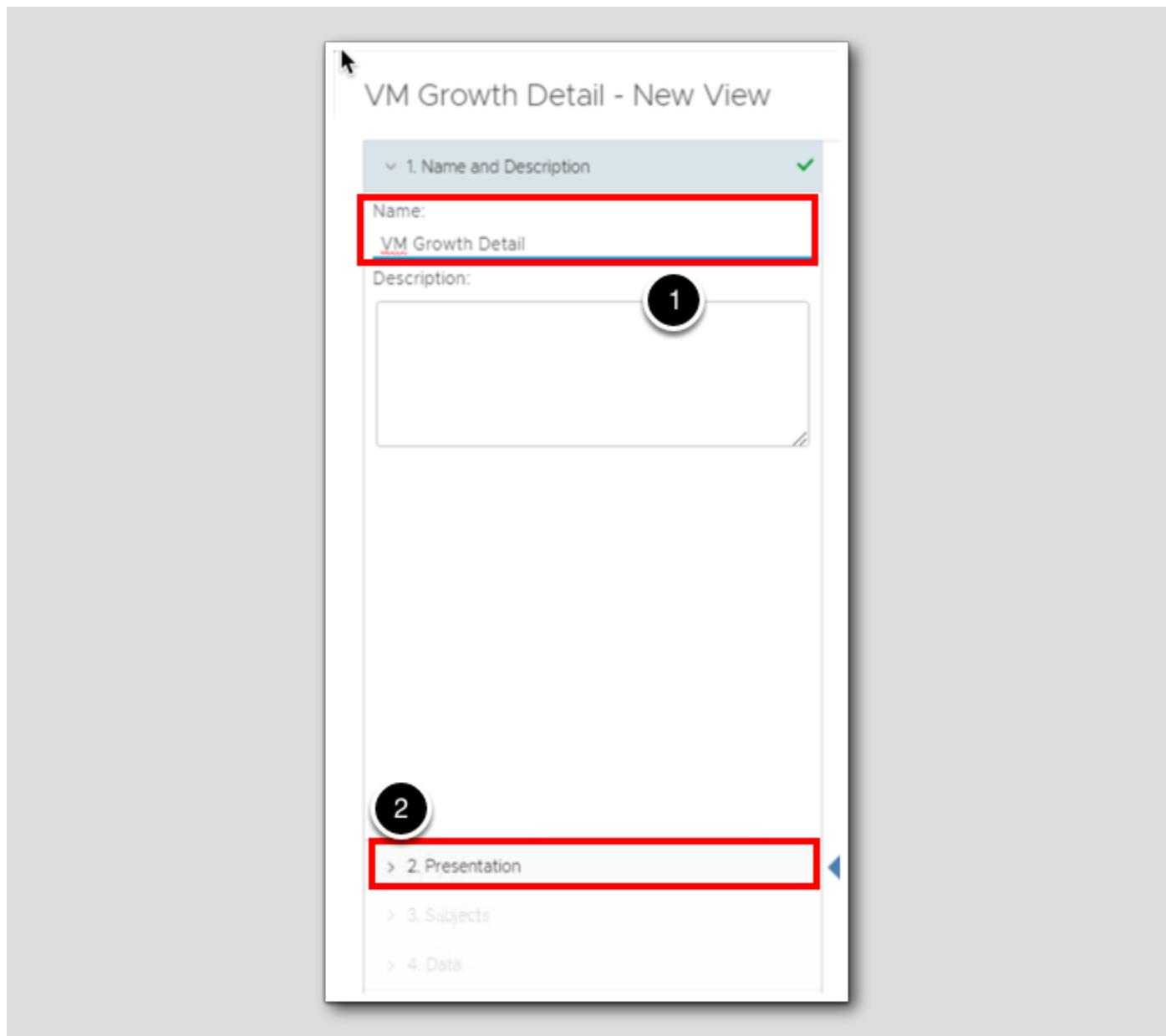
1. Select Dashboards.

## Go to Views



1. Click **Views**.
2. Then click **Create View** to create a new view.

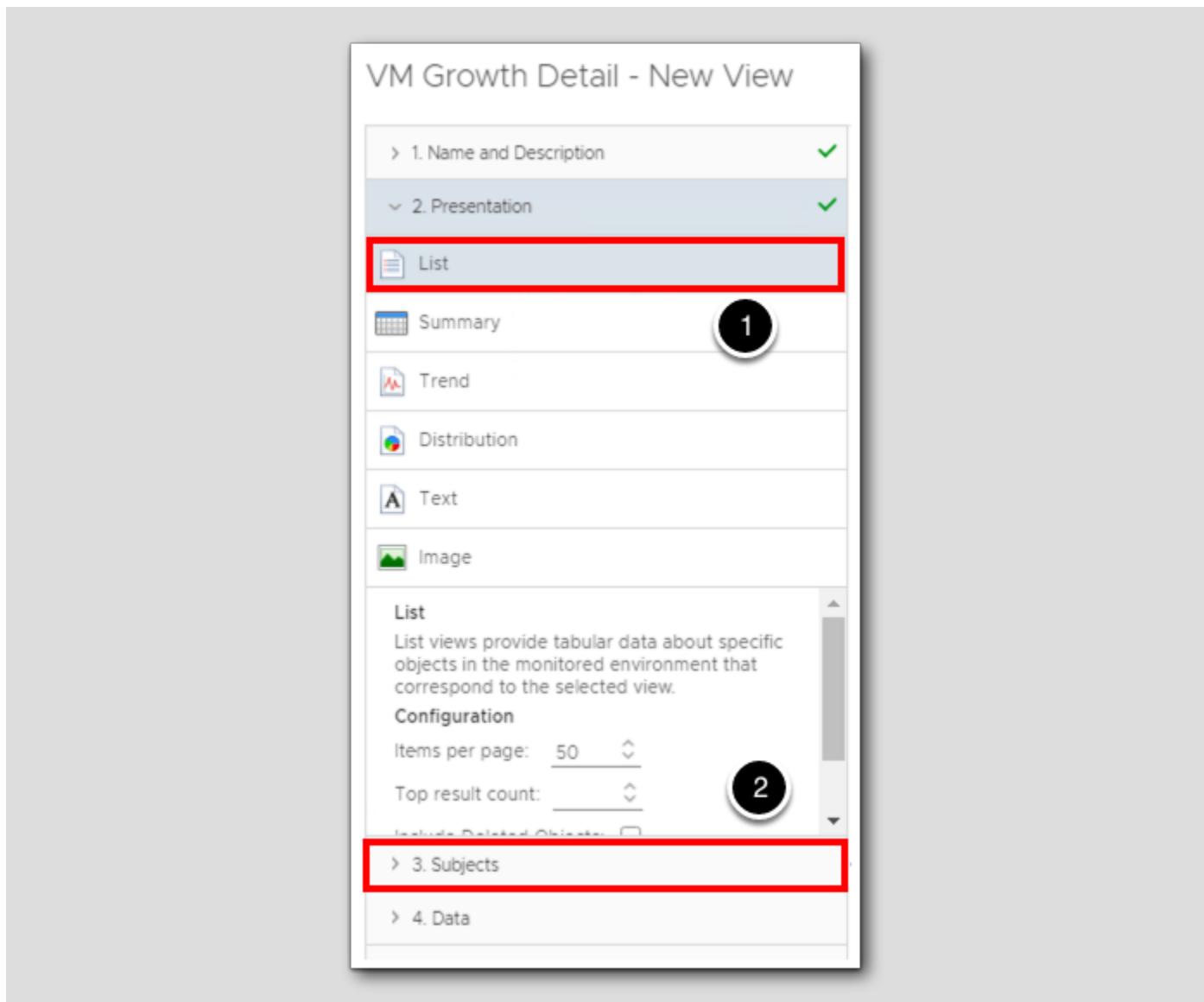
## Add View Name



1. Input the name: VM Growth Detail.

2. Select 2. Presentation.

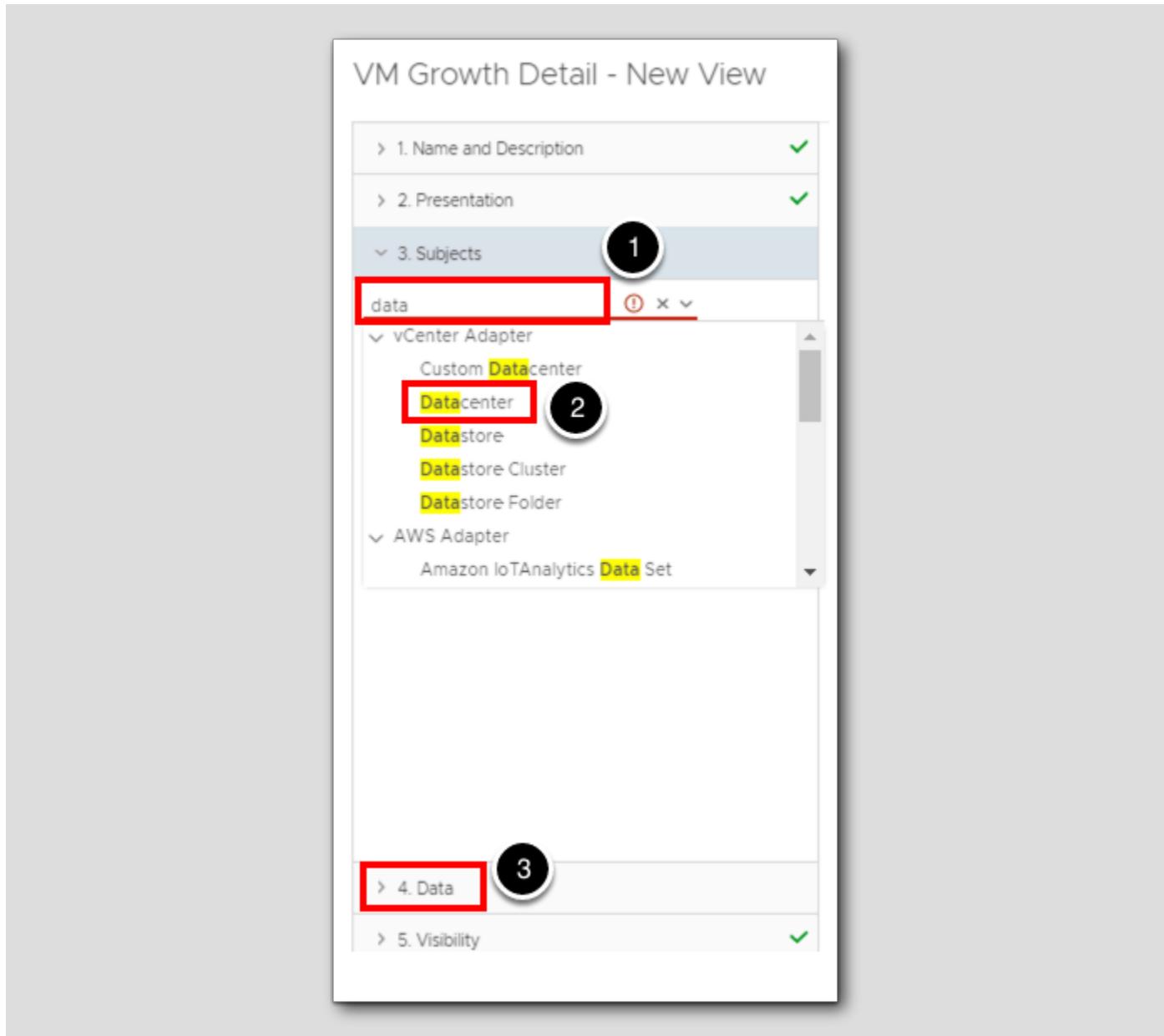
## Presentation Type



1. Select List as the presentation type.

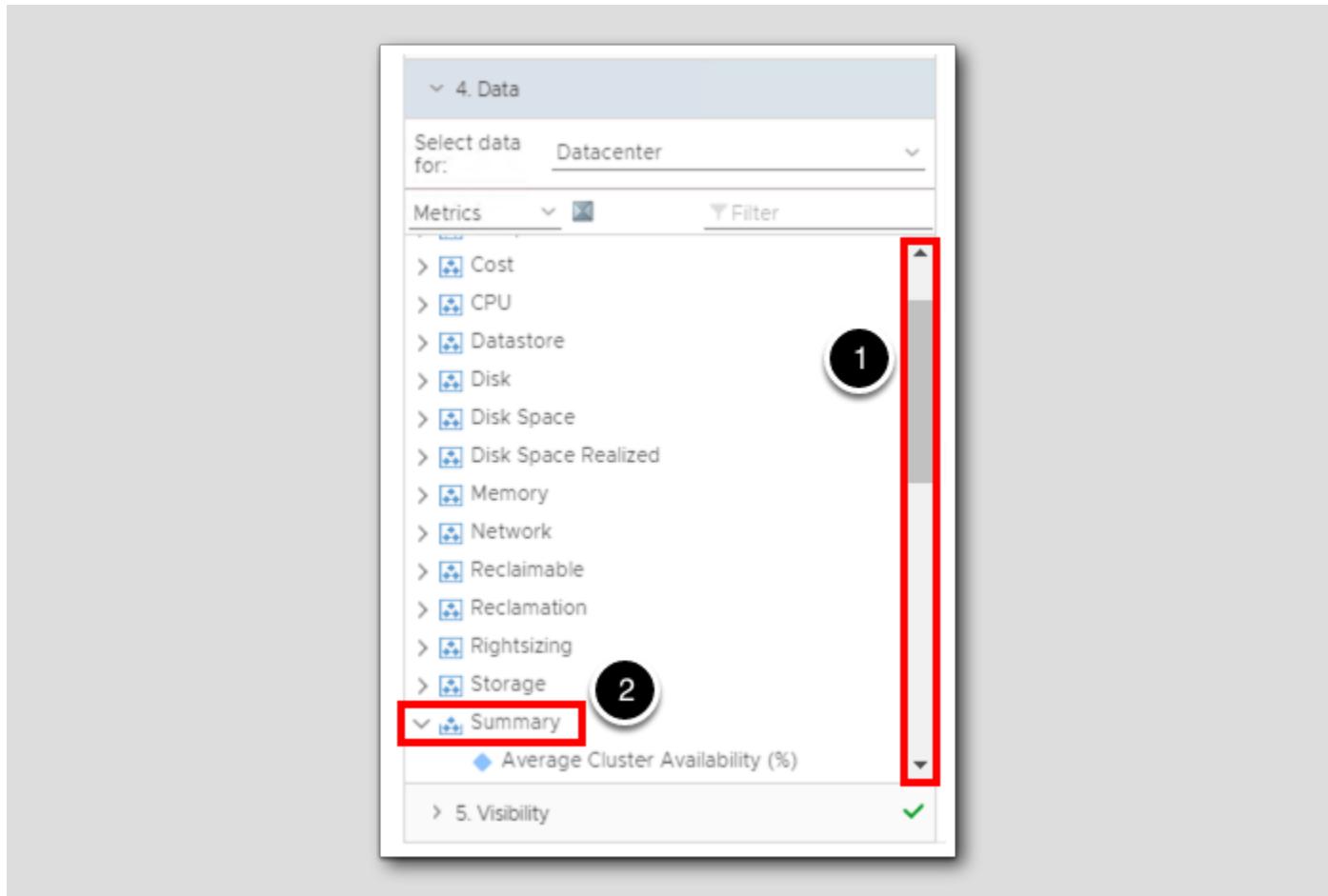
2. Select 3. Subjects.

## Add View Subject



1. Click in the subject input field and type "data".
2. Select the auto populated Datacenter.
3. Select 4. Data.

## Add Metrics to your View



1. Scroll Down to the bottom of the list list of Metrics so you can see Summary.
2. Open **Summary** by clicking on the chevron to the left of Summary.

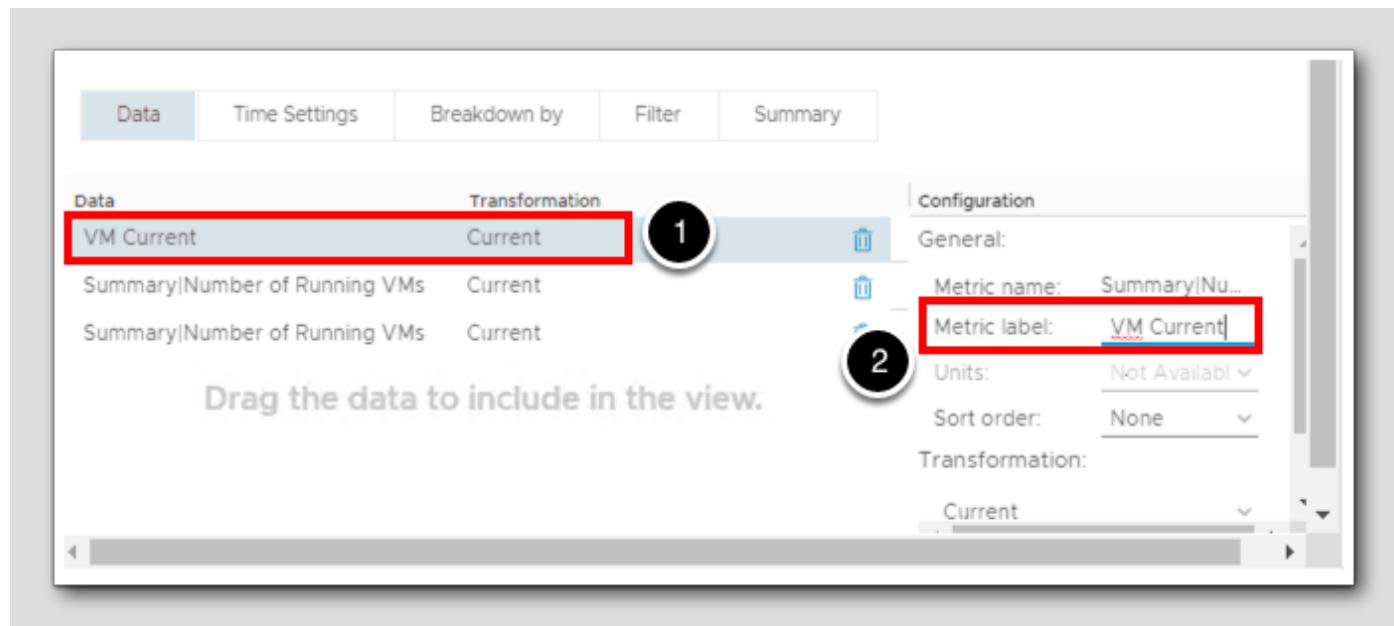
## Add Data to your View

The screenshot shows the 'Add Data to your View' configuration screen. On the left, a list of metrics is displayed, with 'Number of Running VMs' highlighted by a red box and circled with number 2. A scroll bar is visible next to the list. On the right, a table shows three rows of data being added, each also highlighted by a red box and circled with number 3. The table has columns for 'Data' and 'Transformation'. The first row contains 'Summary|Number of Running VMs' and 'Current'. The second row contains 'Summary|Number of Running VMs' and 'Current'. The third row contains 'Summary|Number of Running VMs' and 'Current'. A tooltip at the bottom right says 'Drag the data to include in the view.'

Data	Transformation
Summary Number of Running VMs	Current
Summary Number of Running VMs	Current
Summary Number of Running VMs	Current

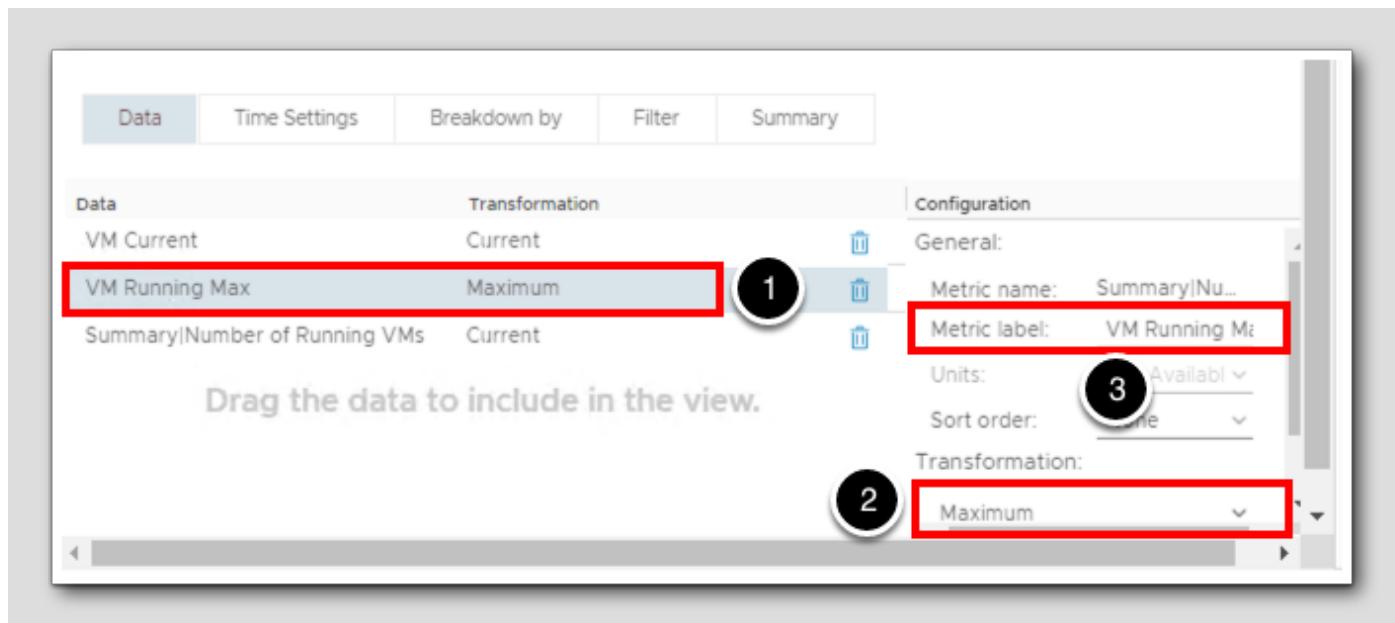
1. Scroll down to see the item Number of Running VMs.
2. Double-click Number of Running VMs 3 times.
3. Afterwards, you should see 3 items in the window on the right.

## Modify Current Number of VMs



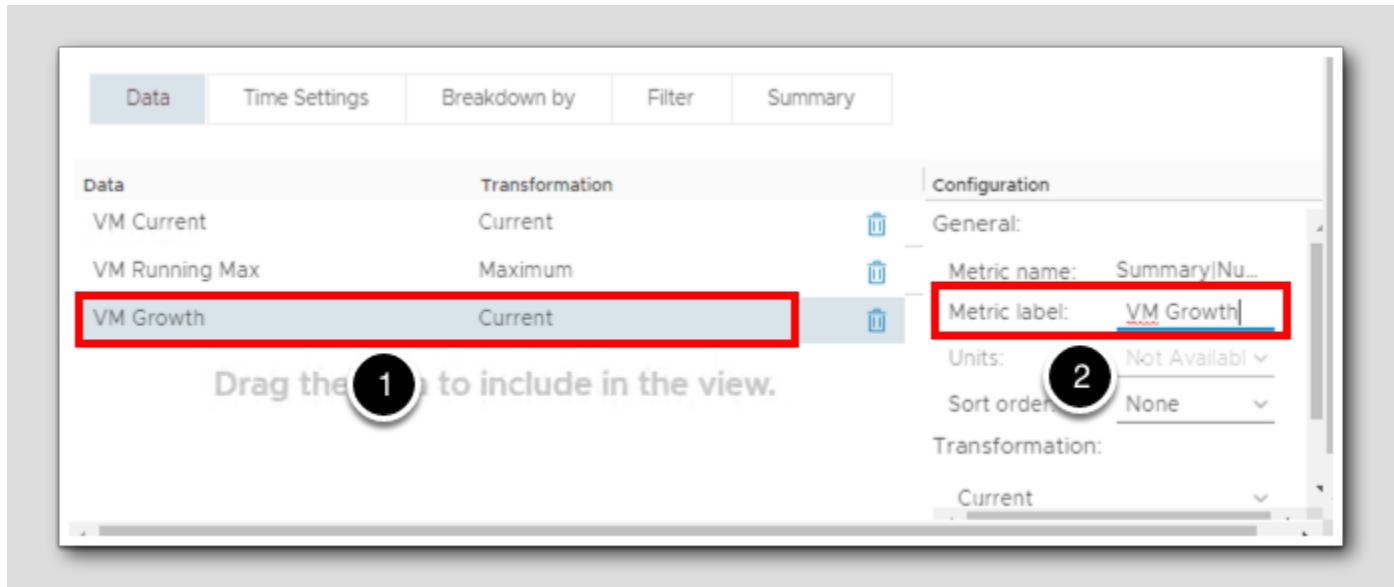
1. Select the 1st Number of Running VMs Metric.
2. In the Metric label field, Type VM Current as the label.

## Add Max Transformation



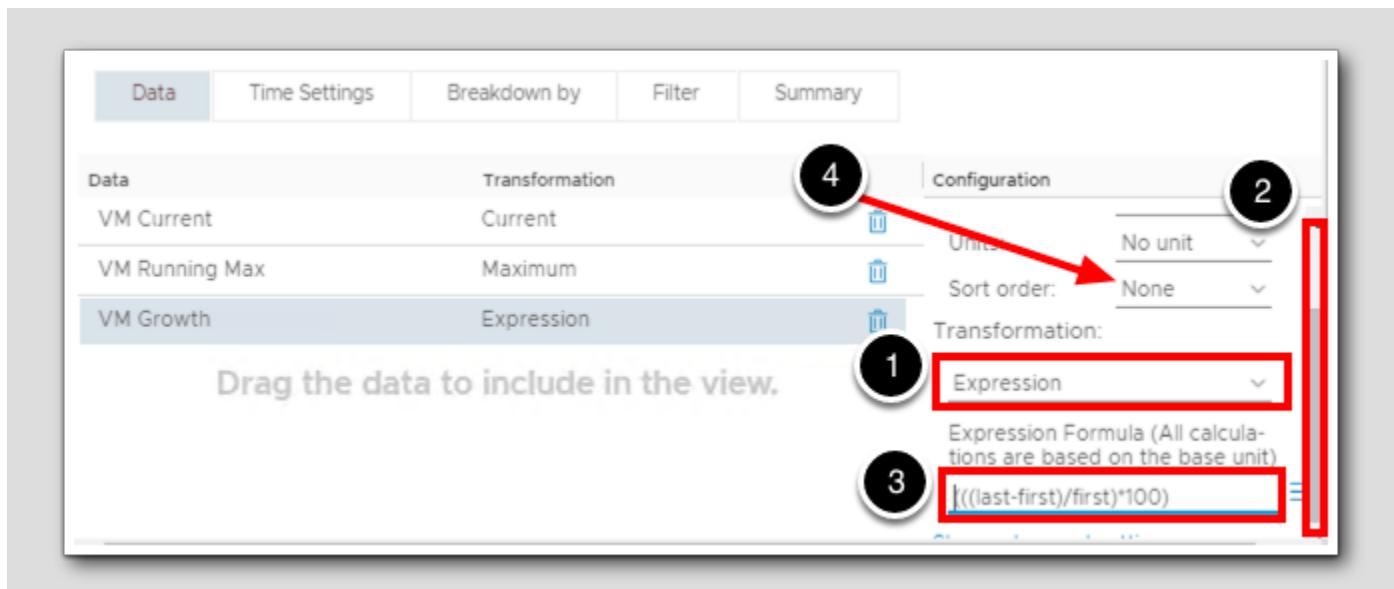
1. Select the 2nd Number of Running VMs Metric.
2. In the Transformation field, select Maximum in the drop down list.
3. Type VM Running Max for the Metric Label.

## Add Growth Transformation



1. Select the 3rd Data object.
2. Name this data Object VM Growth in the Metric label field.

## Add Growth Transformation Expression

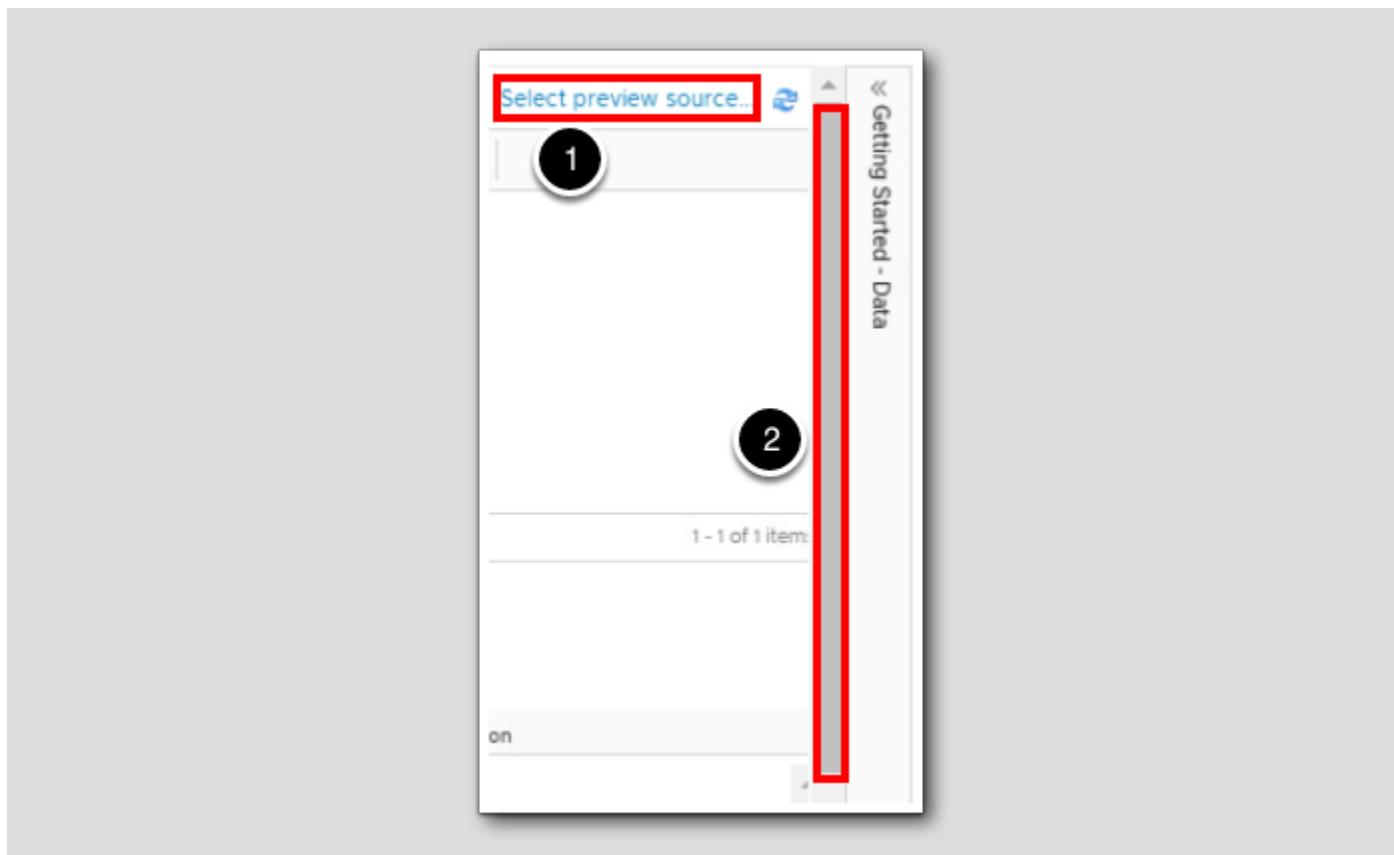


For this datapoint we are adding our own expression for growth. To show growth of VM's per datacenter we will use this expression:  $((last-first)/first)*100$ . This will give use the percentage of growth in VM for the time period of this view.

1. Change the Transformation field type from current to Expression.
2. Scroll all the way down in this window so we can see the Expression Formula.
3. Add the expression  $((last-first)/first)*100$
4. Optional: If you have many datacenters you can select to sort the list by growth - ascending or descending.

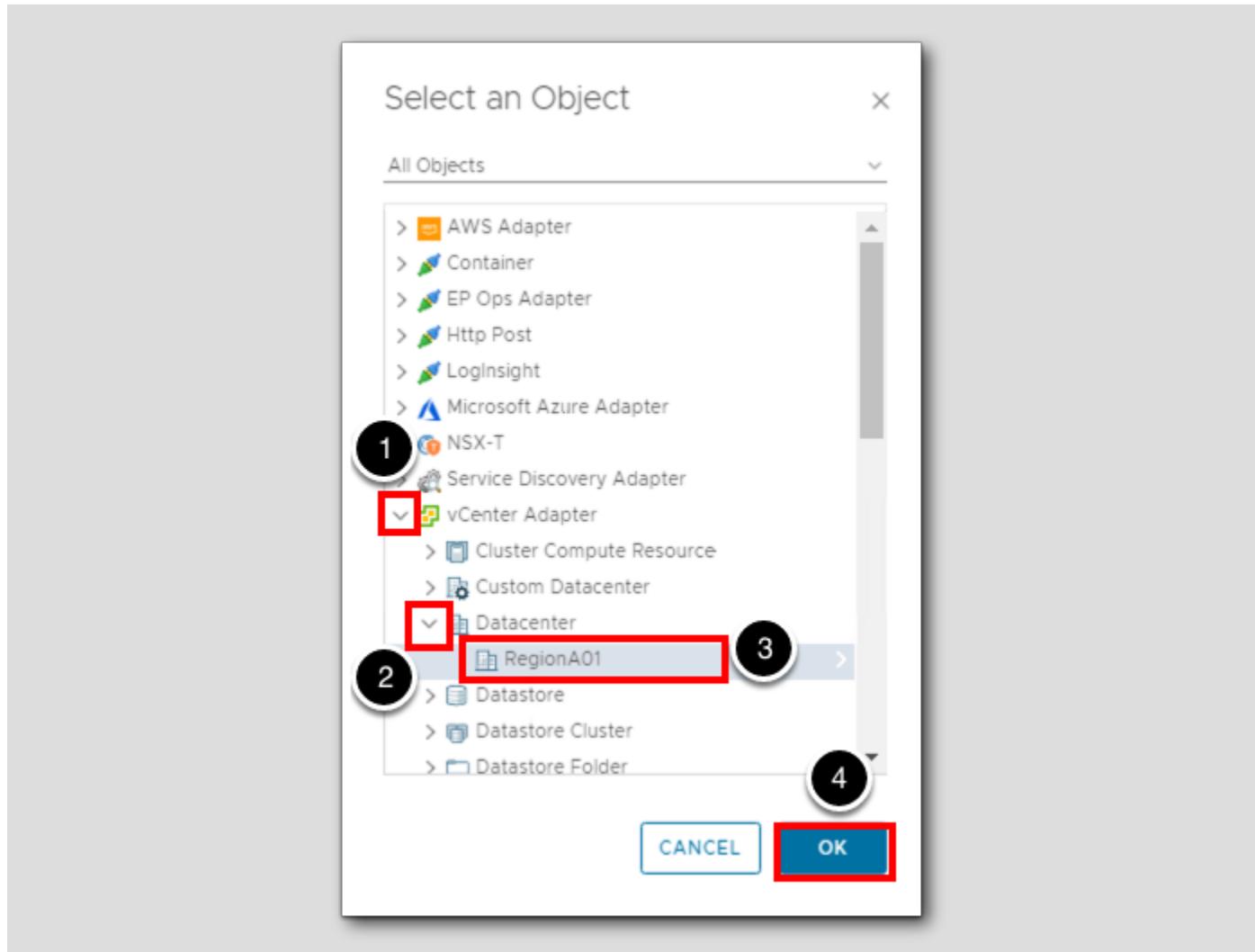
## Select Preview Source

[135]



1. Select preview source.
2. If you do not see Select preview source, you may need to scroll up.

## Select an Object



1. Open the vCenter Adapter.
2. Open Datacenter.
3. Select RegionA01.
4. Select OK.

## Preview Data

Name	VM Current	VM Running Max	VM Growth
RegionA01	19	19	5.56

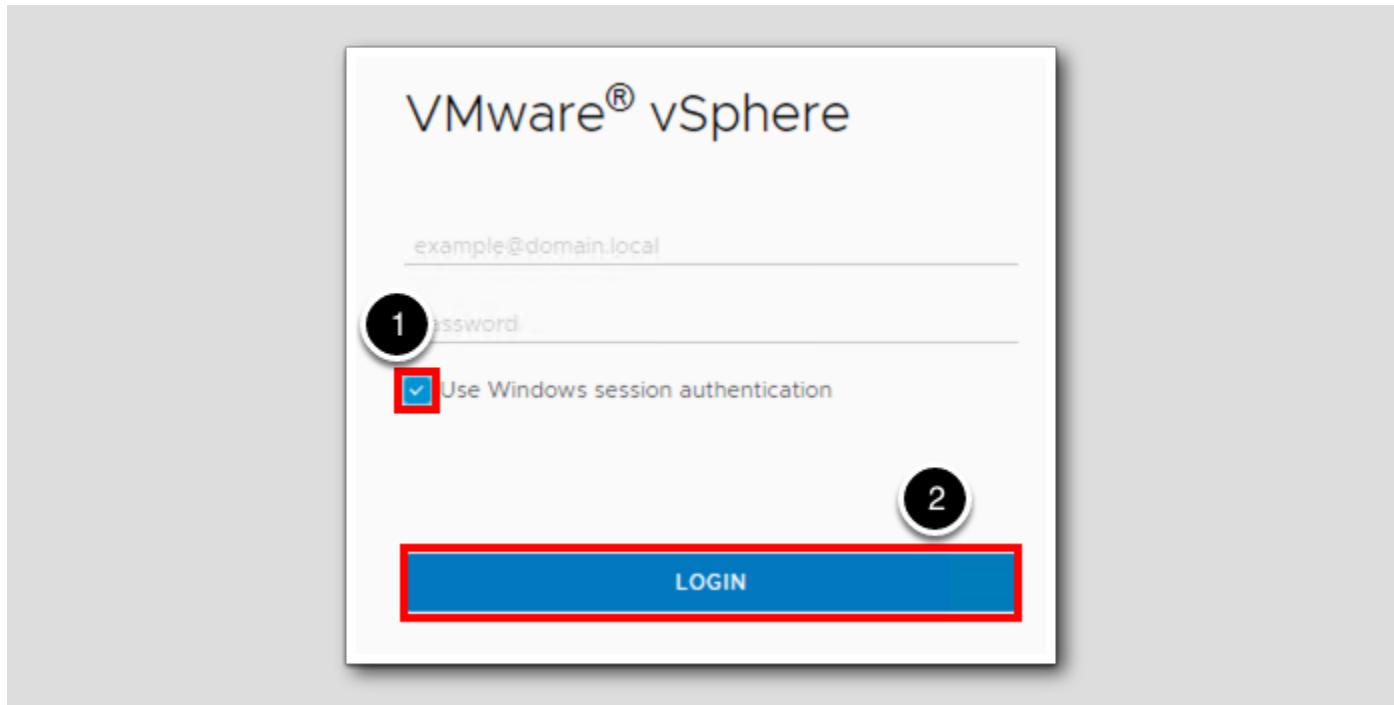
When we look at the preview data, it is always best to ensure the view is working correctly, and it is the right data we want to represent. Notice that the VM current and Max are the same, and we have no VM growth. Now we will make a change in the environment to make our new expression work!

## Open vCenter in a new tab

The screenshot shows a web browser window with the URL `vr-operations.corp.local/ui/index.action#/das`. The toolbar contains several bookmarks: 'Dashboards - vRealize Operation' (active), 'vSphere Client' (highlighted with a red box), 'NSX Manager', 'Lifecycle Manager', and 'vR'. A red box also highlights the '+' button in the top right corner of the browser window. A circular badge with the number '2' is visible on the left side of the toolbar.

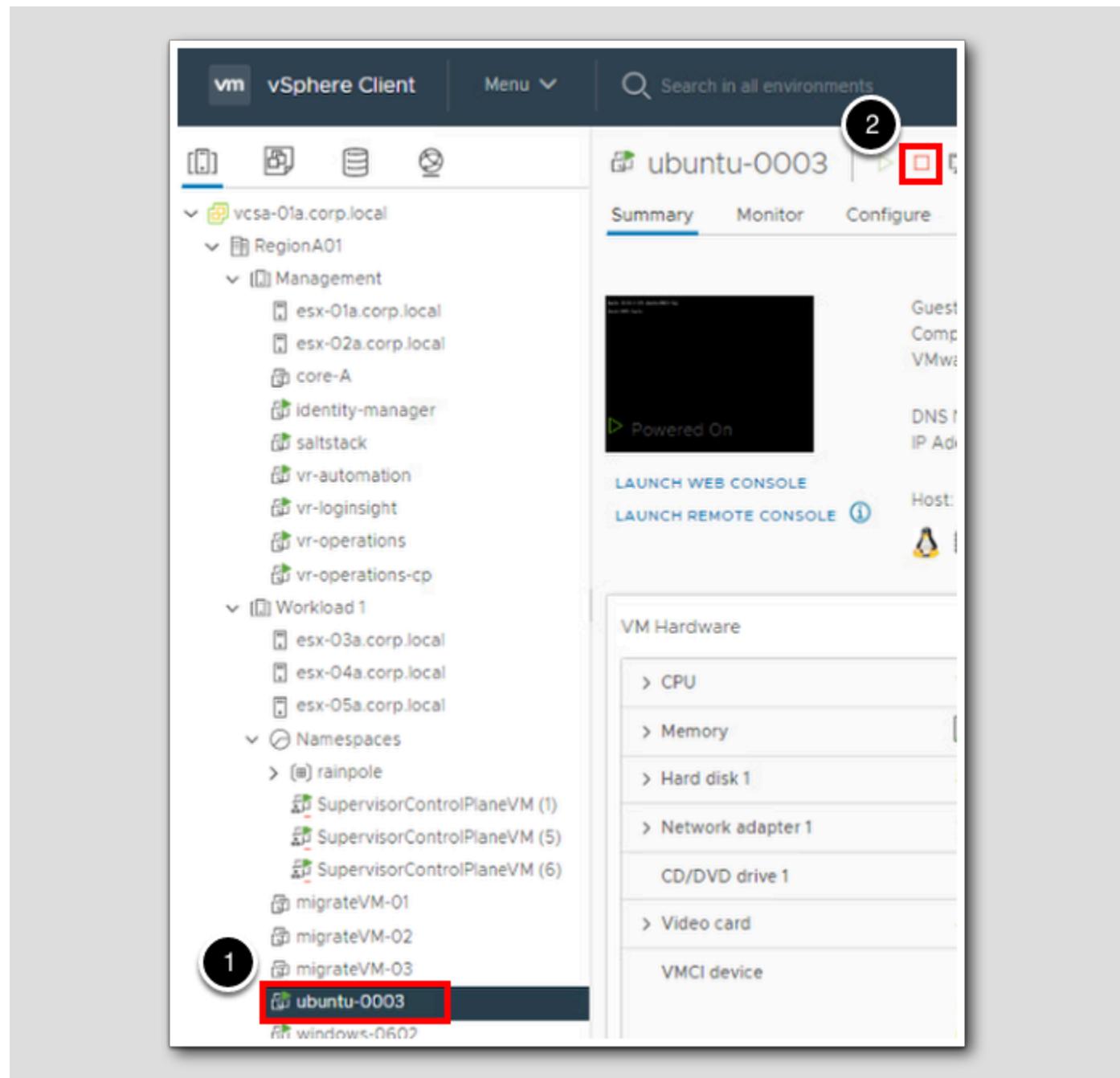
1. Select a **new Tab** to open a new Chrome tab.
2. Click on the **vSphere Client** button in the bookmarks bar.

Log into vCenter



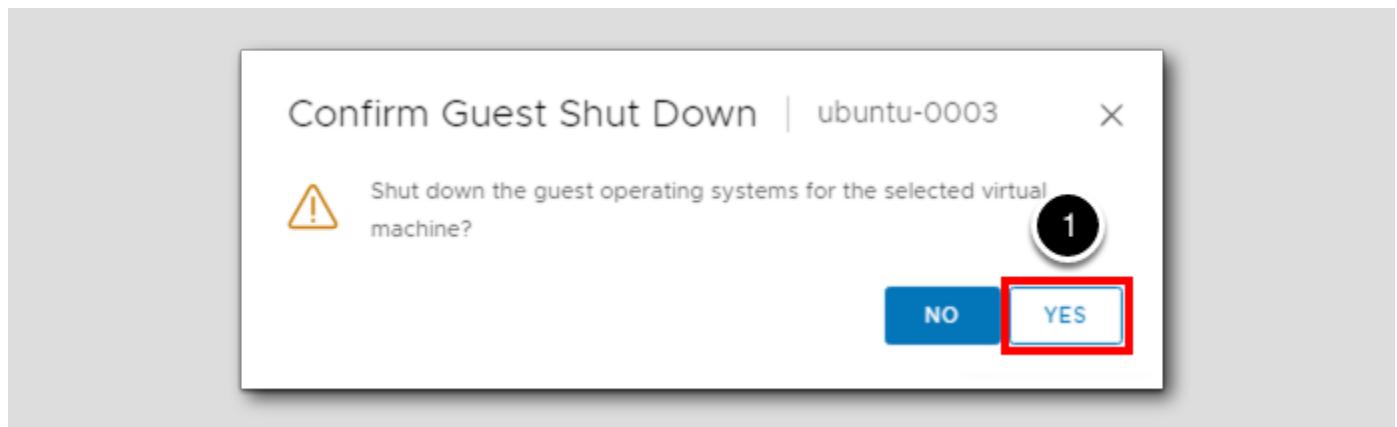
1. Select Use Windows session authentication.
2. Select Login.

## Power Off VM



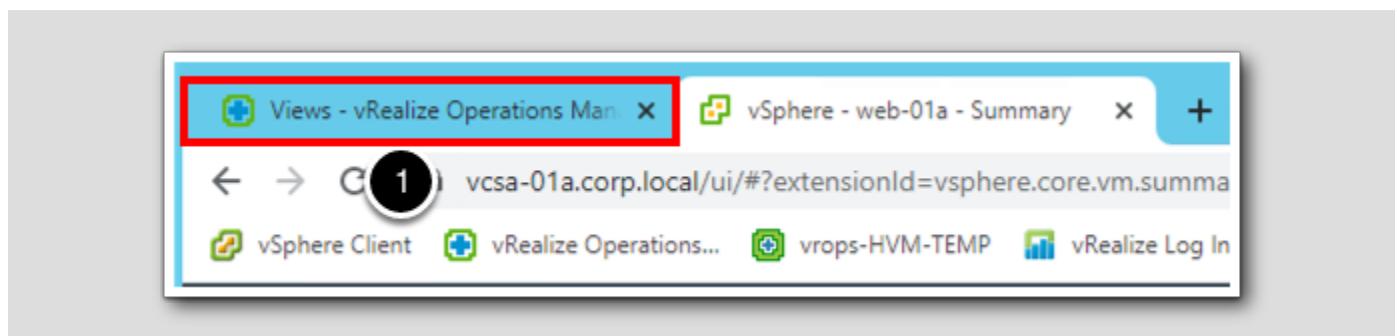
1. Select the VM ubuntu-0003.
2. Select Power Off VM.

## Confirm Power Off



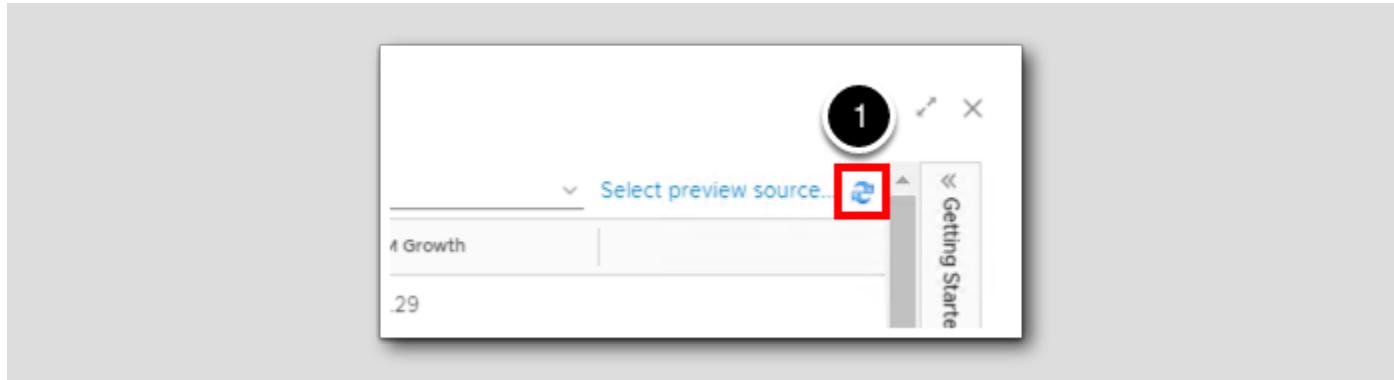
1. Select YES to power off the VM.

## Switch back to vRealize Operations



1. Select vRealize Operations Tab to return to vRealize Operations.

## Refresh the View



1. Select the refresh button to preview the source again.

Note - this may take 1-2 minutes for the next collection cycle to refresh content.

## Preview Final Data

The screenshot shows a 'Preview source: RegionA01 (All Objects)' table with three columns: Name, VM Current, and VM Growth. A row for 'RegionA01' has a red box around it. A circled '1' is next to the row. The table shows values: VM Current is 18, VM Running Max is 19, and VM Growth is 0. Below the table, a message says 'Drag the data to include in the view.' On the right, there's a configuration panel with tabs for General, Transformation, and Expression. Under General, Metric name is 'Summary/Nu...', Metric label is 'VM Growth', Units are 'No unit', and Sort order is 'None'. Under Transformation, Expression is '(((last-first)/first)\*100)'. At the bottom are 'CANCEL' and 'SAVE' buttons, with 'SAVE' highlighted by a red box. A vertical sidebar on the right says 'Getting Started - What is a View?'

Name	VM Current	VM Growth
RegionA01	18	0

1 - 1 of 1 items

Data Time Settings Breakdown by Filter Summary

Data Transformation Configuration

VM Current Current General:

VM Running Max Maximum

VM Growth Expression

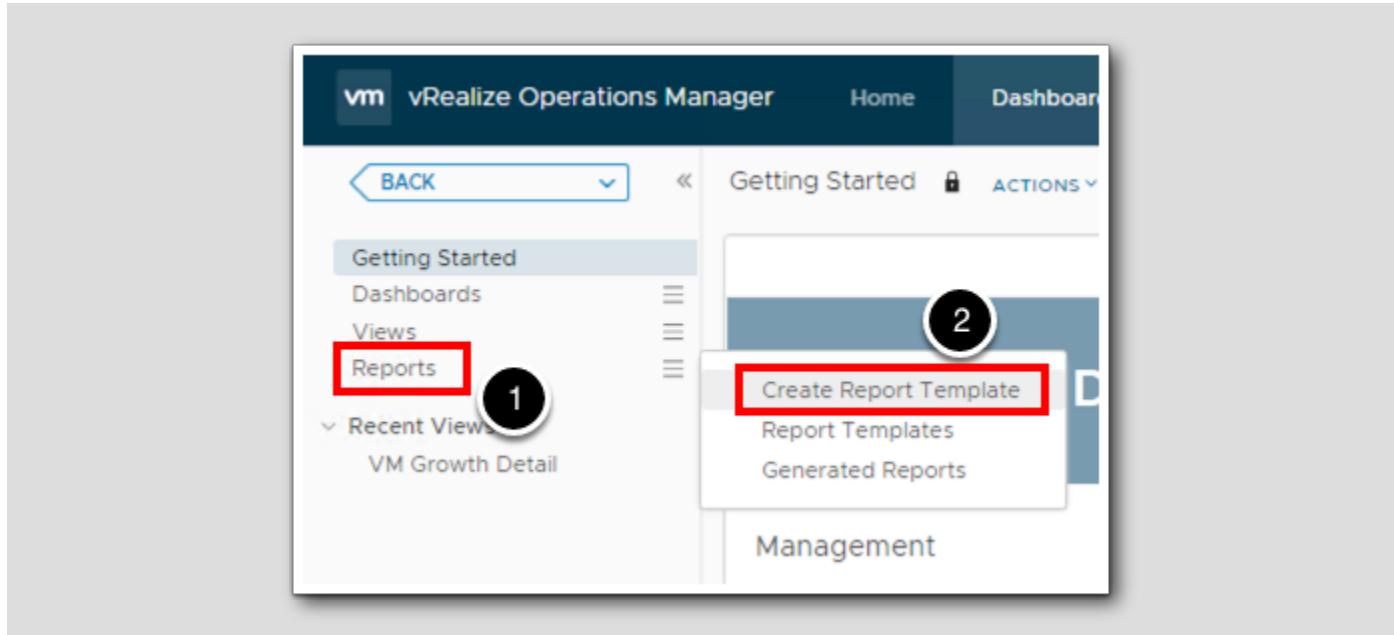
General:  
Metric name: Summary/Nu...  
Metric label: VM Growth  
Units: No unit  
Sort order: None

Transformation:  
Expression  
Expression Formula (All calculations are based on the base unit)  
(((last-first)/first)\*100)

CANCEL SAVE

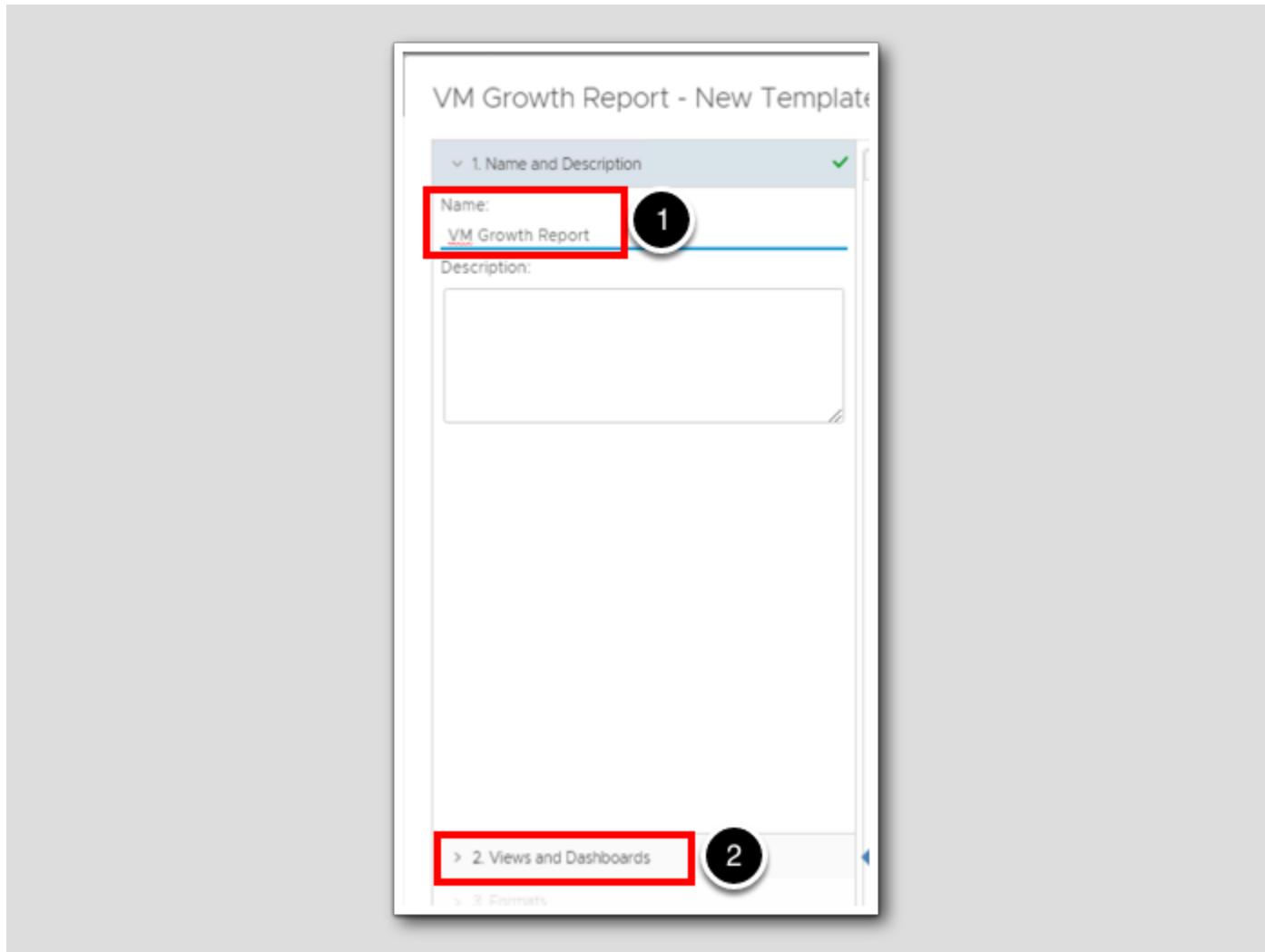
1. Now we can see that the amount of VM's running has decreased from the max value and the VM Growth has also decreased.
2. If you are comfortable with the data, you may select Save.

## Make a Growth List Report



1. Click Reports.
2. Then select Create Report Template to create a new report.

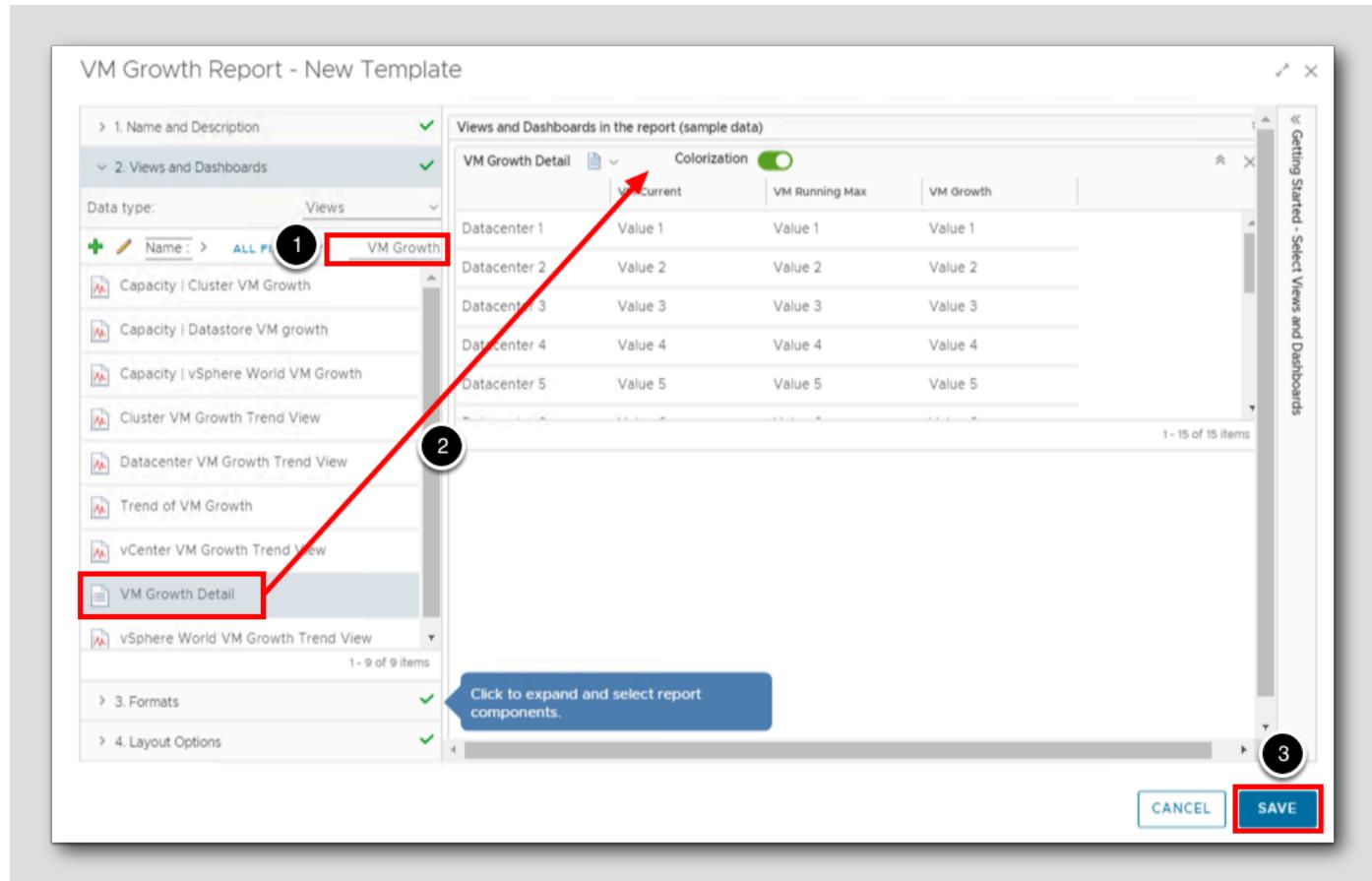
## Name the Report



1. Name the Report VM Growth Report.

2. Select 2. Views and Dashboard.

Add the VM Growth Detail view to the report

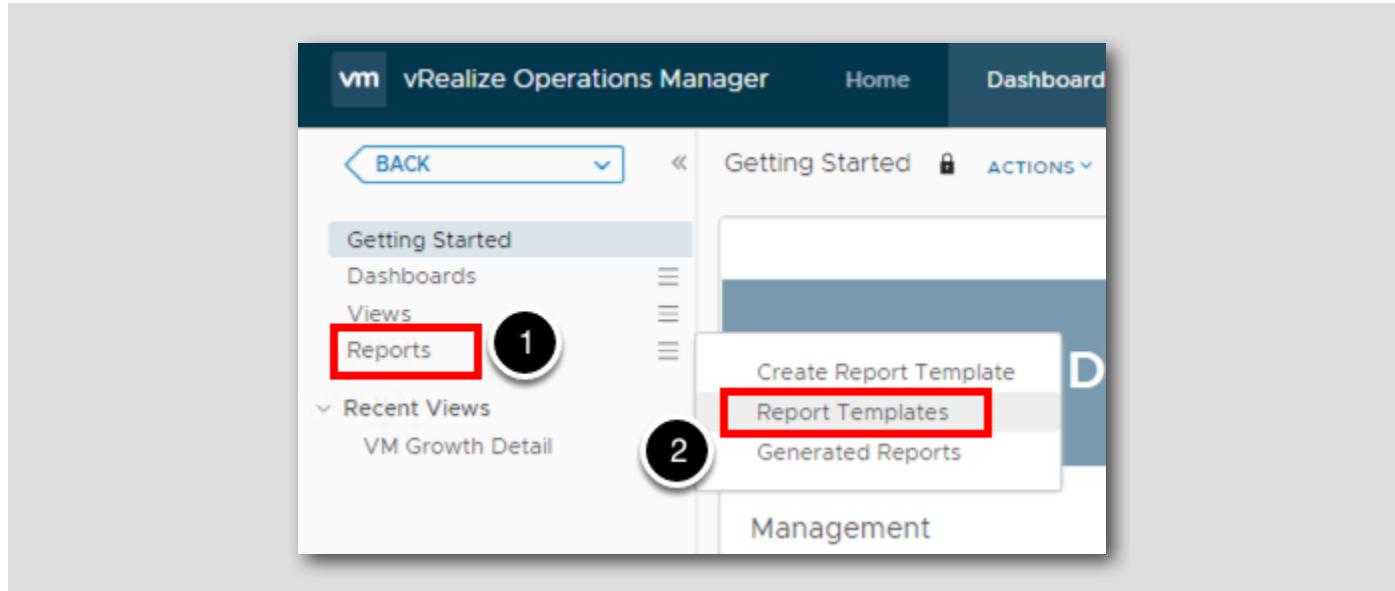


1. Click in the Filter area, and type VM Growth and press Enter.

2. Select the VM Growth Detail View and drag it to the right.

3. Select SAVE.

## Go to the List of Reports



1. Click on Reports.
2. Then Click on Report Templates to open the list of Reports.

## Locate the Newly Created Report

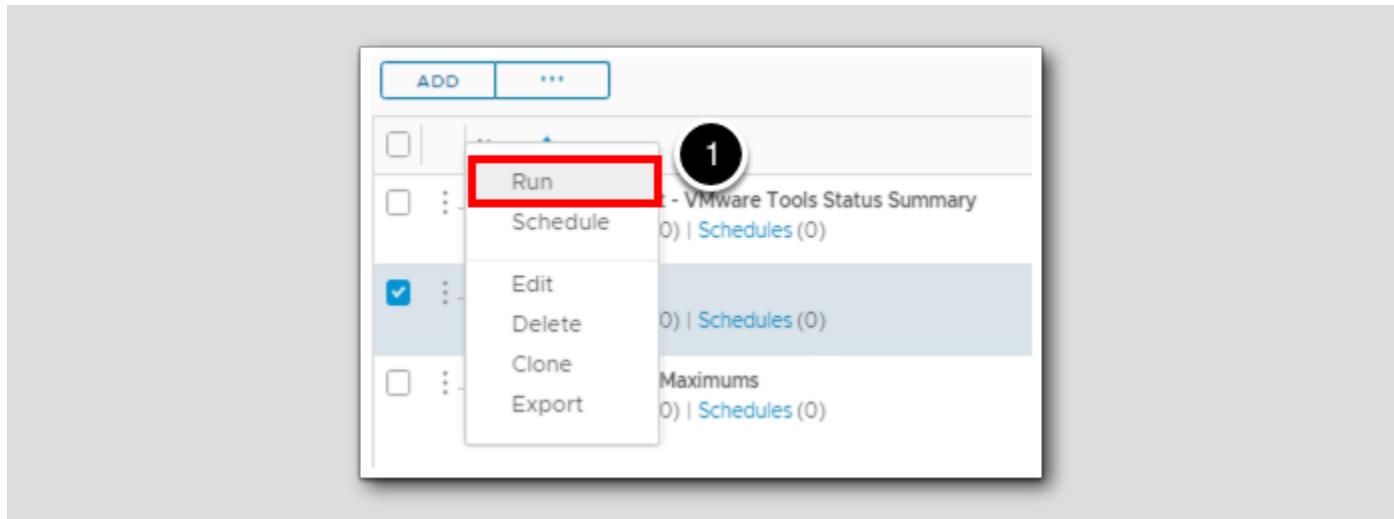
The screenshot shows the 'Reports' section of the vRealize Operations interface. At the top, there are tabs for 'Report Templates' and 'Generated Reports'. Below the tabs is a search bar with 'Name : VM' and a 'ALL FILTERS' dropdown. A red box highlights the 'VM' filter. A black circle with the number '1' indicates a new report. The main area displays a table with three rows of report details:

	Name	Description	Subject	Last Modified	Last run	Modified By
<input checked="" type="checkbox"/>	Optimization Report - VMware Tools Status Summary Generated reports (0)   Schedules (0)	VMware Tools Status Summary.	Virtual Machine	5/14/21 11:28 AM	-	admin
<input type="checkbox"/>	VM Growth Report Generated reports (0)   Schedules (0)	Datacenter	2:37 PM	-	holadmin@corp.l...	
<input type="checkbox"/>	VMC Configuration Maximums Generated reports (0)   Schedules (0)	Alert, Cluster Compute Resource, Da...	5/14/21 11:33 AM	-	admin	

You will now see the list of Reports that have been created in vRealize Operations.

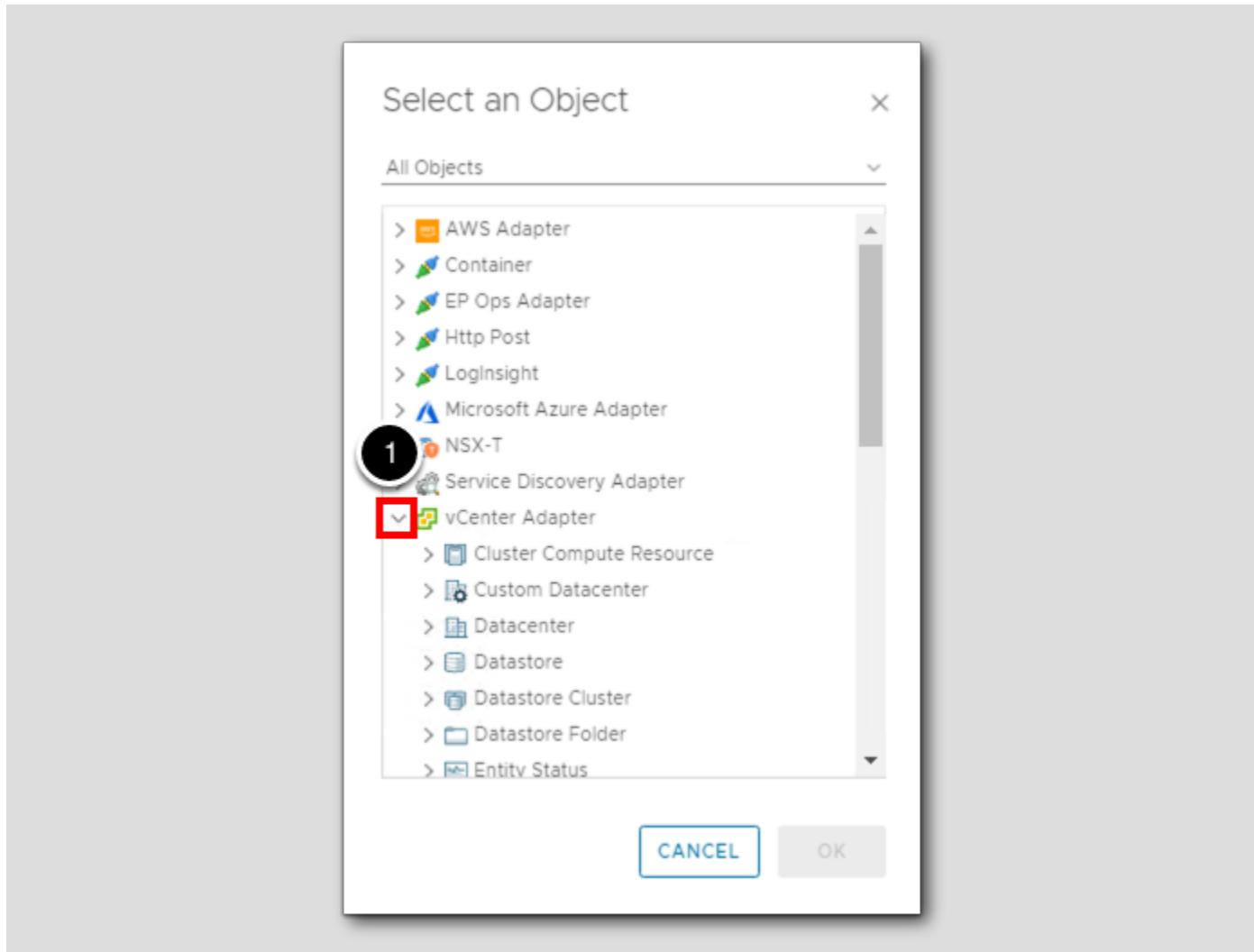
1. In the Quick Filter, type **VM** and then hit **Enter** to filter the list.
2. On the VM Growth Report, click the 3 dots beside the checkbox to open the actions menu.

## Run the Report



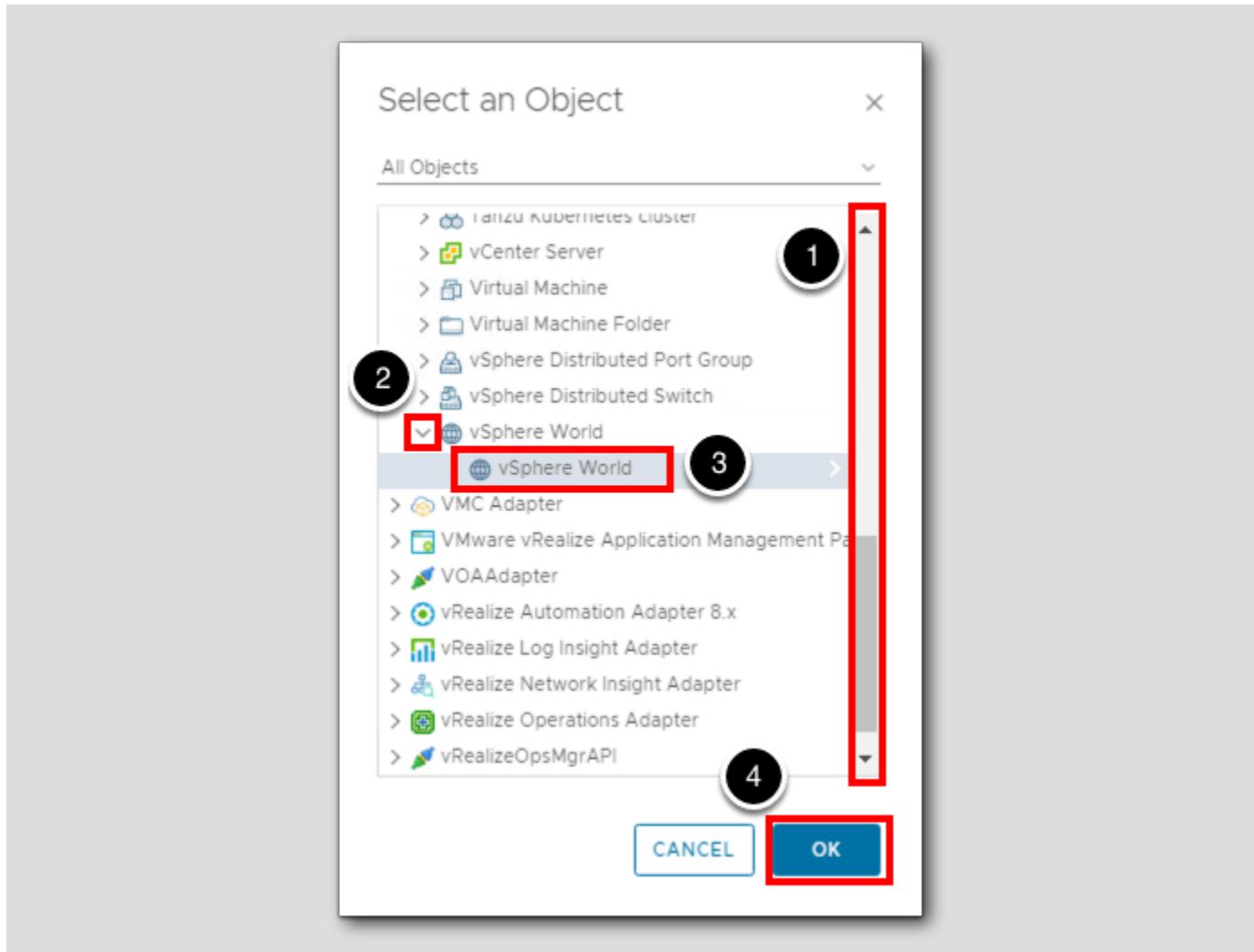
1. Select Run to run the Growth Report.

## Select Object to run the report



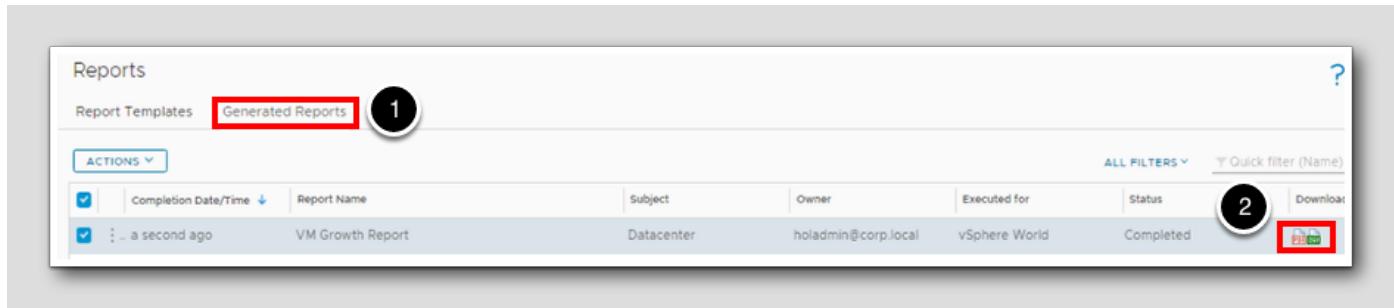
1. Expand vCenter Adapter by clicking on the chevron beside vCenter Adapter.

## Select vSphere World



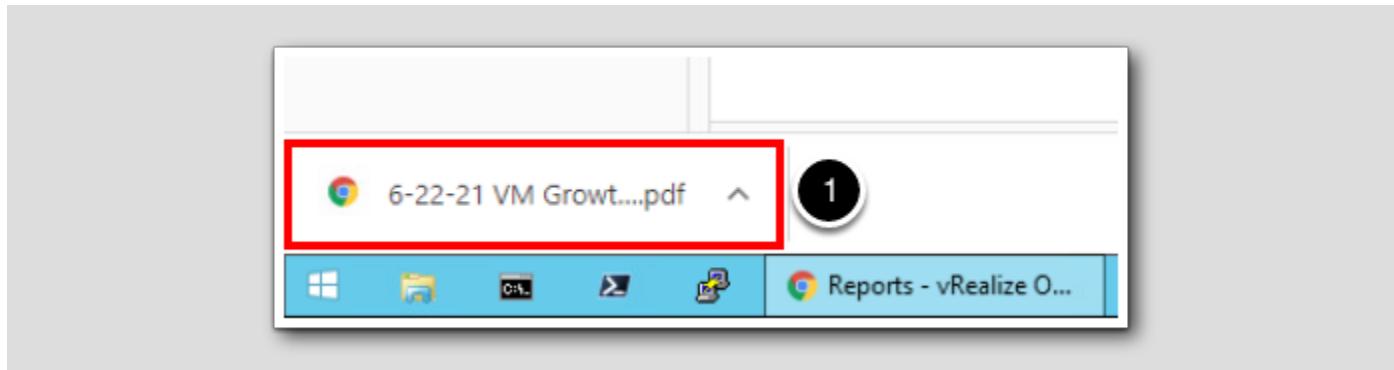
1. Scroll at the way to the bottom of this page so we can vSphere World.
2. Expand vSphere World by clicking the chevron to the left of the text.
3. Select vSphere World.
4. Click OK.

## View the Report



1. Select Generated Reports Tab.
2. We have the option to download the report in either PDF or CSV format, for this exercise select the red PDF icon (note you may have to wait a moment for the report to finish).

## Open the Report



1. Click on the report that was downloaded to open it.

## Review the Report

VM Growth Report vSphere World

### 1. VM Growth Detail

Jun 15, 2021 06:29 - Jun 22, 2021 06:29 (GMT+00:00)

Name	VM Current	VM Running Max	VM Growth
RegionA01	18	19	0

Now we have a report that includes detail about the growth of VM's in each DataCenter. We can send this to leadership to identify the growth trends each month, each week, or every day!

## Switch Back to vCenter

Reports - vRealize Operations Manager vSphere - ubuntu-0003 - Summary +

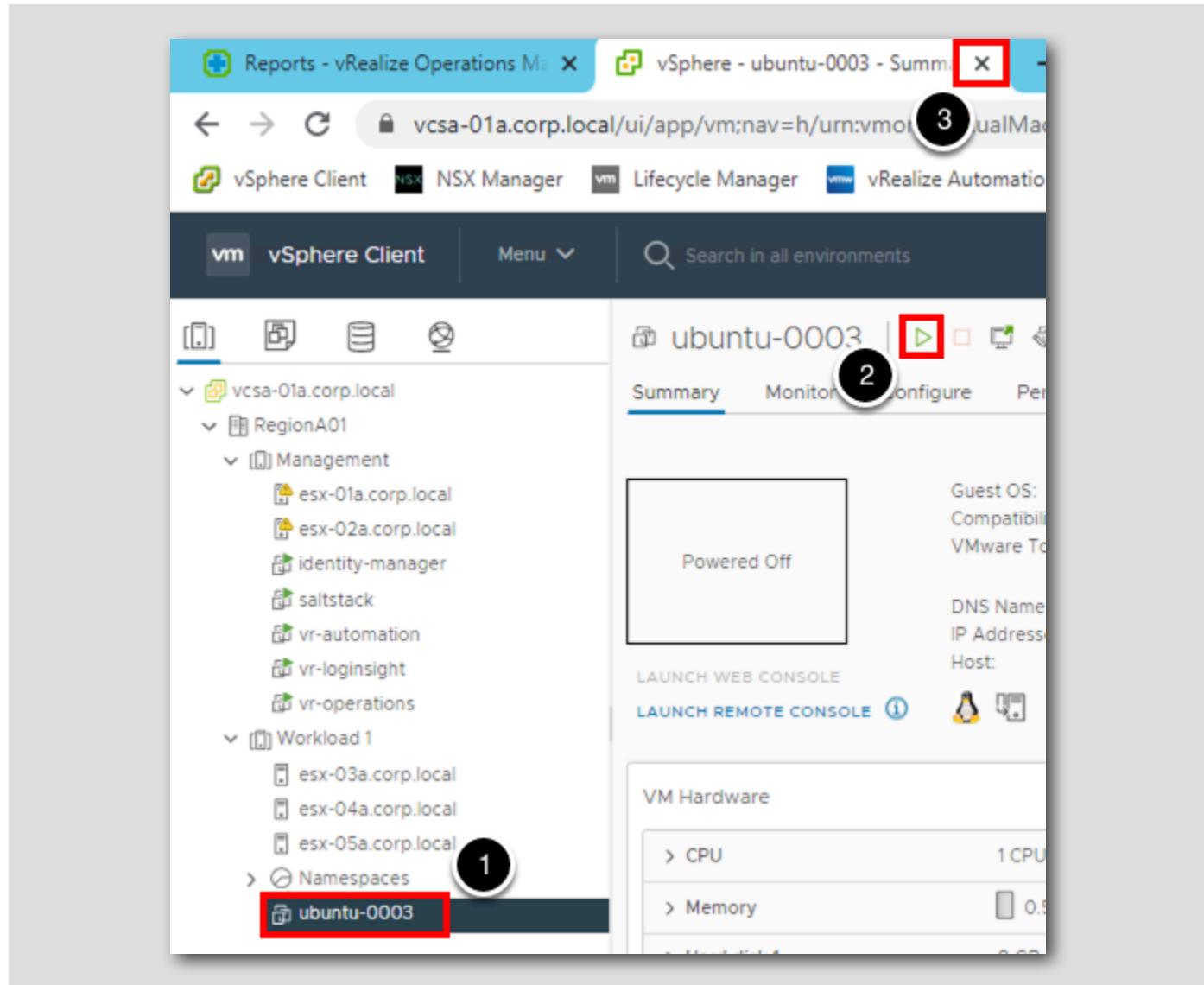
vr-operations.corp.local/ui/index.action#/dashboards/reports/instant

vSphere Client NSX Manager Lifecycle Manager vRealize Automation Env

vRealize Operations Manager Home Dashboards Alerts Env

1. Return to the vCenter by clicking back to the open vCenter Tab. If you closed this tab, you will need to open a new tab and log back into vCenter.

## Start the ubuntu-0003 VM



Let's restart the ubuntu-0003 VM that we shutdown earlier because this VM will be needed in future lessons.

1. Click on the VM ubuntu-0003.
2. Click the green Start icon to restart this VM (or right-click and select Power On).
3. You may now click the x on the vCenter tab to close it.

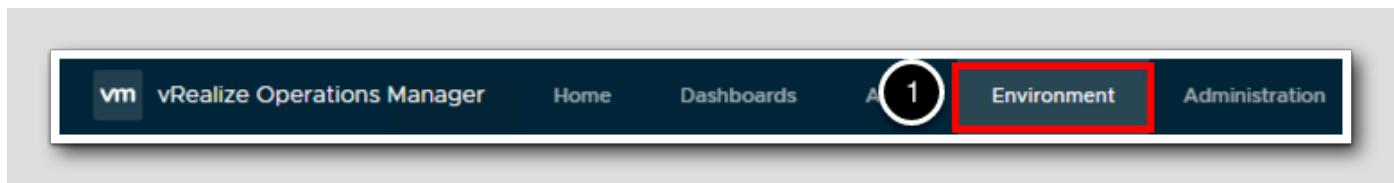
## Lesson End

This concludes the Create a View that shows VM Growth Lesson.

## Create a View with Distribution Data

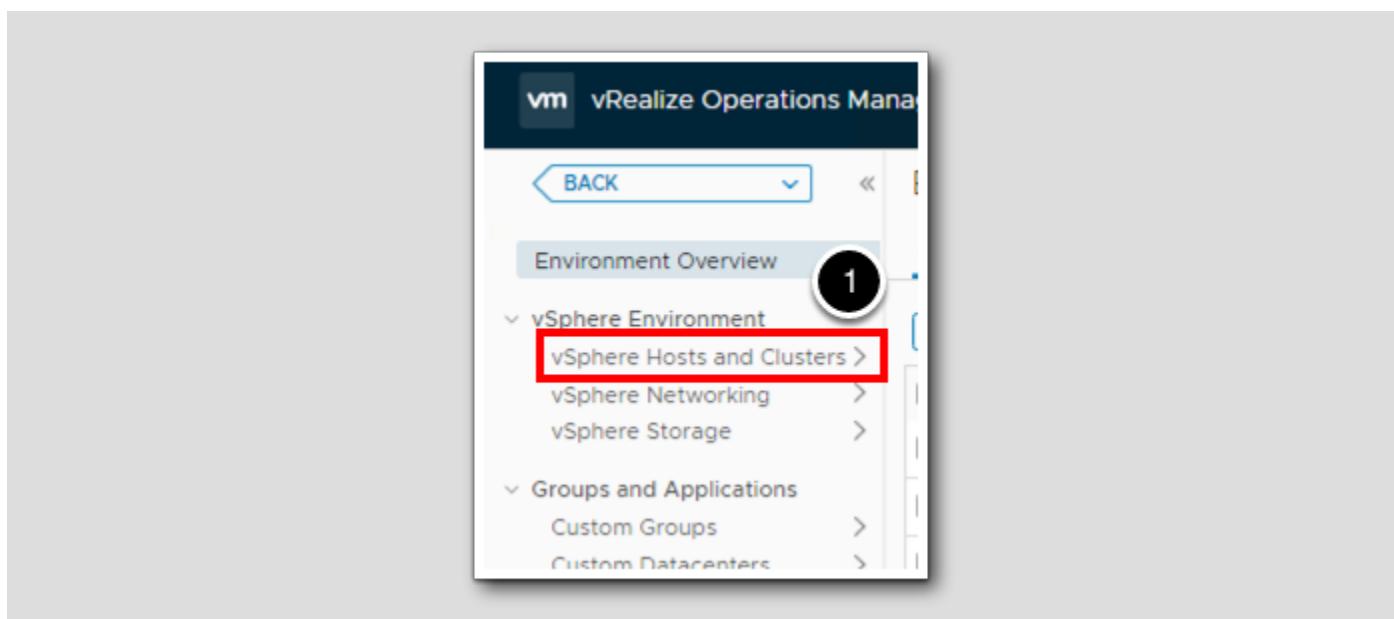
If you've completed the previous lessons in this module, we have created various views. In this lesson, we continue creating custom views with the Distribution view. The distribution view gives us the ability to create pie charts based on data from selected object type.

### Go to Environment



1. Click on Environment.

### Hosts and Clusters



1. Click on vSphere Hosts and Clusters.

## Select a vCenter Server

The screenshot shows the vRealize Operations Manager interface. The top navigation bar includes Home, Dashboards, Alerts, Environment, and Administration. Below the navigation is a breadcrumb trail: BACK << Private Cloud. The main content area is titled "Private Cloud" and includes tabs for Summary, Alerts, Metrics, Capacity, Compliance, Logs, Events, and more... (which is circled in red). The "more..." tab is highlighted with a red box and a circled number 3. On the left, there's a sidebar with a dropdown menu labeled "vSphere Hosts and Clusters" (circled in black and numbered 1) which is expanded to show "vSphere World" and "Private Cloud" (circled in red and numbered 2).

1. Expand vSphere World by clicking the chevron to the left of the text.
2. Select vCenter Server Private Cloud.
3. Click on more...

## Create a View

The screenshot shows the 'Private Cloud' dashboard in vRealize Operations. The 'Views' tab is selected. A red box highlights the 'ADD' button, and a black circle with '2' highlights the '...' button. A red box highlights the 'Details' tab in the top navigation bar, and a black circle with '1' highlights the notification badge.

Name	Type	Description
Admission Control Enabled?	Distribution	vSphere Cluster Admin
Alerts that are currently active	List	Show alerts for the s

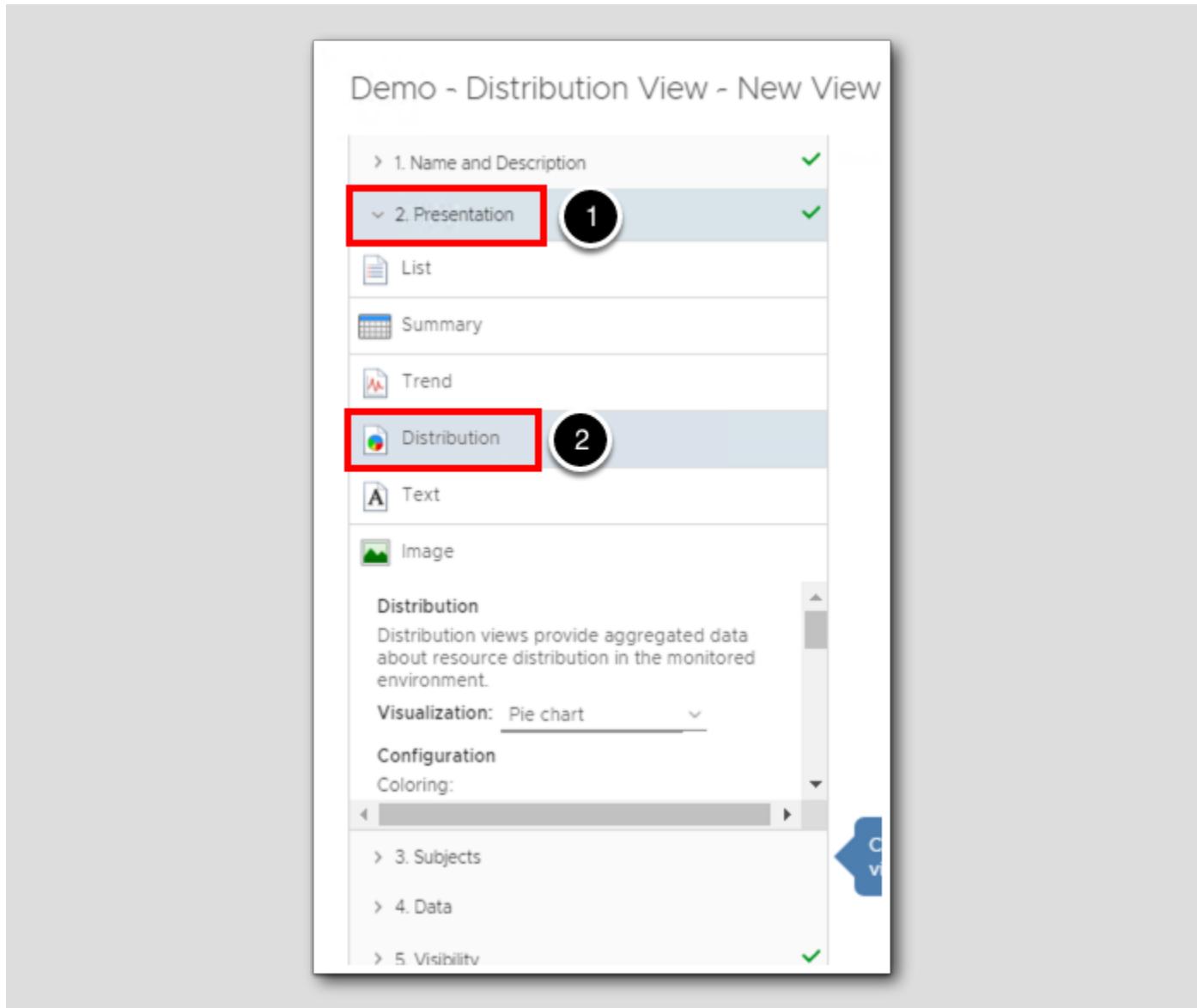
1. Click on Details.
2. Click ADD to create a new view.

Enter the View name



1. Enter the view name **Demo - Distribution View**.

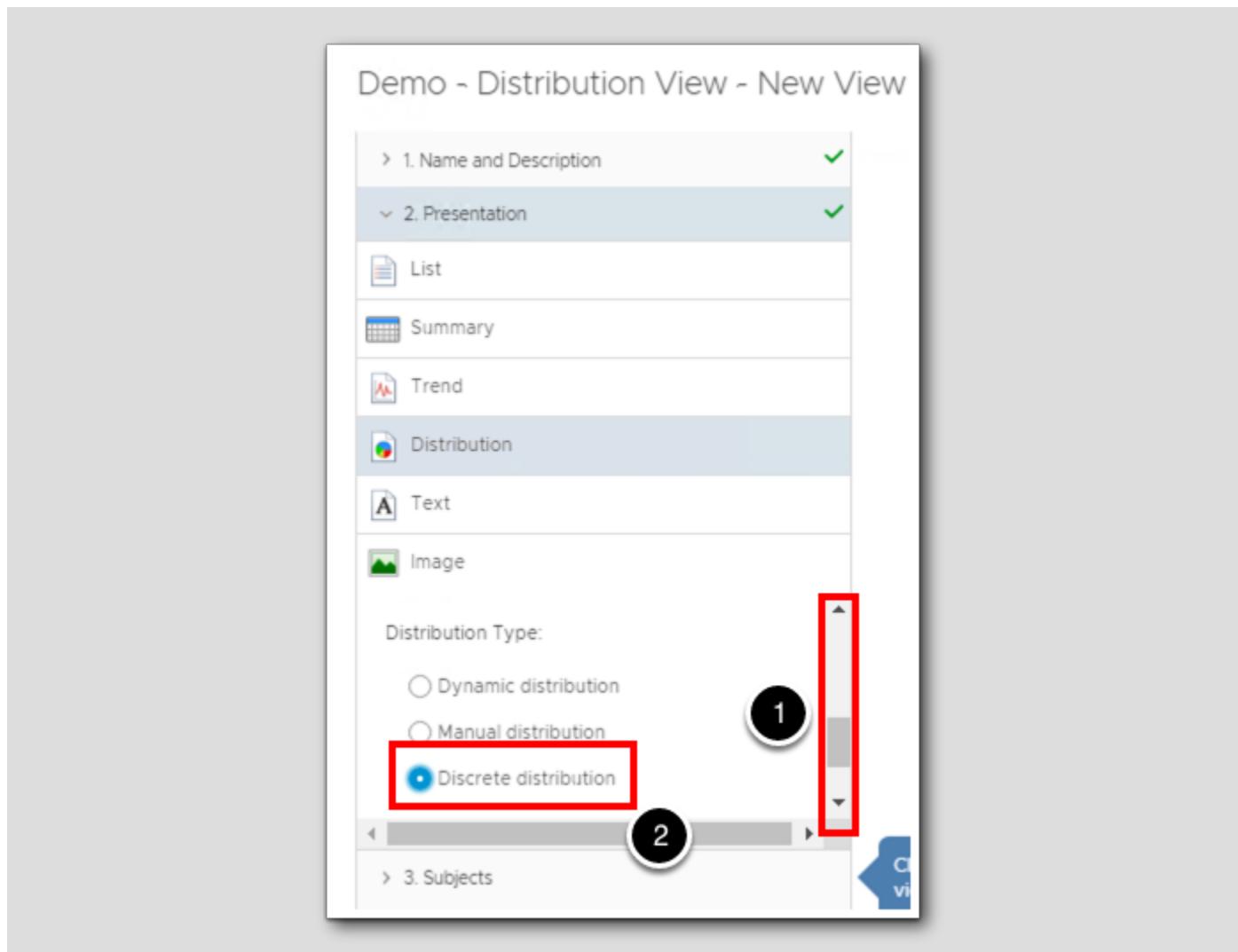
## View Presentation



1. Click on 2. Presentation.

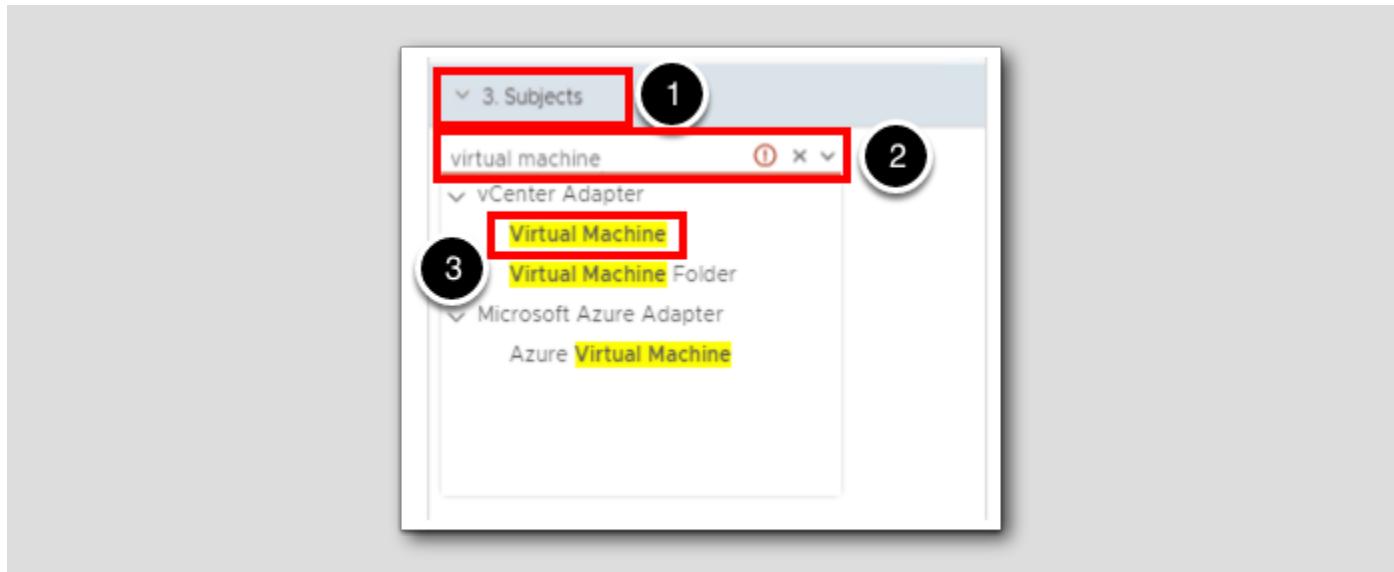
2. Select Distribution.

## Distribution Type



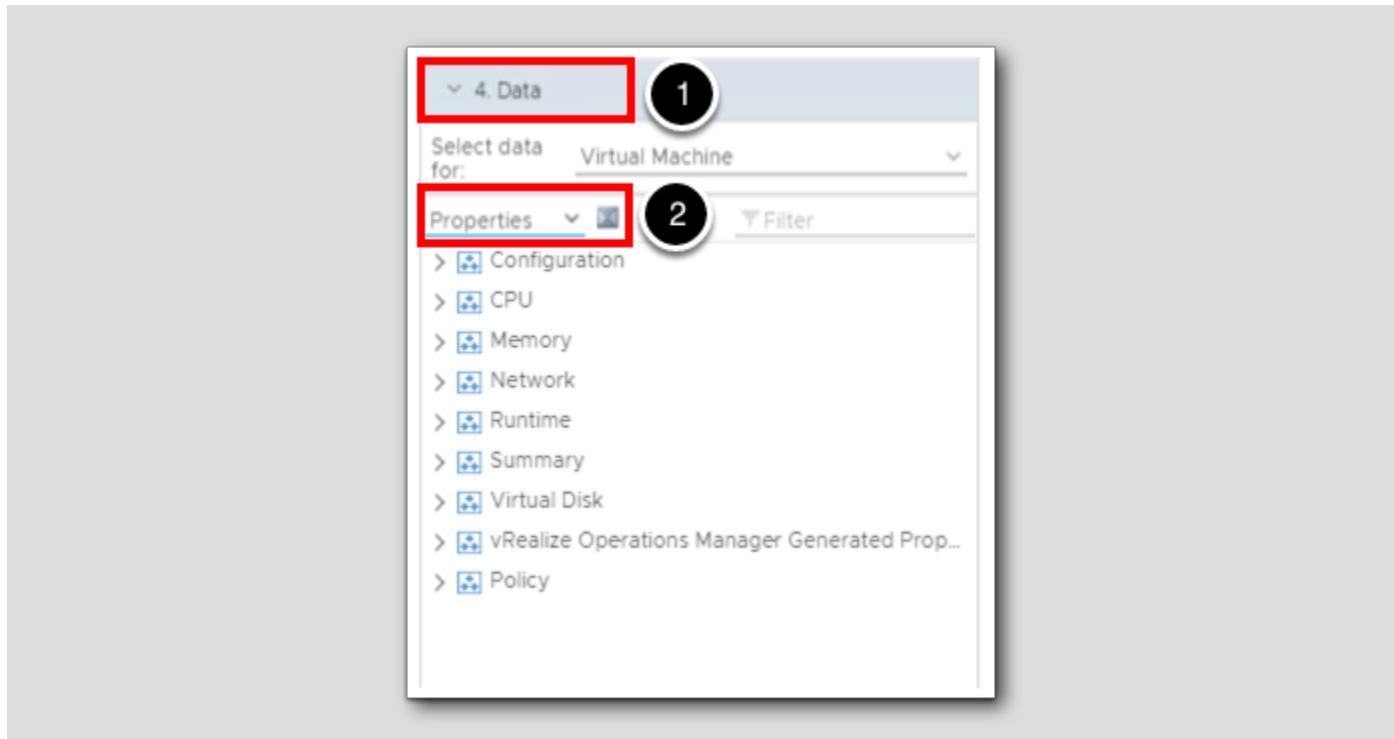
1. Scroll down in this window until you see **Distribution Type**.
2. Select **Discrete distribution** as the Distribution Type.

## View Subjects



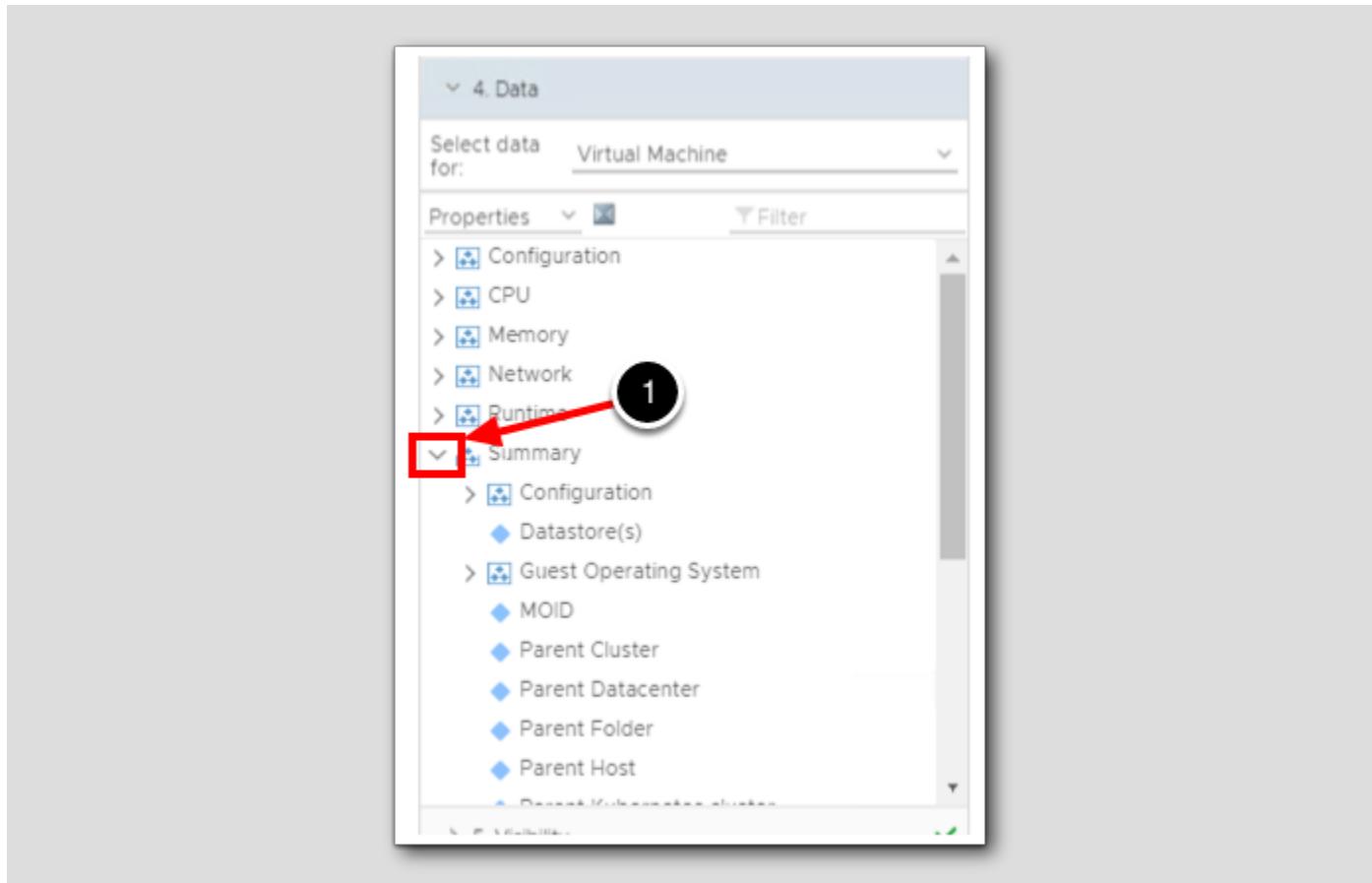
1. Click on 3. Subjects.
2. Type virtual machine. The filter will display resources that match what is typed.
3. Click on Virtual Machine.

## Select Properties



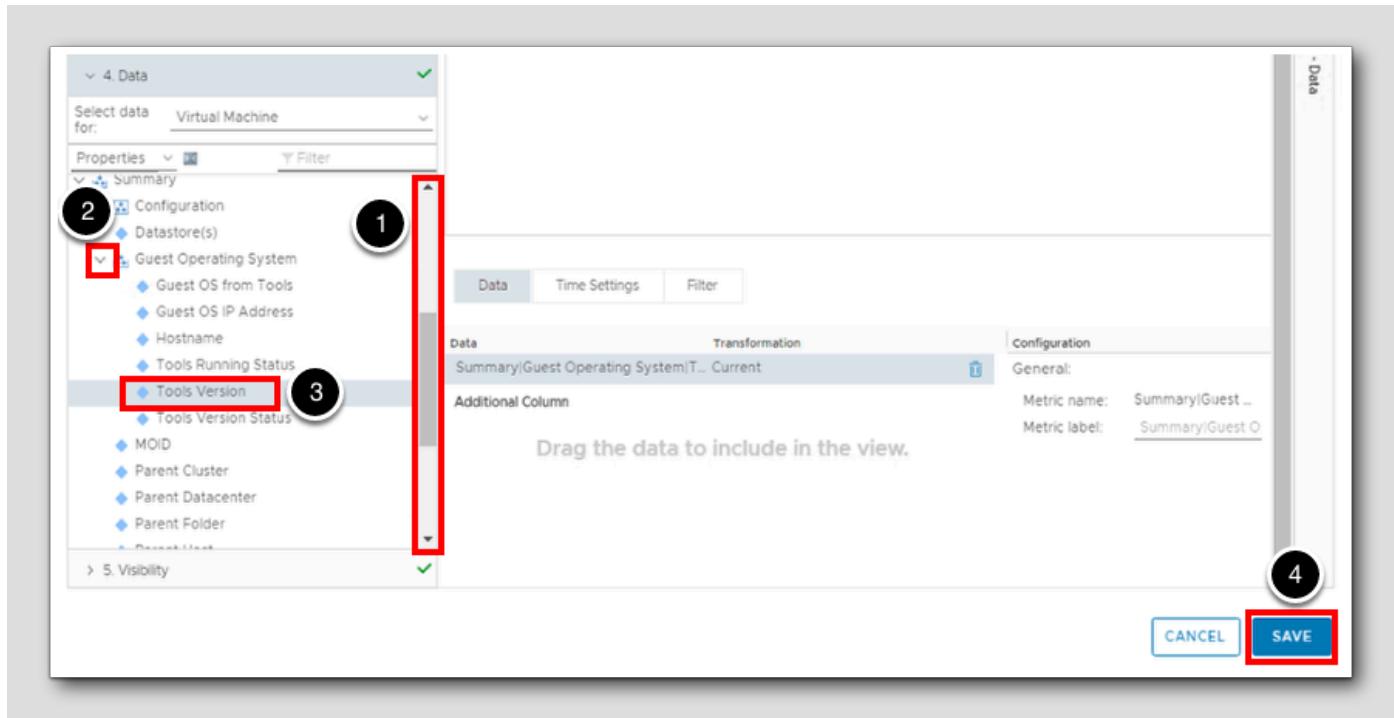
1. Select 4. Data.
2. Switch from Metrics to Properties.

## Expand Properties



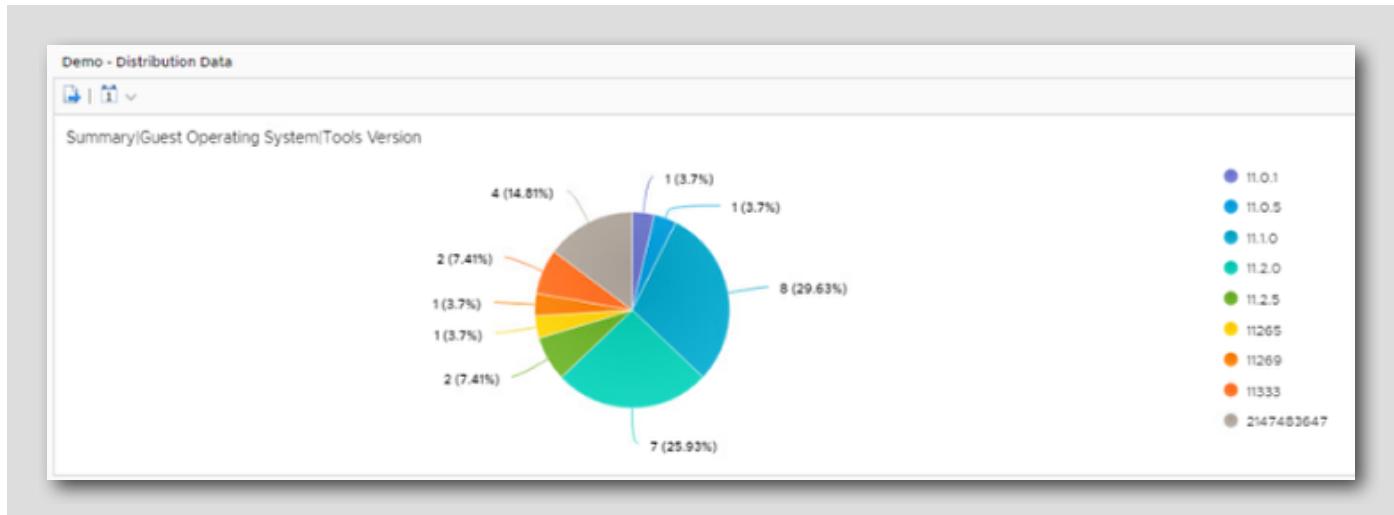
1. Expand **Summary** by clicking the chevron to the left of the text.

## Select a Property



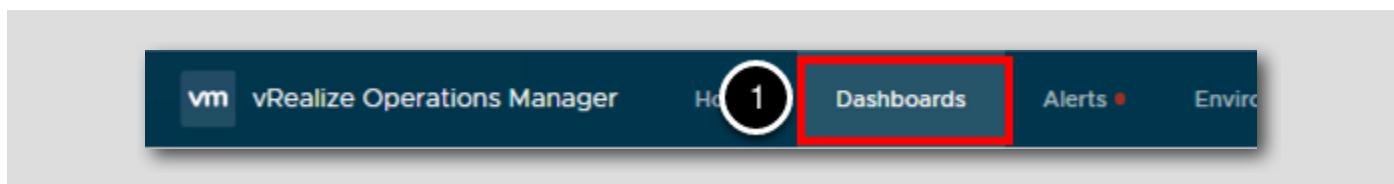
1. Scroll down so we can see the Guest Operation System Item under the Summary group.
2. Expand Guest Operating System by clicking on the chevron to the left of the text.
3. Double-click on Tools Version to add it to the Data list on the right side of this window.
4. Click SAVE.

## View Report Output



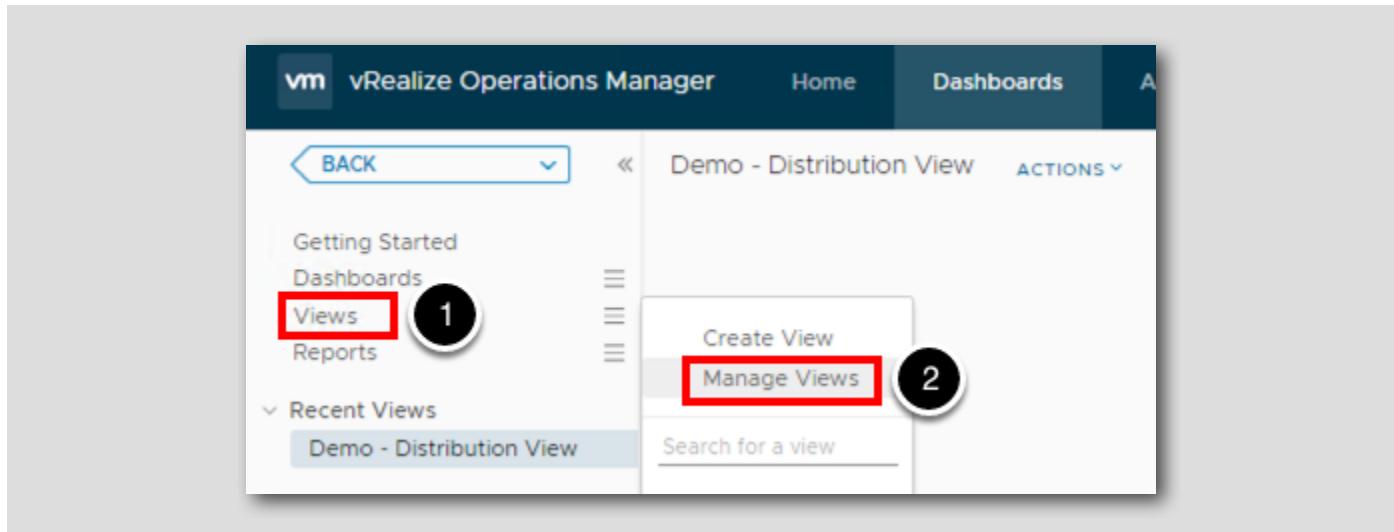
We can now see the results of our new View for the 'Private Cloud' vSphere environment that we selected in the beginning of this lesson. But what if we have multiple environments that we want to look at and inspect individually? To do that we can go to the main views page and then select the environment we want to use as the source to create this view. In the next steps, we'll walk through this.

## Go to Dashboards Tab



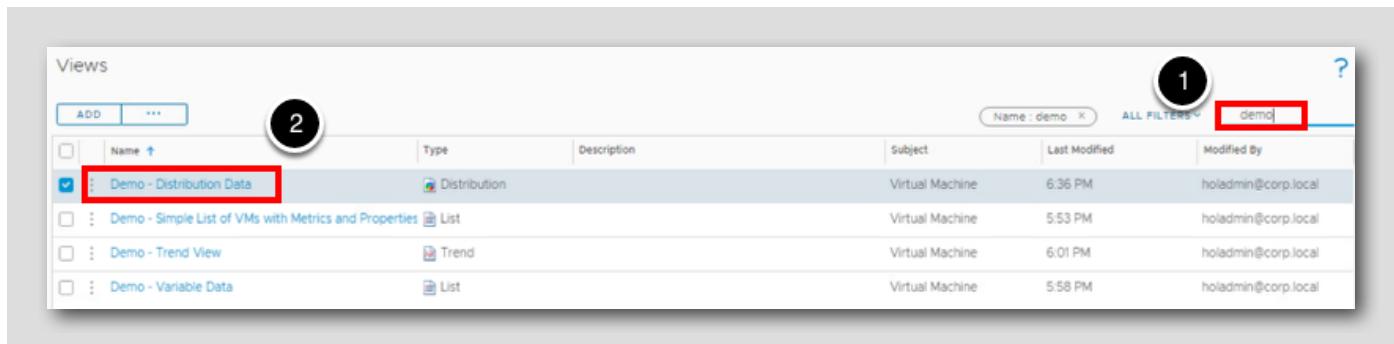
1. Click on Dashboards to go to the list of Dashboards, Views and Reports.

## Open Manage View



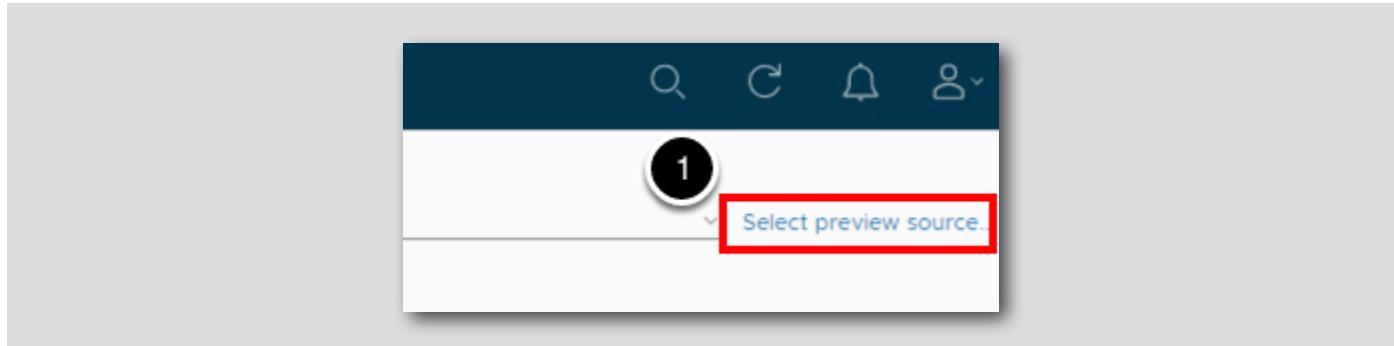
1. Click on **Views**.
2. Click on **Manage Views** to open the list of Views.

## Find our Newly Created View



1. In the quick search filter, type Demo and hit Enter.
2. Click on the text **Demo - Distribution View** to open the View.

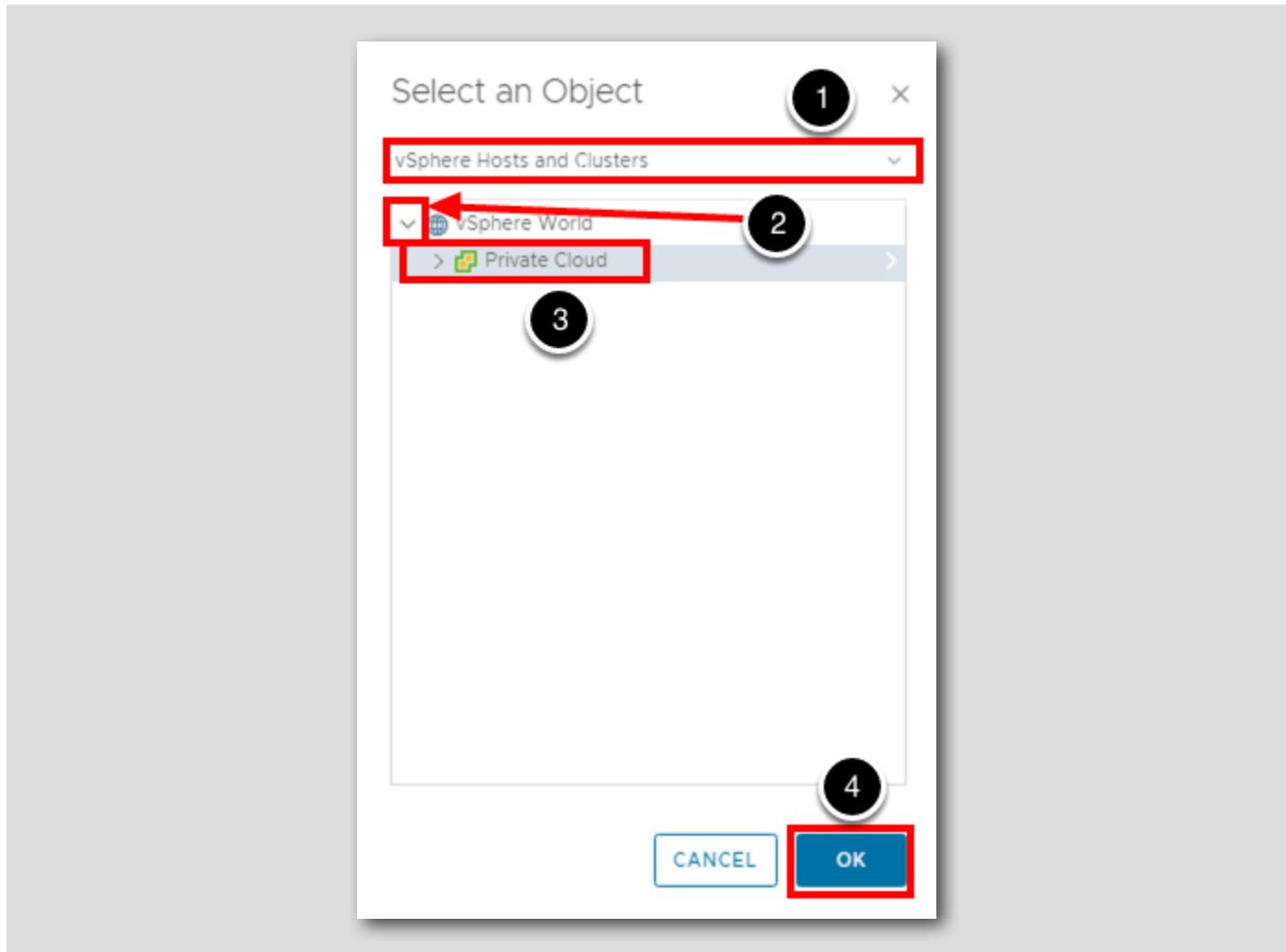
## Select Preview Source



Our view is blank because we haven't selected a data source.

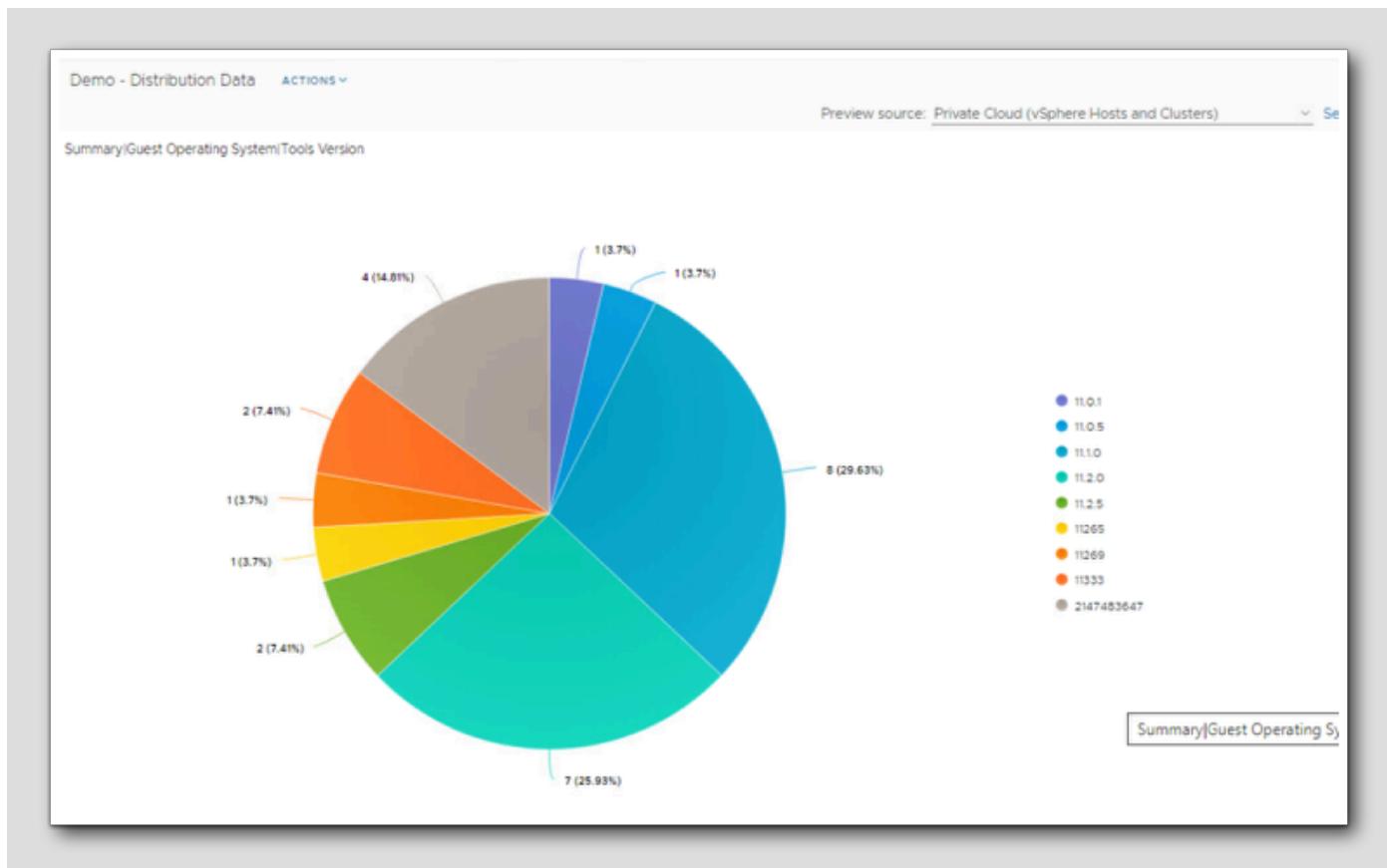
1. Click **Select preview source...** in the top right-hand corner of the window.

## Select the Private Cloud Object



1. In the drop-down, select **vSphere Hosts and Clusters**. (Note: You will need to scroll down in the drop-down list to see the vSphere Hosts and Clusters item)
2. Expand **vSphere World** by clicking the chevron.
3. Click **Private Cloud** to select that object as the preview source for our new view.
4. Click **OK**.

## View Results



We will now have a distribution of the VMware Tools versions in the environment!

## Lesson End

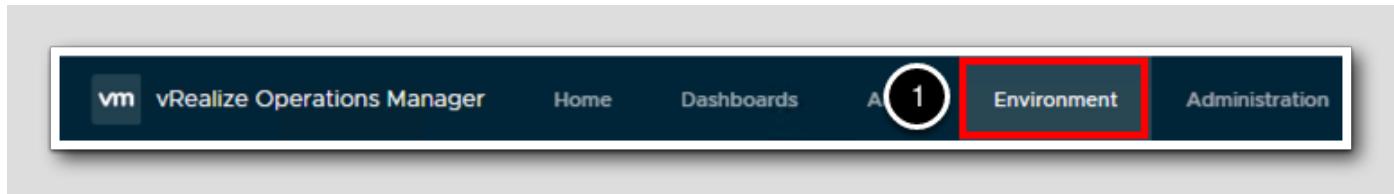
We have completed this lesson on Creating a View with Distribution Data! In the next lesson, we take you through the process to put views and dashboards into reports.

## Create Reports from Views and Dashboards

In this lesson, we show how to create custom reports using both views and dashboards.

## Go to Environment

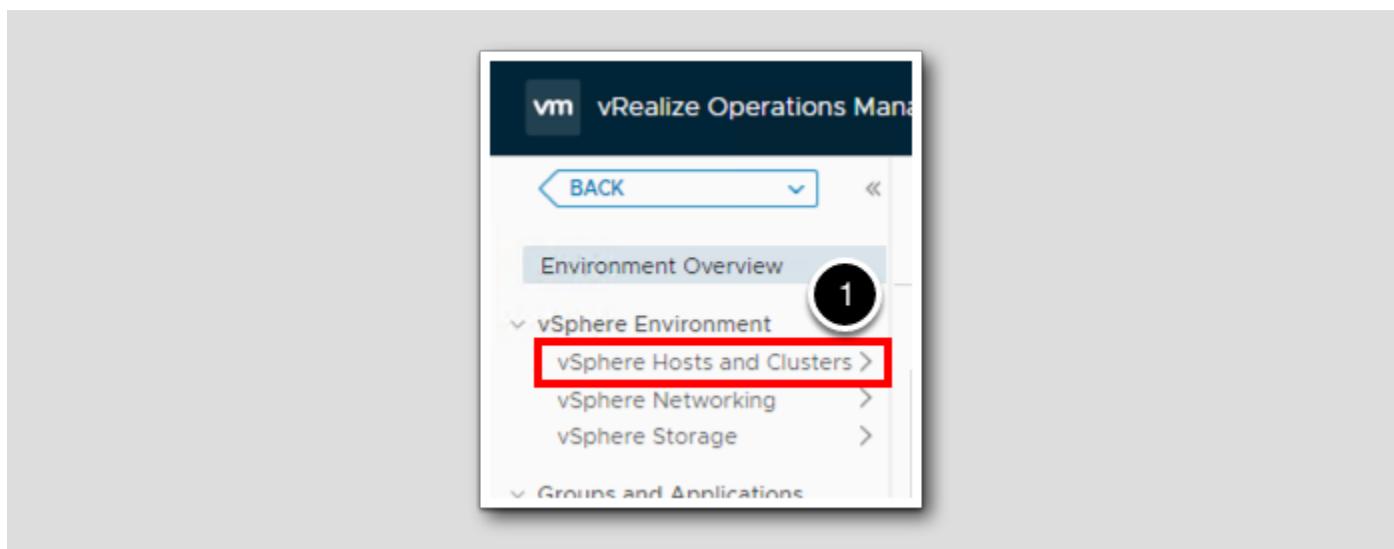
[180]



1. Click on Environment.

## Hosts and Clusters

[181]



1. Click on vSphere Hosts and Clusters.

## Select a vCenter Server

The screenshot shows the vRealize Operations Manager interface. The top navigation bar includes 'vRealize Operations Manager', 'Home', 'Dashboards', 'Alerts', 'Environment' (which is selected), and 'Administration'. Below the navigation is a 'BACK' button and a dropdown menu for 'vSphere Hosts and Clusters'. A red box highlights the 'vSphere World' item under this dropdown. A red box also highlights the 'Private Cloud' item under the 'vSphere World' dropdown. The main content area is titled 'Private Cloud' and contains tabs for 'Summary' (selected), 'Alerts', 'Metrics', 'Capacity', 'Compliance', 'Logs', 'Events', and 'more...'. A red box highlights the 'more...' button. The summary section displays the following data:

	Value
Cluster:	2
ESXi Host:	5
Virtual Machine:	23
Datastore:	6
Version:	7.0.2-17694817

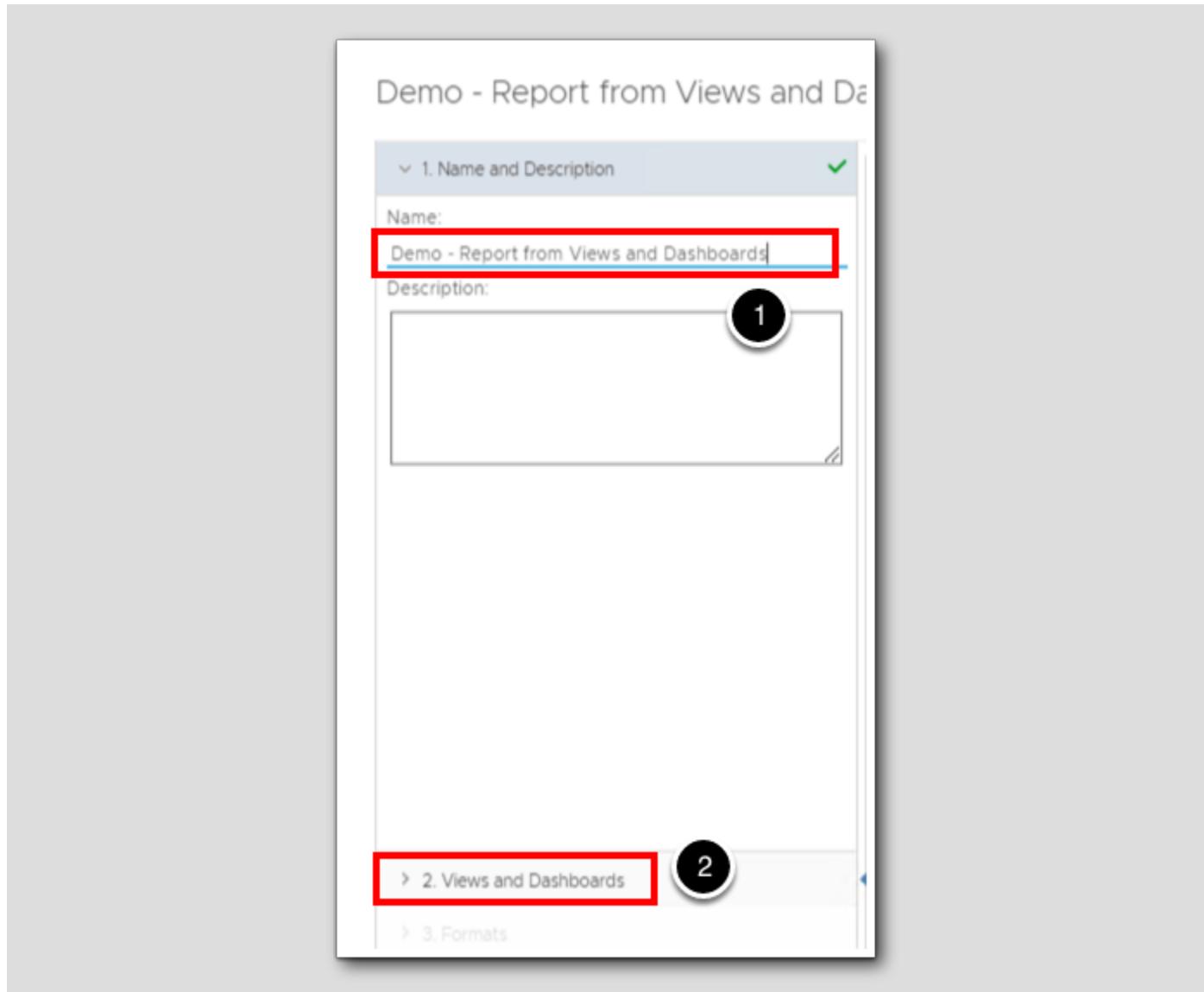
1. Expand vSphere World by clicking the chevron to the left of the text.
2. Select vCenter Server Private Cloud.
3. Click on more...

## Create a Report

The screenshot shows the 'Private Cloud' report management screen. The top navigation bar includes 'TROUBLESHOOT', 'Actions' (dropdown), 'Summary', 'Alerts', 'Metrics', 'Capacity', 'Compliance', 'Logs', 'Events', 'Details', 'Environment', 'Reports' (selected), and 'less...'. A red box highlights the 'Reports' tab. Below the tabs, there are two buttons: 'Report Templates' and 'Generated Reports'. A red box highlights the 'ADD' button under 'Report Templates'. The main area displays columns for 'Name' (with an upward arrow icon), 'Description', and 'Subject'.

1. Click on Reports.
2. Click ADD to create a new report.

## Report Name



1. Name the report Demo - Report from Views and Dashboards.

2. Click 2. Views and Dashboards.

## Selected Views

Demo - Report from Views and Dashboards - New Tem

1. In the search box, type sized and hit Enter.

2. Double-click Oversized Virtual Machines.

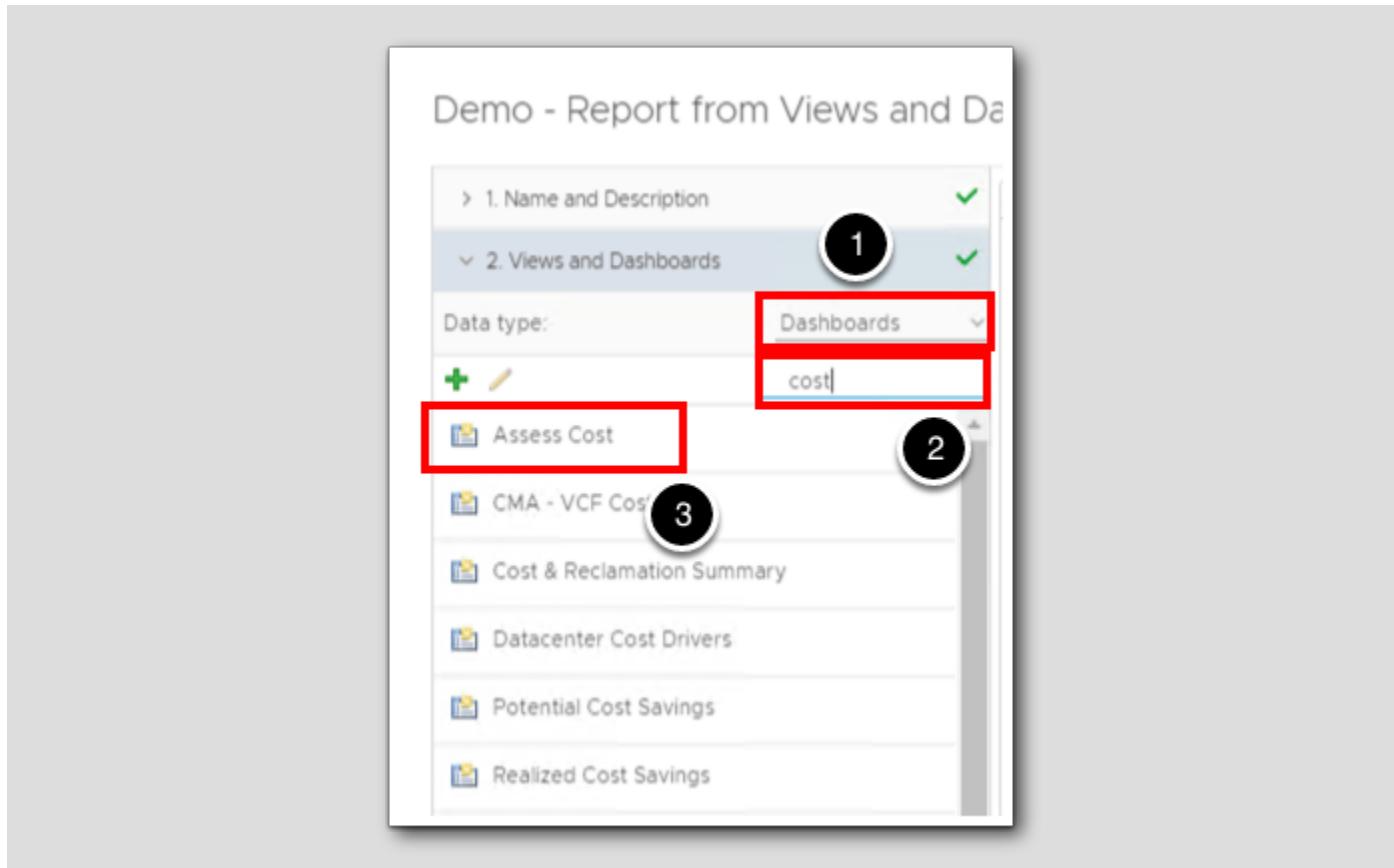
3. Double-click Undersized Virtual Machines.

Name	Configured
vr-automation	12
saltstack	8
identity-manager	6
SupervisorControlPI...	2
SupervisorControlPI...	2

Name	Configured
dev-project-worker...	2
vr-loginsight	4
Total	6

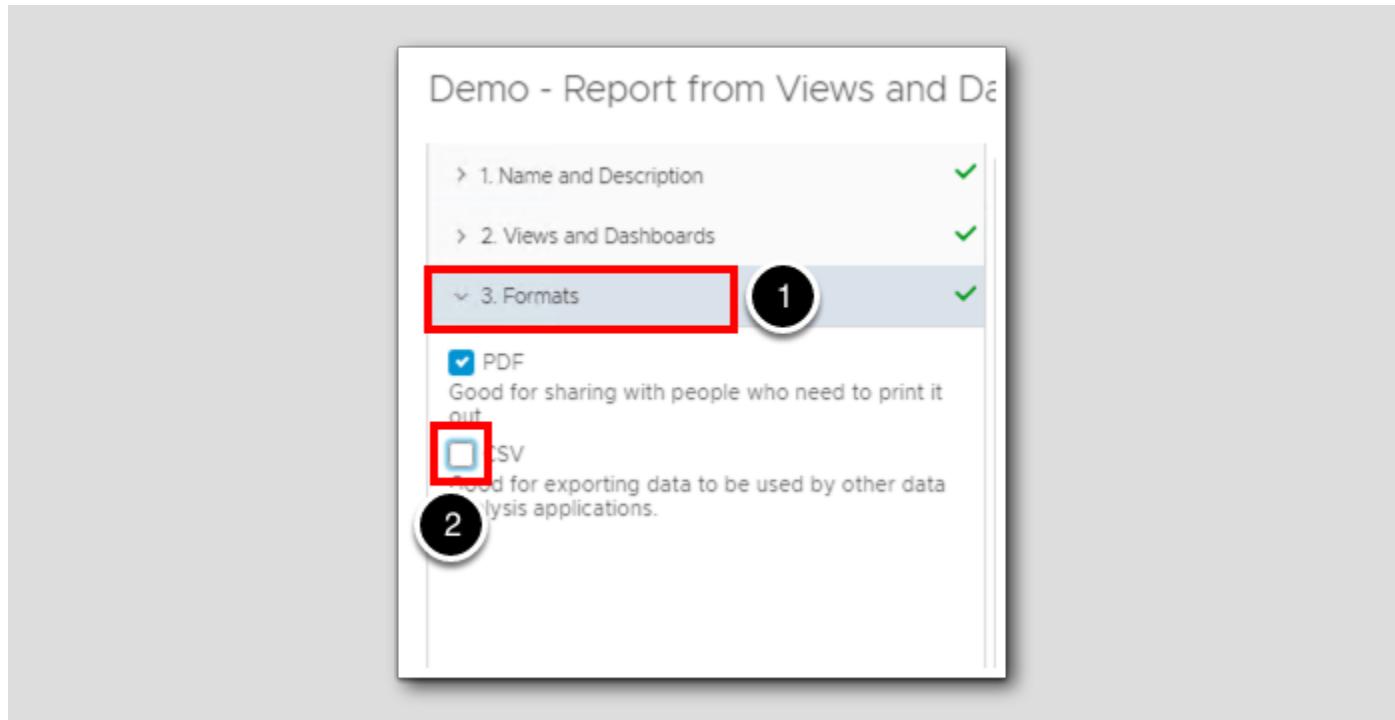
Click to expand and select report components.

## Select Dashboard



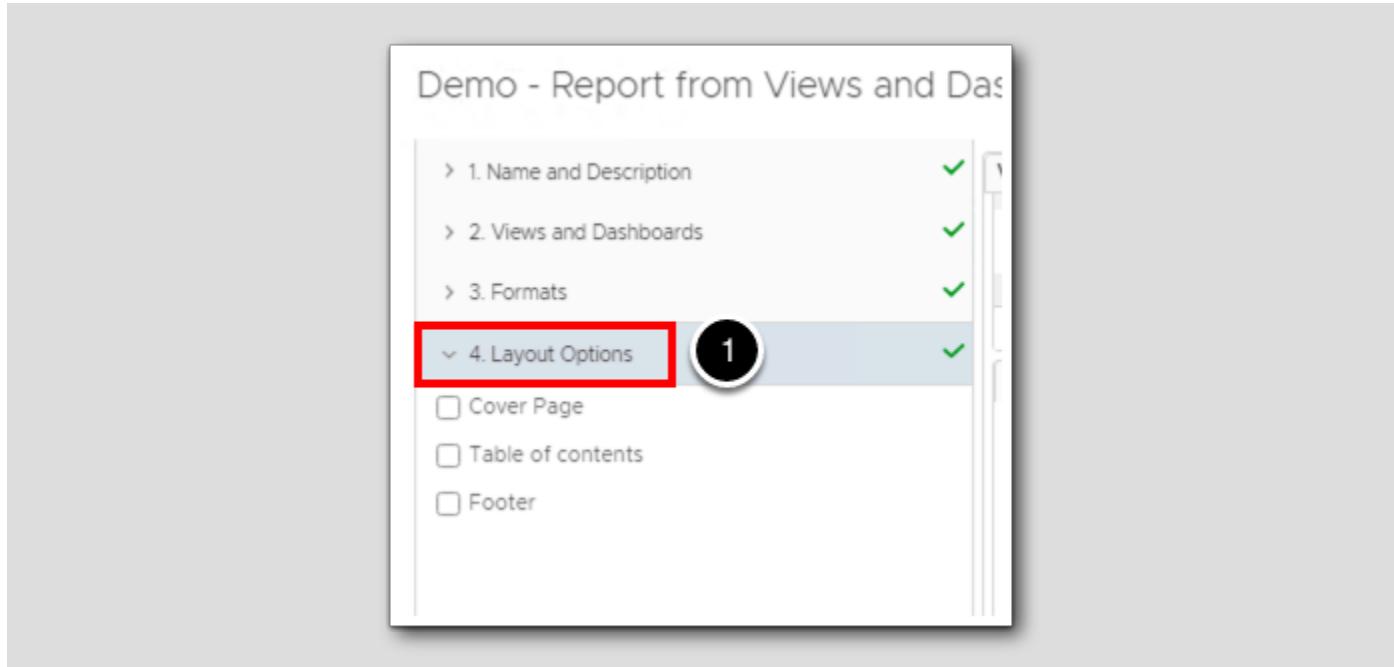
1. Change the Data Type from Views to Dashboards.
2. In the Quick Filter, type cost and hit Enter.
3. Double-click Assess Cost to add it to the Report.

## Report Format



1. Select 3. Formats.
2. Since we are including a dashboard as part of this report, uncheck CSV. A dashboard will not convert to CSV (comma separated values).

## Layout Options



1. Select 4. Layout Options.

We have the ability to include the following:

- Cover Page
- Table of contents
- Footer

For a Cover Page:

- Can contain an image up to 5 MB.
- The default report size is 8.5 inches by 11 inches. The image is resized to fit the report front page.

Table of Contents

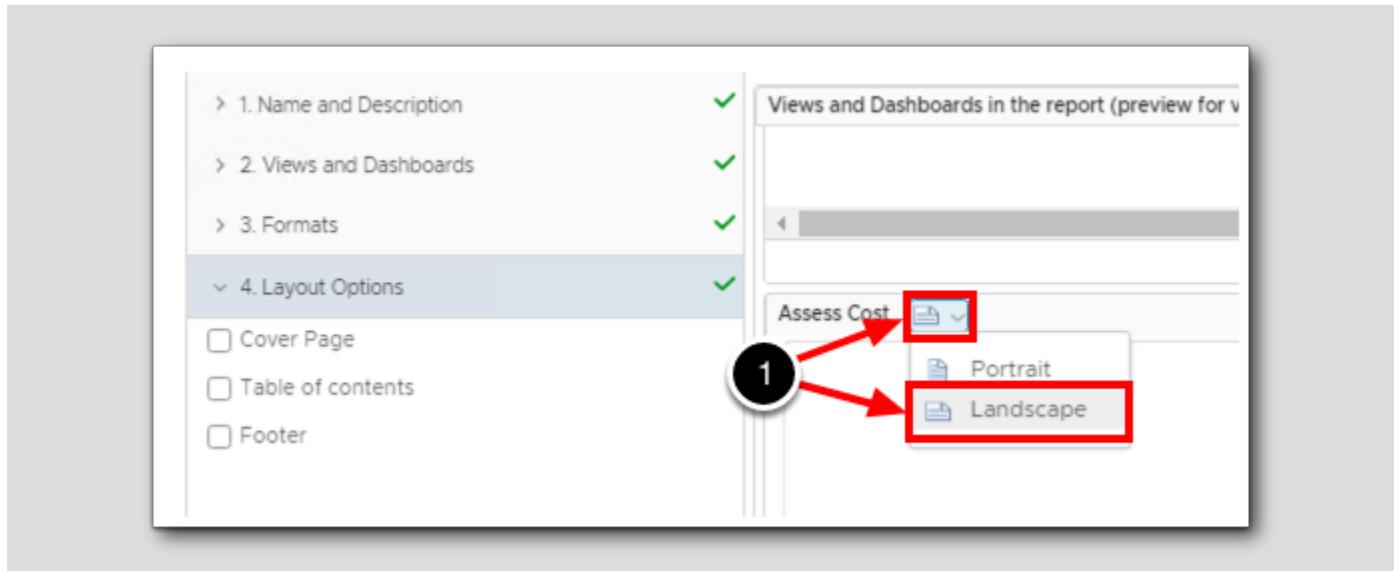
- Provides a list of the template parts, organized in the order of their appearance in the report

Footer

- Includes the date when the report is created, a note that the report is created by VMware vRealize Operations Manager, and page number.

Don't make any changes here, we will use the default settings.

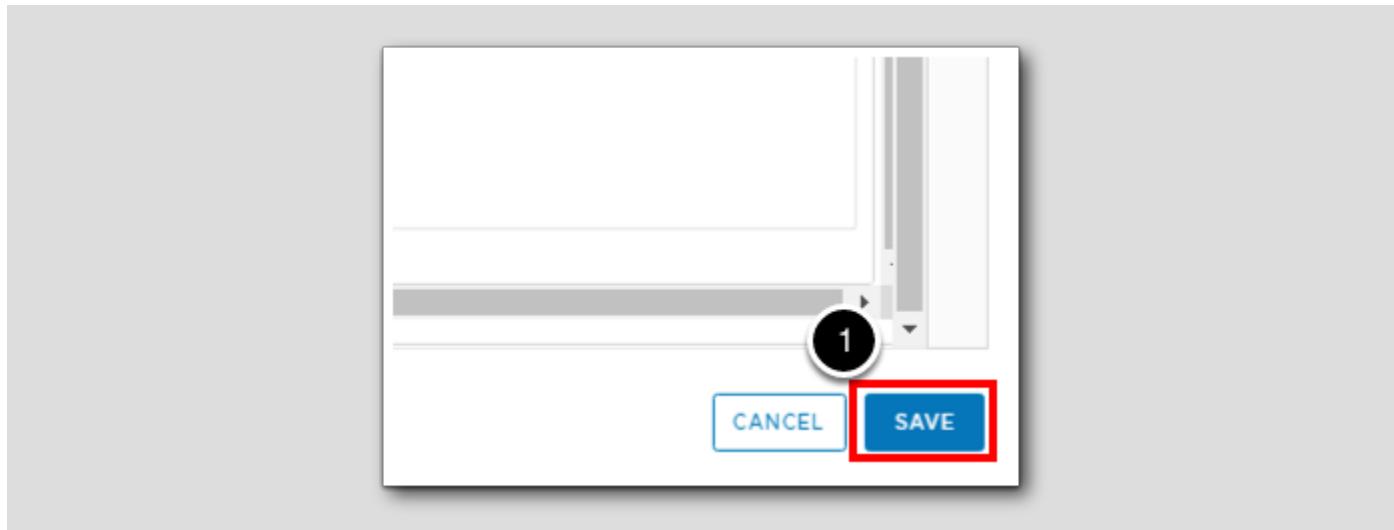
## Portrait or Landscape



Each view and dashboard can be oriented to portrait or landscape mode. For dashboards in a report, landscape will likely be a better choice to simulate the aspect ratio of a monitor. Some dashboards require scrolling. When a dashboard is too large to be displayed on the screen, it will not fit into a report very well either. Make sure Assess Cost is set to Landscape.

1. Click the layout icon and select Landscape.

## Save



1. Click **SAVE** in the bottom right corner of the window.

## New Report has been Created

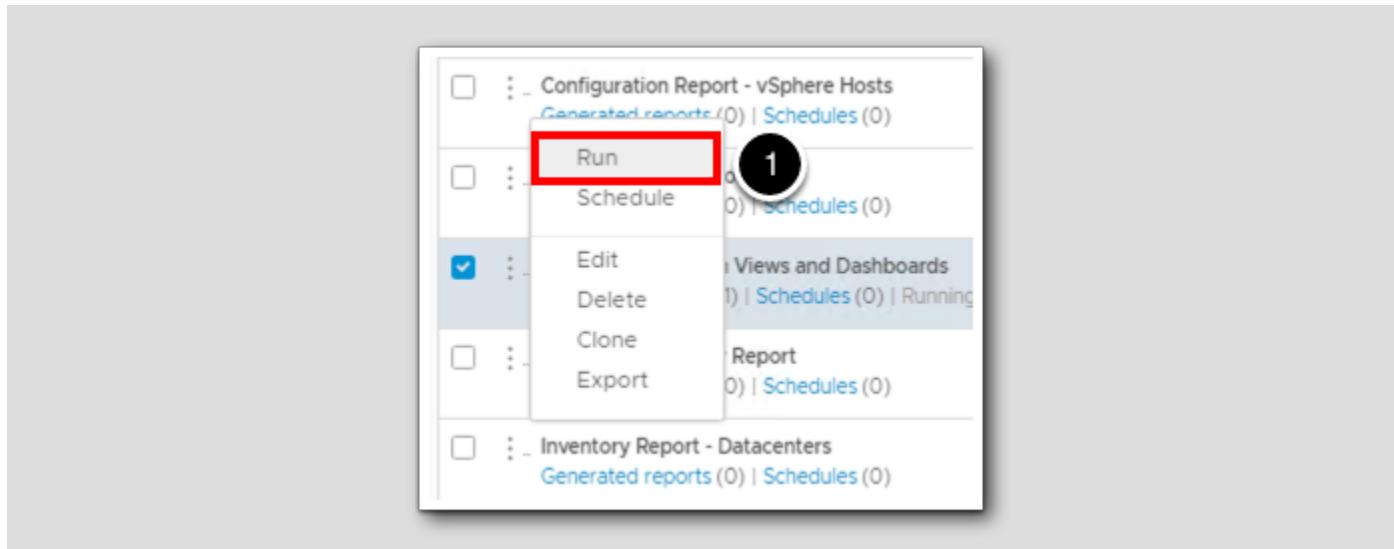
The screenshot shows the 'Generated Reports' tab of the Reports List interface. At the top, there are 'Report Templates' and 'Generated Reports' tabs, with 'Generated Reports' selected. Below the tabs are 'ADD' and '...' buttons. The main area displays a list of reports. The first four reports are standard configuration reports for Virtual Machines, vSphere Clusters, and vSphere Hosts. The fifth report, 'Datastore Cost Report', is circled with a black circle containing the number '1'. The sixth report, 'Demo - Report from Views and Dashboards', is highlighted with a red box around its icon and has a checkmark next to it. This indicates that the new report has been successfully created.

Name	Type	Generated reports	Schedules
Configuration Report - Virtual Machines	Virtual Machine	(0)	(0)
Configuration Report - vSphere Clusters	Cluster	(0)	(0)
Configuration Report - vSphere Hosts	Host	(0)	(0)
Datastore Cost Report	Datastore	(0)	(0)
Demo - Report from Views and Dashboards	Custom	(0)	(0)

We can now see our new report in the Reports List.

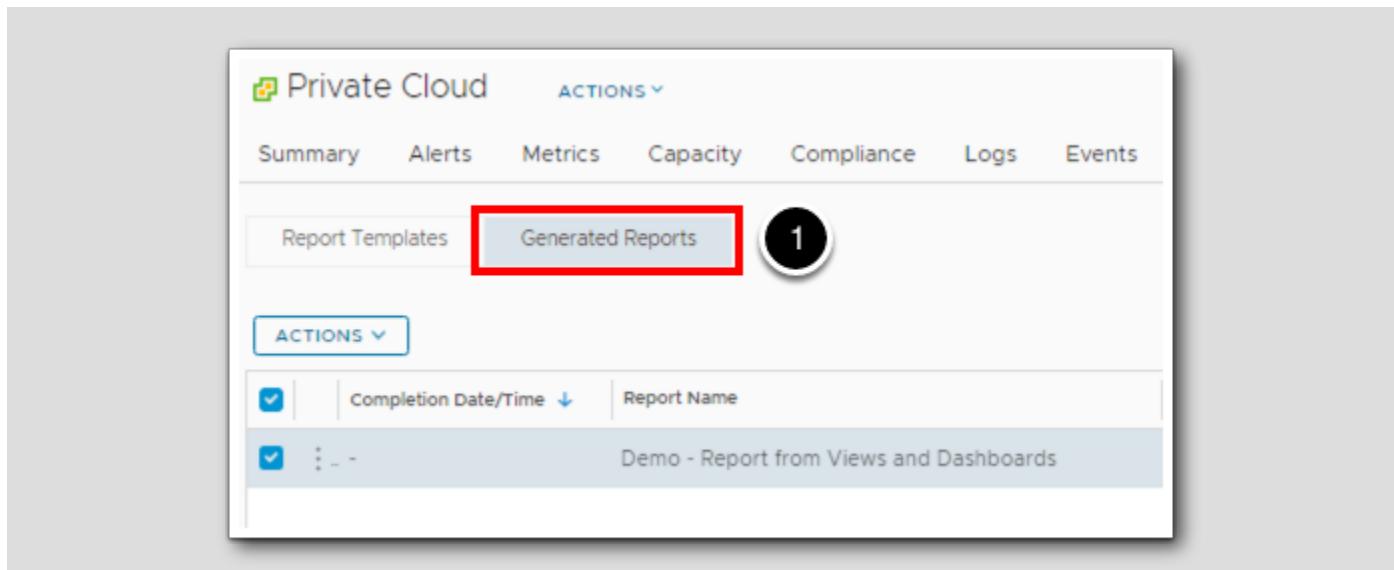
1. Click the 3 dots to the left of the report name to open the actions menu.

## Run the Report



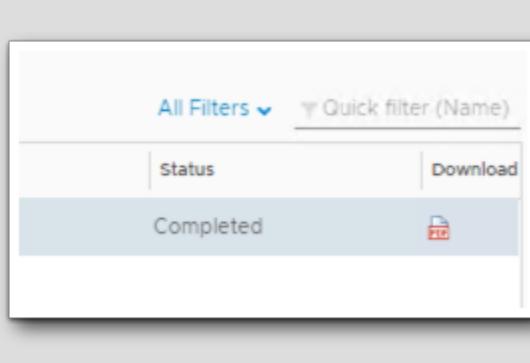
1. Click Run the run the report.

## Generated Reports



1. Click on Generated Reports to see the newly created report.

## Select PDF



The report will be available as a PDF for viewing. Note: In this HOL environment, it may take a few minutes for this to complete before the PDF is available.

Clicking the PDF icon will allow you to save it to the local drive. Feel free to save and open the PDF to see the results.

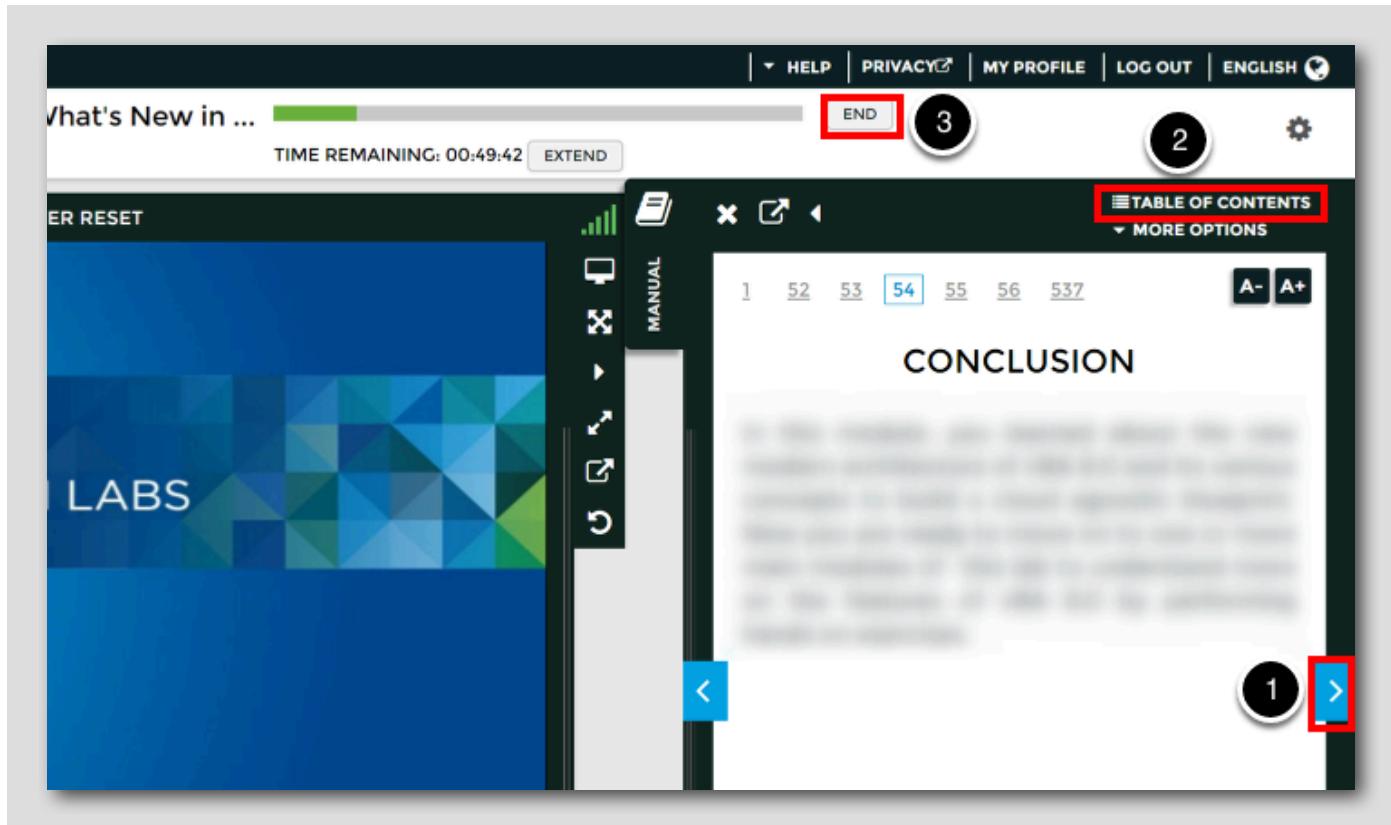
## Lesson End

You have completed the last lesson in this module. You should now have an understanding in creating new views. You also now have the tools to create reports from any view or dashboard.

## Conclusion

In this module you explored a few approaches for creating new and customizing views and reports in vRealize Operations.

You've finished Module 2



Congratulations on completing the lab module.

If you are looking for additional general information on vRealize Operations 8.4, try one of these:

- VMware Product Public Page - vRealize Operations: <https://www.vmware.com/products/vrealize-operations.html>
- vRealize Operations 8.4 - Release Notes: <https://docs.vmware.com/en/vRealize-Operations-Manager/8.4/rn/vRealize-Operations-Manager-84.html>
- vRealize Operations 8.4 - Documentation: <https://docs.vmware.com/en/vRealize-Operations-Manager/8.4/com.vmware.vcom.core.doc/GUID-7E6B5805-3D2F-41C4-ADFF-B7248386E7AC.html>
- VMware Cloud Management Blog - What's New in vRealize Operations 8.4 and Cloud: <https://blogs.vmware.com/management/2021/04/whats-new-in-vrealize-operations-8-4-and-cloud.html>

From here you can:

1. Click to advanced to the next page and continue with the next lab module
2. Open the TABLE OF CONTENTS to jump to any module or lesson in this lab manual
3. Click on the END button if you are done with the lab for now and want to exit



## Module 3 - Creating and Managing Dashboards (30 minutes)

### Introduction

[199]

vRealize Operations Manager includes a broad set of simple to use, but customizable dashboards to get you started with monitoring your VMware environment. The predefined dashboards address several key questions including how you can troubleshoot your VMs, the workload distribution of your hosts, clusters, and datastores, the capacity of your data center, and information about the VMs. You can also view log details.

Each set of dashboards is complemented with a series of out-of-the-box customizable alerts and reports to assist with your operational awareness. Alerts, reports, and dashboards, each have a purpose with minimal overlap. Several activities that are carried out using alerts should be carried out using dashboards.

In this Module, we'll cover the following lessons:

- Cloning and Modifying Existing Dashboards
- Creating a New Custom Dashboard
- Importing Dashboards
- Sharing Dashboards

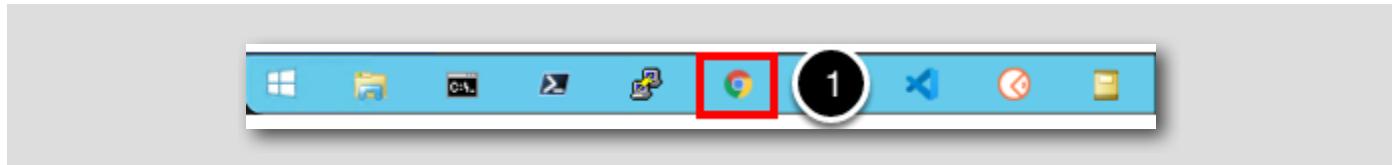
### Log in to vRealize Operations

[200]

To begin this exercise, we will log in to vRealize Operations. If you are not currently logged into any instance of vRealize Operations, continue to the next page, but if you are already logged into vRealize Operations, click [here](#) to skip ahead.

### Open the Chrome Browser from Windows Quick Launch Task Bar

[201]



If your browser isn't already open, launch Google Chrome

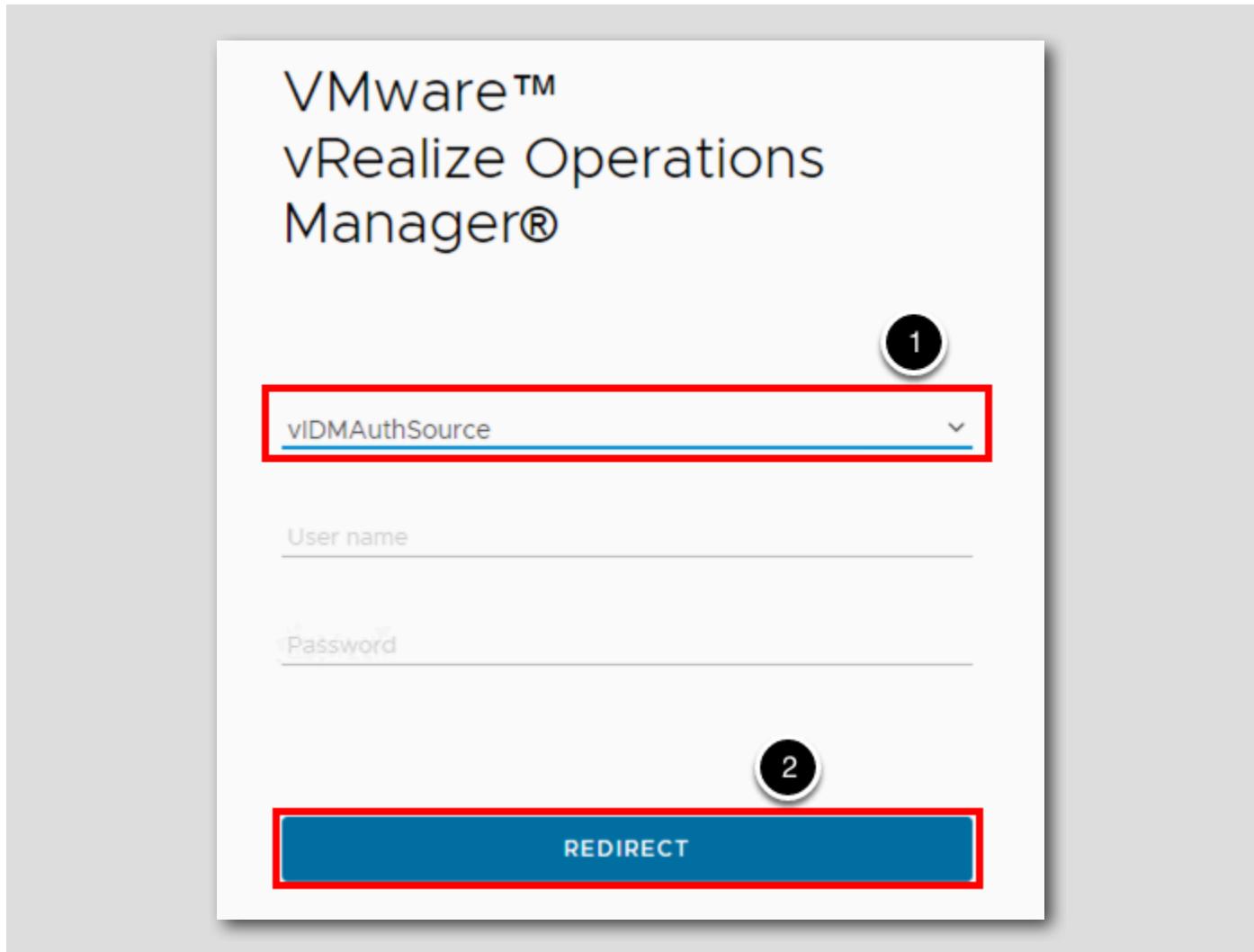
1. Click the Chrome icon on the Windows Quick Launch Task Bar



The browser Bookmarks Bar has links to the different applications that are running in the lab.

1. Click the vRealize Operations Bookmark

## Log in to vRealize Operations

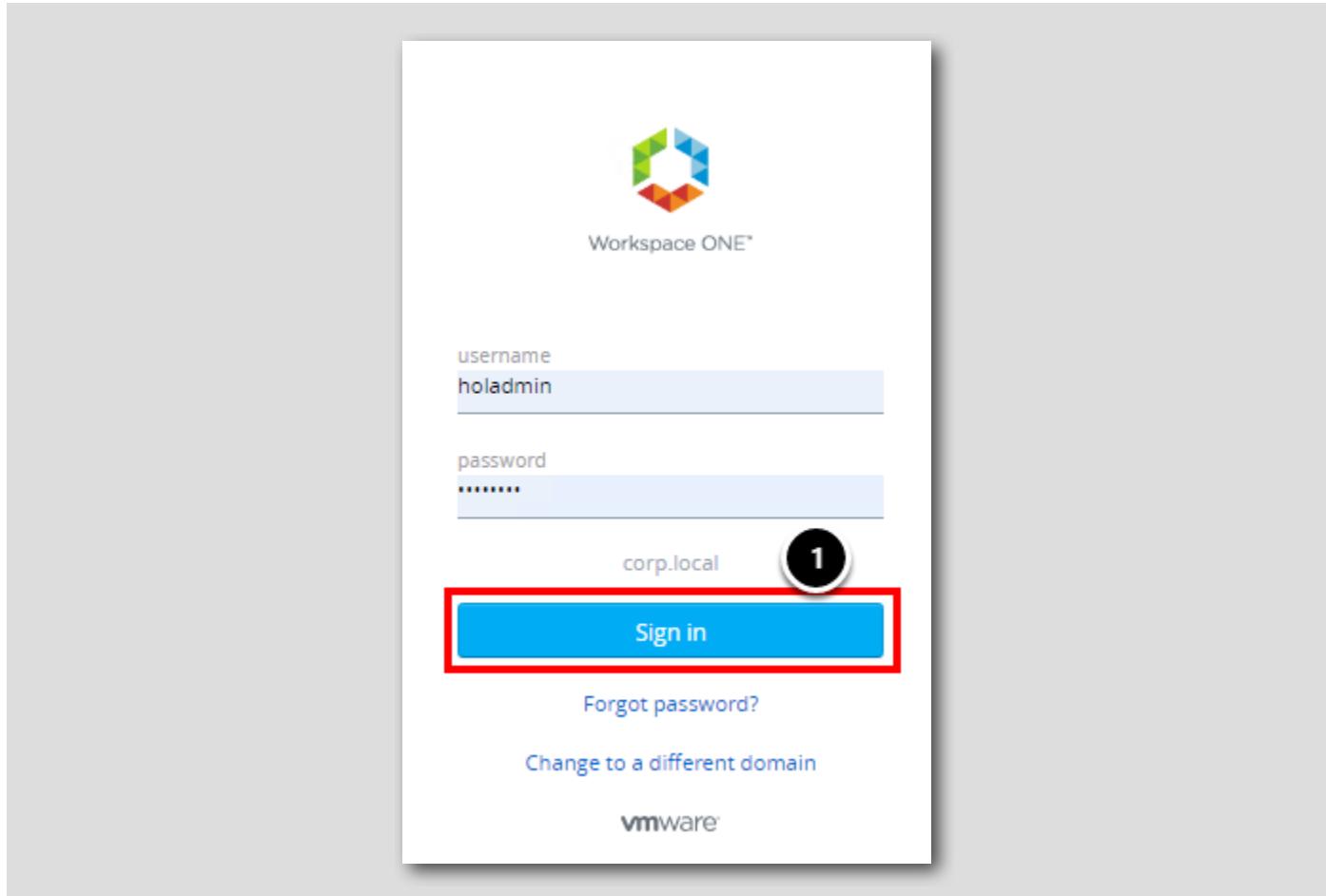


vRealize Operations is integrated with VMware Identity Manager which we will use for user authentication in this lab.

vIDMAuthSource (VMware Identity Manager) should be pre-selected as the identity source. However, if it is not you will choose it.

1. Click the drop-down arrow if vIDMAuthSource is not selected.
2. Click REDIRECT to be taken to the authentication page.

## VMware Identity Manager Login



At the Workspace ONE login screen, use these credentials:

username: holadmin

password: VMware1!

1. Click Sign in

## vRealize Operations Home Screen

You should be at the vRealize Operations Home screen and ready to start the module.

## Clone and Modify Existing Dashboards

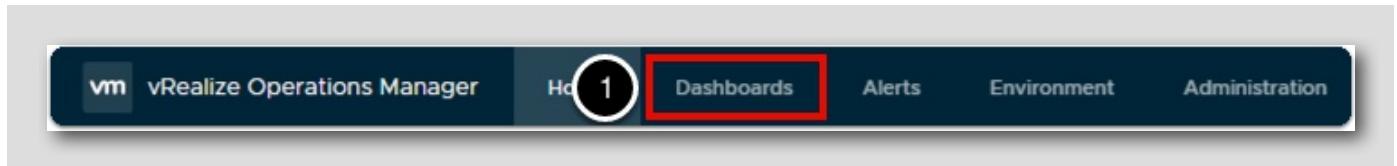
In this lesson, we will learn how to clone an existing dashboard and modify it to make it our own.

vRealize Operations has numerous out-of-the-box dashboards that were created by industry experts who have a deep understanding of vRealize Operations as well as the characteristics and behavior of the underlying objects being managed. However, personalizing a Dashboard to fit a specific role or consolidate other information into a single view is a common use case for most administrators.

To start, we will clone and make some simple changes to create a custom Overview Dashboard for our administrators. For this example, we will clone an existing dashboard and add the Scoreboard Health, Object relationship and Top Alerts widgets. We will also minimize the three Top-15 widgets that are in the existing dashboard so we will have more screen real estate in the dashboard.

Cloning an existing dashboard to create a new or modified dashboard is considered a best practice to ensure your custom content is not affected during an upgrade of vRealize Operations.

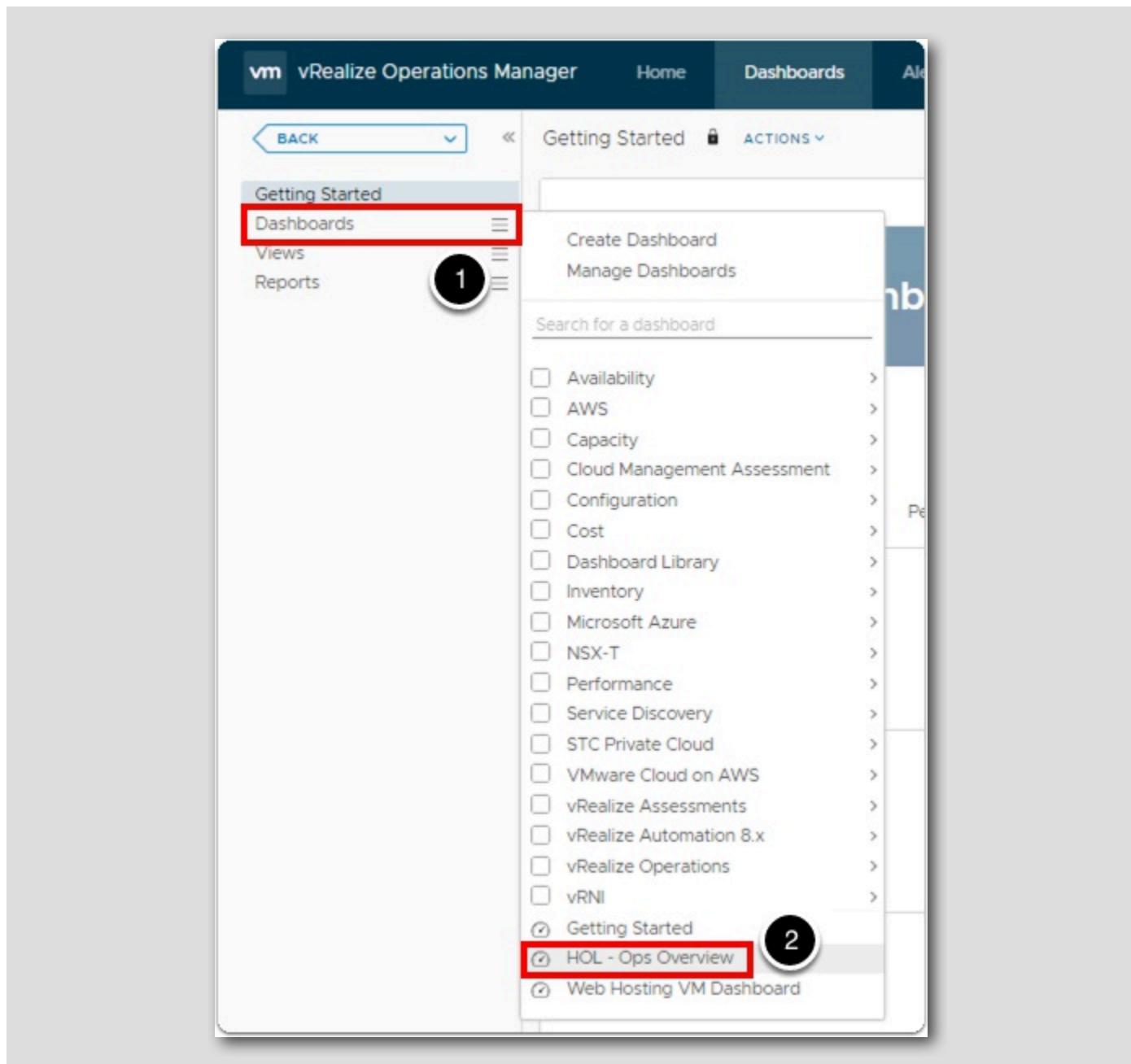
## Dashboards



NOTE: If we are already on the Dashboard tab, we can skip this step.

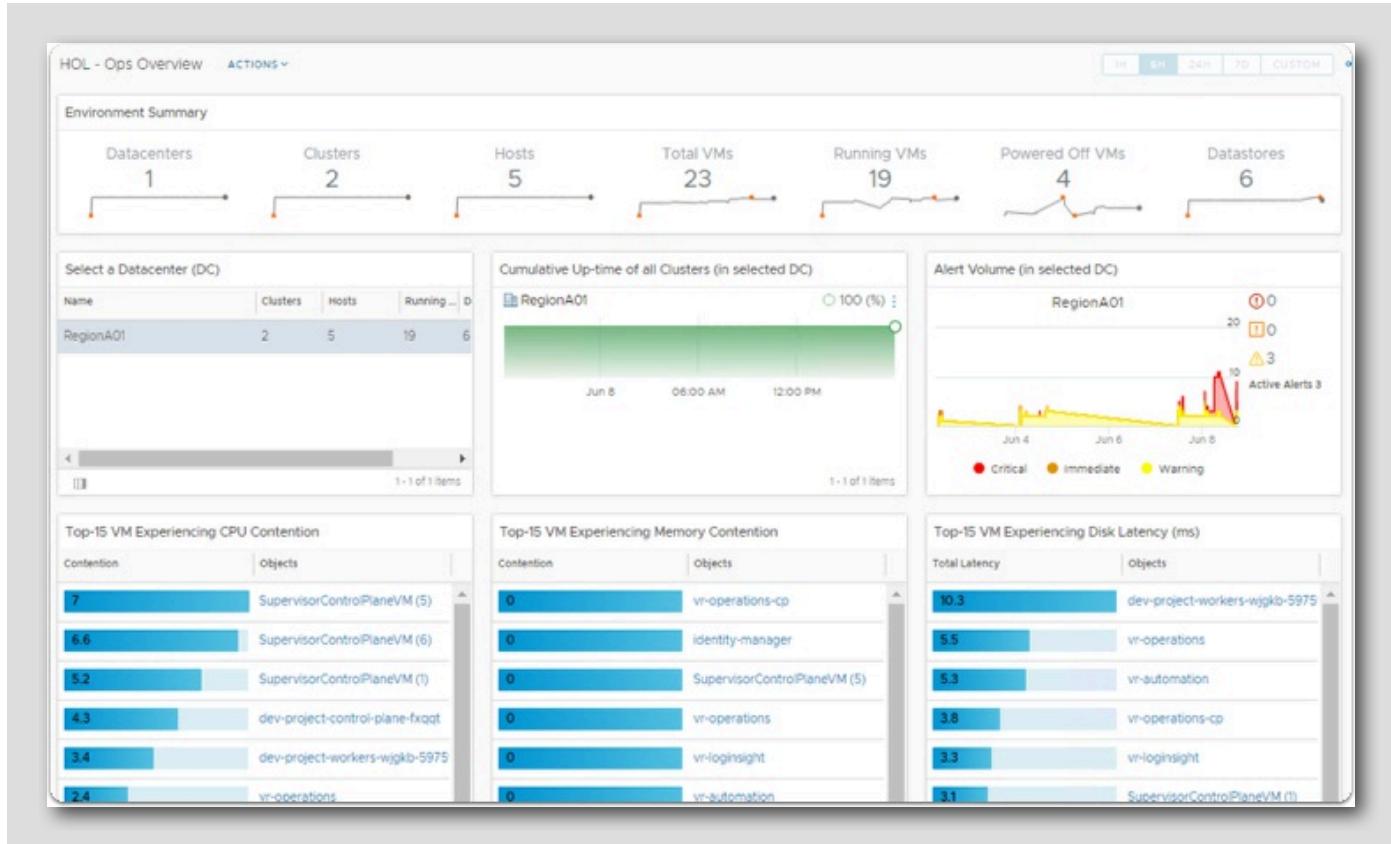
1. Click on **Dashboards** in the menu bar at the top of the user interface.

## HOL - Ops Overview Dashboard



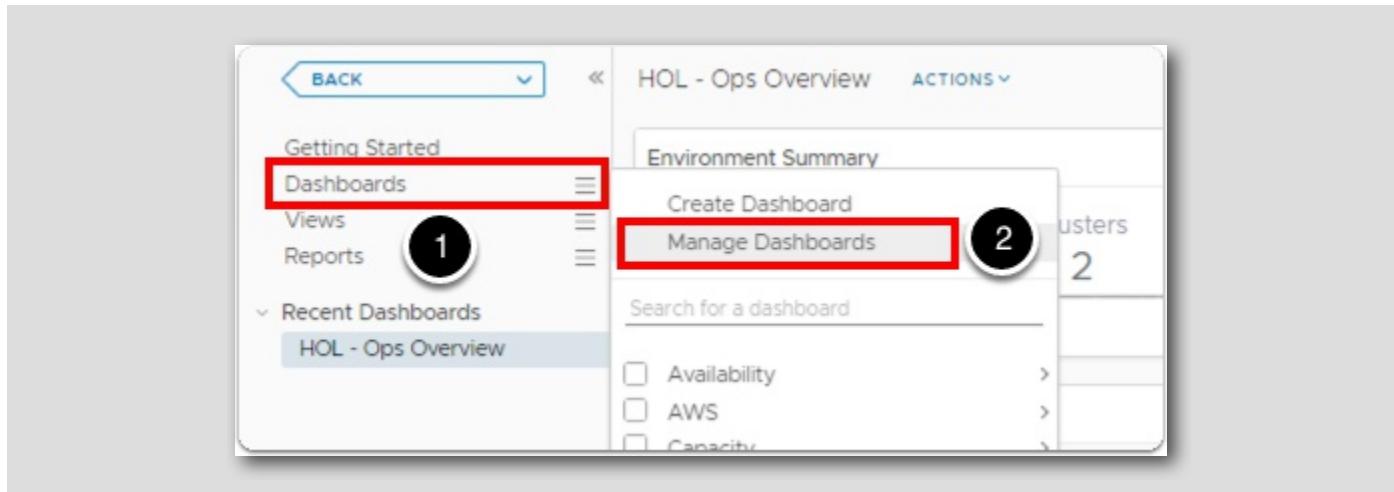
1. Click on Dashboards to expand the Dashboards menu.
2. Then click on HOL - Ops Overview.

## HOL - Ops Overview Dashboard Review



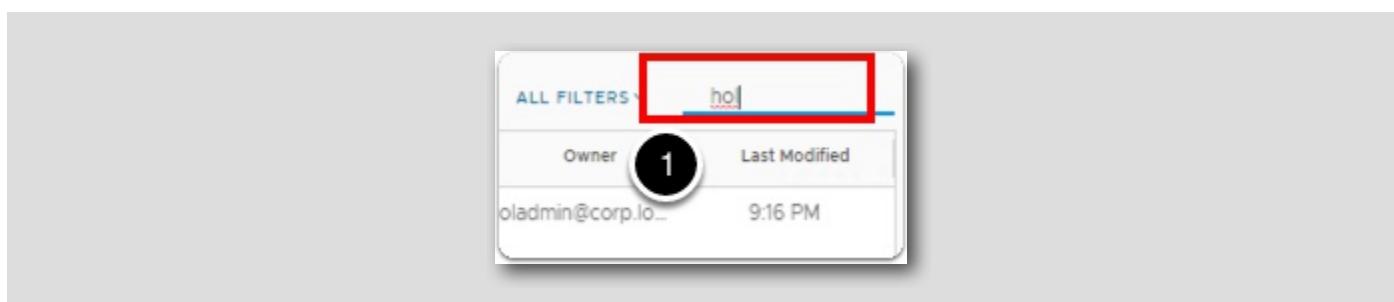
We can now see the HOL - Ops Overview dashboard, which will be the basis for our own customized version of this dashboard. In order to modify this or any other existing dashboard, we will first want to "clone" it and then modify the cloned version. We do not want to edit any master or default out-of-the-box dashboards so we don't potentially break the content and flow. We ALWAYS want to clone a dashboard and edit the clone or just create a brand new custom dashboard from scratch as a best practice!

## Manage Dashboards



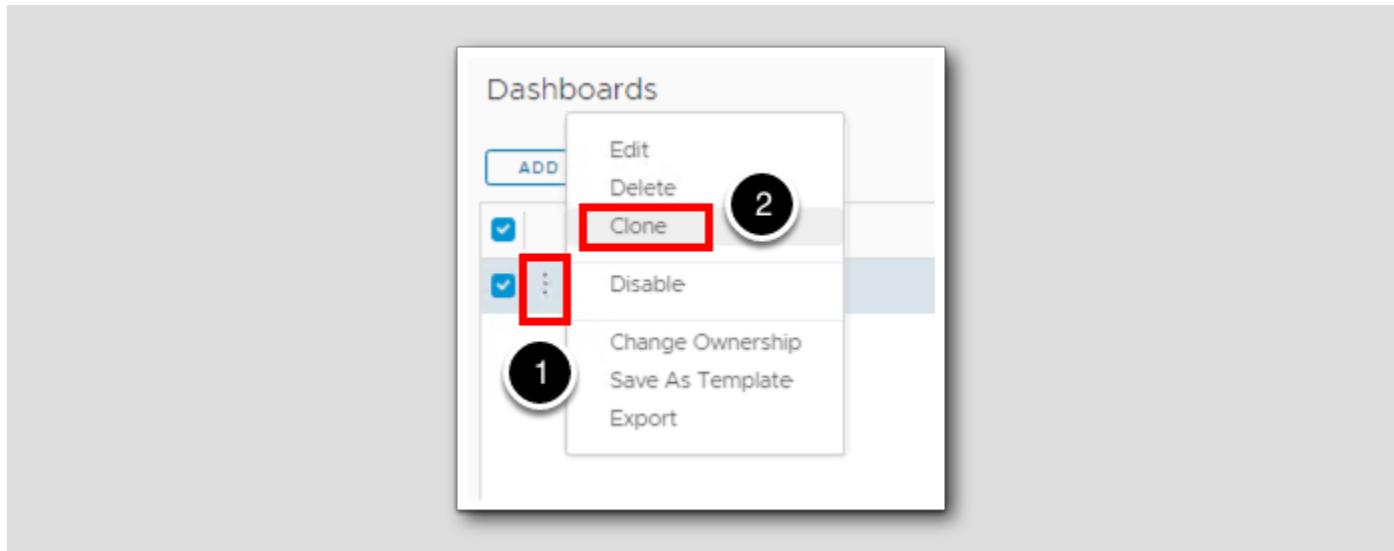
1. Click on the Dashboards again in the left column.
2. Then click on Manage Dashboards.

## Filter for HOL - Ops Overview Dashboard



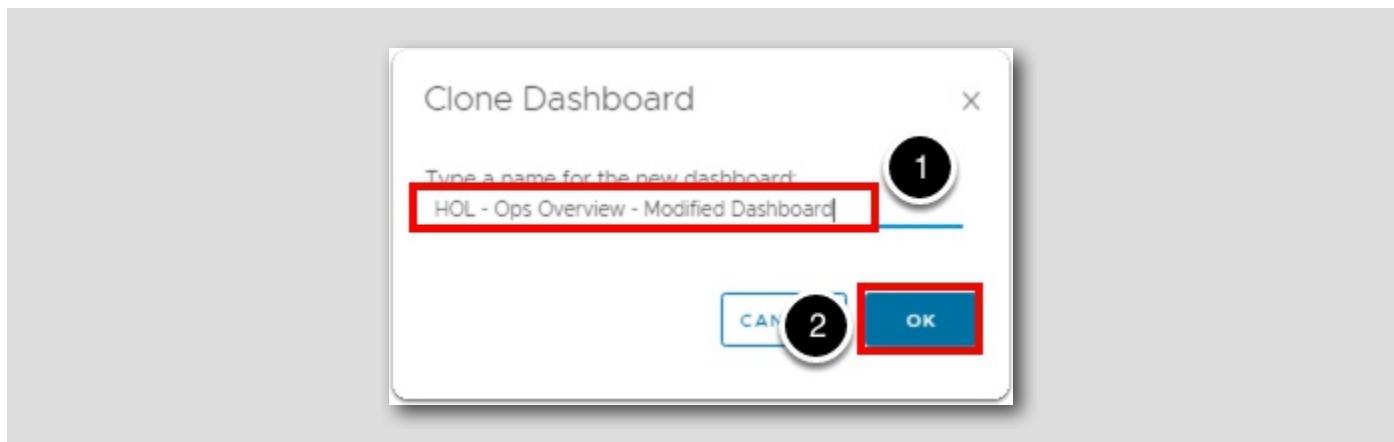
1. Type hol into the Quick filter (Name) field and then hit the ENTER key on our keyboard to search for dashboards with the word hol in the title.

## Clone Dashboard



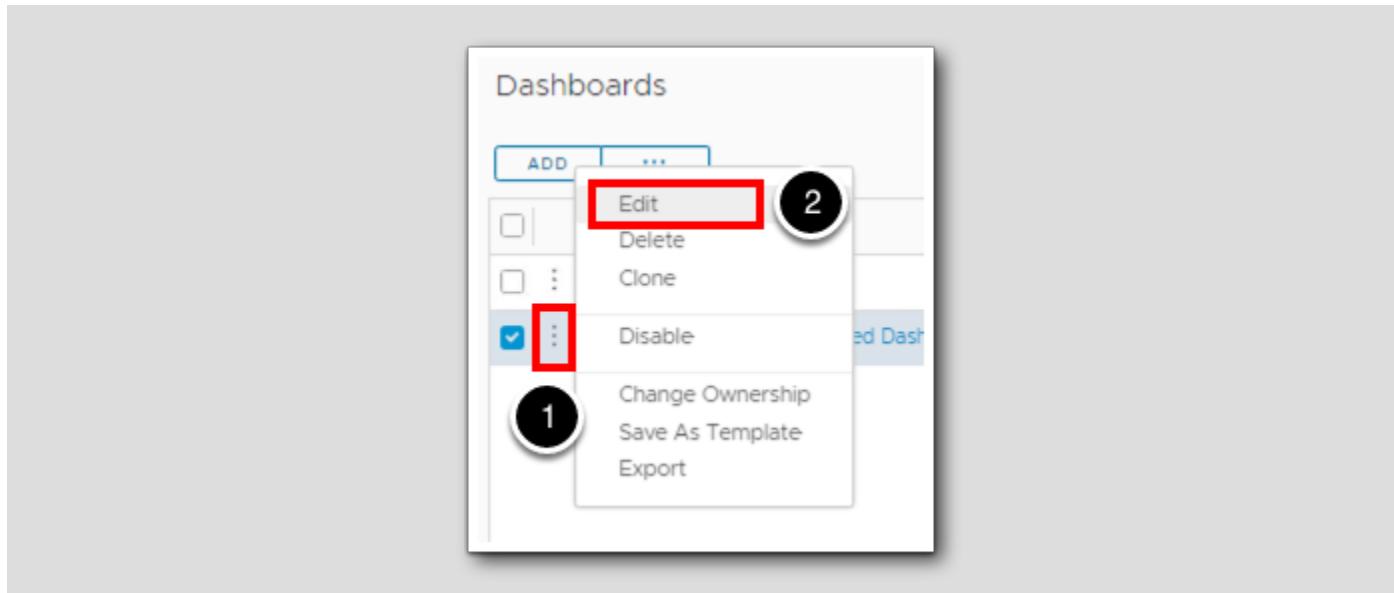
1. Click on the 3 dots to the right of the checkbox on the HOL - Ops Overview Dashboard row to open the actions menu.
2. Then click Clone to start the cloning process.

## Clone Dashboard - Name the New Dashboard



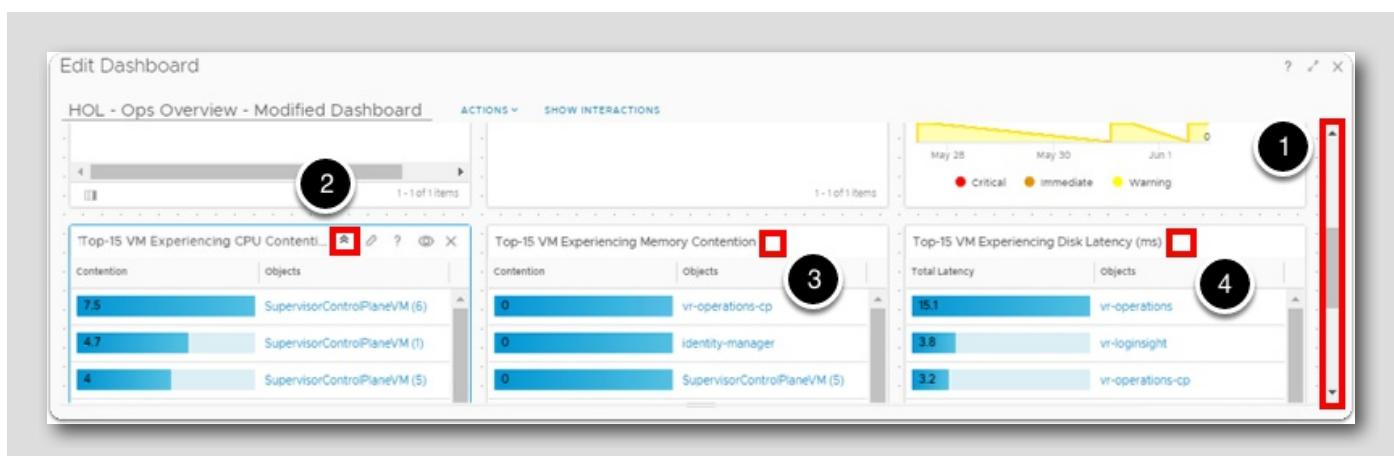
1. Type HOL - Ops Overview - Modified Dashboard into the name text field.
2. Then click on the OK button to save the name.

## Manage Dashboards - Edit Dashboard



1. Click on the 3 dots next to the checkbox on the HOL - Ops Overview - Modified Dashboard Dashboard row to open the actions menu.
2. Then click Edit.

## Edit Dashboard - Minimize

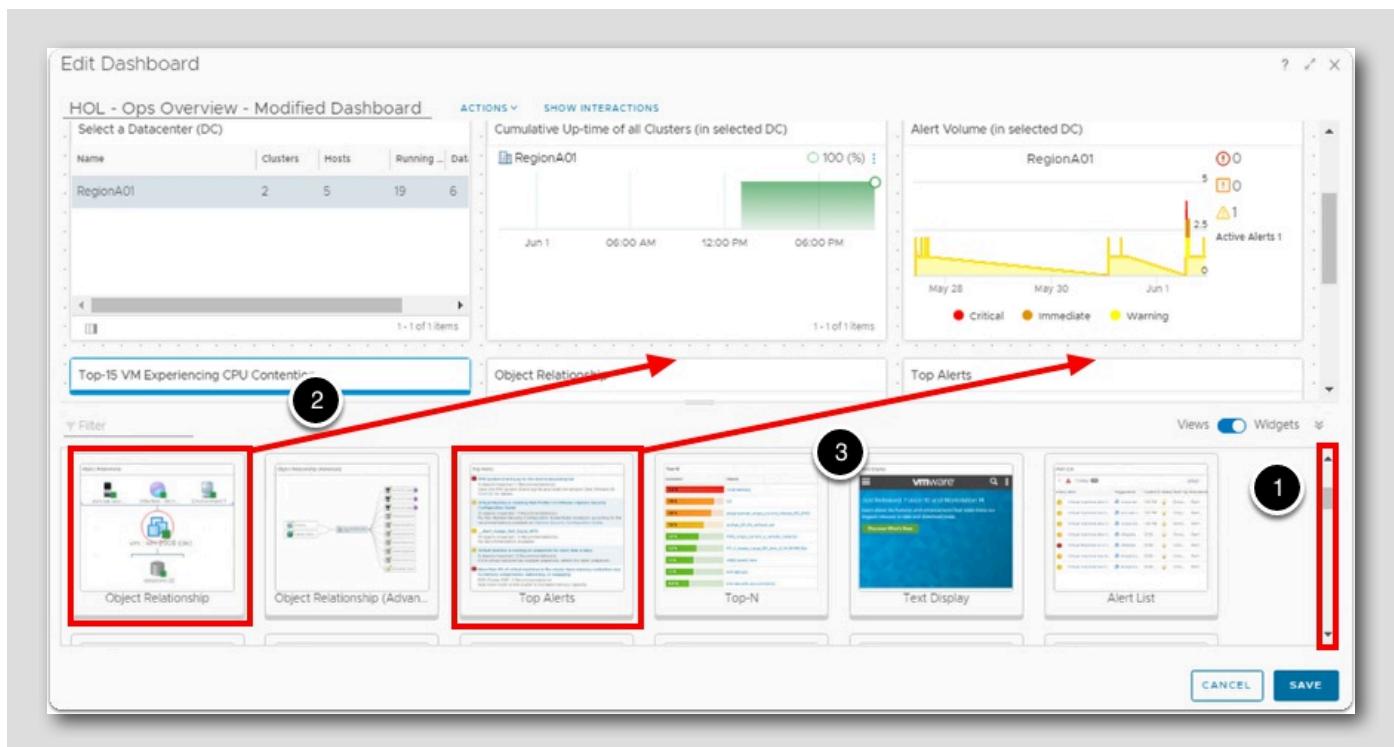


In our custom dashboard, we want to minimize the three Top-15 widgets.

1. Drag the top scroll bar down until we can see the (3) Top-15 widgets.
2. Hover the mouse over the right-hand corner of the Top-15 VM Experiencing CPU Contention widget and click on the double arrow to minimize it.
3. Hover the mouse over the right-hand corner of the Top-15 VM Experiencing Memory Contention widget and click on the double arrow to minimize it. (Note: double arrow not shown in screenshot, but it will become visible when we hover over this widget.)
4. Hover the mouse over the right-hand corner of the Top-15 VM Experiencing Disk Latency (ms) widget and click on the double arrow to minimize it. (Note: double arrow not shown in screenshot, but it will become visible when we hover over this widget.)

## Edit Dashboard - Add Widgets

[215]



1. Drag the bottom scroll bar down until we see the Object Relationship widget in the list. (should be the second row of new widgets)
2. Click on and drag the Object Relationship widget to the center column above where the Top-15 VM Experiencing Memory Contention widget is located.
3. Click on and drag the Top Alerts widget to the right-hand column above where the Top-15 VM Experiencing Disk Latency (ms) widget is located.

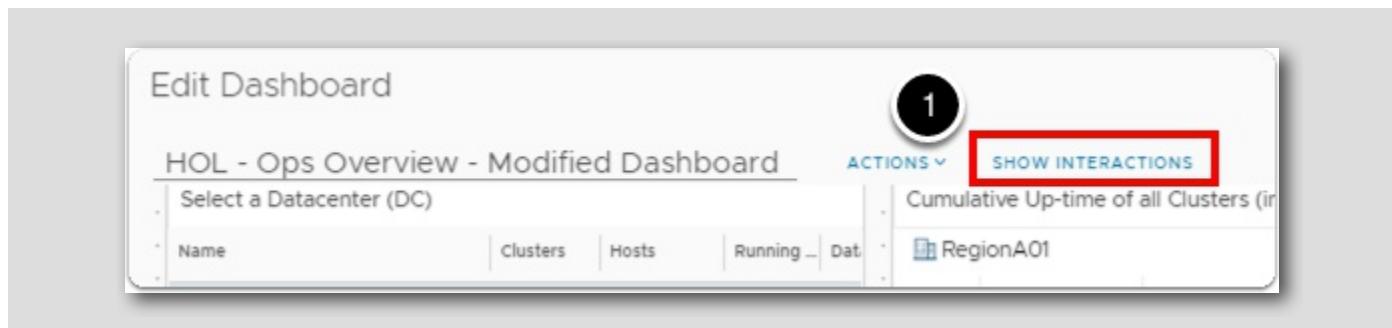
## Edit Dashboard - Add Widgets (continued)

[216]

The screenshot shows the 'Edit Dashboard' window with the title 'HOL - Ops Overview - Modified Dashboard'. On the left, there's a sidebar for 'Select a Datacenter (DC)' with 'RegionA01' selected. The main area contains several widgets: 'Cumulative Up-time of all Clusters (in selected DC)', 'Alert Volume (in selected DC)', 'Scoreboard Health' (highlighted with a red box and circled with 2), 'Object Relationship' (circled with 2), 'Top-N', 'Top-15 VM Experiencing Memory Contention' (highlighted with a red box and circled with 1), 'Top Alerts', 'Text Display', 'Alert List', 'Workload Pattern', 'Environment Overview', 'Sparkline Chart', 'Scoreboard Health' (highlighted with a red box and circled with 2), 'View', and 'Environment Status'. At the bottom right are 'CANCEL' and 'SAVE' buttons.

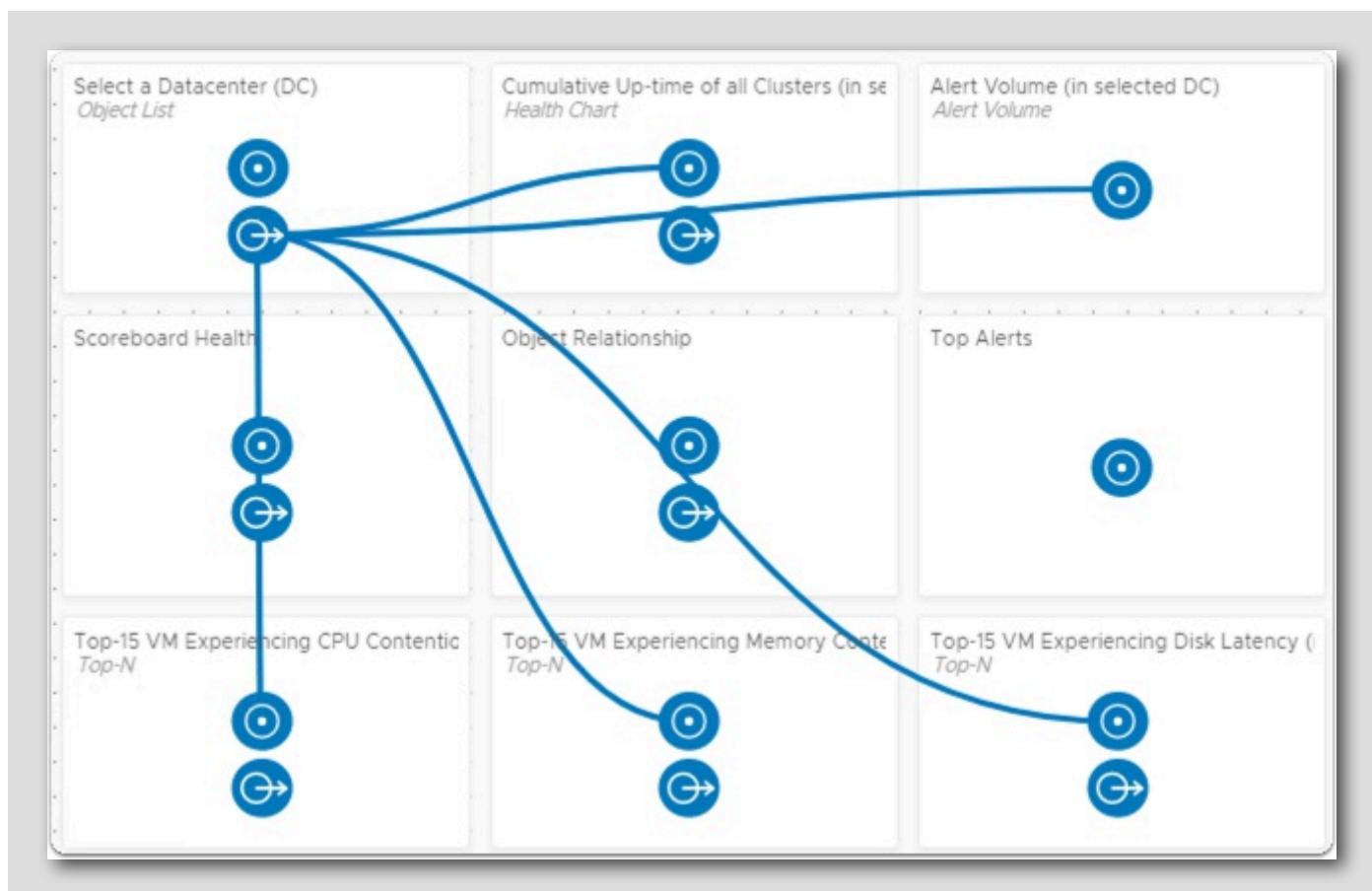
1. Drag the bottom scroll bar down until we see the Scoreboard Health widget in the list. (should be the third row of new widgets)
2. Click on and drag the Scoreboard Health widget to the left-most column above the Top-15 VM Experiencing Memory Contention widget.

## Edit Dashboard - Show Interactions



1. Click on the Show Interactions text link at the top of the pop-up window.

## Edit Dashboard - Connected Relationships

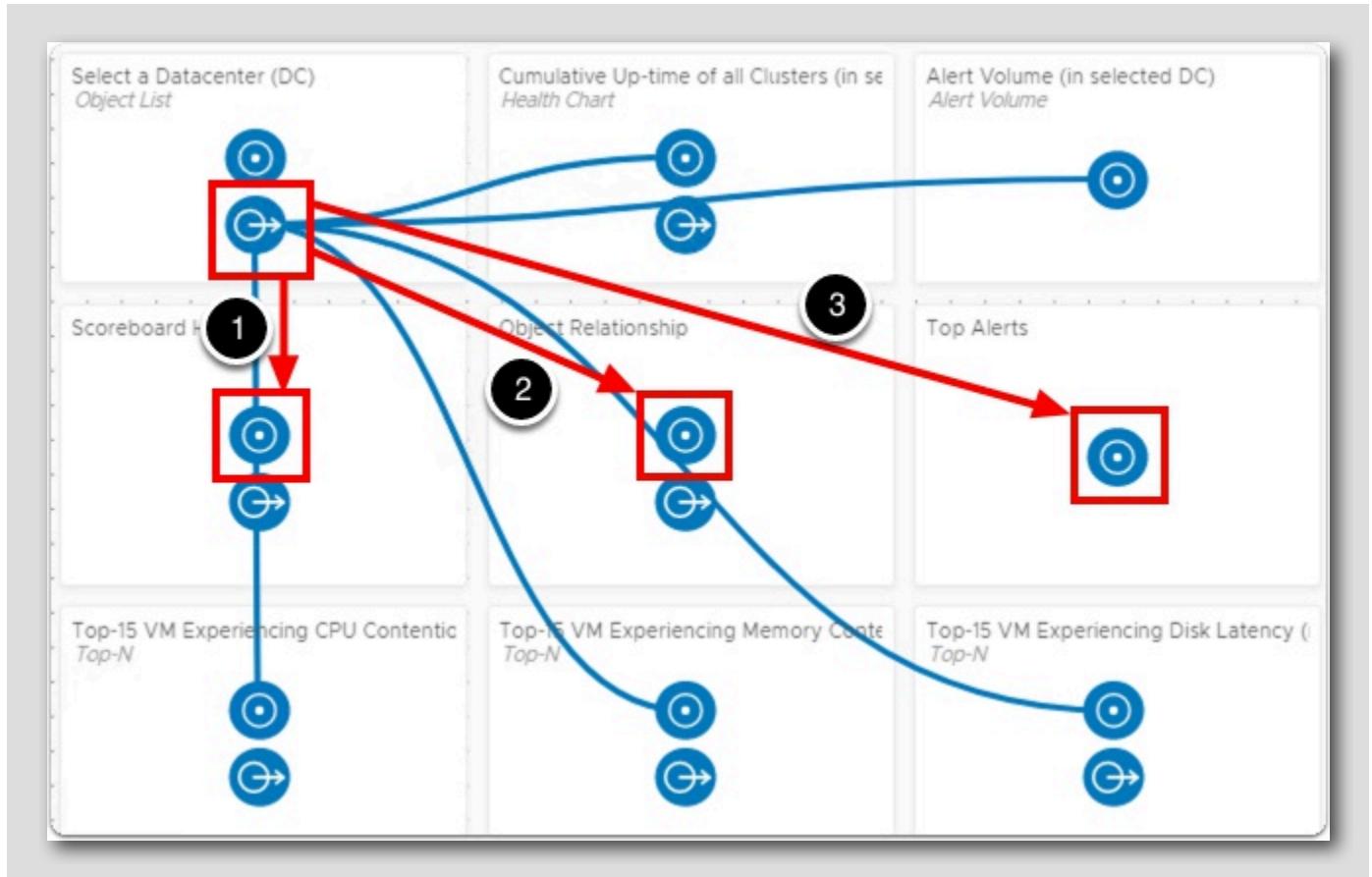


We see that since we cloned an existing dashboard, there are already relationships created from the "Select a Datacenter (DC)" object to the previous included objects (Cumulative Up-Time of all Clusters, Alert Volume and the (3) Top-15 widgets).

Now we need to connect the "Select a Datacenter (DC)" widget to the (3) widgets that we just added (Scoreboard Health, Object Relationship and Top Alerts). We'll do this in the next step.

## Edit Dashboard - Connecting Relationships

[219]

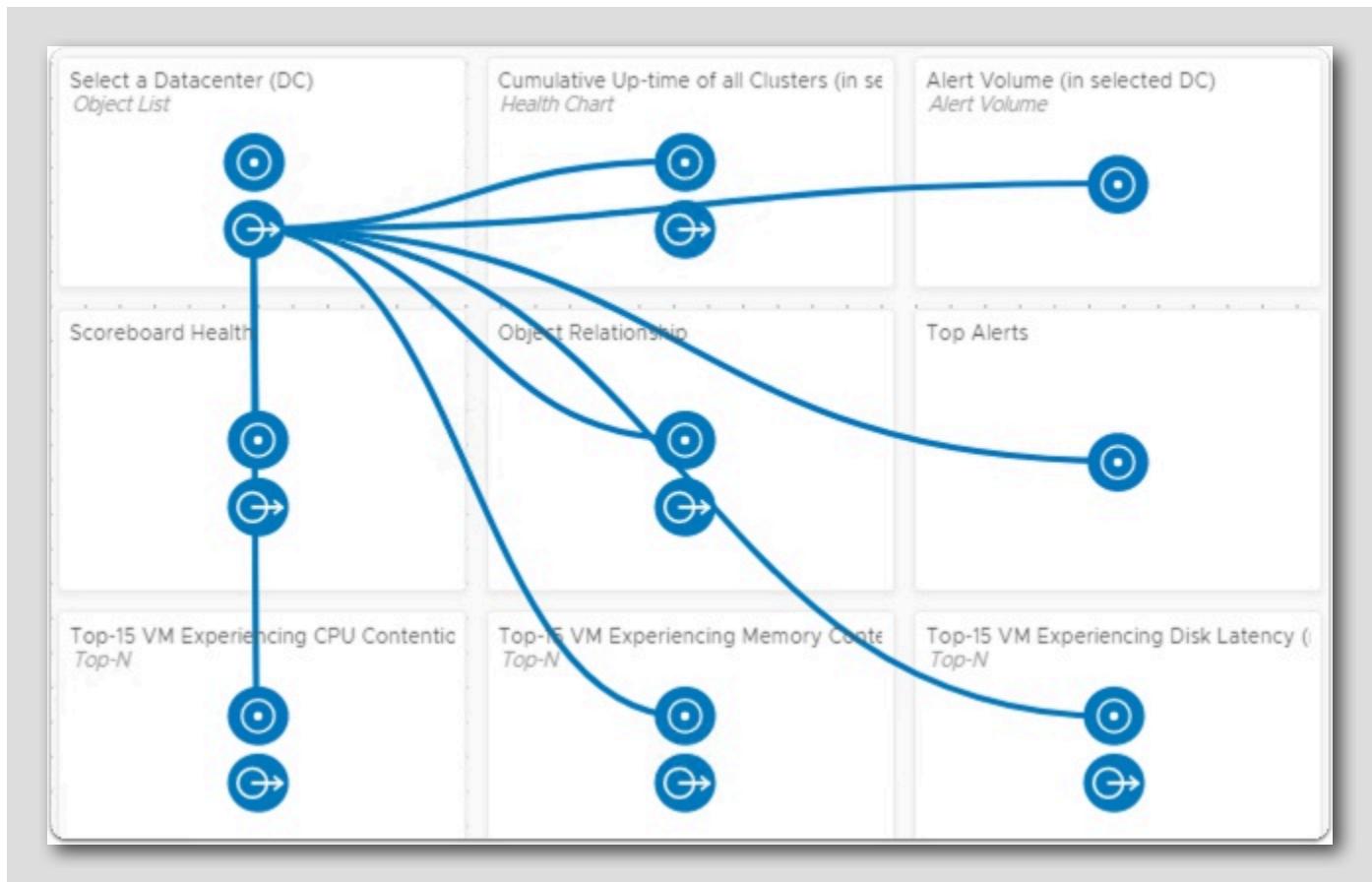


Here is where we need to connect and create the relationships between the "Select a Datacenter (DC)" widget and the three new widgets we have added. We will do this by dragging and dropping from the "Select a Datacenter (DC)" icon to each of the three icons in the new widgets we added.

1. Click on the circle with an arrow icon in the Select a Datacenter (DC) widget and drag it on top of the circle with the dot icon in the Scoreboard Health widget.
2. Click on the circle with an arrow icon in the Select a Datacenter (DC) widget and drag it on top of the circle with the dot icon in the Object Relationship widget.
3. Click on the circle with an arrow icon in the Select a Datacenter (DC) widget and drag it on top of the circle with the dot icon in the Top Alerts widget.

## Edit Dashboard - Completed Relationships

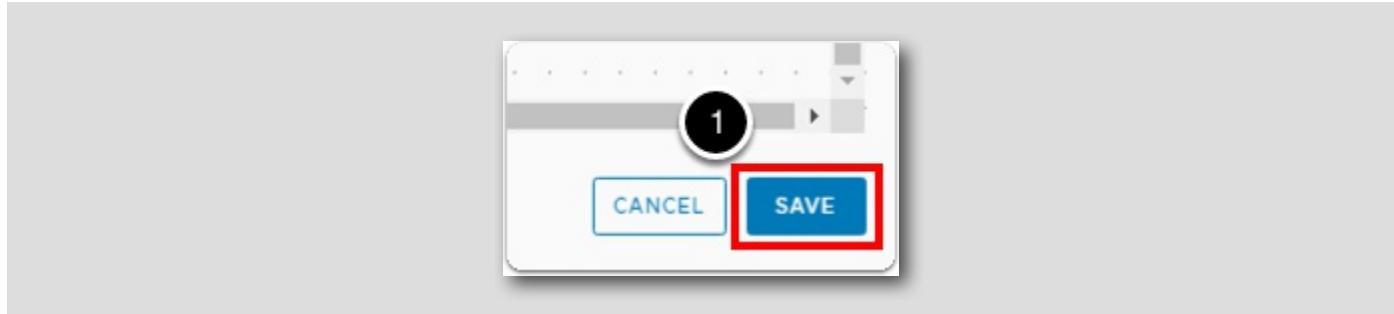
[220]



We should now see the lab environment match the screen capture.

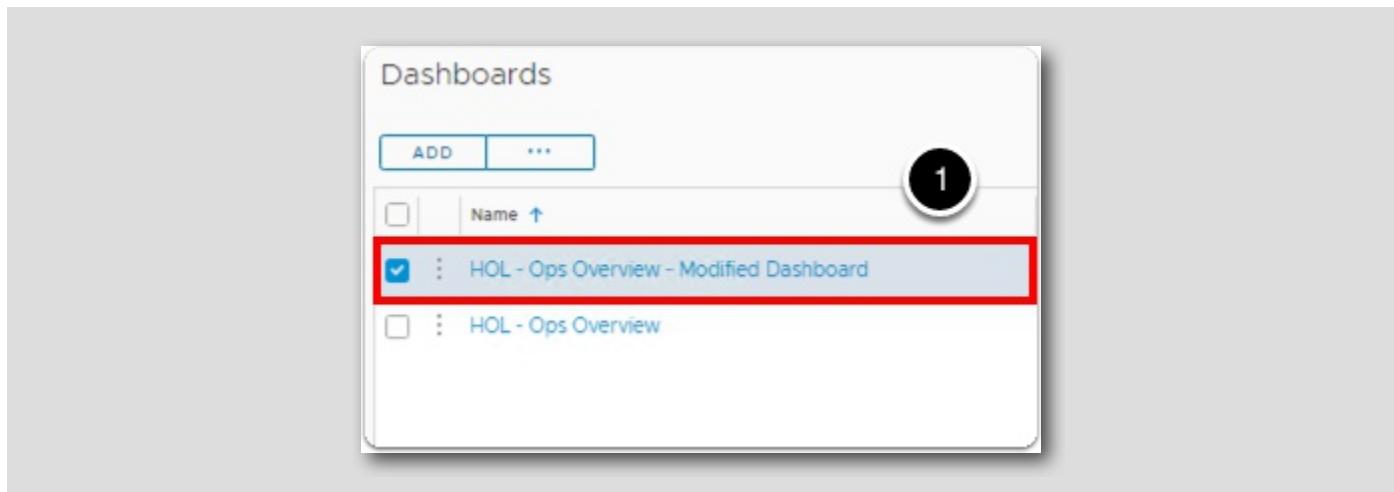
As we see here, we have connecting relationship lines from the Select a Datacenter (DC) widget to each of the 3 new widgets we added.

## Edit Dashboard - Save



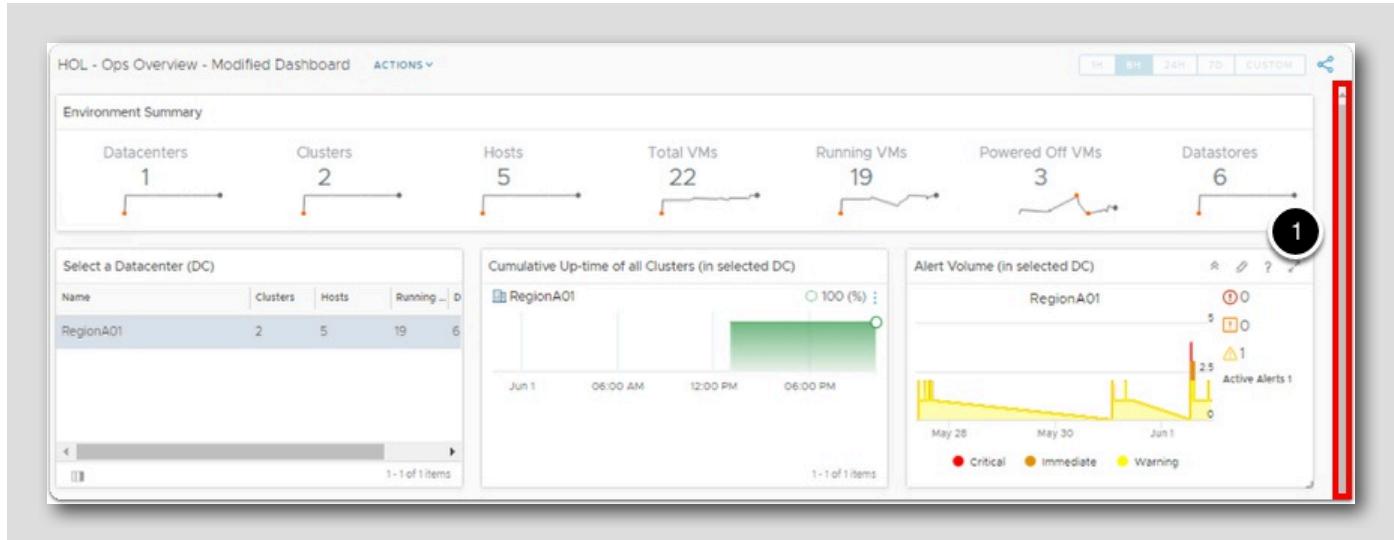
1. Click on the SAVE button to save our changes to the dashboard.

## HOL - Ops Overview - Modified Dashboard



1. Click on the HOL - Ops Overview - Modified Dashboard text link to go into our cloned/modified dashboard.

## Completed Dashboard



We see that the top (2) rows of widgets are the original ones that were in the default HOL - Ops Overview Dashboard.

1. Drag the scroll bar down to the very bottom of the dashboard.

## Review Modifications to Dashboard



1. We now see our (3) new widgets (**Scoreboard Health**, **Object Relationship** and **Top Alerts**) that we added. Because we configured the relationships, when we select a datacenter from the **Select a Datacenter (DC)** widget, it populates the associated data for the widget we added.
2. We also see the (3) **Top-15 widgets are minimized**, as previously configured.

## Lesson End

[225]

Congratulations, we just completed the **Clone and Modify Existing Dashboards** lesson!

In this lesson, we started out by cloning the HOL - Ops Overview Dashboard and then customized the cloned dashboard. We minimized the three Top-15 columns and then added the Scoreboard Health, Object Relationship and Top Alerts widgets to our custom dashboard.

## Creating a New Custom Dashboard

[226]

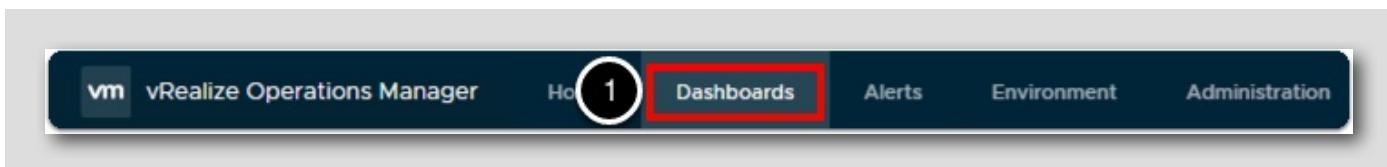
In this lesson, we will learn how to create a new dashboard from scratch.

We will create a brand new dashboard from scratch that will contain an Object List for a list of virtual machines. We will then add the following widgets to the dashboard as well:

- Object Relationship Topology
- Top Alerts
- Health Heat Map
- Top-N for CPU
- Top-N for Memory
- Top-N for Disk Space

## Dashboards

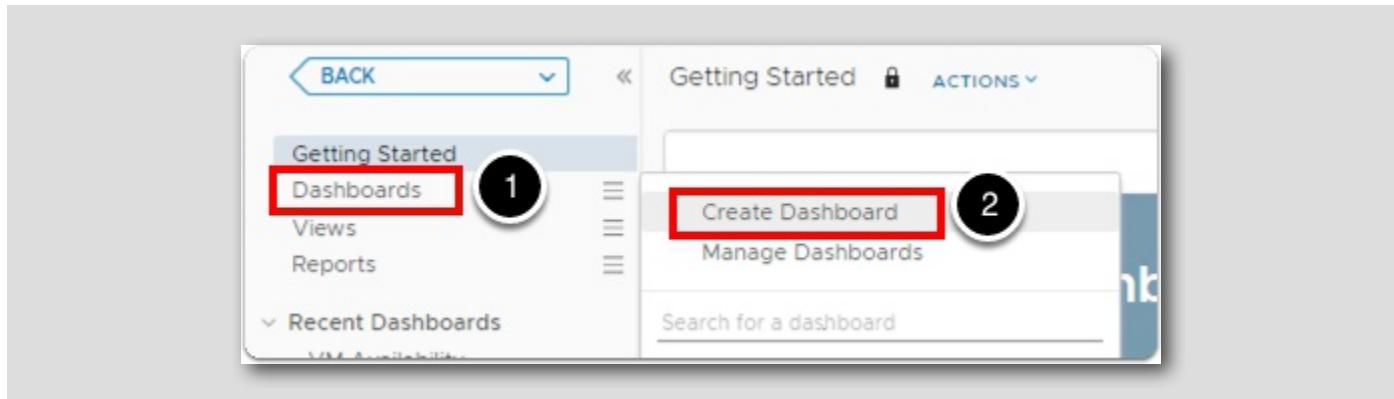
[227]



**NOTE:** If we are already on the Dashboard tab, we can skip this step.

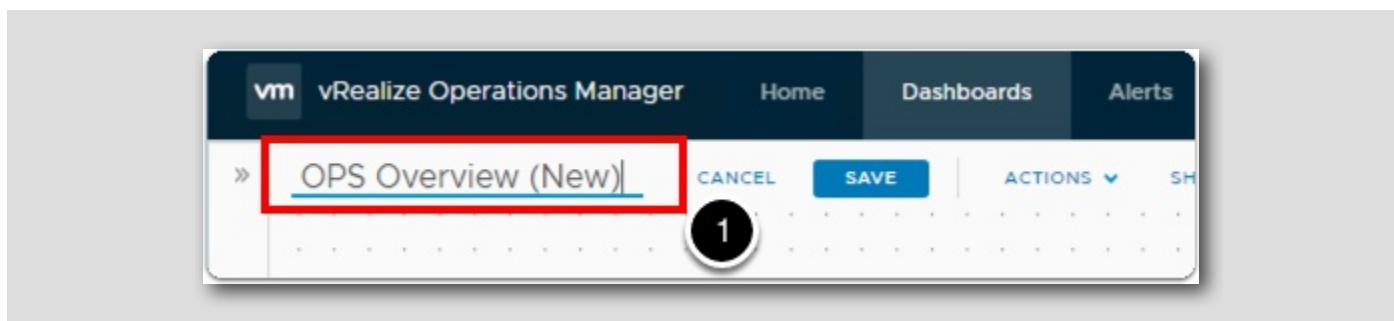
1. Click on the **Dashboards** tab in the menu bar at the top of the user interface.

## Create Dashboard



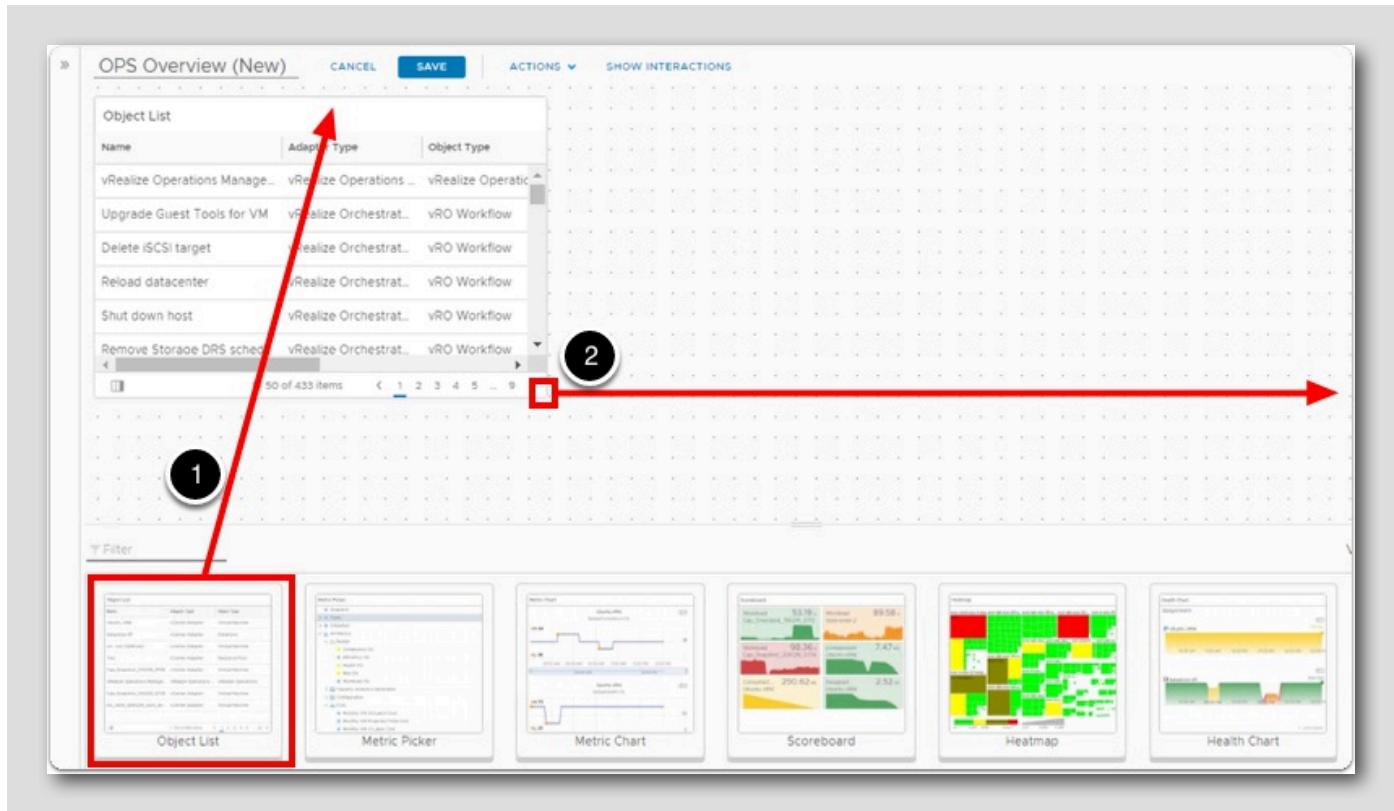
1. Click on Dashboards.
2. Then click on Create Dashboard.

## Create Dashboard - Name



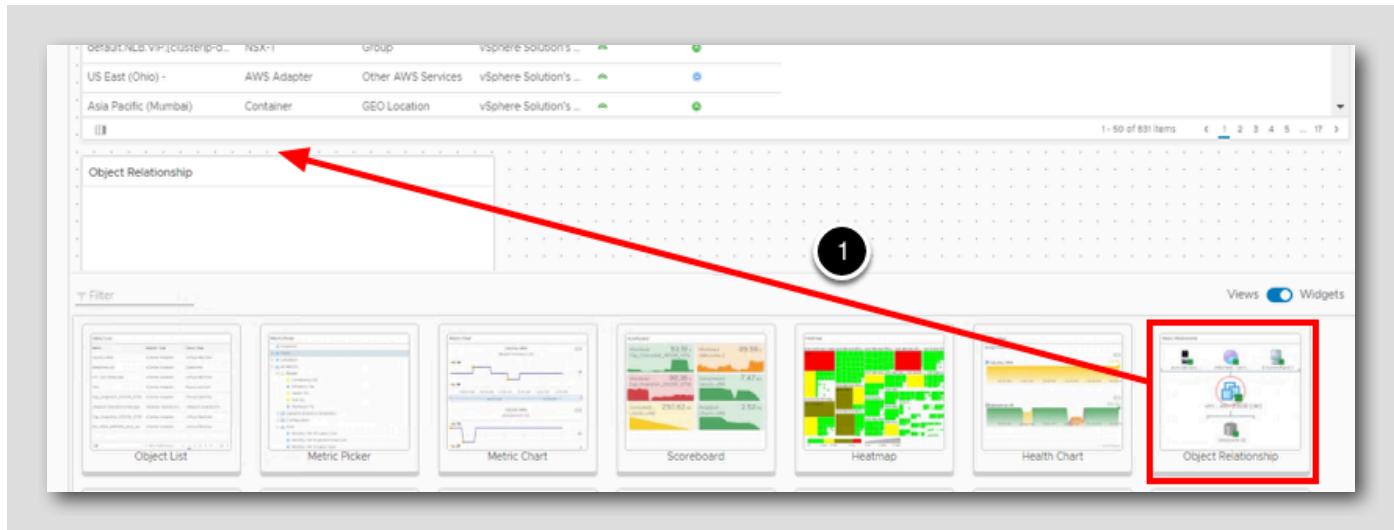
1. Replace the New Dashboard text with OPS Overview (New) in the name text field.

## Create Dashboard - Object List



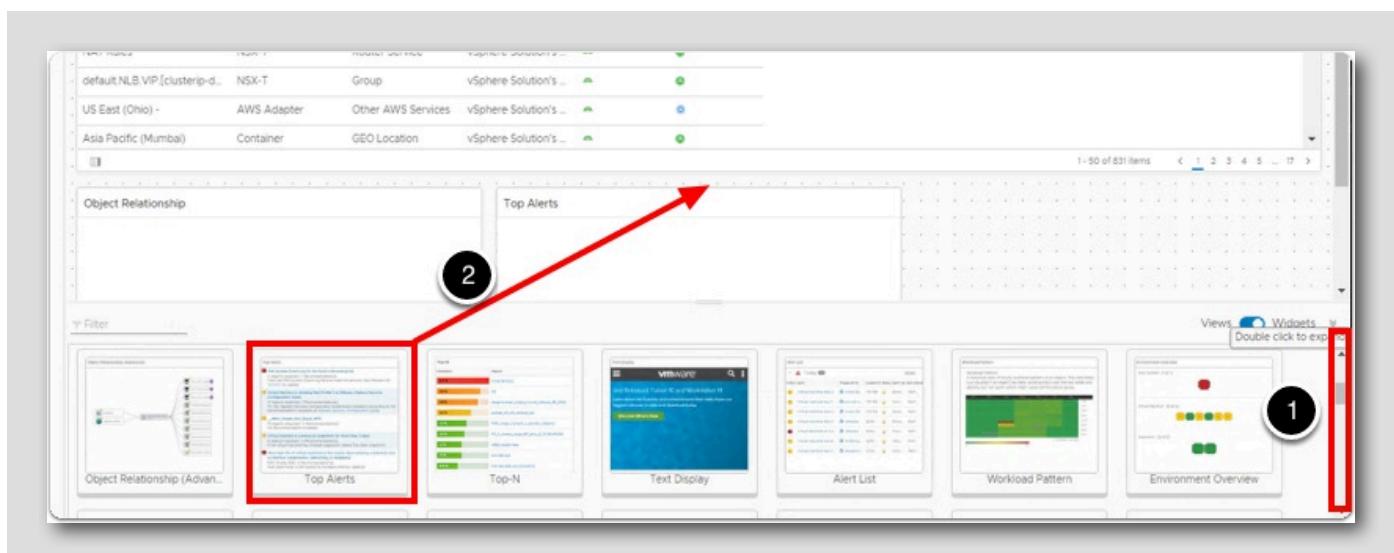
1. Click on and drag the Object List widget to the left side of the open space.
2. Click on the lower right-hand corner of the widget and drag it all the way to the right of the dashboard interface.

## Create Dashboard - Object Relationship



1. Click on and drag the Object Relationship widget to the left most column in the open space below the Object List widget.  
*(should be the last one on the first row of new widgets)*

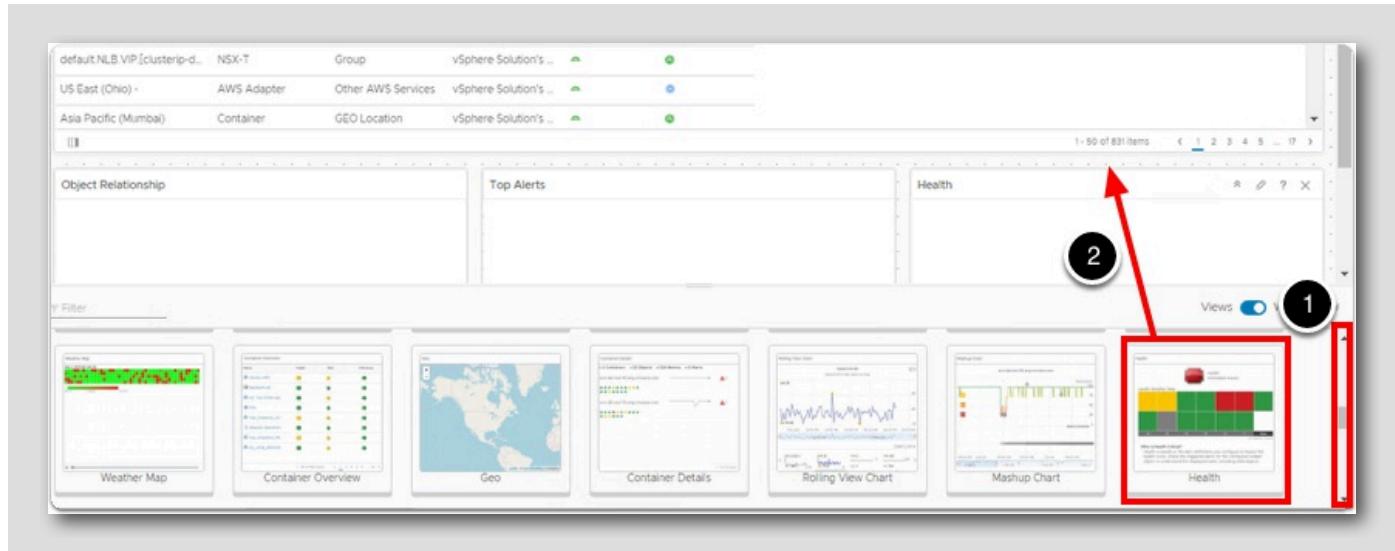
## Create Dashboard - Top Alerts



1. Drag the scroll bar down until we see the Top Alerts widget in the list. (*should be the second row of new widgets*)
2. Click on and drag the Top Alerts widget to the middle column in the open space below the Object List widget.

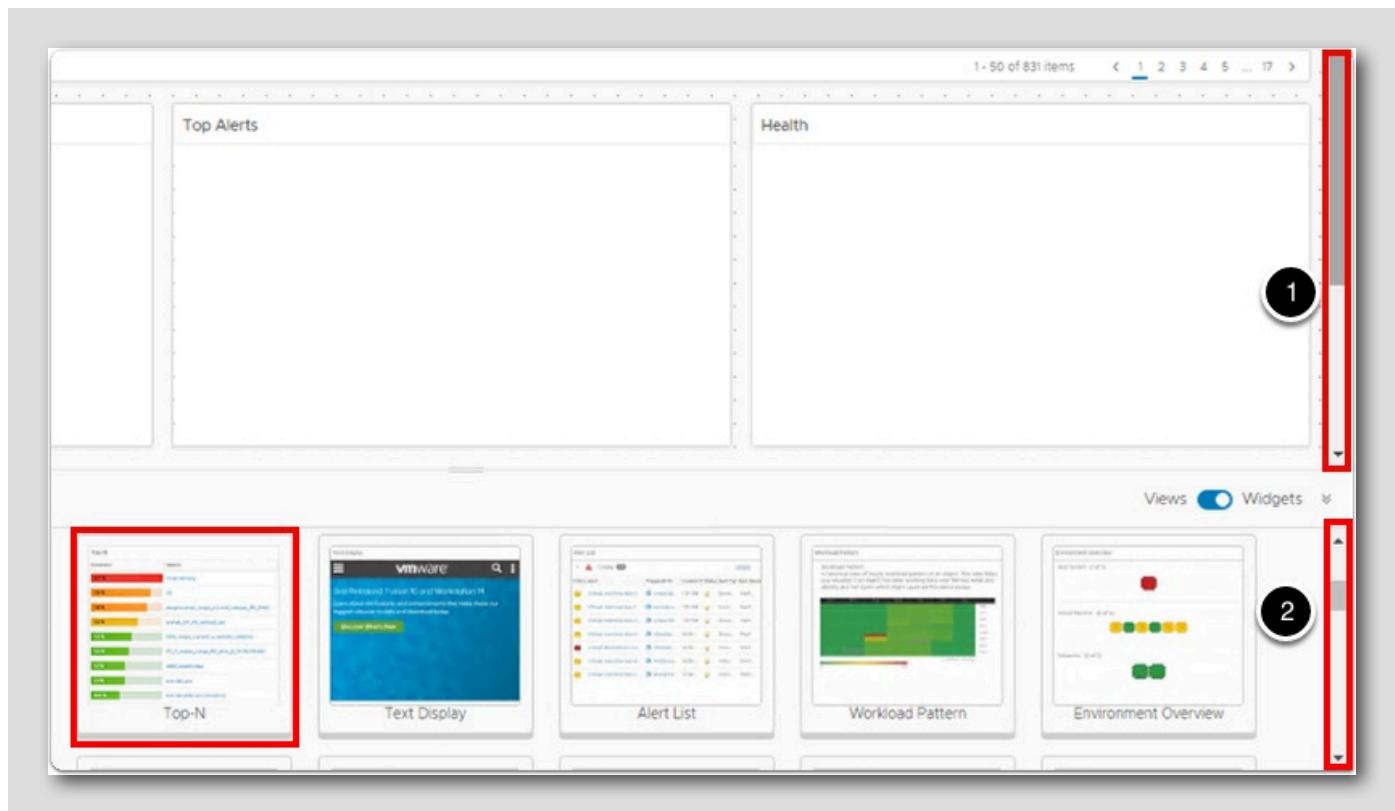
## Create Dashboard - Health

[233]



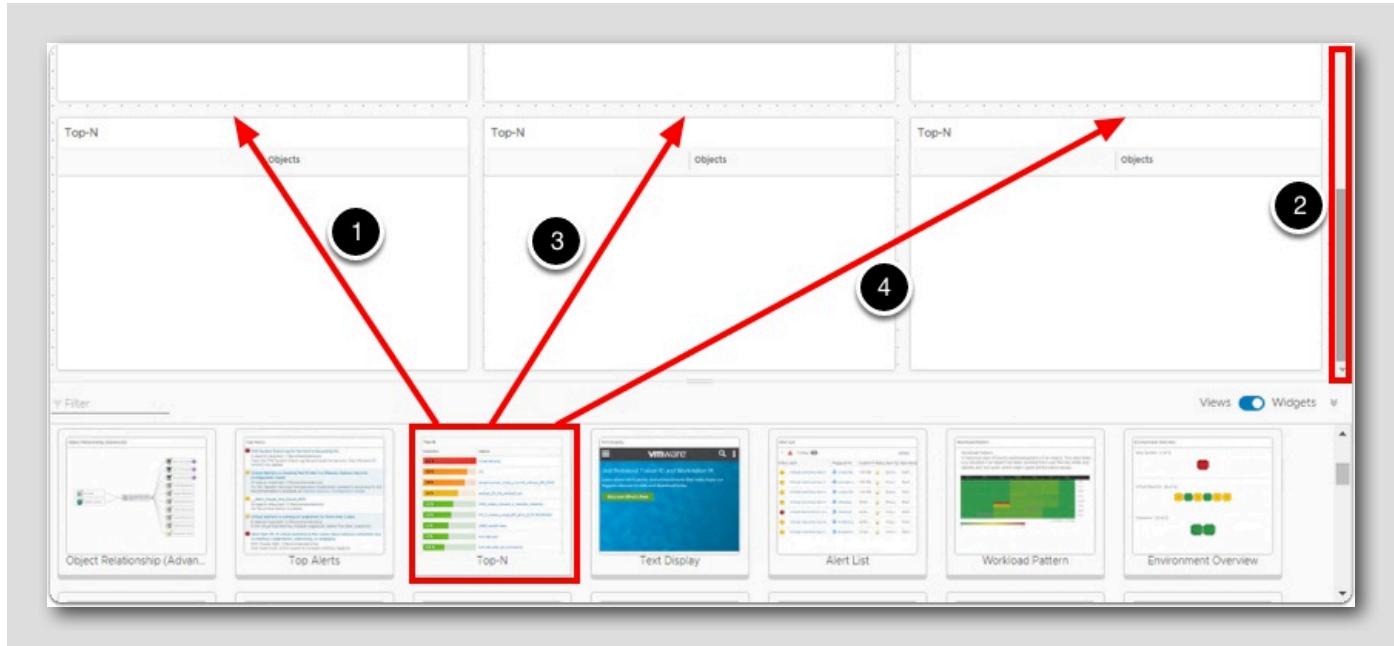
1. Drag the scroll bar down until we see the Health widget in the list. (*should be on the fourth row of new widgets*)
2. Click on and drag the Health widget (*not the Scoreboard Health widget*) to the far right column in the open space below the Object List widget.

## Create Dashboard - Top-N



1. Drag the scroll bar all the way down to the bottom.
2. Drag the widgets scroll bar up until we can see the Top-N widget in the second row of widgets.

## Create Dashboard - Top-N



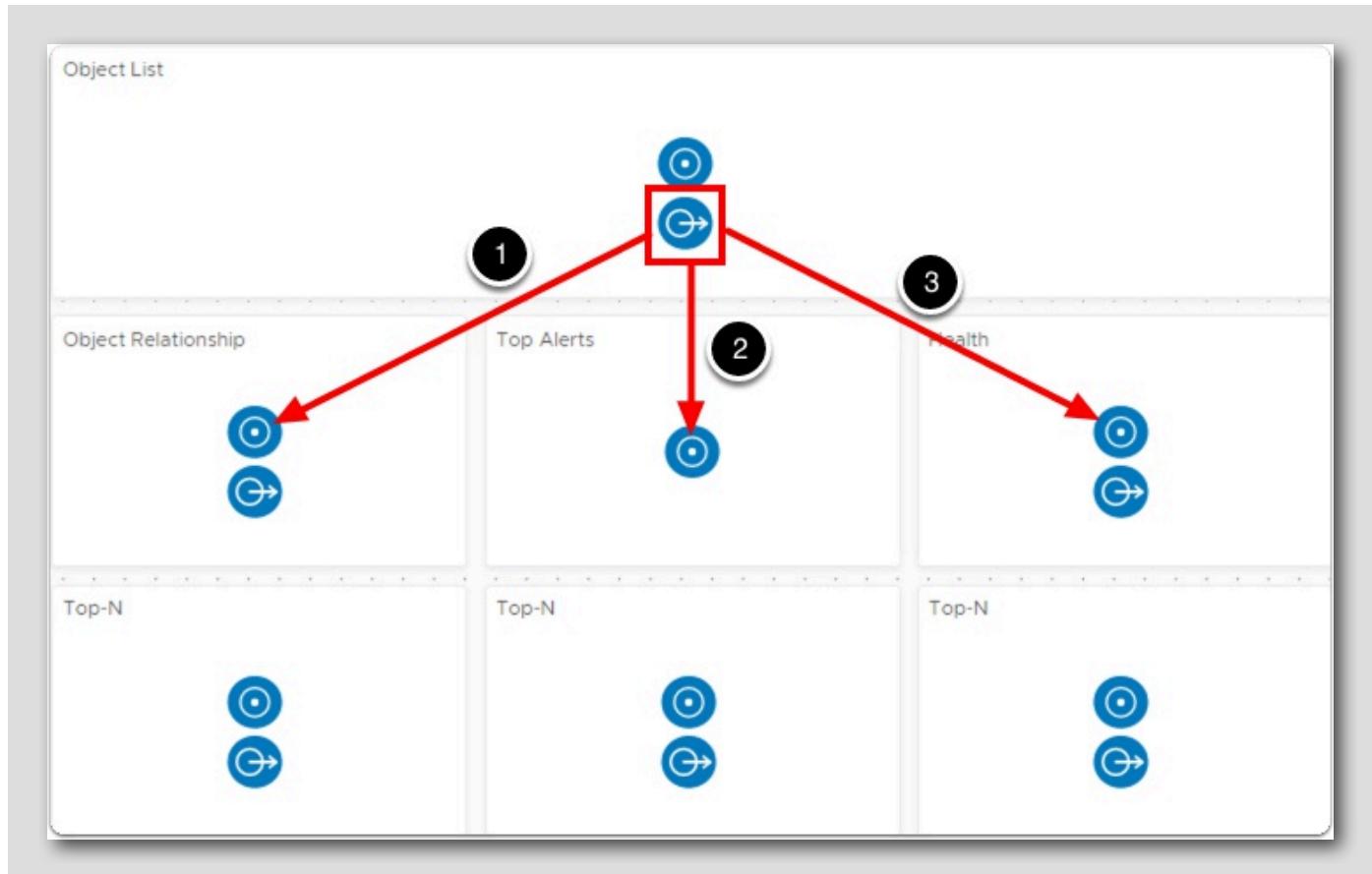
1. Click on the Top-N view and drag it to the left column.
2. Drag the scroll bar all the way down to the bottom so we can see the new Top-N view.
3. Click on the Top-N view and drag it to the middle column.
4. Click on the Top-N view and drag it to the right column.

## Create Dashboard - Show Interactions



1. Click on SHOW INTERACTIONS text link at the top of the user interface.

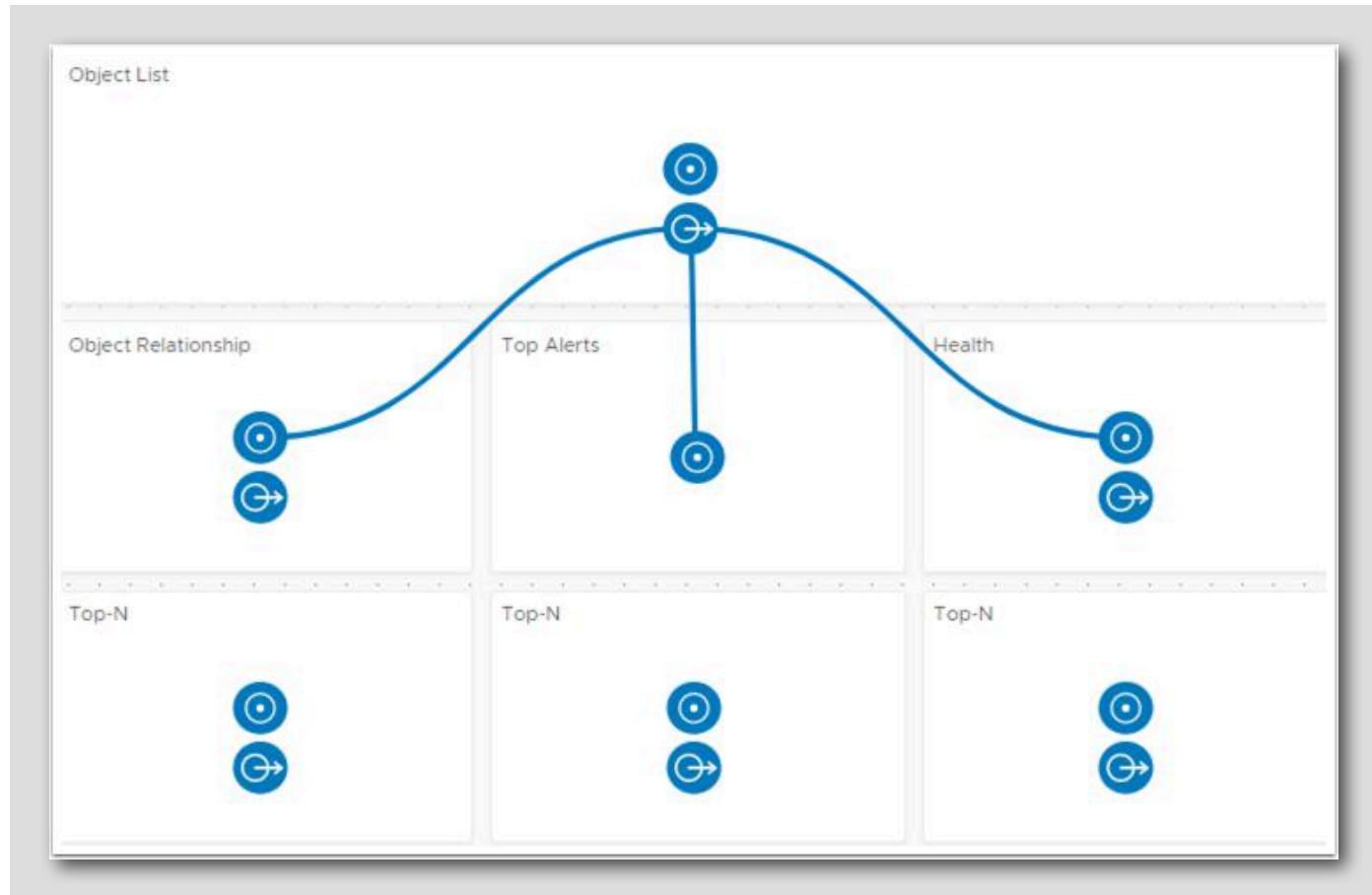
## Create Dashboard - Create Relationships



We now have to create the relationships between the widgets. We want to be able to click on a virtual machine in the Object List widget and have the rest of the widgets present the data associated with what we selected in the Object List.

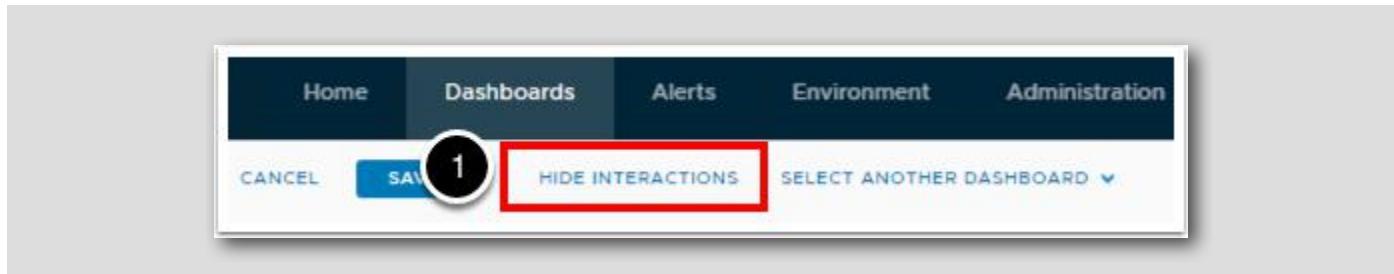
1. Click on the circle and arrow icon in the Object List widget and drag it to the circle with a dot icon in the Object Relationship widget.
2. Click on the circle and arrow icon in the Object List widget and drag it to the circle with a dot icon in the Top Alerts widget.
3. Click on the circle and arrow icon in the Object List widget and drag it to the circle with a dot icon in the Health widget.

## Create Dashboard - Create Relationships (continued)



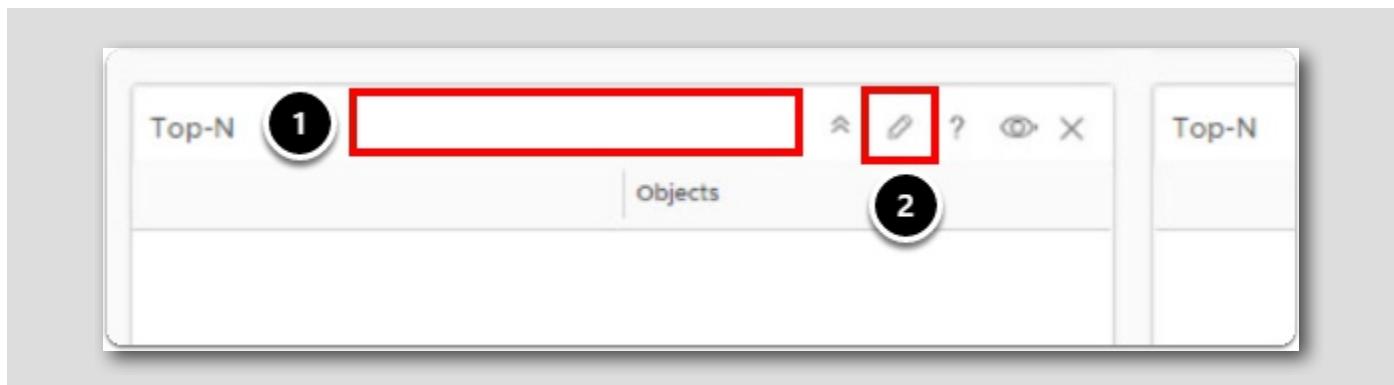
After completing the previous steps, we should now see the connecting line from the Object List to the Object Relationship, Metric Chart and Health widgets. We will not be connecting the Object List to the (3) Top-N widgets since we want them to show the Top 10 virtual machines with contention for CPU, Memory and Disk Space. We will see this later once we are done configuring the entire dashboard.

## Create Dashboard - Show Interactions



1. Click on HIDE INTERACTIONS text link at the top of the user interface.

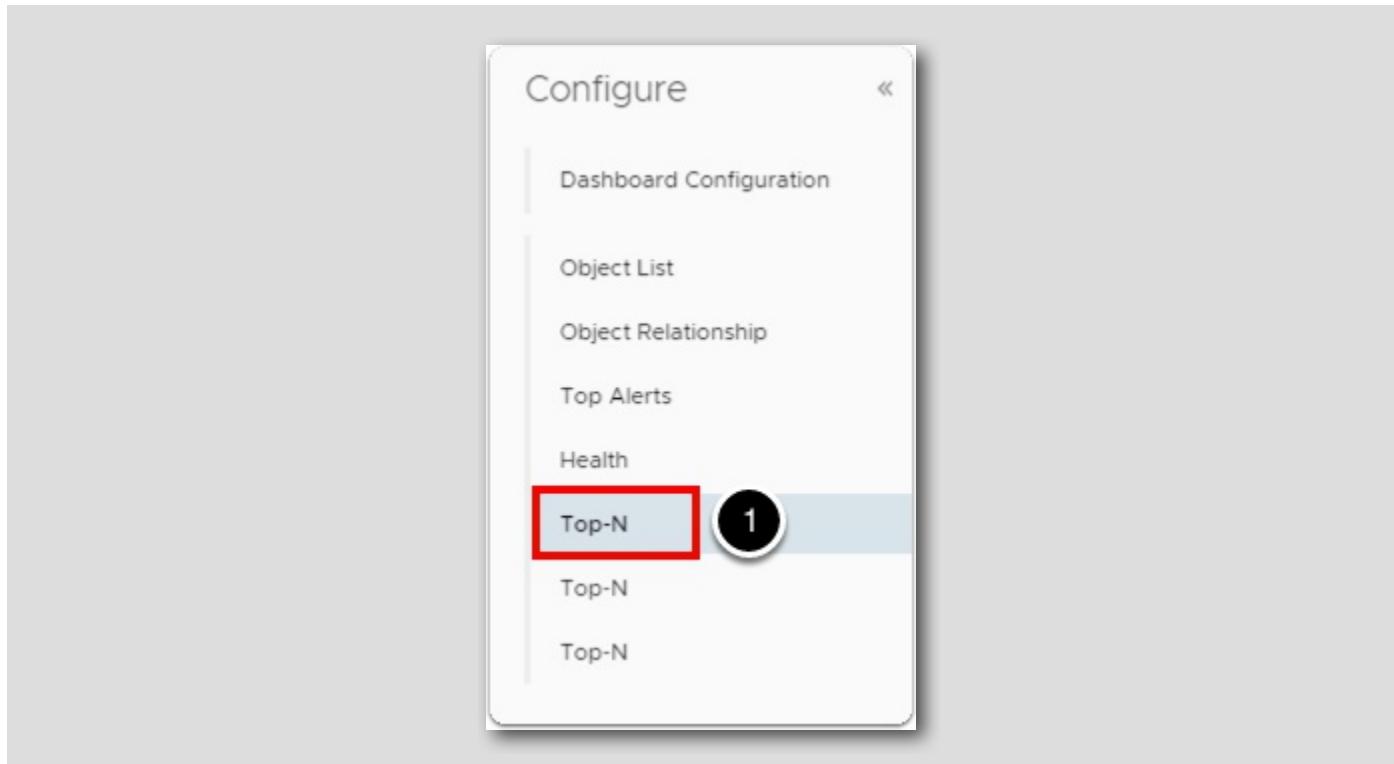
## Configure Top-N Widget - Menu



We now need to go into the settings of the widgets to make some configuration changes so that they will present the appropriate data in each of the widgets.

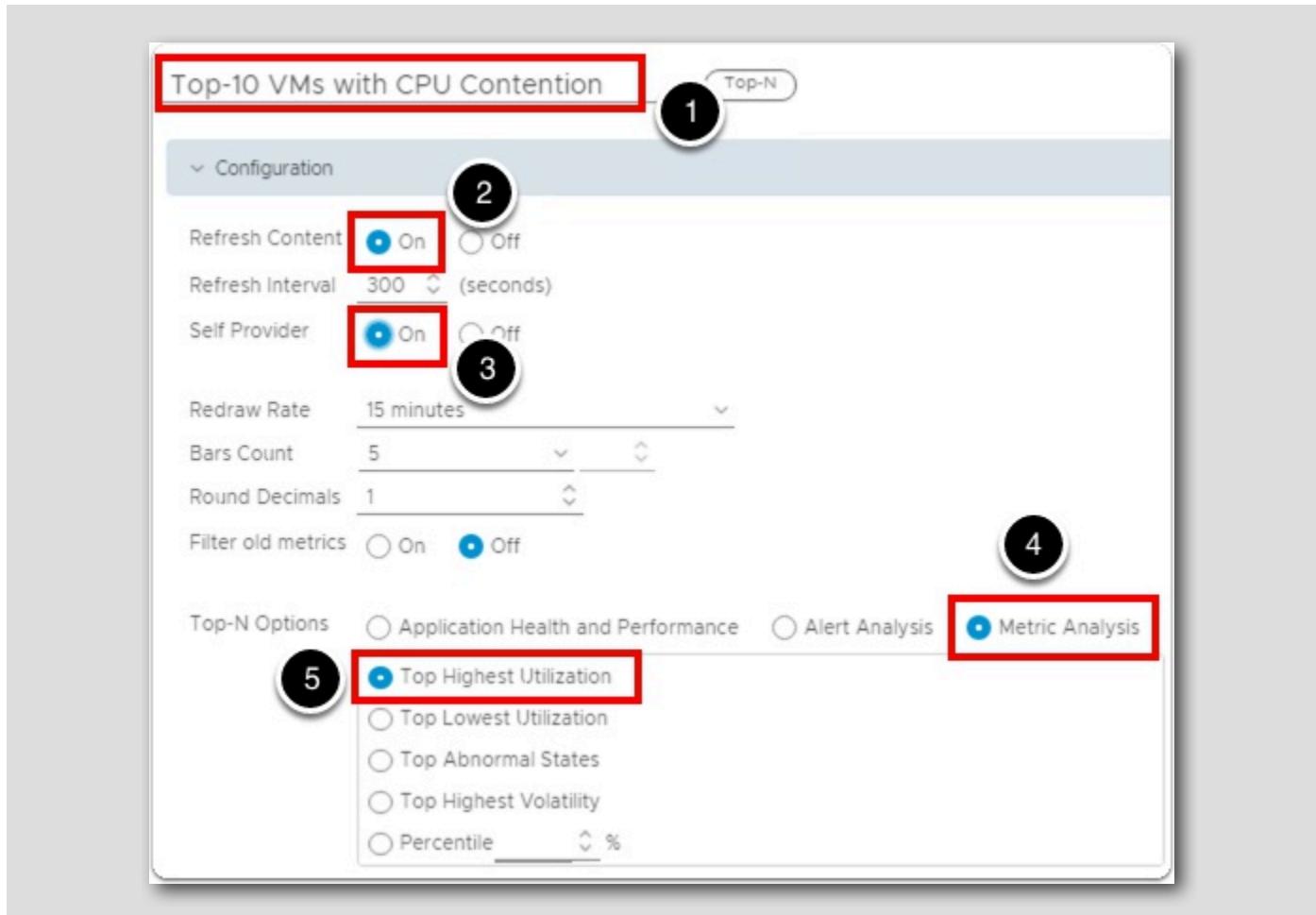
1. Hover the mouse over the top of the 1st Top-N (or any other widget) widget in the dashboard to expose the hidden menu.
2. Click on the Edit Widget (pencil) icon to edit the widget.

## Configure Top-N Widget - Name



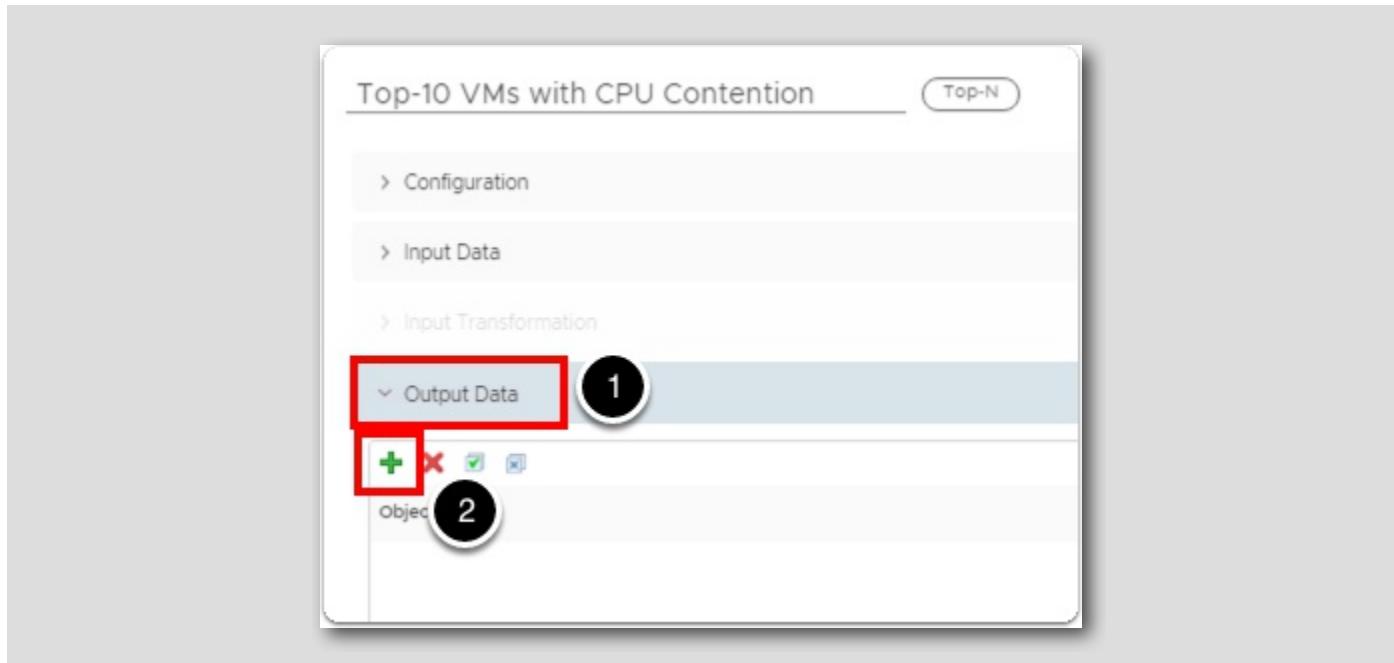
1. Click on the first Top-N in the left Navigation Pane to edit its properties.

## Configure Top-N Widget - Change Name



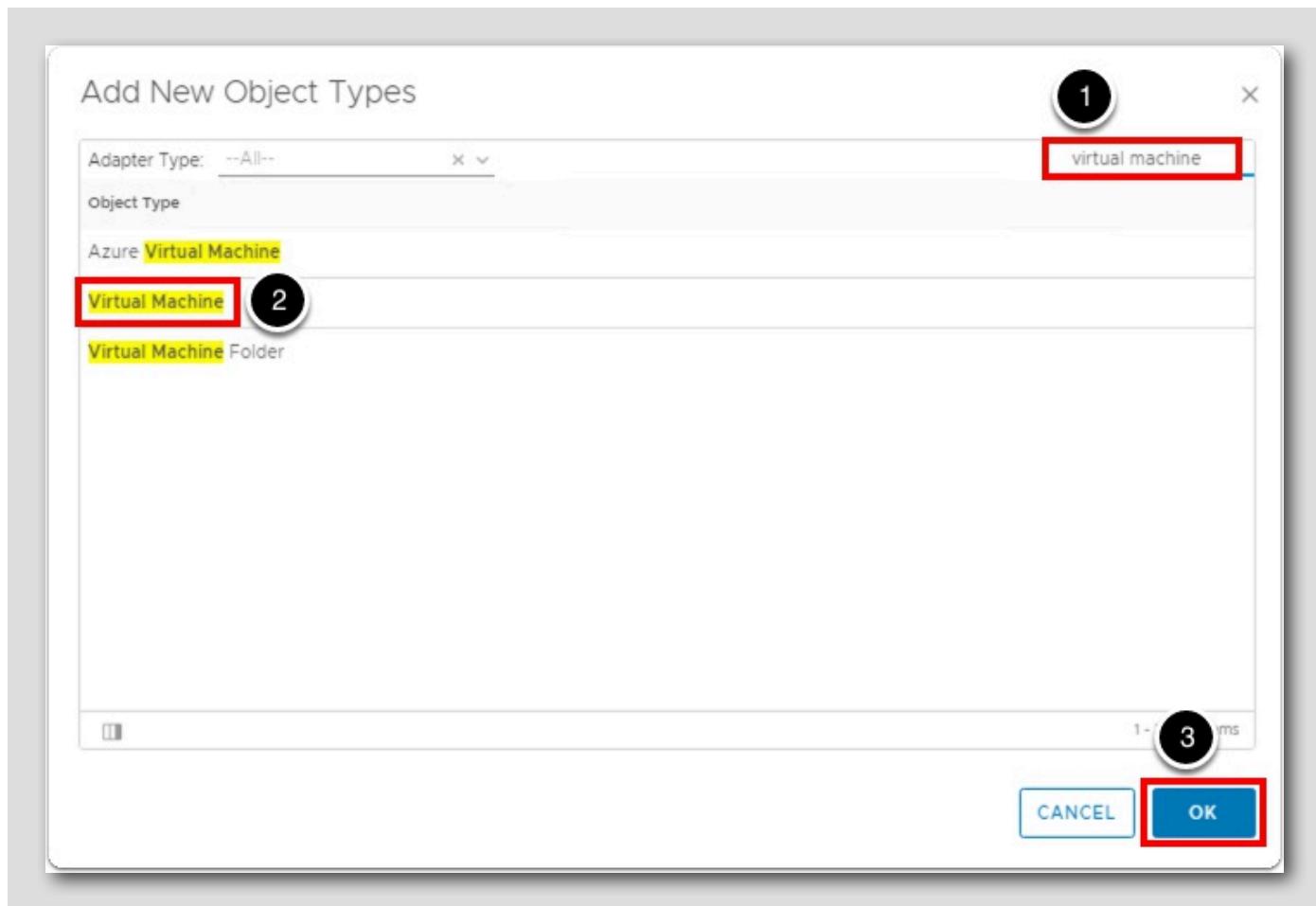
1. Replace the text Top-N with Top-10 VMs with CPU Contention.
2. Click on the On radio button next to Refresh Content.
3. Click on the On radio button next to Self Provider.
4. Click on the Metric Analysis radio button next to Top-N Options.
5. We see that it automatically selected the Top Highest Utilization radio button for us.

## Configure Top-N Widget - Object Types



1. Click on the Output Data selection to expand it.
2. Click on the Add Object Type (*green plus sign*) to add an object type.

## Configure Top-N Widget - Virtual Machine

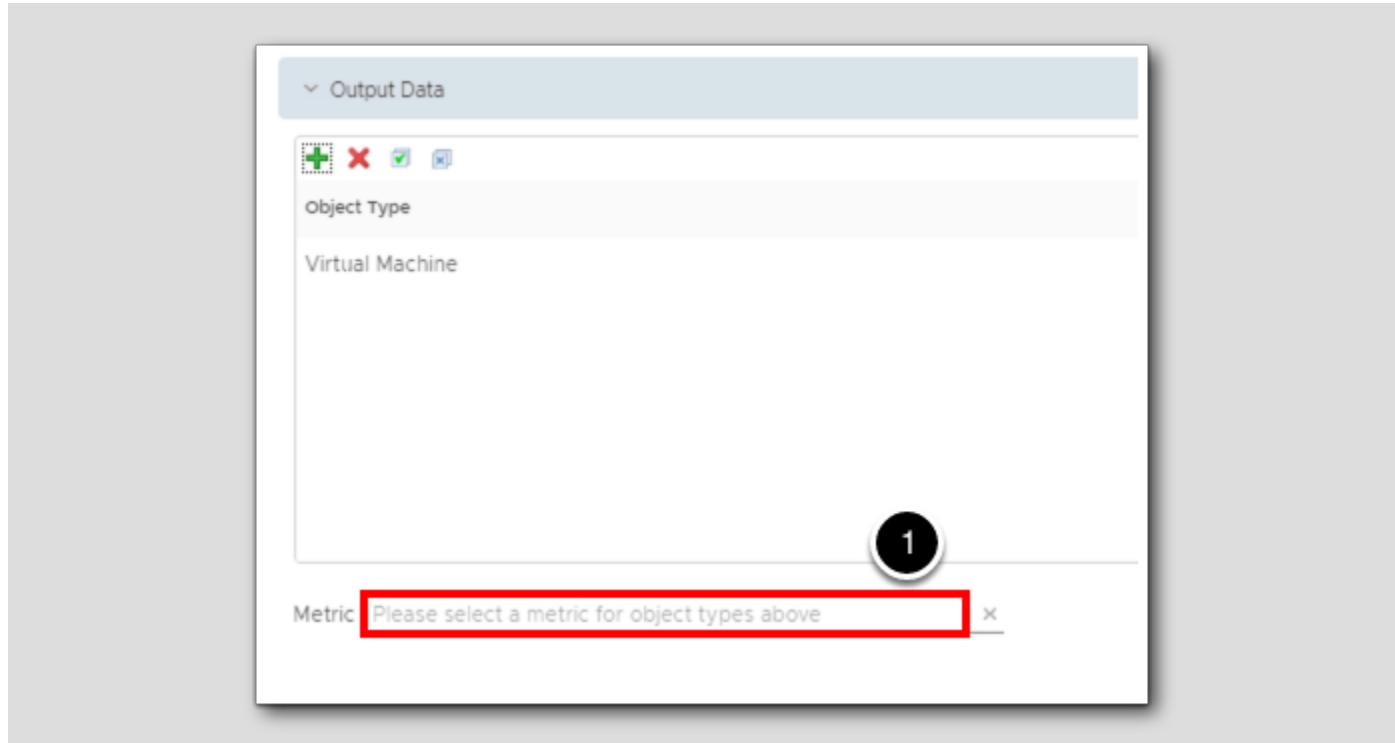


1. Type virtual machine into the Filter text field and hit the ENTER key on the keyboard.

2. Click on Virtual Machine in the list to select it.

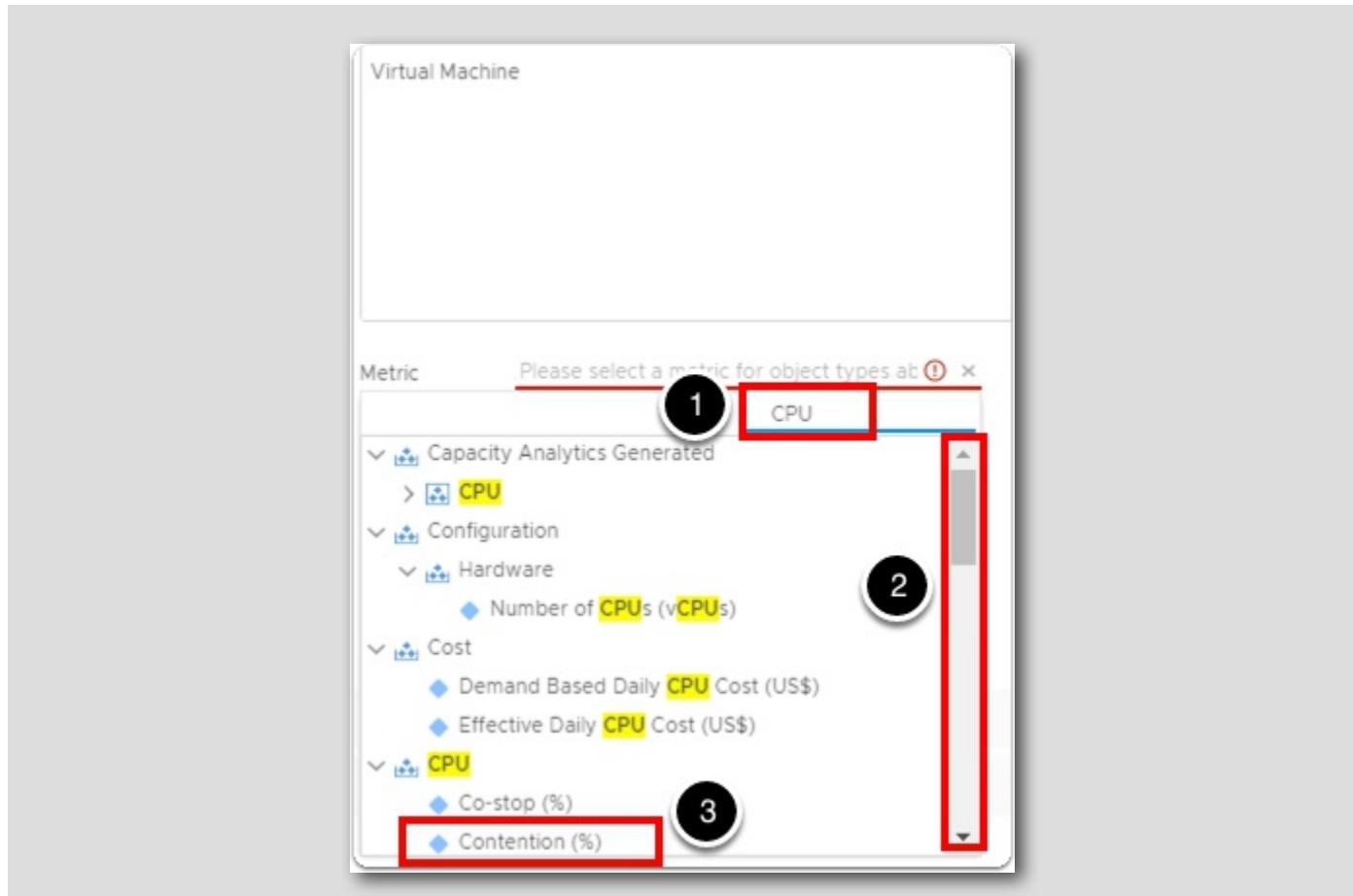
3. Then click on the OK button.

## Configure Top-N Widget - Widget



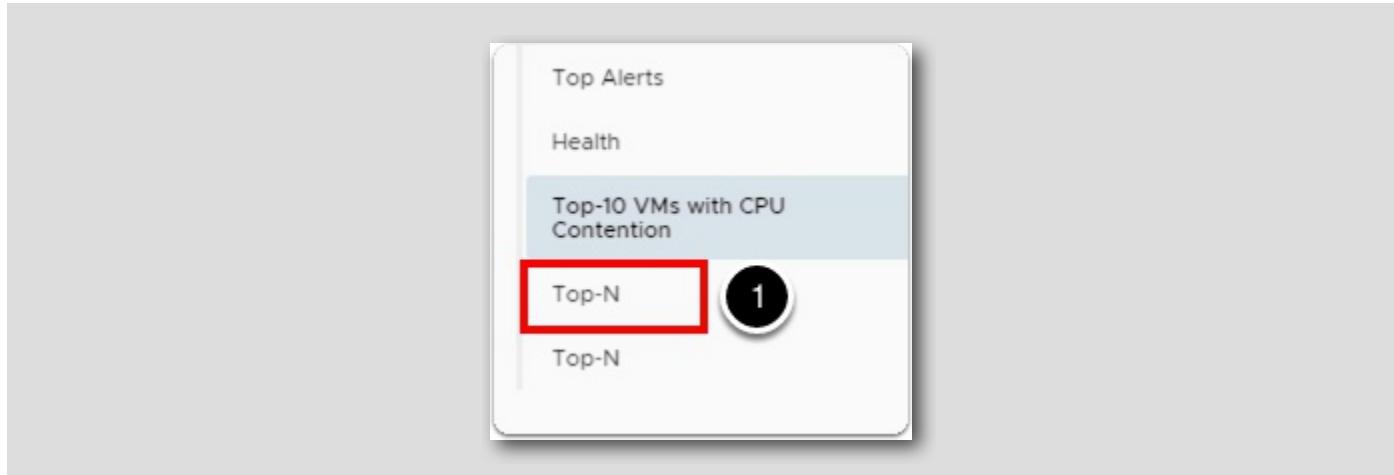
1. Click anywhere inside the **Metric** text field in order to expose the filter option.

## Configure Top-N Widget - CPU Contention (%)



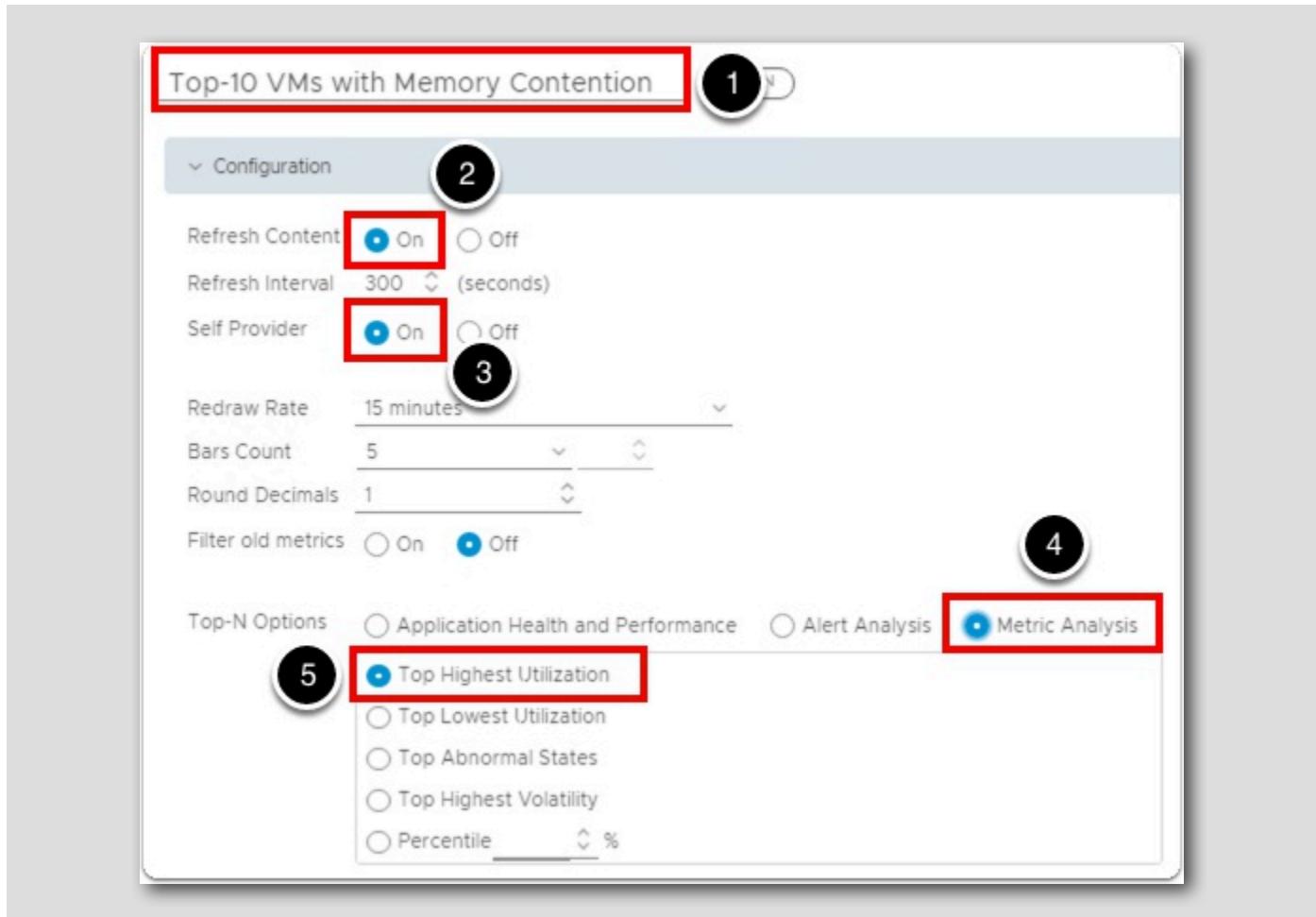
1. Type CPU into the Metric text field and hit ENTER on the keyboard to filter for it.
2. Drag the scroll bar down until we can see Contention (%) (*CPU > Contention*) in the drop-down list.
3. Double-Click on Contention (%).

## Configure Top-N Widget - Top-N



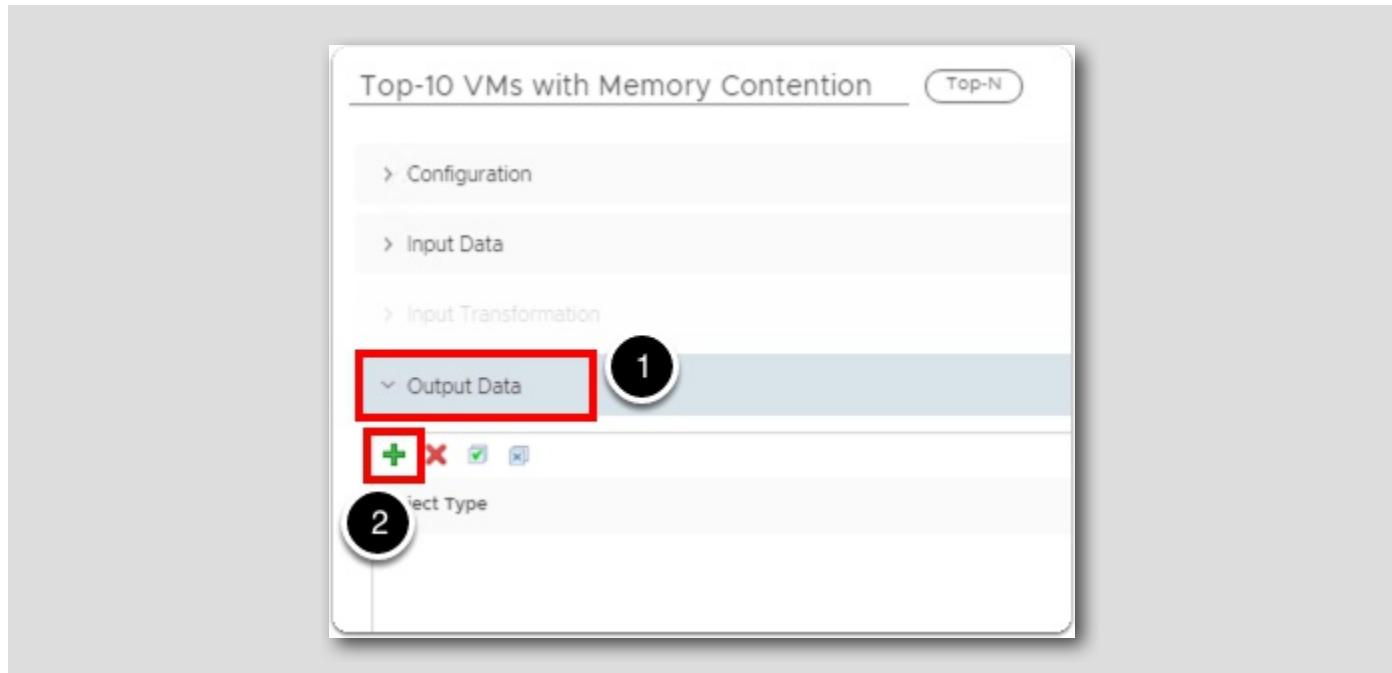
1. Click on the next Top-N in the Navigation bar on the left side of the pop-up window.

## Configure Top-N Widget - Change Name



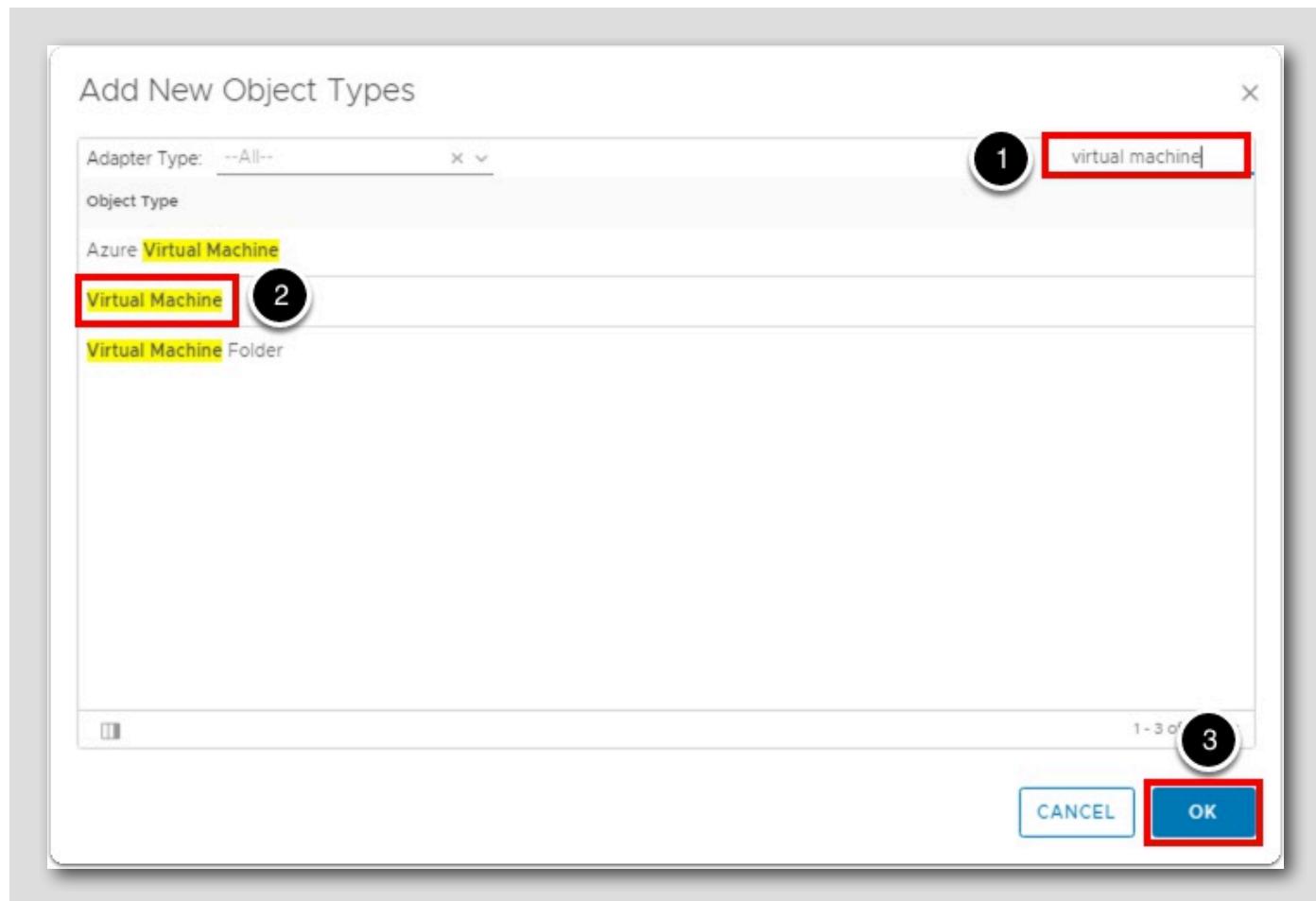
1. Replace the text Top-N with Top-10 VMs with Memory Contention.
2. Click on the On radio button next to Refresh Content.
3. Click on the On radio button next to Self Provider.
4. Click on the Metric Analysis radio button next to Top-N Options.
5. We see that it automatically selected the Top Highest Utilization radio button for us.

## Configure Top-N Widget - Object Types



1. Click on the Output Data selection to expand it.
2. Click on the Add Object Type (*green plus sign*) to add an object type.

## Configure Top-N Widget - Virtual Machine

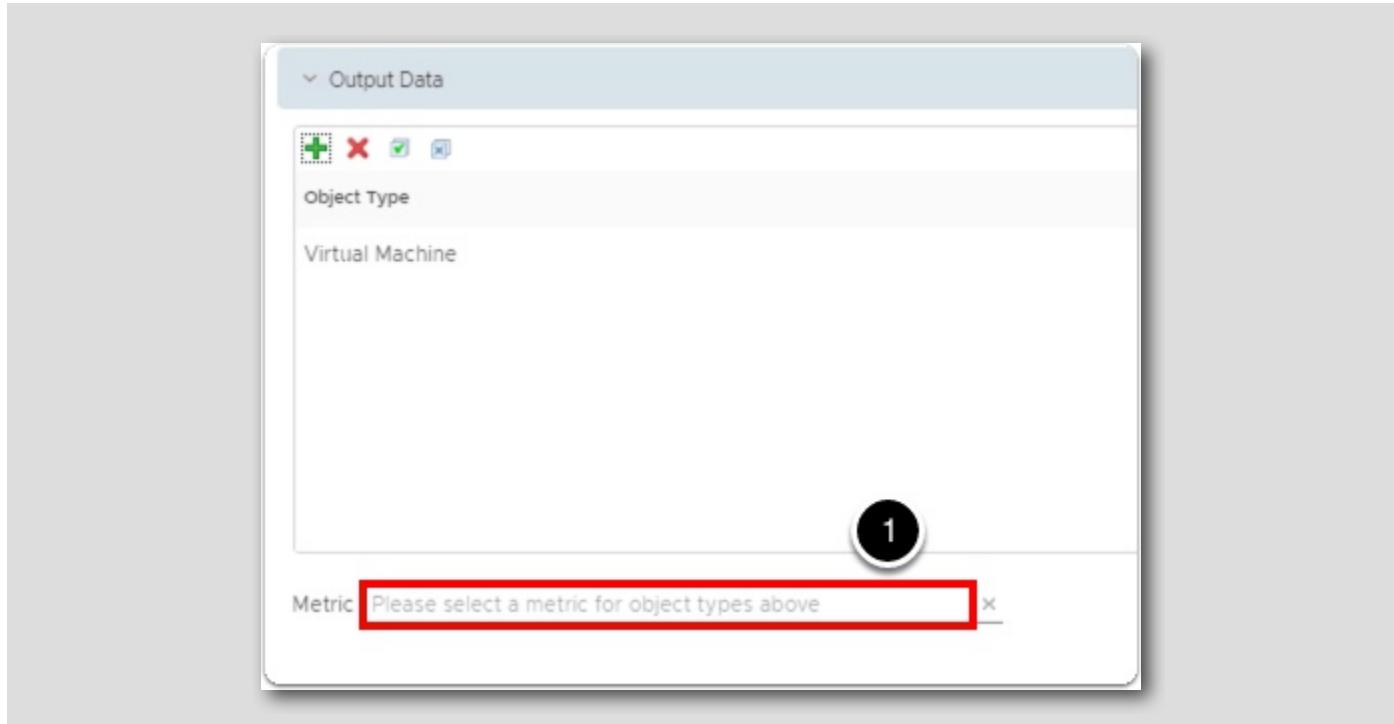


1. Type virtual machine into the Filter text field and hit the ENTER key on the keyboard.

2. Click on Virtual Machine in the list to select it.

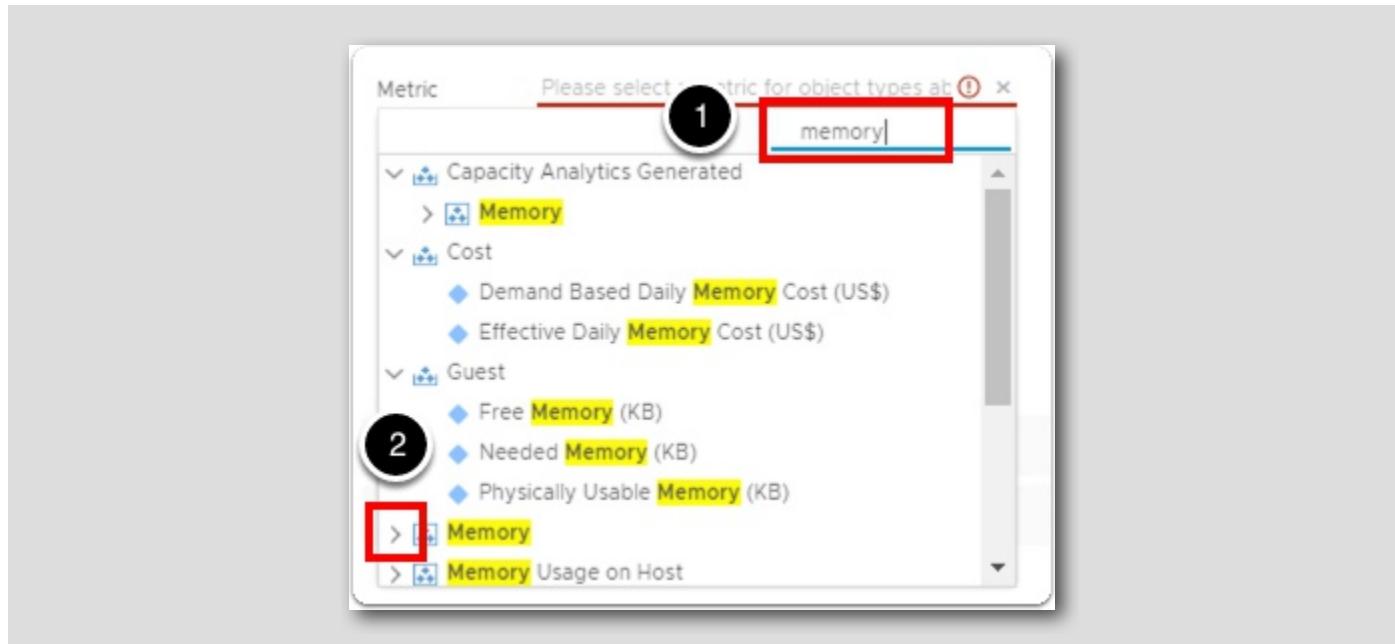
3. Then click on the OK button.

## Configure Top-N Widget - Metric



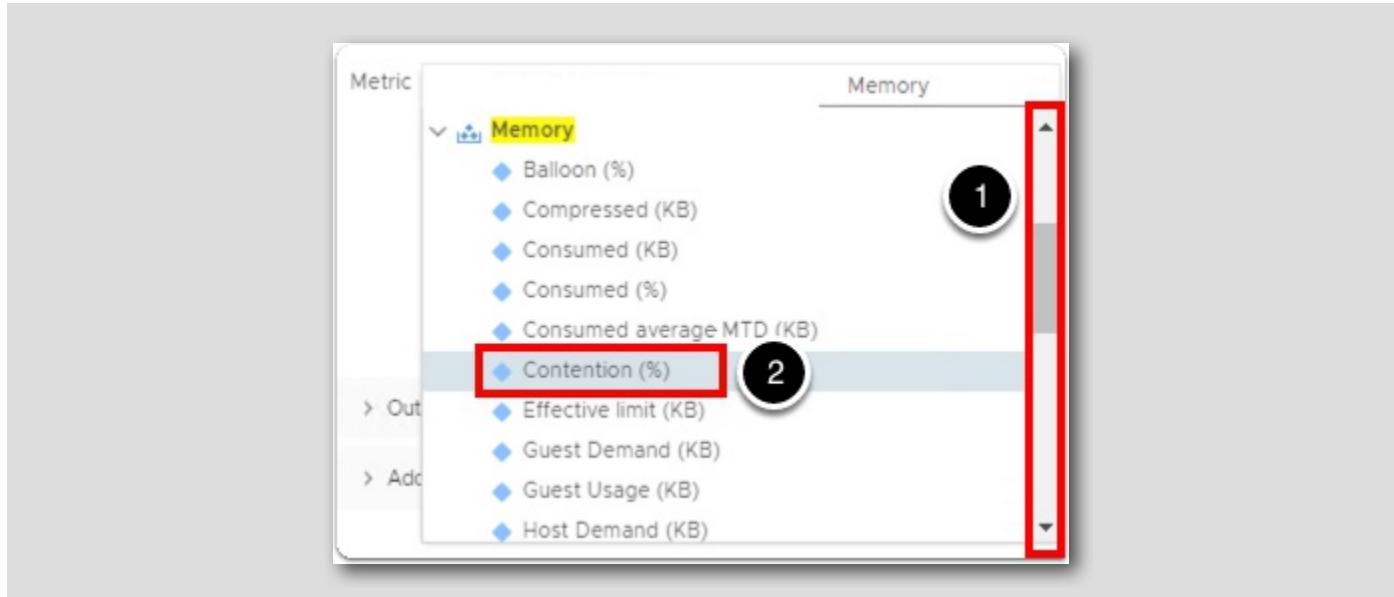
1. Click anywhere inside the **Metric** text field in order to expose the filter option.

## Configure Top-N Widget - Memory



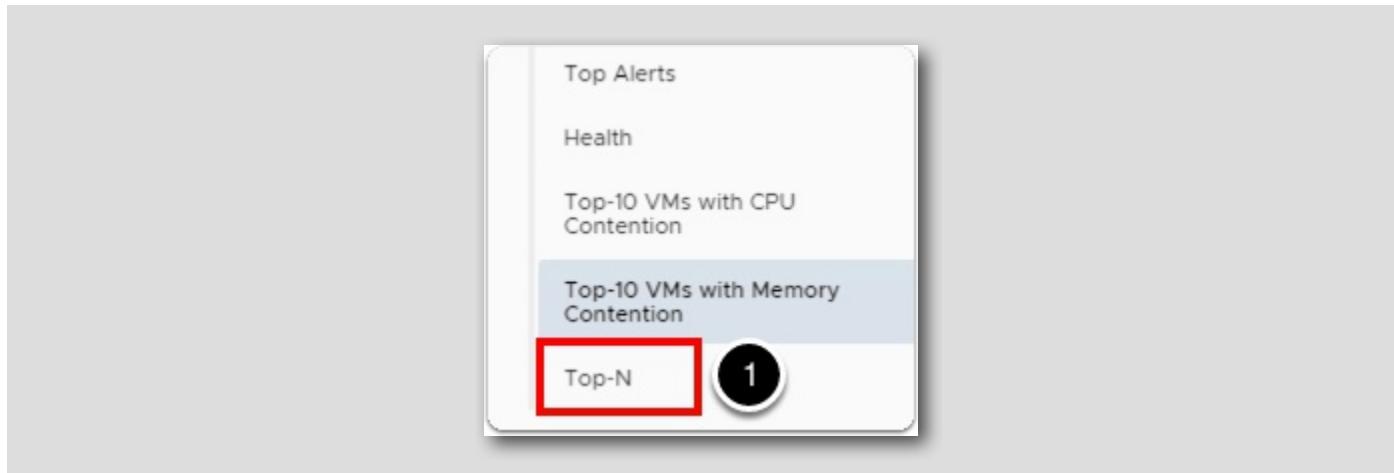
1. Type **Memory** into the filter text field and hit **ENTER** on the keyboard to filter for it.
2. Then click on the **arrow** next to **Memory** to expand its drop-down menu.

## Configure Top-N Widget - Memory Contention (%)



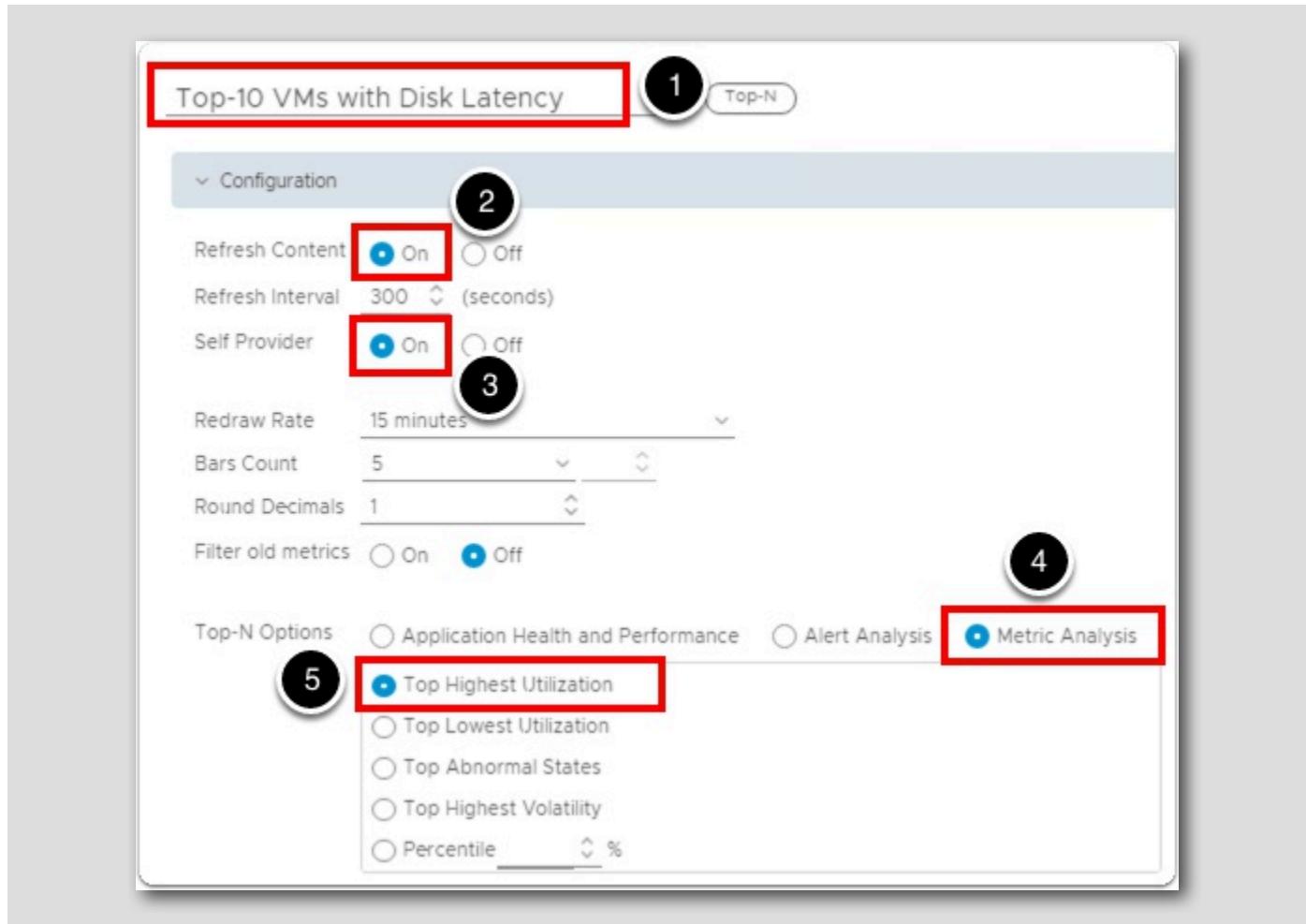
1. Drag the scroll bar down until we can see Contention (%) in the drop-down list.
2. Double-Click on Contention (%).

## Configure Top-N Widget - Top-N



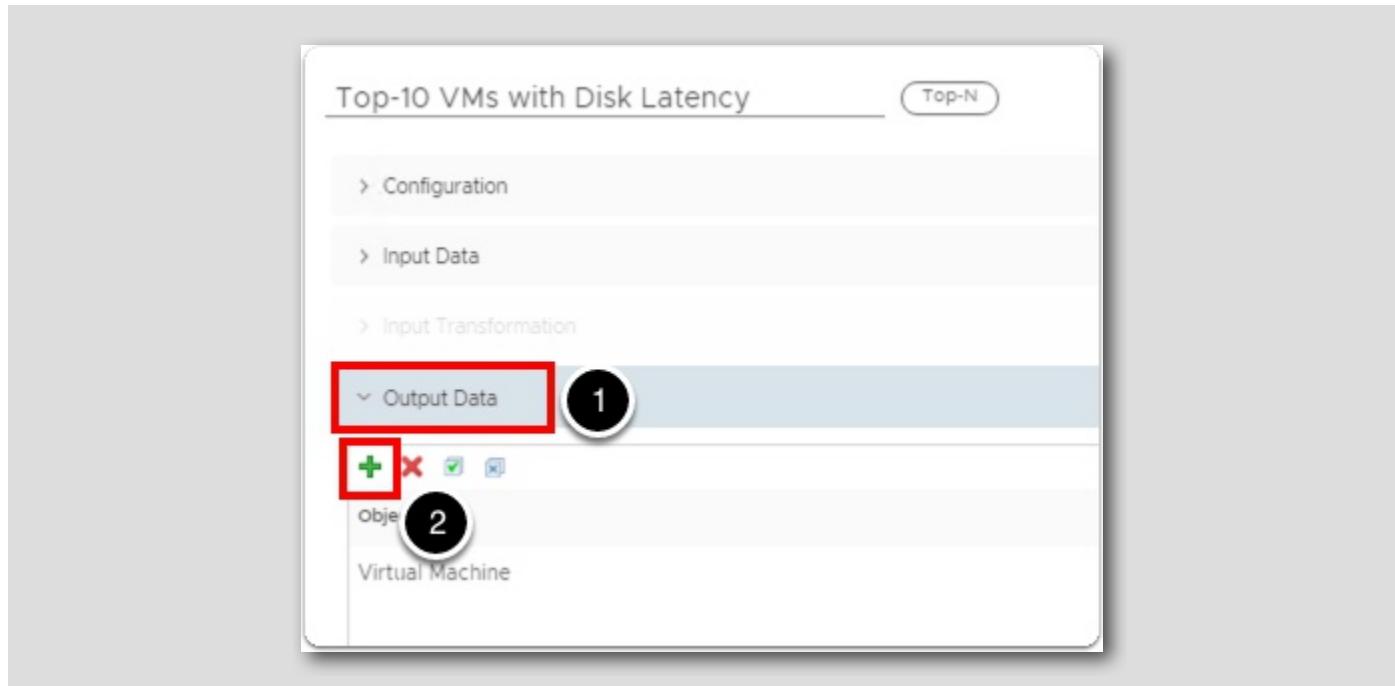
1. Click on the last Top-N in the Navigation bar on the left side of the pop-up window.

## Configure Top-N Widget - Change Name



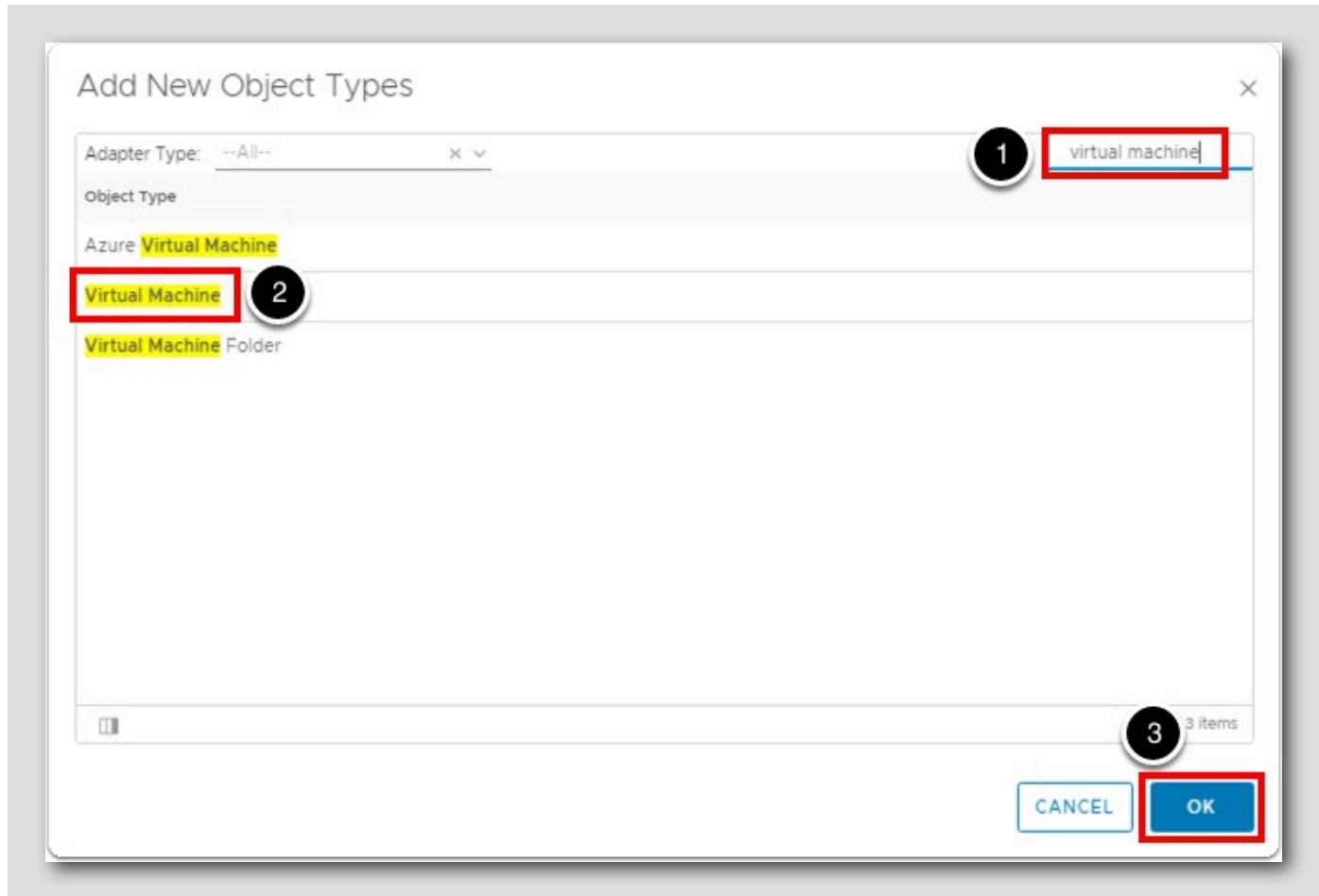
1. Replace the text Top-N with Top-10 VMs with Disk Latency.
2. Click on the On radio button next to Refresh Content.
3. Click on the On radio button next to Self Provider.
4. Click on the Metric Analysis radio button next to Top-N Options.
5. We see that it automatically selected the Top Highest Utilization radio button for us.

## Configure Top-N Widget - Object Types



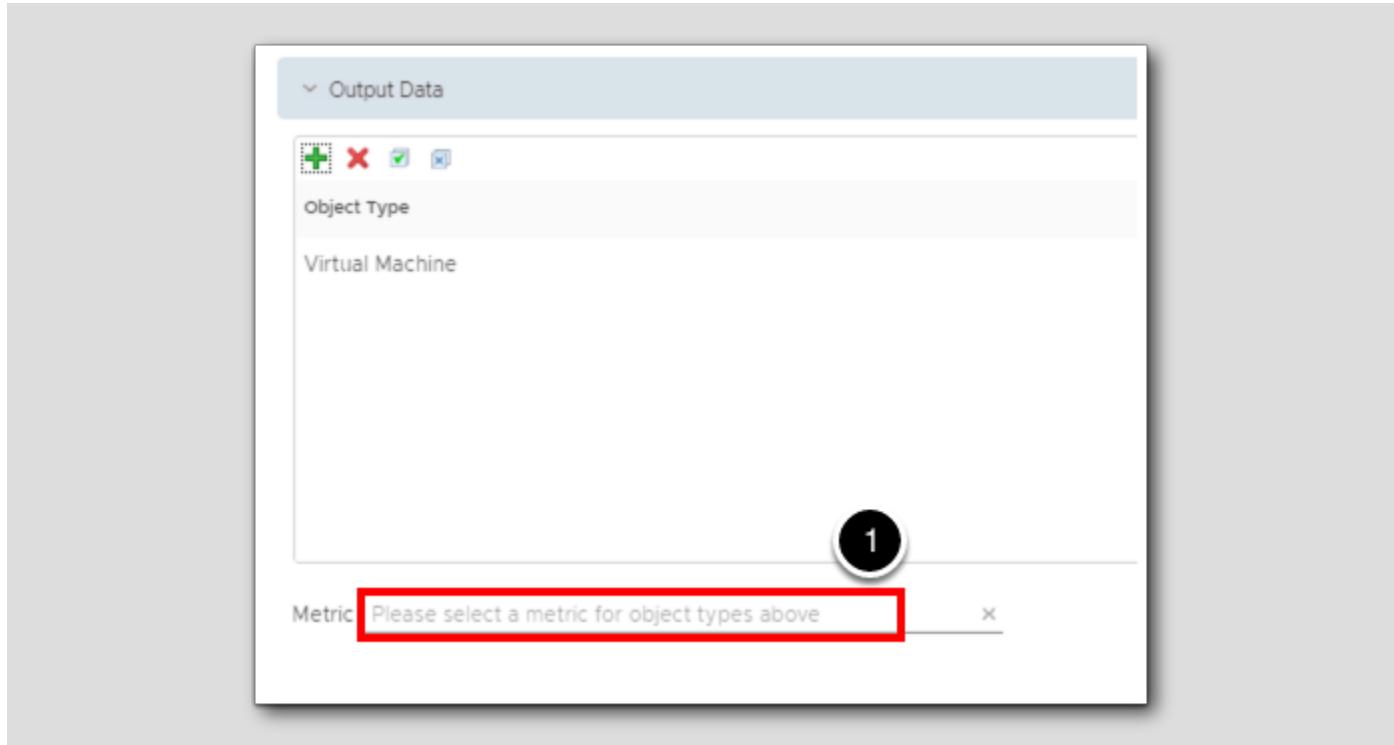
1. Click on the Output Data selection to expand it.
2. Click on the Add Object Type (*green plus sign*) to add an object type.

## Configure Top-N Widget - Virtual Machine



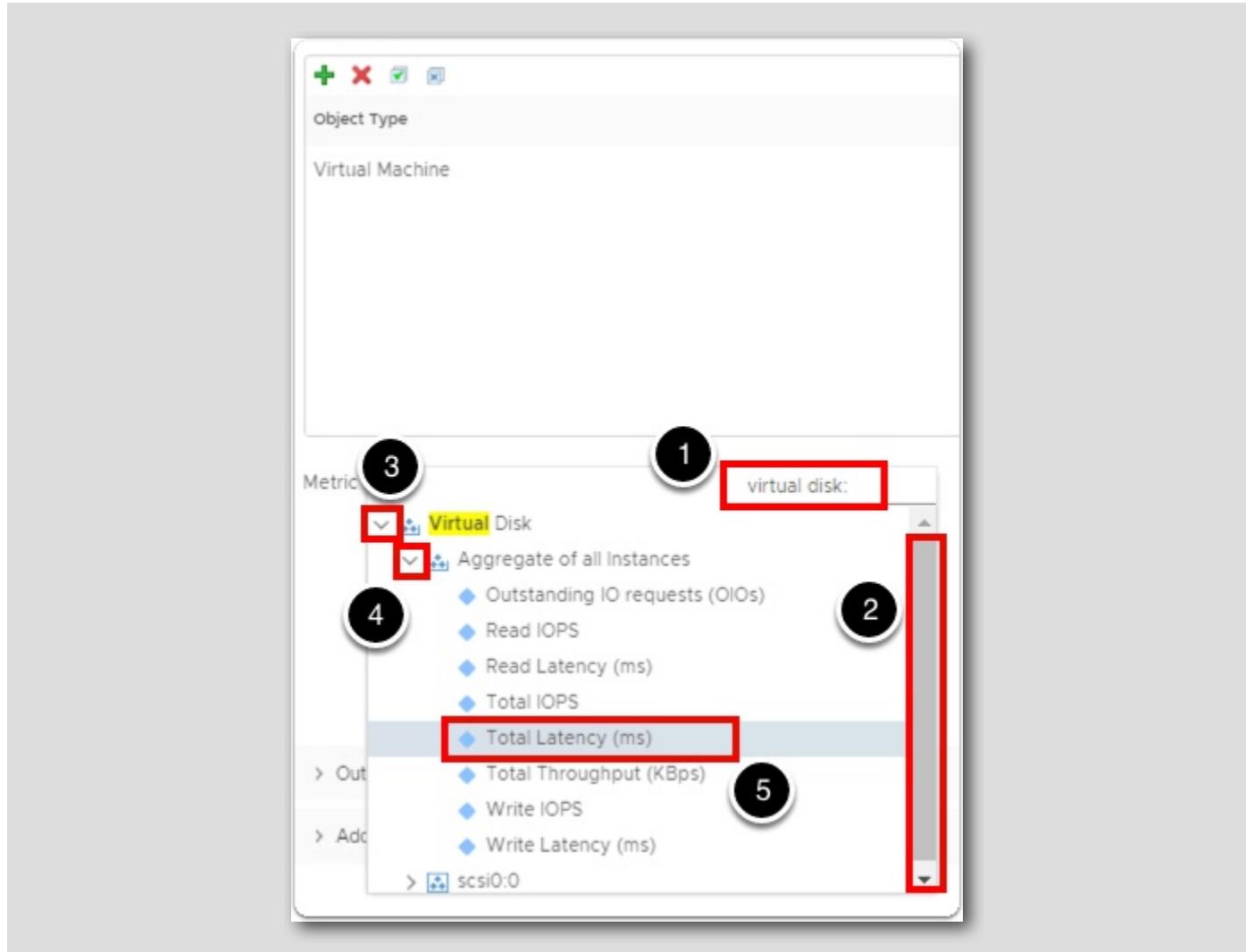
1. Type virtual machine into the Filter text field and hit the ENTER key on the keyboard.
2. Click on Virtual Machine in the list to select it.
3. Then click on the OK button.

## Configure Top-N Widget - Metric



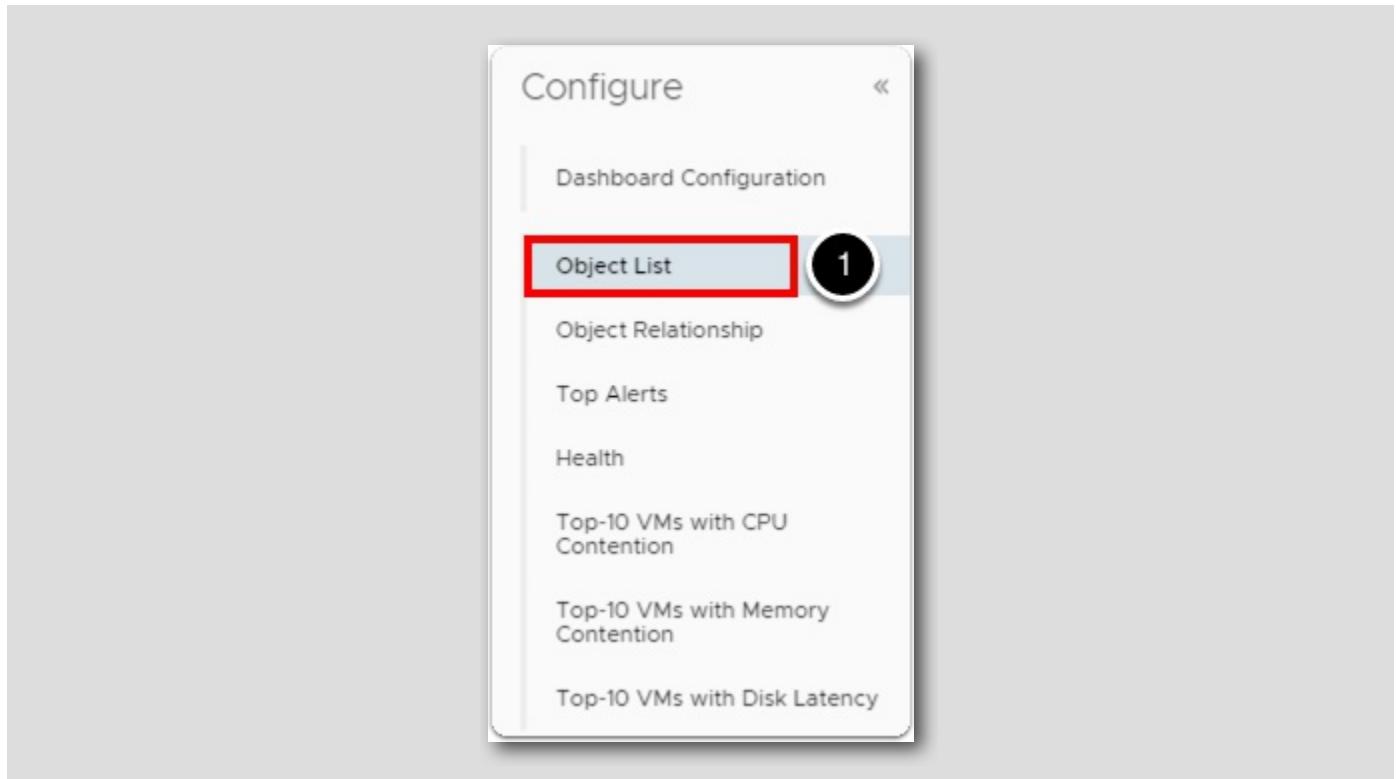
1. Click anywhere inside the **Metric** text field in order to expose the filter option.

## Configure Top-N Widget - Virtual Disk Total Latency (ms)



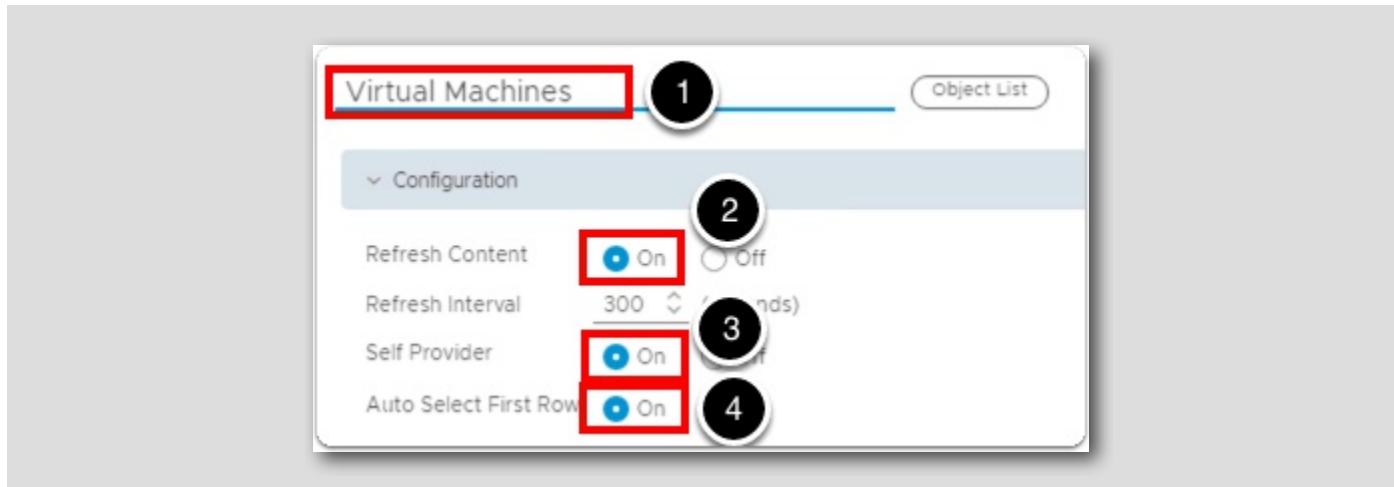
1. Type **virtual disk:** into the Metric text field and hit **ENTER** to filter for it.
2. Scroll Down to the bottom of the list to see **Virtual Disk**.
3. Click on the Chevron beside **Virtual Disk** to expand it.
4. Click on the Chevron beside **Aggregate of all Instances** to expand it (You may need to scroll down more in the list to see it).
5. Double-Click on **Total Latency (ms)**.

## Configure Object List



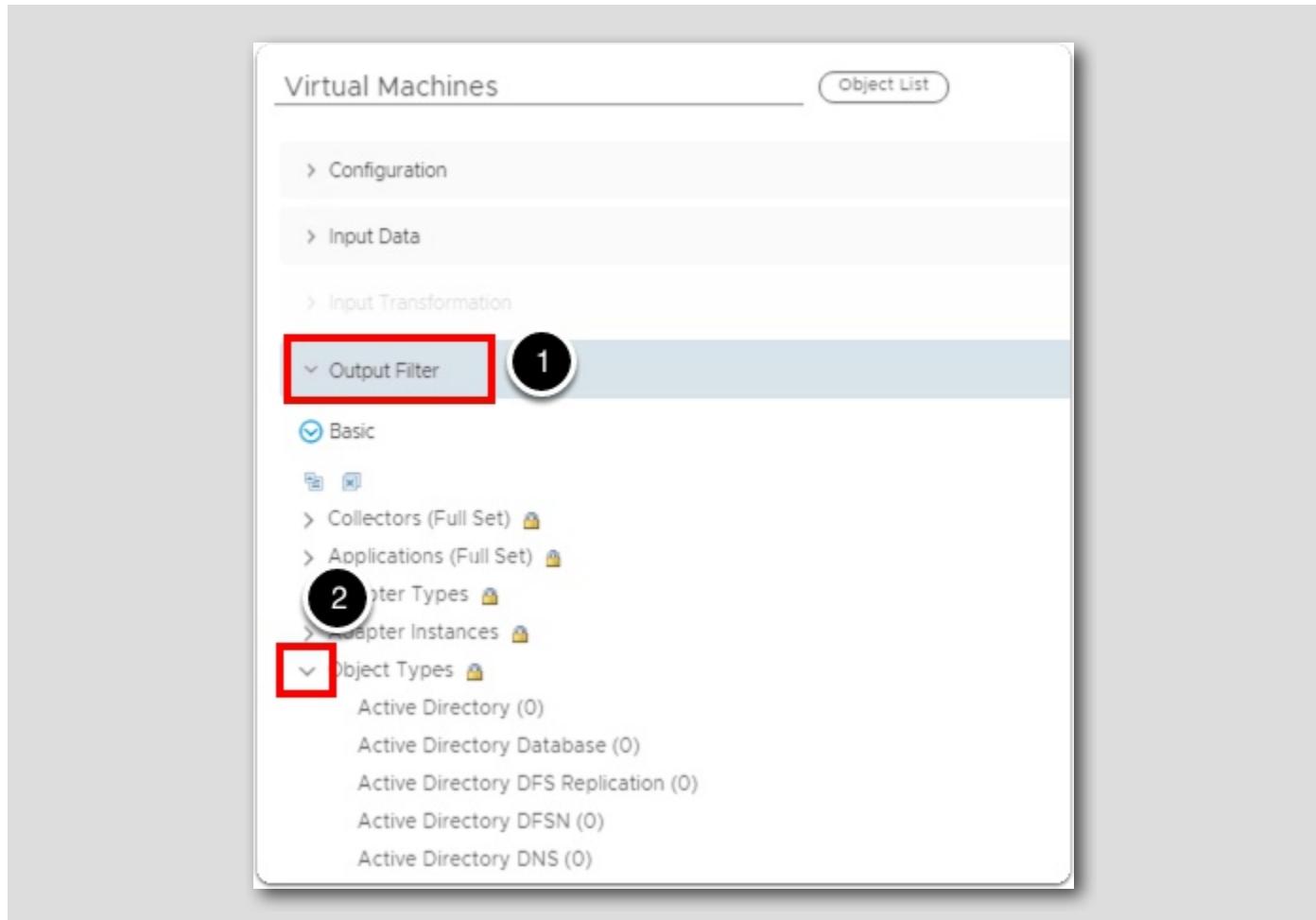
1. Click on Object List in the left Navigation Pane of the pop-up window.

## Configure Object List - Change Name



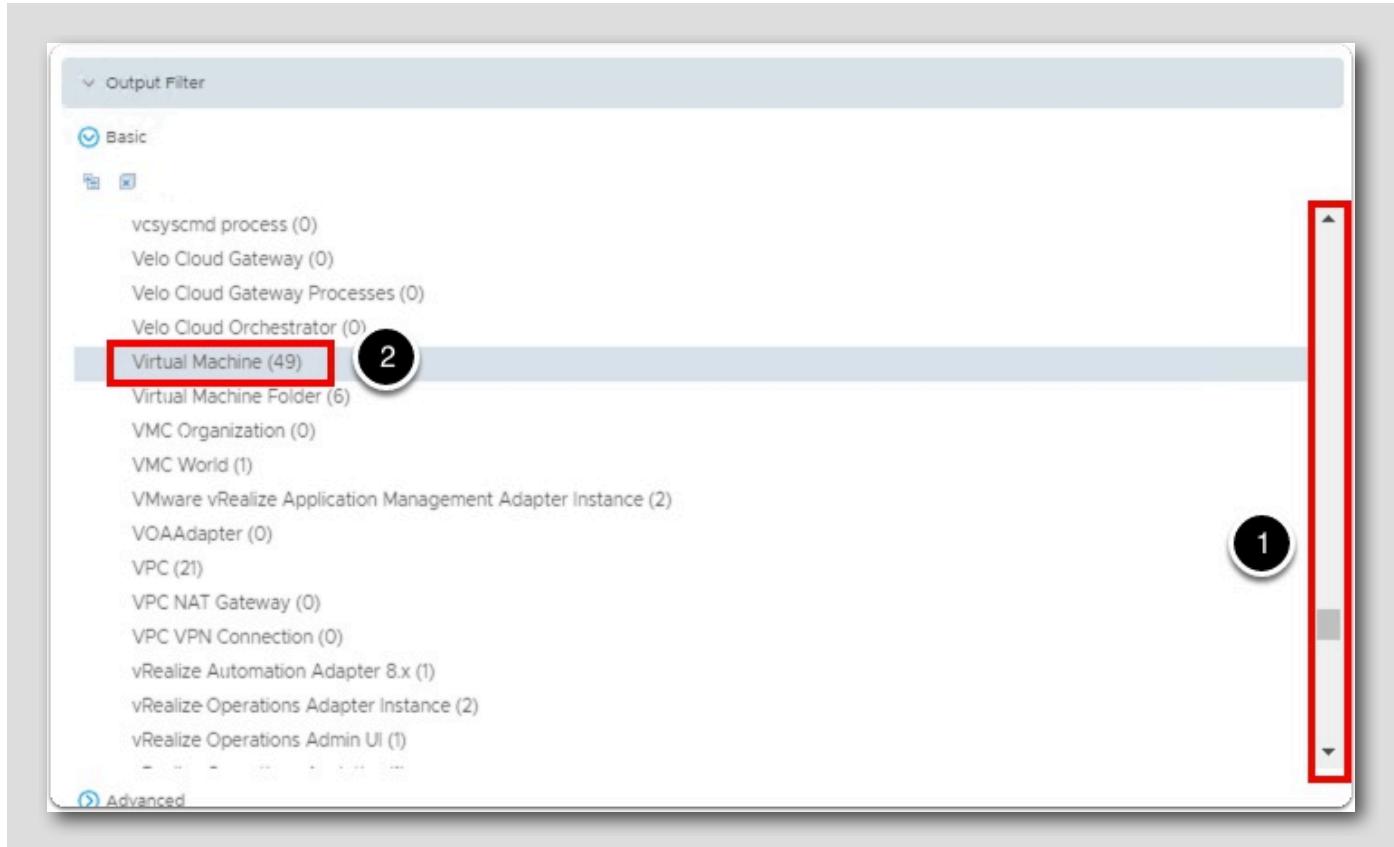
1. Type **Virtual Machines** into the Name text field.
2. Click on the **On** radio button to the right of Refresh Content.
3. Click on the **On** radio button to the right of Self Provider.
4. Click on the **On** radio button to the right of Auto Select First Row.

## Configure Object List - Output Filter



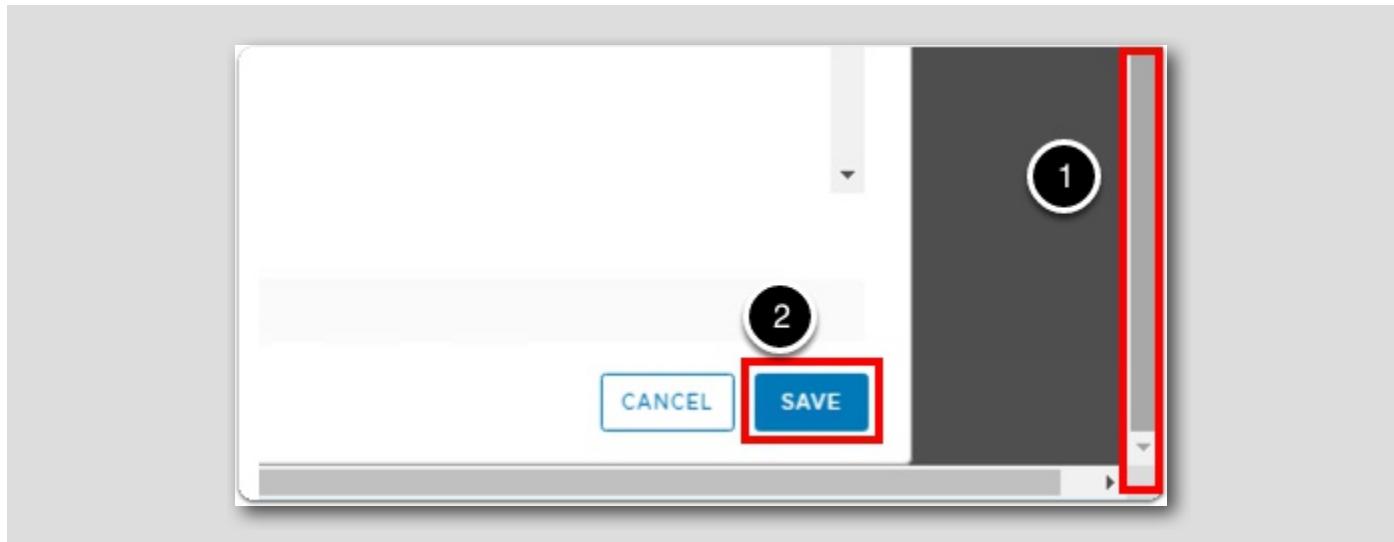
1. Click on Output Filter.
2. Then click on the arrow next to Object Types to expand its menu.

## Configure Object List - Virtual Machine (8)



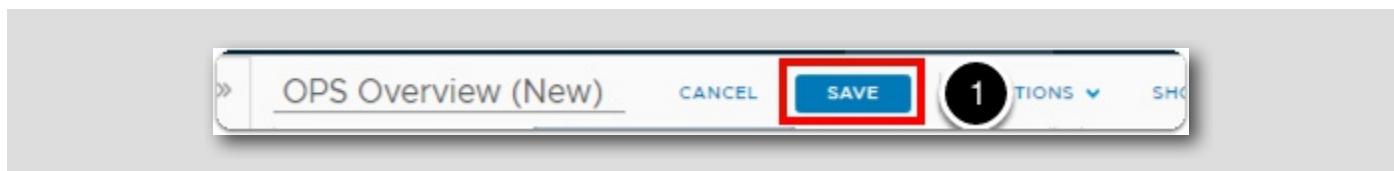
1. Drag the scroll bar down until we can see Virtual Machine in the drop-down list.
2. Then click on Virtual Machine.

## Save Dashboard Layout



1. Drag the scroll bar all the way to the bottom of the pop-up window.
2. Then click on the **SAVE** button to save our configuration settings for this new Dashboard.

## Save Dashboard



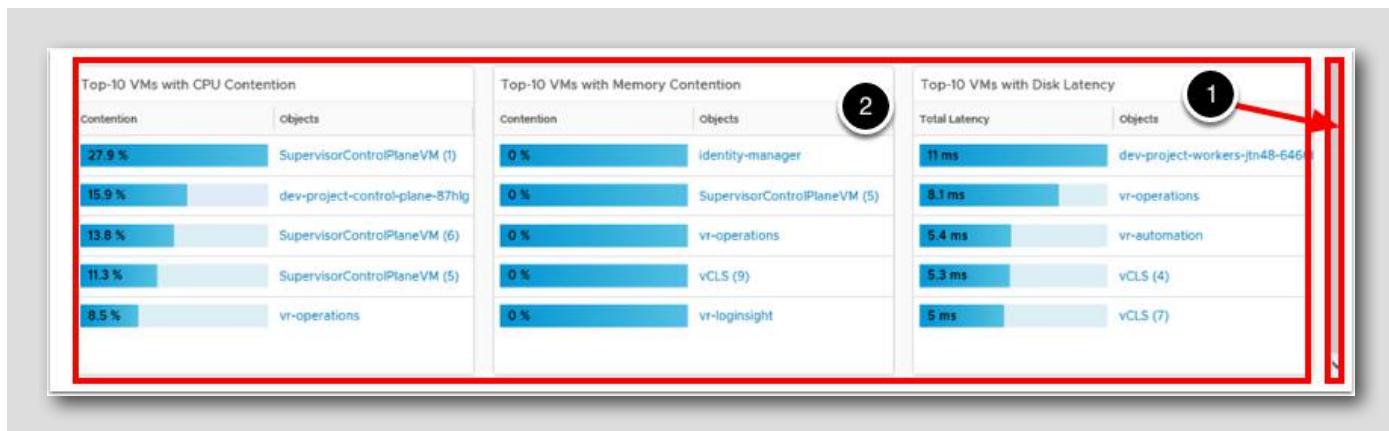
1. Click on the **SAVE** button to save our Dashboard.

## Review Dashboard

The screenshot shows the OMC Review Dashboard. At the top, there's a table titled 'Virtual Machines' with columns for Name, Adapter Type, Object Type, Policy, Collection State, and Collection Status. A red box highlights the row for 'ubuntu-0003', which is circled with number 2. In the top right corner, there's a scroll bar with a red border around it, circled with number 1. Below the table is a large red box containing the 'Object Relationship' graph for 'ubuntu-0003'. This graph shows various components like 'esx-05a.corp.local', 'Workloads', 'ho-ubuntu', 'VM-RegionA...', and 'RegionAD1-H...'. The 'ubuntu-0003' VM is highlighted with a green circle. To the right of the graph are three widgets: 'Top Alerts' (showing 'No Issues'), 'Health' (with a green icon and 'Health immediate issues'), and 'Why is health Good?' (explaining the metric). At the bottom of the dashboard are three smaller cards: 'Top-10 VMs with CPU Contention', 'Top-10 VMs with Memory Contention', and 'Top-10 VMs with Disk Latency'.

1. Drag the scroll bar all the way to the top of the new dashboard.
2. Click on the the VM ubuntu-0003 to view the stats for that object (You may need to scroll down a little in the list of VMs to see it).
3. We now see that the three widgets (Object Relationship, Top Alerts and Health) now are populated with metrics related to the ubuntu-0003 virtual machine.

## Review Dashboard (continued)



1. Drag the scroll bar all the way to the bottom of the dashboard.
2. We see that we have the (3) Top-10 VMs widgets based on CPU Contention, Memory contention and Disk latency.

## Lesson End

Congratulations, we have completed the lesson on **Creating a New Custom Dashboard!**

In this lesson, we created a brand new custom dashboard that contained an Object List of virtual machines that had relationships to all the other widgets. However, we did not create the relationship from the virtual machine in the Object List widget to the Top-N widgets. This ensures that no matter which virtual machine we selected from the Object List widget, the Top-N widgets will always show the Top-10 VMs with CPU contention, Memory contention and Disk latency.

## Importing New Dashboards

In this lesson, we will learn how to import new dashboards into vRealize Operations.

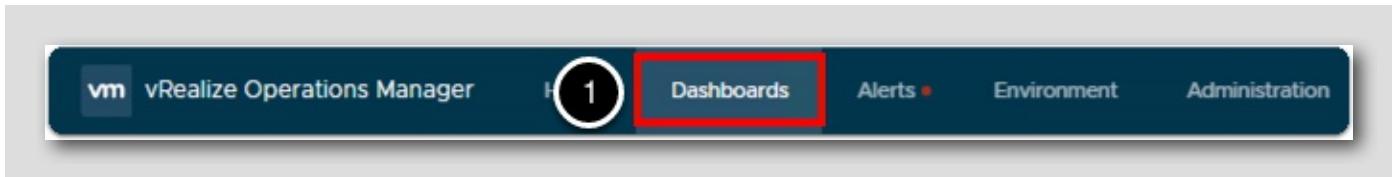
Perhaps you have multiple vRealize instances and you need to import a dashboard that one of your teammates has created on a different vRealize instance. This could be very useful and is very common when we have multiple vRealize Operations instances or we have a Development instance that we use to develop and test our custom content.

We also have a great website to download and contribute cool dashboards we have made called the Dashboard Exchange. We can get to the dashboard exchange quickly by visiting this site at <https://vrealize.vmware.com/sample-exchange/>.

In this lesson, we'll look at some downloadable community content that is available for use to use in vRealize Operations and we'll show how to access and import that content.

## Dashboards

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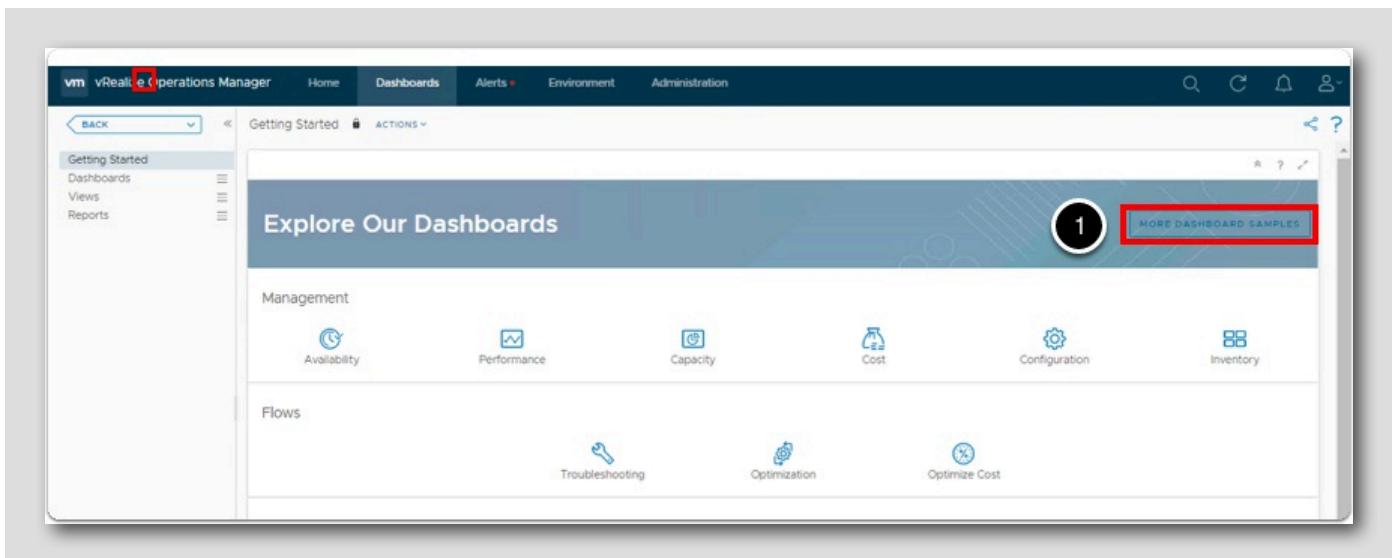


NOTE: If we are already on the Dashboard tab, we can skip this step.

1. Click on the Dashboards tab in the menu bar at the top of the user interface.

## Getting Started

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As we mentioned, we have a Dashboard Exchange that we can use to download community content. We can access this directly from vRealize Operations. However, for this lab environment, we will use your browser to access that page instead of going through the vRealize Operations UI due to firewall/proxy issues in the lab pod.

1. Note the link in vRealize Operations BUT DON'T CLICK IT
2. Click here to open the vRealize Operations Sample Exchange in your browser.

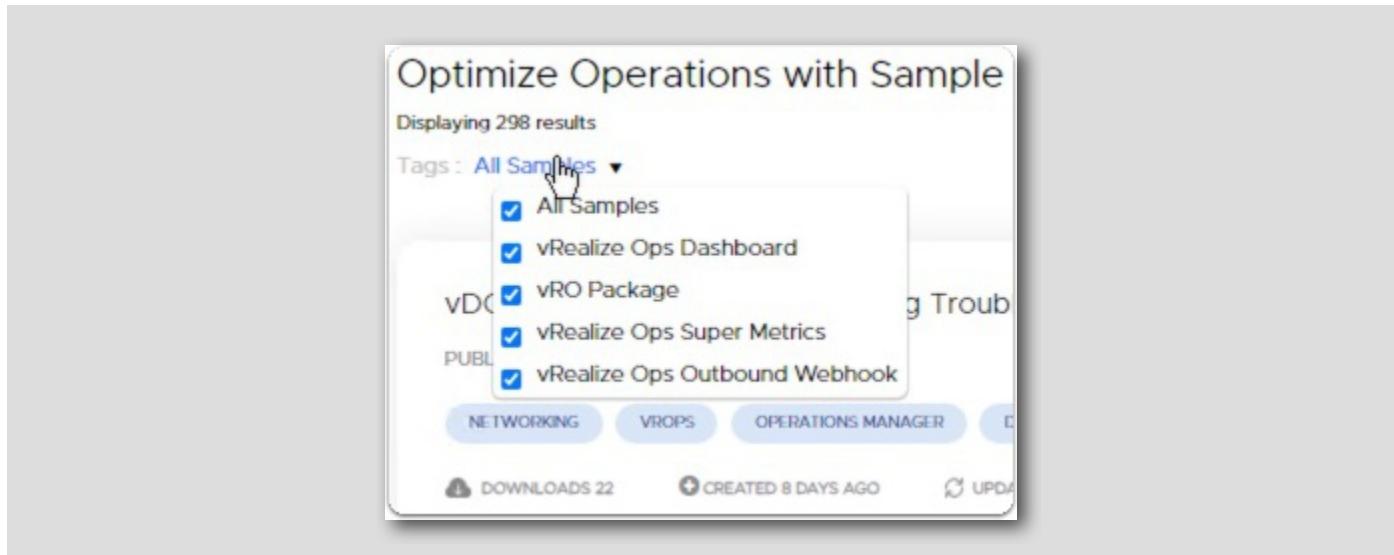
## vRealize Operations Sample Exchange

The screenshot shows a web browser window for the vRealize Operations Sample Exchange at <https://vrealize.vmware.com/sample-exchange/vrealize-o...>. The page title is "vRealize Operations Sample Exchange". The main content area features a heading "vRealize Operations Sample Exchange" and a sub-section titled "Optimize Operations with Sample Dashboards and Workflows from VMware and the Community". A callout box highlights the "All Samples" dropdown menu, which is circled with a red box and labeled with a number "1". Other visible elements include a search bar, navigation links, and a "DOWNLOAD" button for a specific sample item.

Everything in the Sample Exchange is community provided content and can be downloaded free of charge. If you login with your MyVMware account, you can also submit content that you've created to share with other users as well.

1. Hover over All Samples to show the different types of content that are available.

## Sample Types



Here we can see the different types of content we can download from the sample exchange.

- vRealize Ops Dashboard - Dashboards, as we have covered in previous lessons, are great ways to quickly see a summary of various parts of your environment. There are many great dashboards built-in to vRealize Operations, but the customization options are endless and they can be easily modified to suit your needs.
- vRO Package - vRealize Orchestrator (vRO) packages can be used to further integrate vRealize Operations into other products into the vRealize Suite. For example, we can use a vRealize Orchestrator package to allow us to assign a vRO workflow as a recommended action inside of a vRealize Operations alert which greatly extends the capabilities of recommendations and/or automated actions inside of vRealize Operations.
- vRealize Ops Super Metrics - Super Metrics are a way to create custom metrics inside of vRealize Operations to discover metrics about your environment that the built in metrics won't cover. Note, HOL-2201-09-CMP will cover these super metrics in more detail.
- vRealize Ops Outbound Webhook - A webhook, which can also be called a HTTP push API, is a way for vRealize Operations to provide other applications with data or information. The webhooks in the sample exchange provide examples of webhooks to some popular applications that you may want to receive data from vRealize Operations.

## Search for our Sample Dashboard

The screenshot shows a web browser window titled "vRealize Operations Sample Exchange". The address bar displays the URL "vrealize.vmware.com/sample-exchange/vrealize-operations-sample-exchange". The top navigation bar includes links for "SX Manager", "Lifecycle Manager", "vRealize Automation", "vRA Build", "vRealize Operations...", "vRealize Log Insight", and "SaltStack Config". Below the navigation is a section titled "vmware® Product Walkthroughs" with a "US(English)" link. A red box highlights the search icon (magnifying glass) in the top right corner of the page header. The main content area is titled "vRealize Operations Sample Exchange" and contains a brief description: "Explore and download community created content for custom dashboard samples as well as workflows that can be used with the vRealize Orchestrator Management Pack." It also mentions "Log in to sample exchange using your MyVMware credentials to submit requests for new samples, contribute your own samples, as well as propose a sample as a solution for open requests." Below this, there is a section titled "Optimize Operations with Sample Dashboards and Workflows from VMware and the Community" which displays "Displaying 298 results". A dropdown menu "Tags : All Samples ▾" is on the left, and a "Sort By: Recently Added | Downloads | Title | Author" dropdown is on the right. A notification badge with the number "1" is visible in the top right corner of the main content area.

Let's search for a dashboard to use for this lesson.

1. Click the Search Icon on the sample exchange.

Search for Environment Summary Dashboard

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environment summary dashboard X Cancel

1

SAMPLE EXCHANGE Displaying 3 search results

**Clean Executive Summary Dashboard**  
PUBLISHED BY: MATT BRADFORD  
Home > sample-exchange > Clean Executive Summary Dashboard

**VMware Summary Dashboard**  
PUBLISHED BY: BROCK PETERSON  
Home > sample-exchange > VMware Summary Dashboard

**VMware Environment Summary Dashboard V2**  
PUBLISHED BY: BROCK PETERSON  
Home > sample-exchange > VMware Environment Summary Dashboard v2

2

In this example, we will be selecting a dashboard that we can use in a Network Operations Center (NOC) to give us a good high level visual overview about the health of our environment. This search will return several results - a count this is continually increasing as people add additional content to this community sample exchange.

1. In the search box, enter **environment summary dashboard**, and hit Enter.
2. Scroll down or use your browser's search function (Ctrl-F) to search for **environment summary dashboard** and select the **VMware Environment Summary Dashboard v2** once you find it.

Alternately, you can use this [direct link](#) to find the dashboard.

## Download Dashboard

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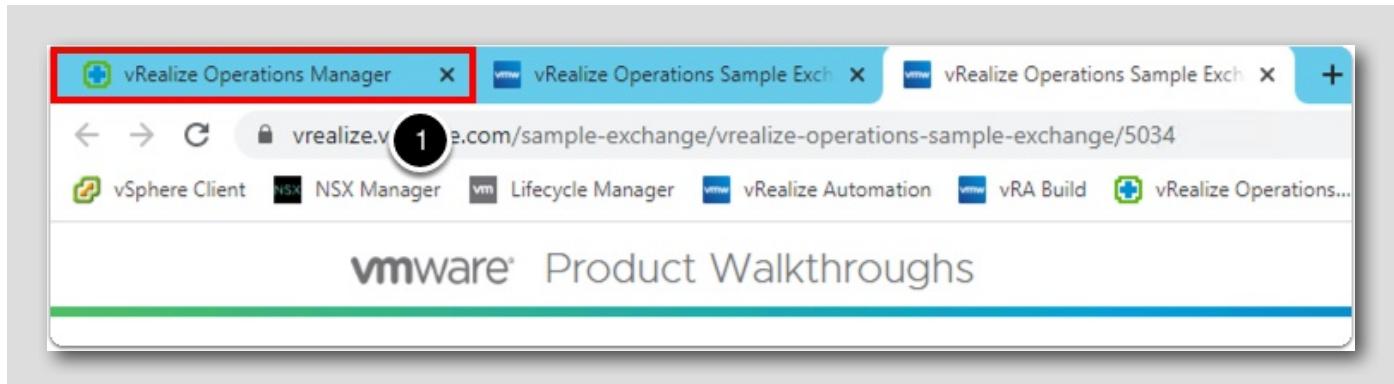
The screenshot shows the 'VMware Environment Summary Dashboard v2' page on vRealize Operations Manager. At the top, there is a summary card with metrics: Total Datacenters (7), Total Clusters (22), Total Hosts (37), Running hosts (27), Total VMs (1,329), Running VMs (716), and Total Databases (117). Below this is a detailed preview of the dashboard interface, which includes sections for Datacenter Health, Cluster Health, Host Health, VM Health, and Database Health, each showing various status indicators and metrics. On the right side of the page, there is a 'DOWNLOAD' button (marked with a red box and number 1) and a file download link 'dashboard.json' (marked with a red box and number 2).

On this page we can see details about the dashboard. Some dashboards samples will also include screenshots of the dashboard showing what data it will include.

1. If you wanted to download the dashboard file, you would click on the DOWNLOAD button. However, we already have a copy of the file in our lab pod.

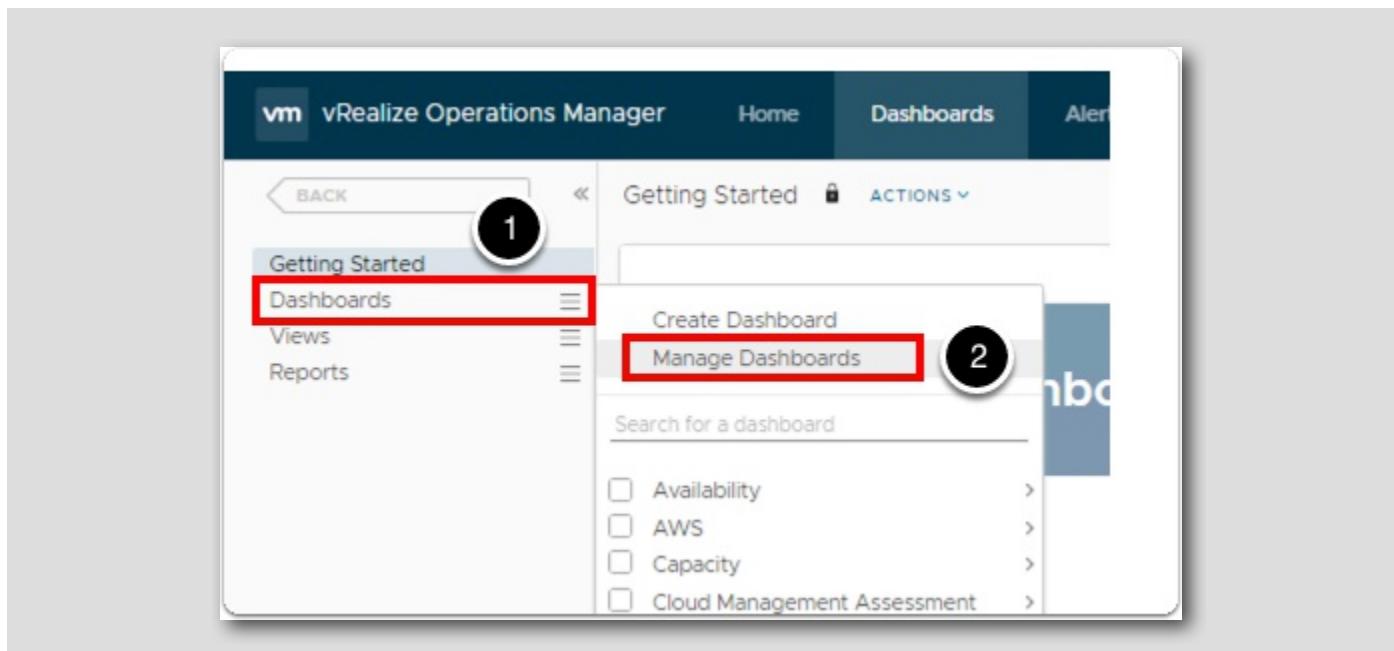
You can download the file and view the json if you want to see how a dashboard is stored as code for portability.

## Return to vRealize Operations



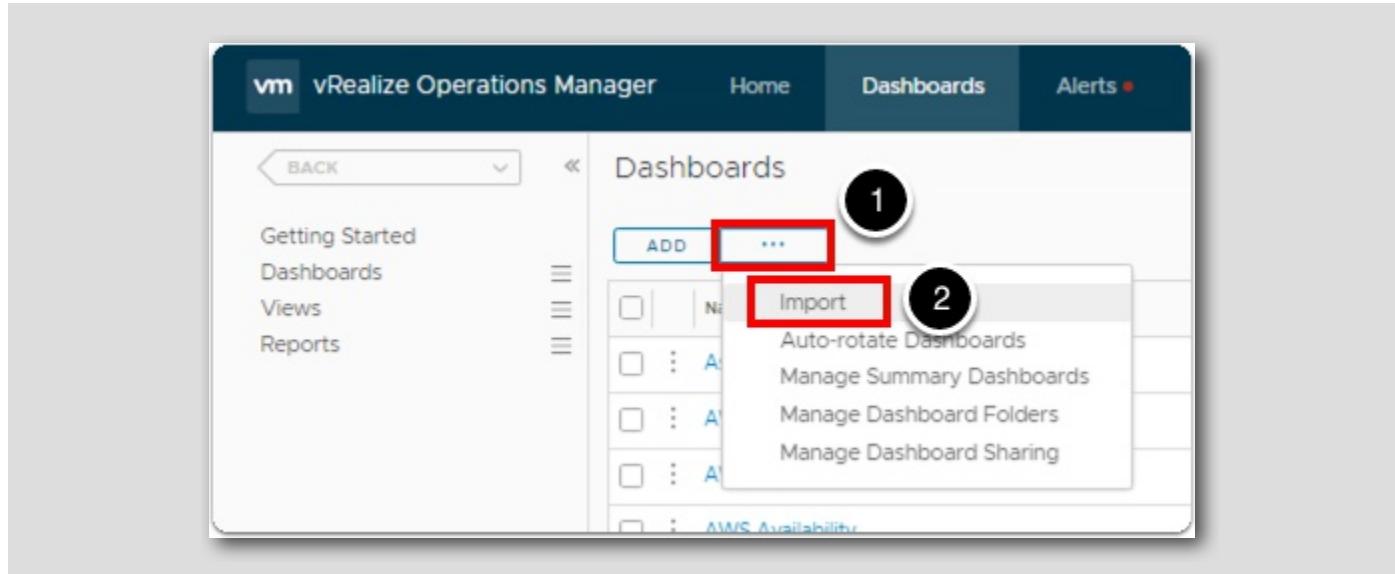
1. Return to the vRealize Operations Manager tab in your lab console.

## Manage Dashboards



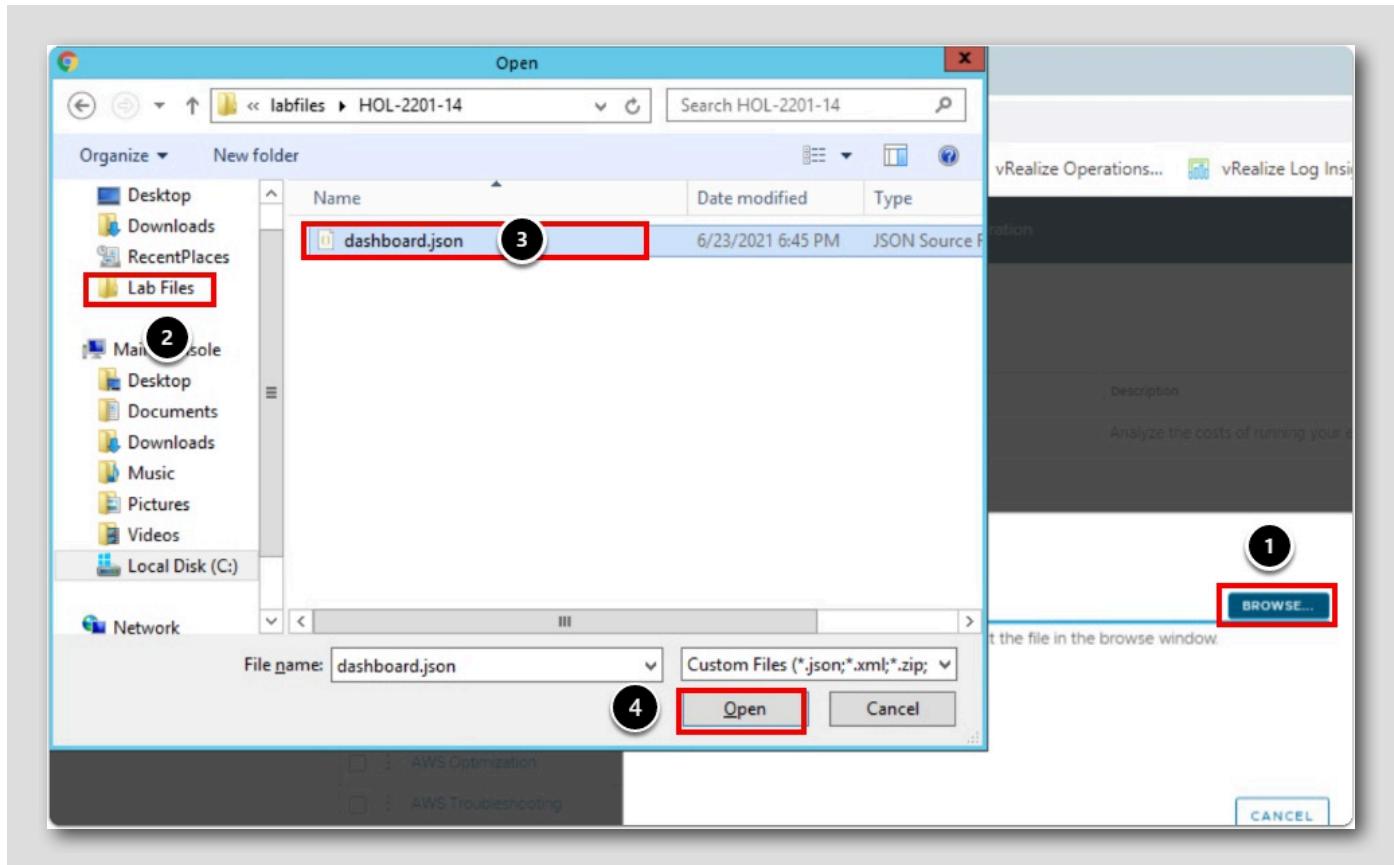
1. Click on Dashboards.
2. Click on Manage Dashboards.

## Import Dashboard



1. On the Dashboards page, click the bottom with 3 dots to open the action menu.
2. Then click **Import** to start the import process.

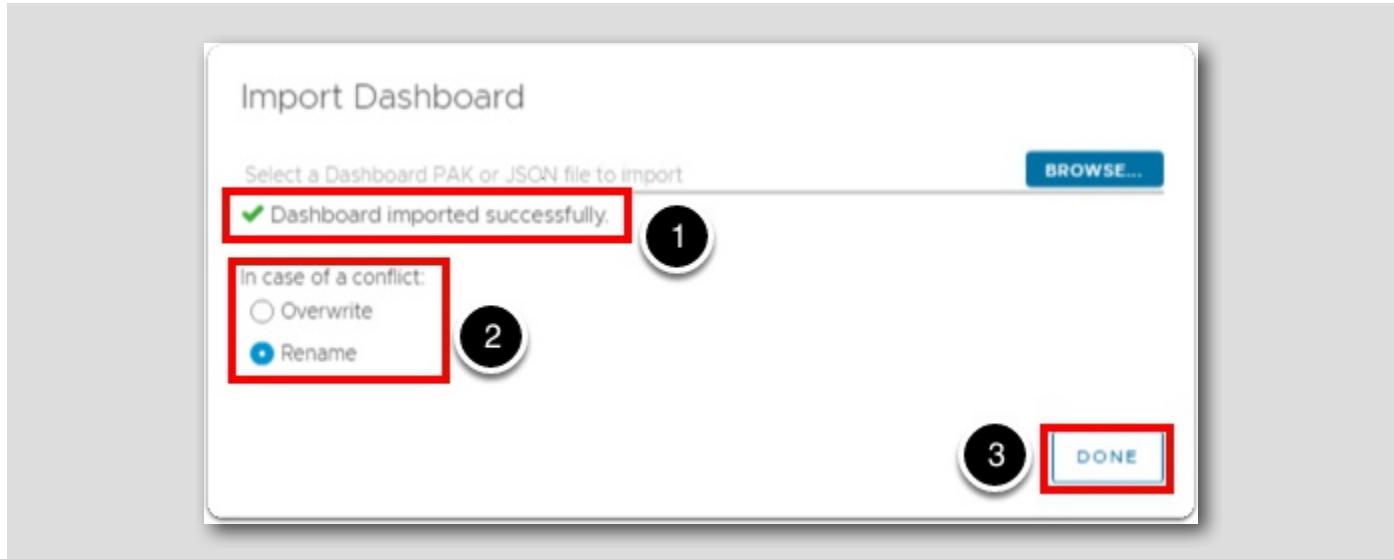
## Import Dashboard File



Note: We have already downloaded the dashboard file for you. It is in the Lab Files --> HOL-2201-14 directory on your Main Console VM in the lab environment.

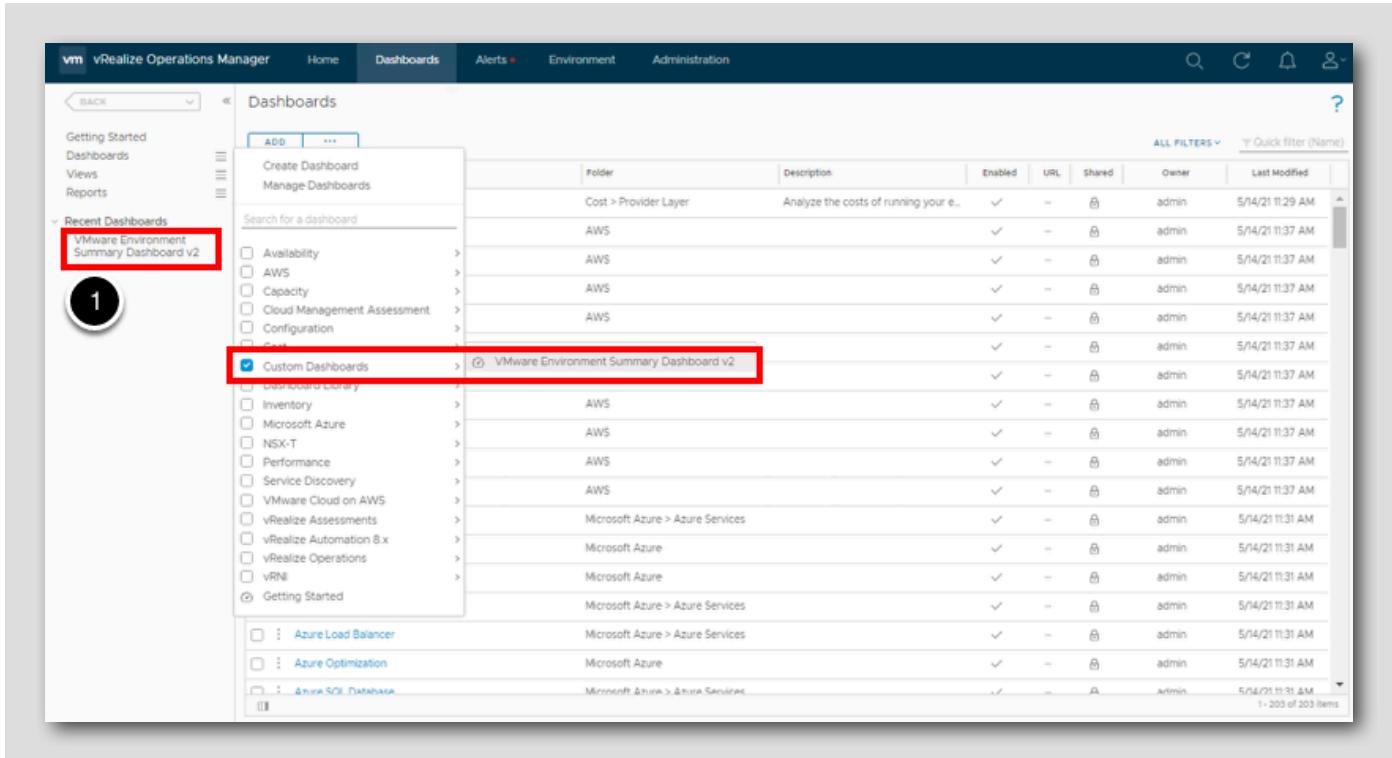
1. On the Import Dashboard pop-up, click BROWSE to locate the json file we looked at earlier.
2. In the next window, click Lab Files then HOL-2201-14 (not shown)
3. Click to highlight the dashboard.json file.
4. Click Open to choose this file and begin the import.

## Dashboard Imported Successfully



1. Here we can see the dashboard was successfully imported.
2. Notice here also that we have the option to either overwrite any existing dashboards that may have the same name as what you're importing. Or we can choose to rename the newly imported dashboard instead of overwriting existing content.
3. Click DONE to close this window.

Find our Imported Dashboard



The dashboard we just imported will show up in our list of dashboards, as well as be added to the list of Recent Dashboards. In this case it was imported under Custom Dashboards because that was where the creator placed this dashboard before they exported it. The location of imported dashboards can vary and can be modified after they are imported.

1. To open our dashboard, click **VMware Environment Summary v2** under Recent Dashboards.

## Dashboard Actions

The screenshot shows the vRealize Operations Manager dashboard interface. At the top, there's a navigation bar with tabs like Home, Dashboards, Alerts, Environment, and Administration. The 'Dashboards' tab is selected. Below the navigation is a breadcrumb trail: BACK > VMware Environment Summary Dashboard v2. To the left, a sidebar lists 'Getting Started', 'Dashboards', 'Views', 'Reports', and a 'Recent Dashboards' section containing 'VMware Environment Summary Dashboard v2'. The main content area displays the 'VMware Environment Overall Status' with two cards: 'Total Datacenters' (1) and 'Total Clusters' (2). Below this are three sections: 'Datacenter Health', 'Cluster Health', and 'Host Health', each with sub-sections like 'Private Cloud', 'RegionA01', 'Workload 1', 'Management', and specific host names like 'esxi-02a.corp.lo'. A red box highlights the 'ACTIONS' dropdown menu, which is open and lists five options: 'Edit Dashboard', 'Delete Dashboard', 'Remove Dashboard from Menu', 'Set as Dashboards landing page', and 'Set as Home landing page'. Numbered callouts point to these actions: '1' points to the 'ACTIONS' button, and '2' points to the list of options.

Now we can see our imported dashboard! As a final step, let's look at some of the available options.

1. Select ACTIONS beside the dashboard name.
2. Here we can see the available options for this newly imported dashboard to further integrate it into our environment.

## Lesson End

Congratulations, we have just completed the Importing Dashboards lesson.

In this lesson, we learned how to import dashboards into vRealize Operations. We also learned about the Sample Exchange, which is a website where we can find some great ready-to-use content that we can use to easily extend the power of vRealize Operations.

In the next lesson we'll use this new Dashboard and we'll learn about the options we have to share this dashboard with other users.

## Sharing Dashboards

In this lesson, we will learn how to share the numerous dashboards available in vRealize Operations.

There are several very useful options for administrators to share dashboards to other personnel in their company. Now we can share a dashboard using a URL that can be given to ANYONE in our organization and they don't even need to be able to access our vRealize Operations environment. This is a super useful feature when we need to share performance or capacity information to others in the organization, but don't want them logging into our vRealize Operations instance.

We will see that we can also set an expiration time frame for the shared dashboard to be available. This is also really useful when you just want to give someone a view into a specific portion of the infrastructure for a limited period of time.

We can also share a dashboard through an email just by selecting the correct SMTP instance we have already set up in vRealize Operations and entering the email of the recipient you want to have your new dashboard. Like with the other sharing options, we can also put an expiration time frame for the email as well.

We can even embed the dashboard into any other web page by simply copying the HTML code provided and pasting it into any system like Confluence or our own internal intranet portal.

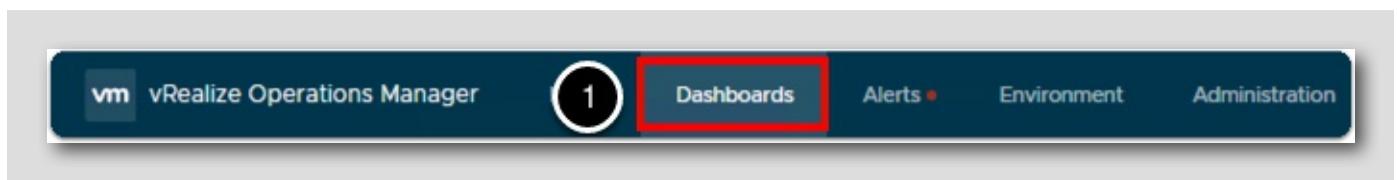
Group sharing is simply giving dashboard access to any group that currently is set up through the authentication source we already have configured in vRealize Operations.

The final option gives us the ability to export the dashboard and move it to any other vRealize Operations environment. This is very useful when we have multiple vRealize Operations instances or we have a Development instance that we use to develop and test our custom content.

We have commonly seen the (NOC) Network Operations Center of an IT organization share dashboards on their large monitors in their NOC. They have created web pages that contain various bits of information from various monitoring systems in order to minimize the amount of monitors they have to have in the NOC. We can easily give them what they need by providing them an embedded link to the dashboard in which they can embed into their existing web portal. That way they don't have to add an additional monitor to house the vRealize Operations dashboard. We will use this scenario in this lesson to learn how to share out the VMware Environment Summary Dashboard to them.

## Dashboards

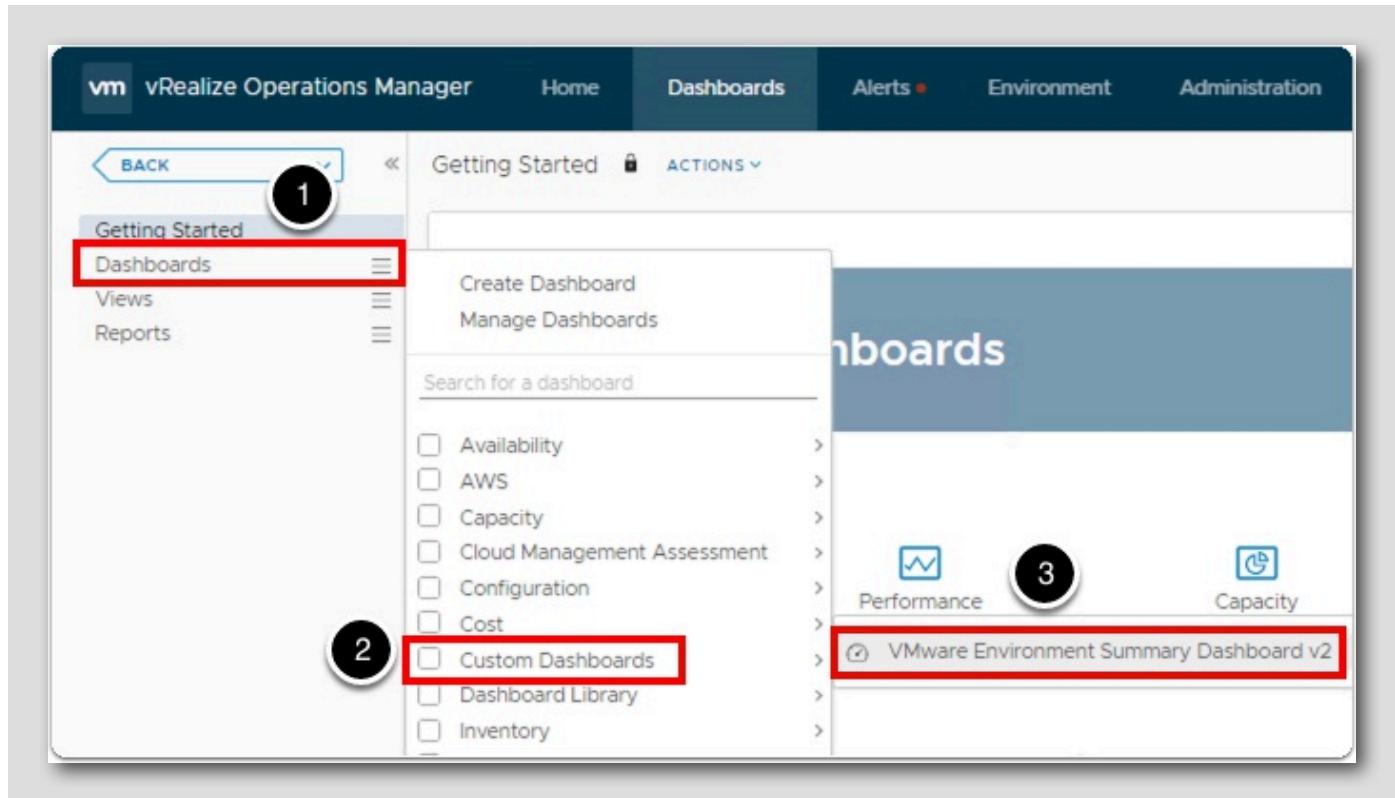
[286]



**NOTE:** If we are already on the Dashboard tab, we can skip this step.

1. Click on the Dashboards tab in the menu bar at the top of the user interface.

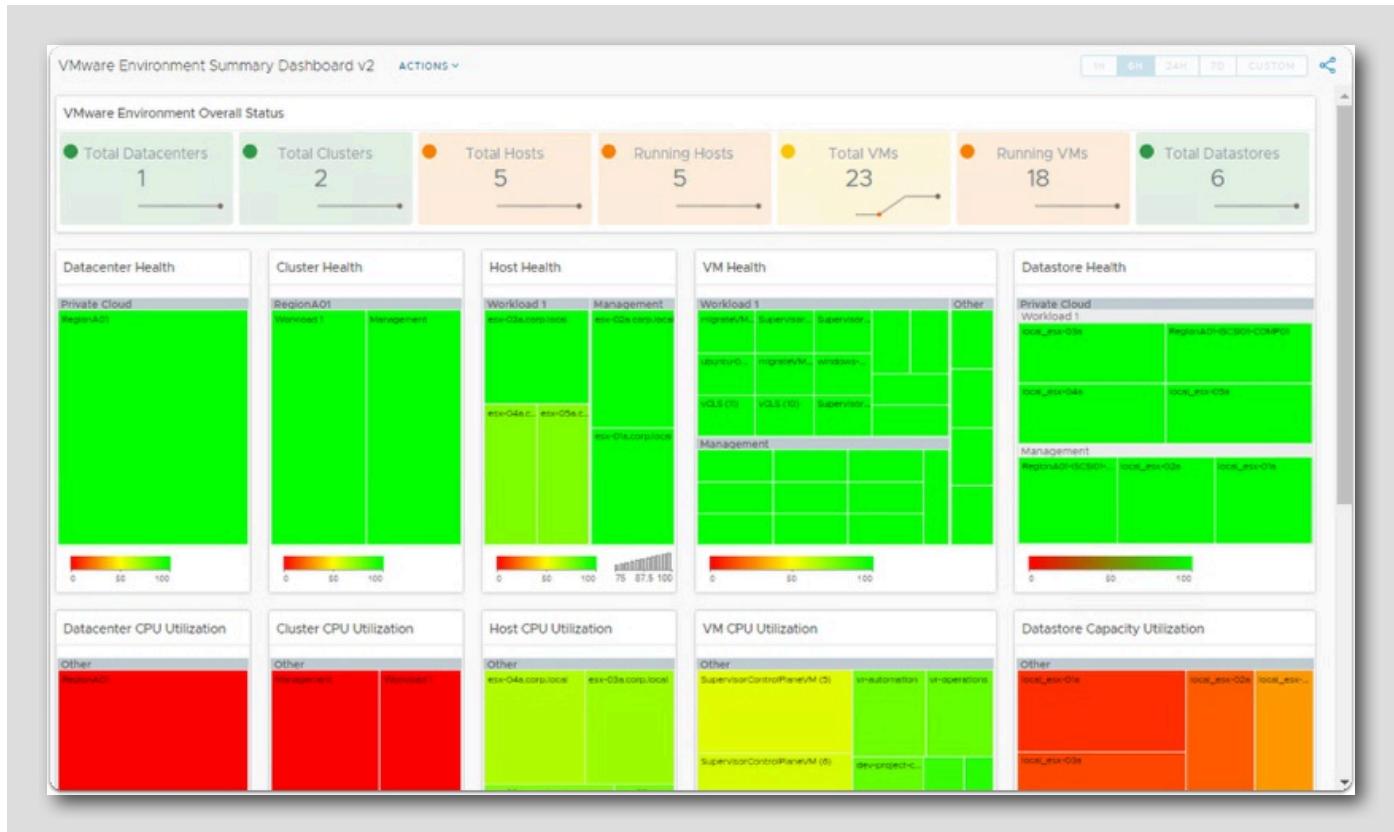
## VMware Environment Summary Dashboard



In our example, we want to share a dashboard with the (NOC) Network Operations Center, so lets go to the Environment Summary dashboard.

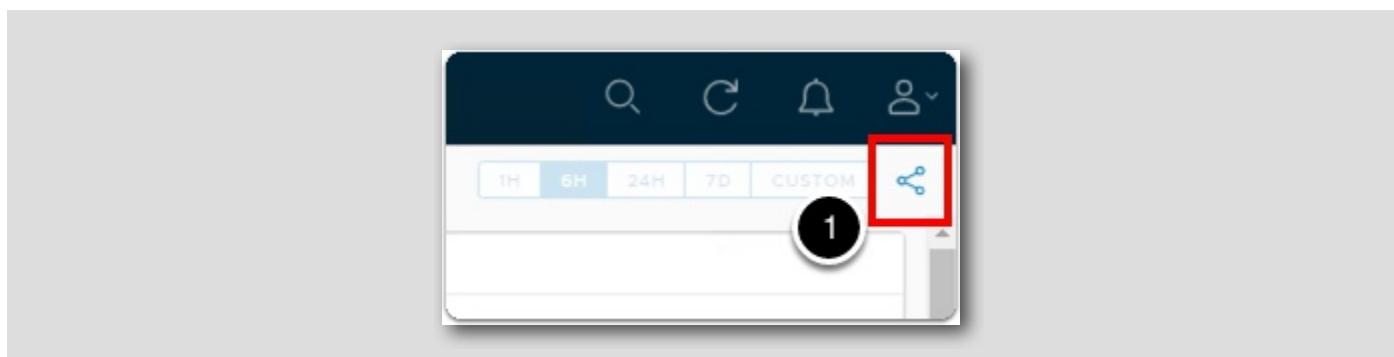
1. Click on Dashboards to expand the list of dashboards.
2. Hover the mouse over Custom Dashboards to open that group of dashboards.
3. Then click on VMware Environment Summary Dashboard v2.

## VMware Environment Summary Dashboard Review



To recap this scenario, the NOC personnel want to have the VMware Environment Summary Dashboard in the NOC at all times so they can monitor the virtual environment after hours. We need to share this dashboard with them, but remember they have a web portal that they use. Therefore, we will need to provide them the embedded link that they can simply add to their existing web portal.

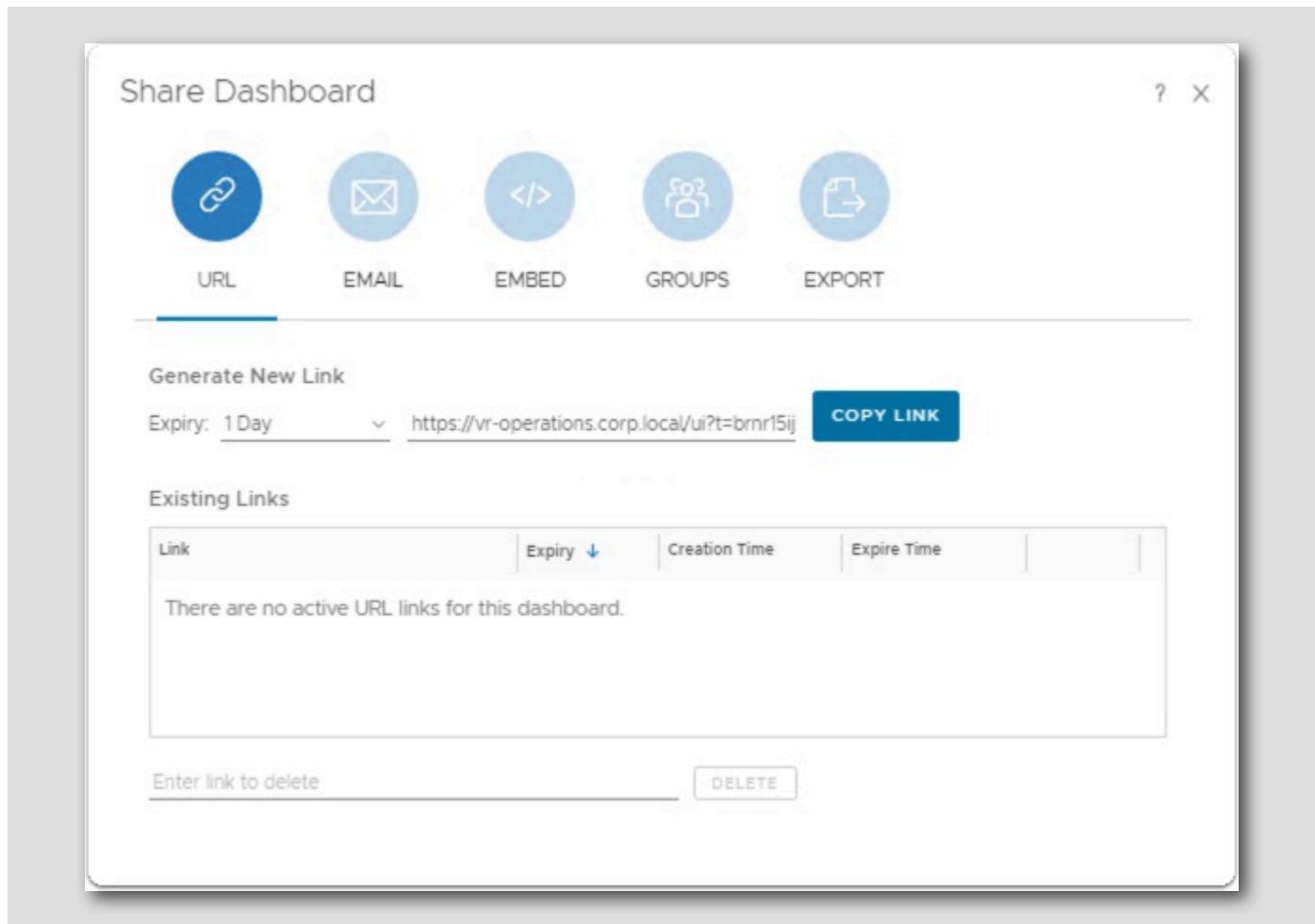
## Share Dashboard



1. Click on the Share Dashboard (three connected circles) icon in the upper right-hand side of the VMware Environment Summary Dashboard.

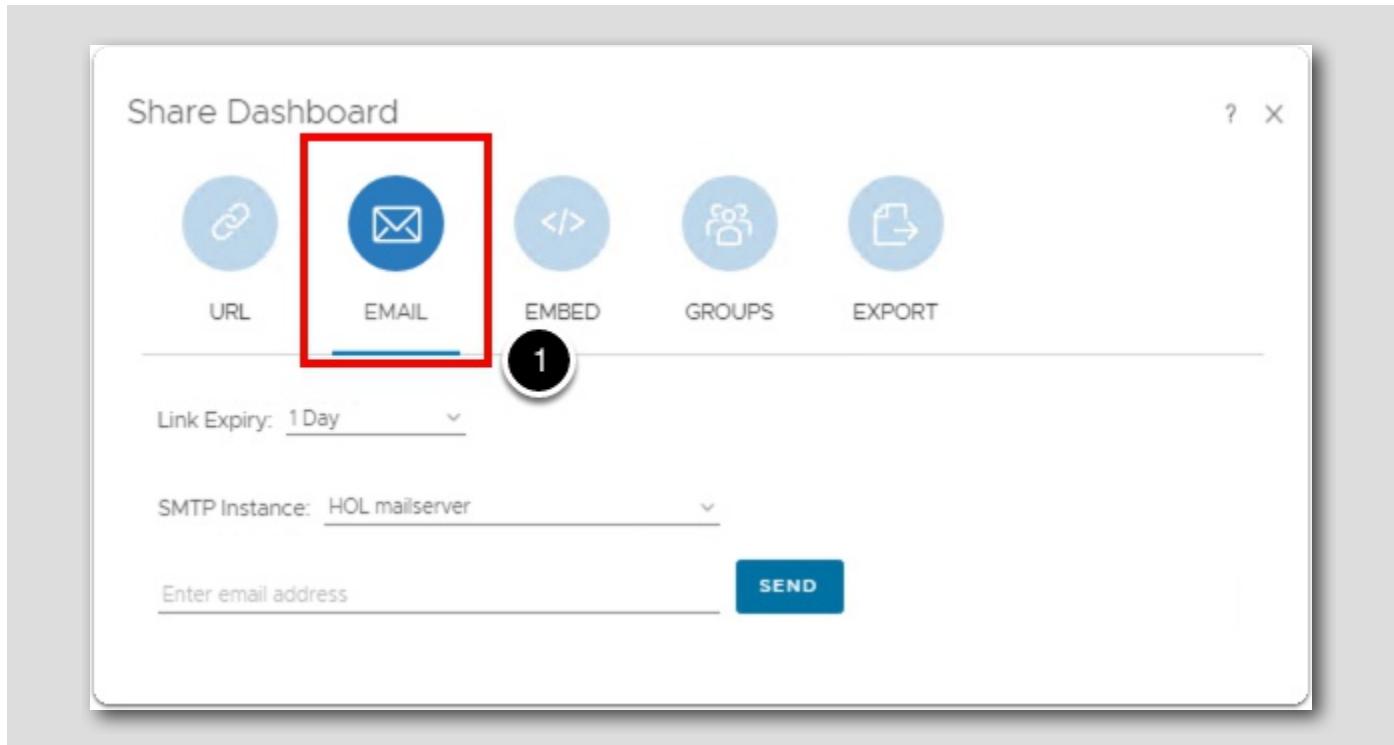
## Share Dashboard - URL

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In this example we can simply create a URL to provide to anyone so they can view the dashboard. For Link Expiry, we have the options to select (1) Day, (1) Week, (1) Month, (3) Months and Never Expire. We see that the link to the dashboard is already filled in. We would then click on the COPY LINK button to copy it to the computer's clipboard allowing us to copy it into a file, email, etc.

## Share Dashboard - Email

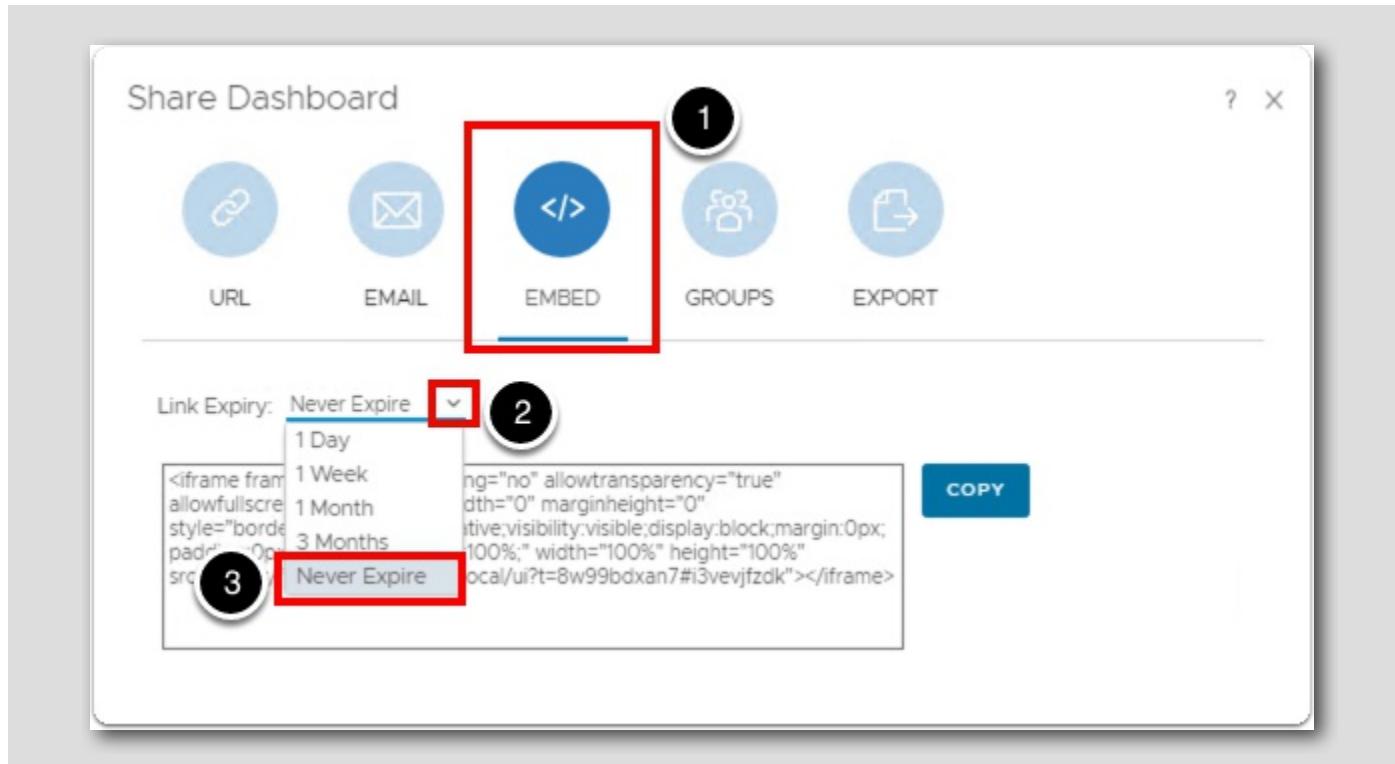


In this example, we want to send the dashboard link to someone via an email address directly from the vRealize Operations interface. As a note, we won't actually be sending the link to the dashboard to an email address. We will just run through the steps as though we are going to.

1. Click on the EMAIL icon to select email as an option to send the link.

Again, we have the options to select (1) Day, (1) Week, (1) Month, (3) Months and Never Expire. In this lab environment, we do not have an SMTP instance configured. In a production environment, we would configure this with the company email server information by clicking on the CONFIGURE button if it wasn't already configured within vRealize Operations. Then we would type the email address of the individual we are sending the link to. Finally, we would click the SEND button to send the email with the link to the dashboard to the receiver.

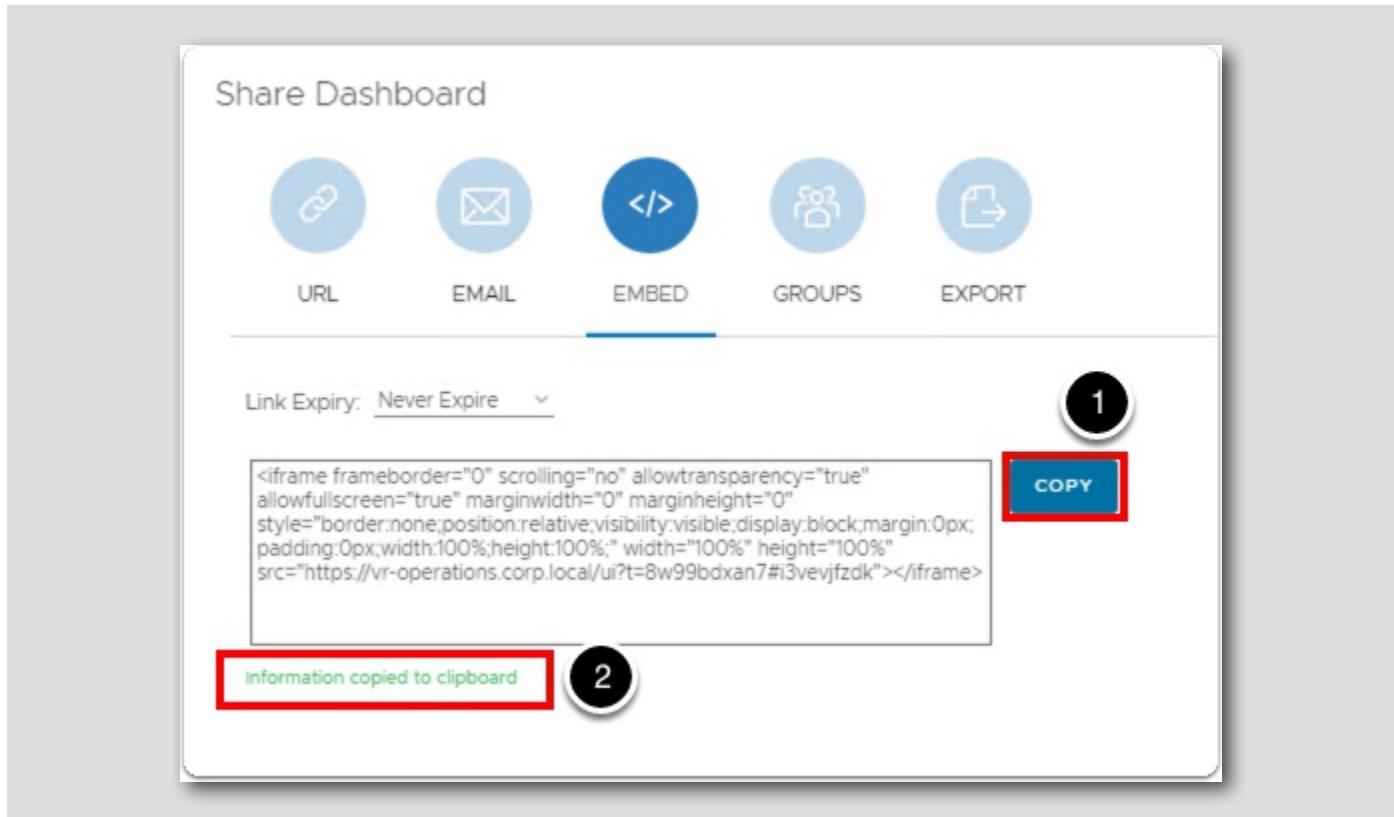
## Share Dashboard - Embed



In the introduction of this lesson, we discussed the scenario of the (NOC) Network Operations Center having a web page that they wanted to embed the VMware Environment Summary Dashboard in. We will now go through the steps associated to accomplish providing them the embedded dashboard.

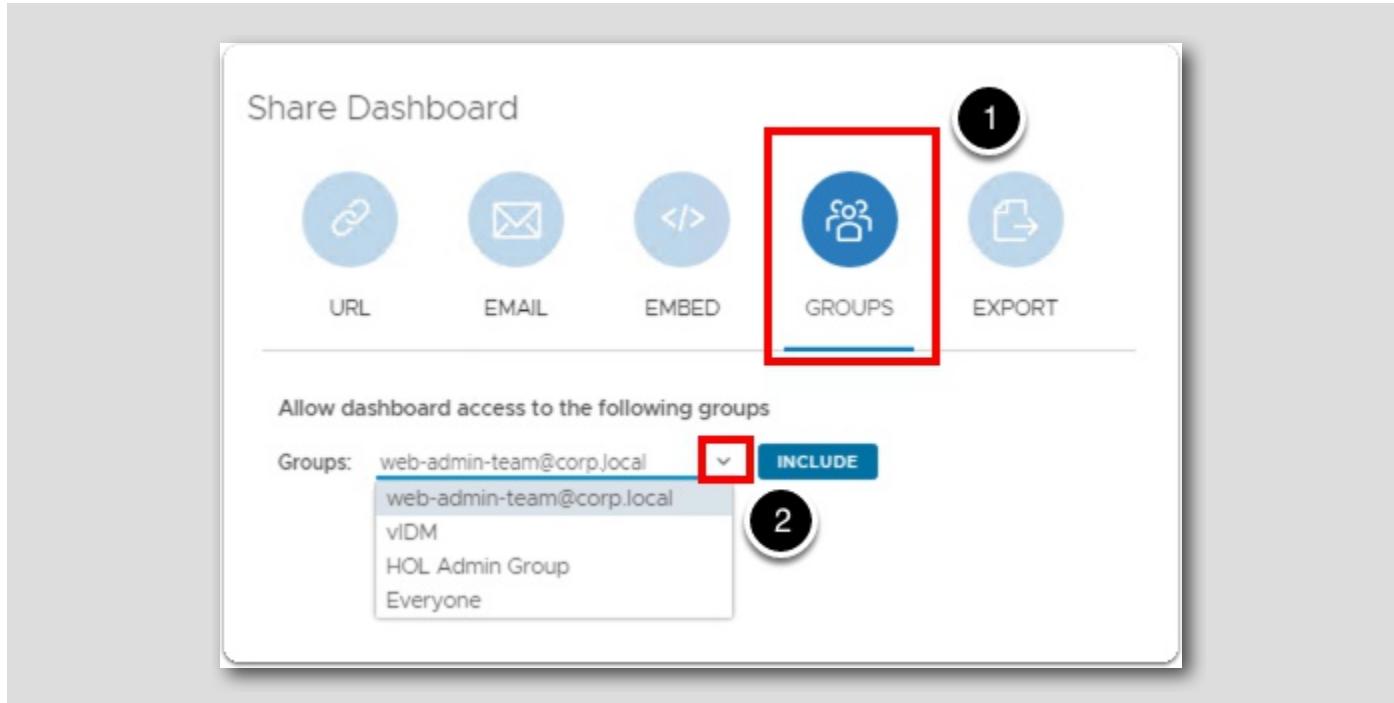
1. Click on the EMBED icon in the Share Dashboard pop-up window. We want this selection since they want the dashboard included in their existing web portal in the NOC.
2. Next click on the arrow next to Link Expiry: to expand its drop-down menu.
3. Click on Never Expire since we want this for the NOC and do not want their access to expire.

## Share Dashboard - Copy to Clipboard



1. Click on the COPY button.
2. We see that by clicking the COPY button, that the embedded link has been successfully copied to the clipboard. It is now ready to be copied into an email or some other method in which we can provide the NOC the link to use in their web portal.

## Share Dashboard - Groups

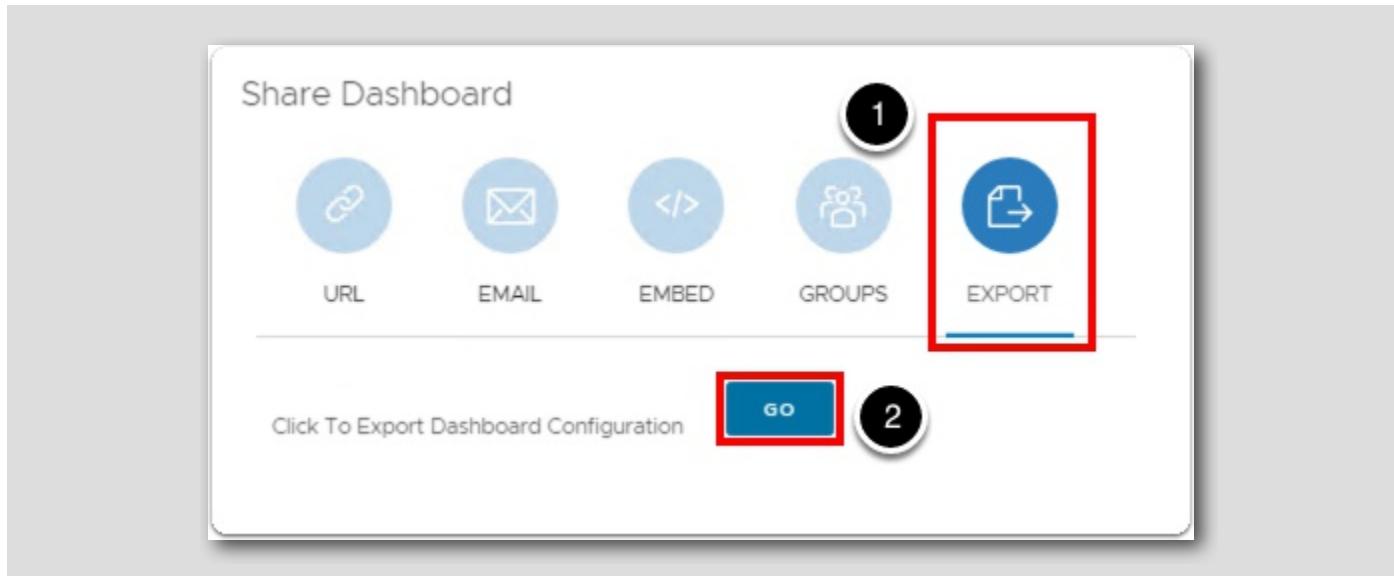


In this example, we need to authorize only a previously established security group in vRealize Operations access to this dashboard. Currently the Everyone group has access to this dashboard, but we want to limit it only to a specified group and remove the Everyone group.

1. Click on the GROUPS icon in the pop-up window.
  2. Click on the arrow to the left of the INCLUDE button. We see that we only have two options configured in this environment.
- This list will vary from one environment to another based on what groups have been configured within vRealize Operations.

We would then click on the INCLUDE button to give this group(s) access to the dashboard.

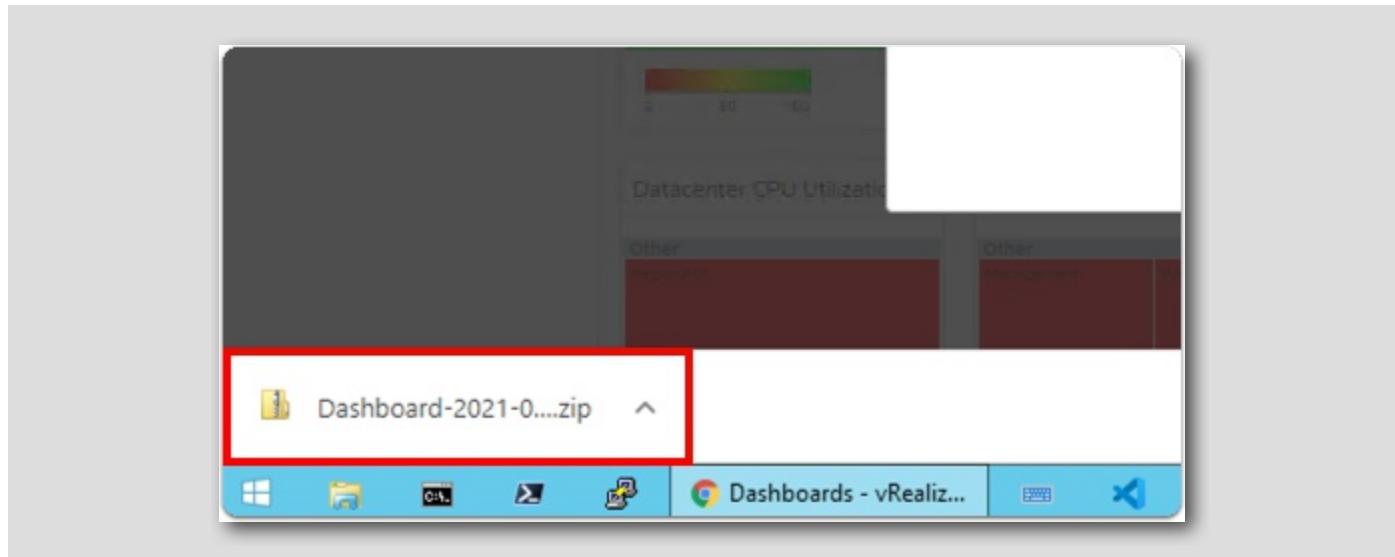
## Share Dashboard - Export



Remember, this VMware Environment Summary dashboard we are currently in is a custom dashboard is not a default out-of-the-box dashboard. We want to export this dashboard because we have another instance of vRealize Operations in a (DR) Disaster Recovery datacenter and want to have the same dashboard in that instance as well. So we need to export the dashboard and then import it into the instance in the DR datacenter.

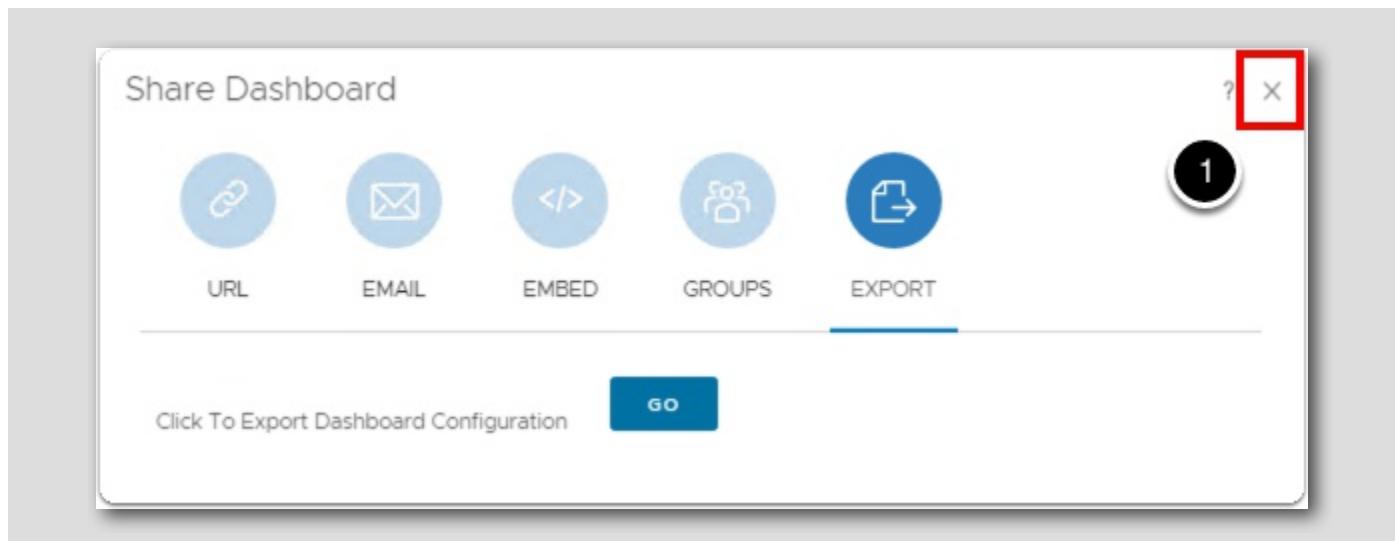
1. Click on the EXPORT button in the pop-up window.
2. Then click on the GO button to export it into a ZIP file format.

## Share Dashboard - Download File



We see that it will download the dashboard as a ZIP file. We could then copy this ZIP file over the DR site and then import it into that vRealize Operations instance.

## Share Dashboard - Exit



That's it, we have gone through all the options for sharing dashboards in vRealize Operations!

1. Click on the X in the upper right-hand corner of the Share Dashboard pop-up window to close it.

## Lesson End

[298]

Congratulations, we have just completed the **Sharing Dashboards** lesson which is the last lesson of **Creating and Managing Dashboards**!

In this lesson, we learned how to share vRealize Operations dashboards through various methods. We can share them via a URL, Email, Embedded file, Groups or Export the dashboard to import into another instance of vRealize Operations.

## Conclusion

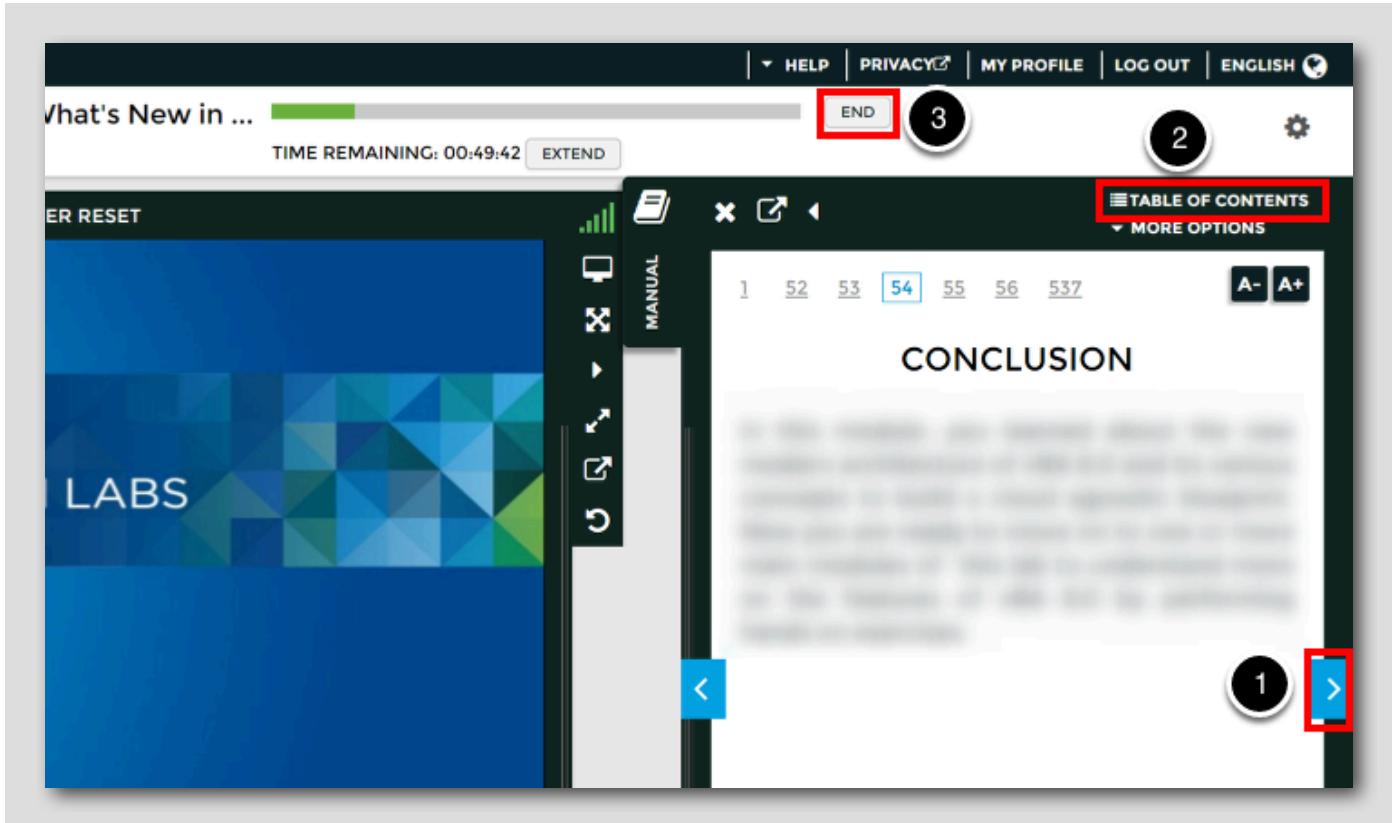
[299]

In this module, we first looked at how to clone an existing dashboard and then modified it to our needs. We did this because it is never a good idea to modified one of the default dashboards in vRealize Operations. By cloning and modifying the cloned copy, it ensures that nothing happens to the default pre-built dashboards.

Next, we created a new custom dashboard that had all the specific widgets we wanted in it. We added various types of widgets, configured each of them and then created the relationships between them.

Lastly, we reviewed the various options on how to share dashboards which included copying the URL, sending via email, embedding the HTML, assigning specific groups and export the dashboard.

You've finished Module 3



Congratulations on completing the lab module.

If you are looking for additional general information on vRealize Operations 8.4, try one of these:

- VMware Product Public Page - vRealize Operations: <https://www.vmware.com/products/vrealize-operations.html>
- vRealize Operations 8.4 - Release Notes: <https://docs.vmware.com/en/vRealize-Operations-Manager/8.4/rn/vRealize-Operations-Manager-84.html>
- vRealize Operations 8.4 - Documentation: <https://docs.vmware.com/en/vRealize-Operations-Manager/8.4/com.vmware.vcom.core.doc/GUID-7E6B5805-3D2F-41C4-ADFF-B7248386E7AC.html>
- VMware Cloud Management Blog - What's New in vRealize Operations 8.4 and Cloud: <https://blogs.vmware.com/management/2021/04/whats-new-in-vrealize-operations-8-4-and-cloud.html>

From here you can:

1. Click to advanced to the next page and continue with the next lab module
2. Open the TABLE OF CONTENTS to jump to any module or lesson in this lab manual
3. Click on the END button if you are done with the lab for now and want to exit



## Module 4 - Managing Users and Roles (30 minutes)

### Introduction

[302]

In this module we will take a deeper look at the part that users and roles play in vRealize Operations. We will look at the built-in role based access controls, and how you can create additional roles with extremely granular control. We look at how to grant access to objects within the environment, and will also review dashboard sharing between user groups and how to manage content that is orphaned when the owner of that content is removed from vRealize Operations.

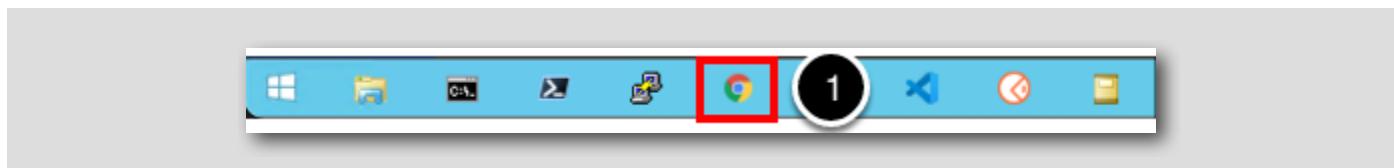
### Log in to vRealize Operations as Local Admin

[303]

To begin this exercise, we will log in to vRealize Operations. If you are not currently logged into any instance of vRealize Operations, continue to the next page, but if you are already logged into vRealize Operations, click [here](#) to skip ahead.

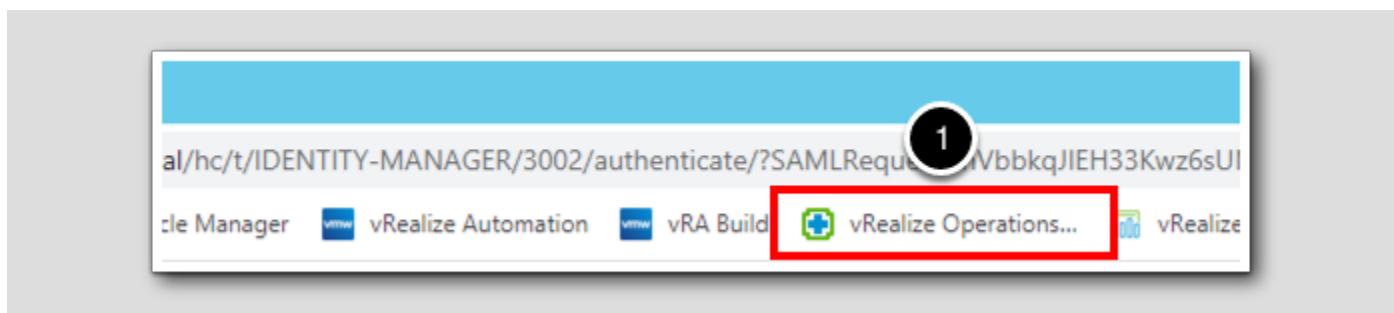
### Open the Chrome Browser from Windows Quick Launch Task Bar

[304]



If your browser isn't already open, launch Google Chrome

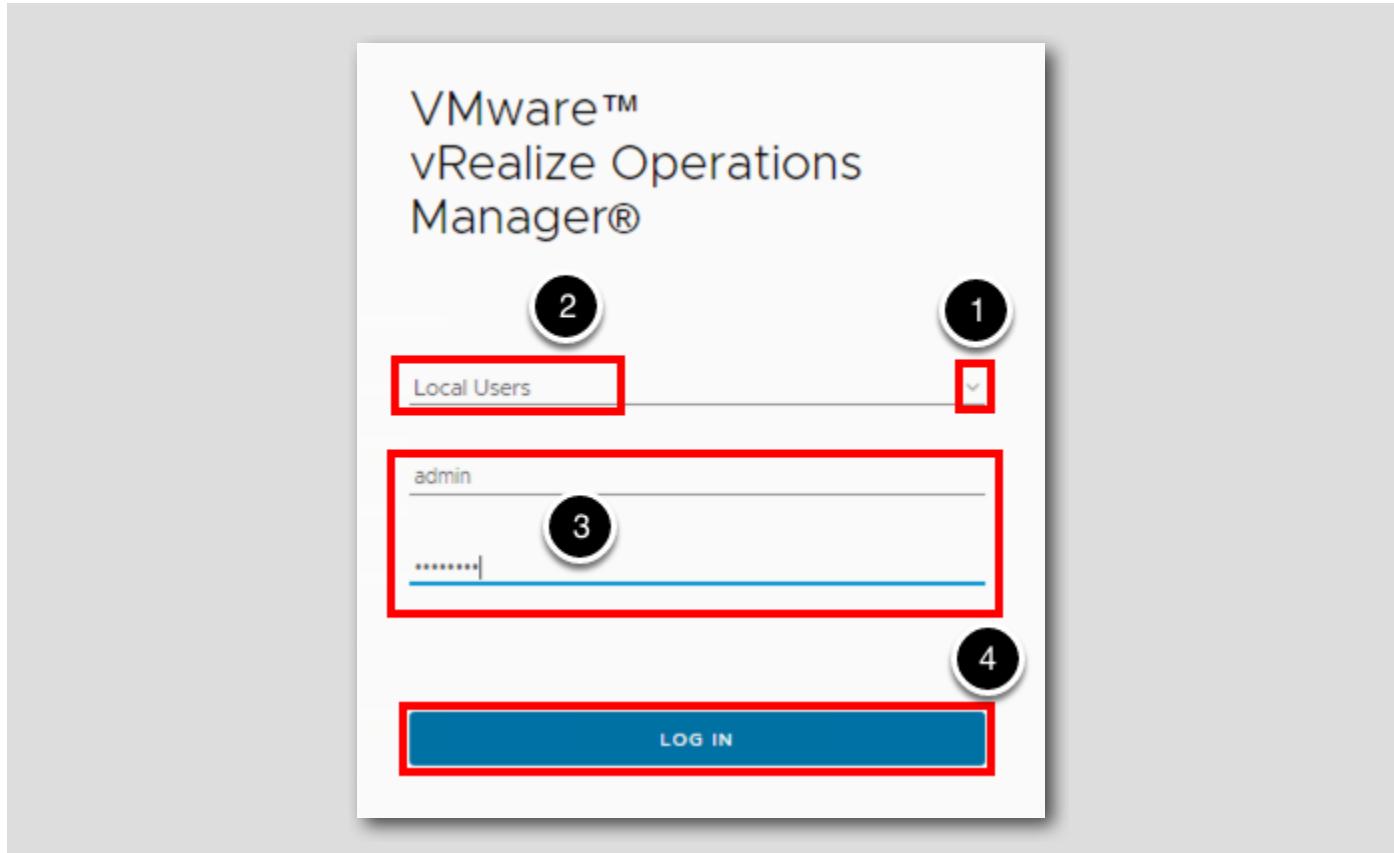
1. Click the Chrome icon on the Windows Quick Launch Task Bar



The browser Bookmarks Bar has links to the different applications that are running in the lab.

1. Click the vRealize Operations Bookmark

## Log in to vRealize Operations as Local Admin



VMware Identity Manager should be pre-selected as the identity source. However, we will be changing that so we can login as a Local Admin.

1. Click the drop-down chevron to show the authentication options.
2. Select Local Users.
3. Fill in the Credentials:
  - UserName: admin
  - Password: VMware1!
4. Click LOG IN.

## vRealize Operations Home Screen

The screenshot shows the vRealize Operations Manager interface. On the left, there's a sidebar with a 'Quick Start' section containing links to 'Optimize Performance', 'Optimize Capacity', 'Troubleshoot', and 'Manage Applications'. The main content area features a 'Quick Start' card with a summary of optimization opportunities. Below this are several cards: 'Optimize Performance' (with 1 datacenter requiring optimization), 'Optimize Capacity' (showing US\$10 in savings), 'Troubleshoot' (using alerts, logs, and dashboards), and 'Manage Configuration' (including Compliance and Configuration management). Each card provides a brief description and a 'VIEW MORE +' button.

You should be at the vRealize Operations Home screen and ready to start the module.

## User and Group Access

To ensure security of the objects in your vRealize Operations Manager instance, as a system administrator you can manage all aspects of user access control. You create user accounts, assign each user to be a member of one or more user groups, and assign roles to each user or user group to set their privileges.

One of the more requested features of vRealize Operations Manager is how to create user specific content, for example a dashboard for leadership, where the user can see that content but no other information. This module will walk you through assigning content to a user, using the example of a user or group specific dashboard. We will create a user that has access to a single dashboard.

## User Access Control

You can authenticate users in vRealize Operations Manager in several ways:

- Create local user accounts in vRealize Operations Manager.
- Use VMware vCenter Server users.
- Add an authentication source to authenticate imported users and user group information that resides on another machine.
  - Use LDAP to import users or user groups from an LDAP server.
  - Create a single sign-on source and import users and user groups from a single sign-on server.

Most customers use VMware Identity Manager - this is the preferred single sign-on (SSO) source for VMware solutions, and enables simple SSO configuration and management between the vRealize solutions.

## VMware Identity Manager

VMware Identity Manager (vIDM) is a service that extends on-premises directory infrastructure to provide a seamless Single Sign-On (SSO) experience. It is supported for all vRealize solutions, as well as many other VMware and non-VMware products.

VMware Identity Manager does not replace Active Directory, it integrates with it. Microsoft Active Directory integration will be configured in VMware Identity Manager instead of in the individual products.

*Why not go directly to AD? Active Directory is an identity provider. vIDM is an identity service, which can connect to multiple identity providers, including AD.*

## Authentication Sources

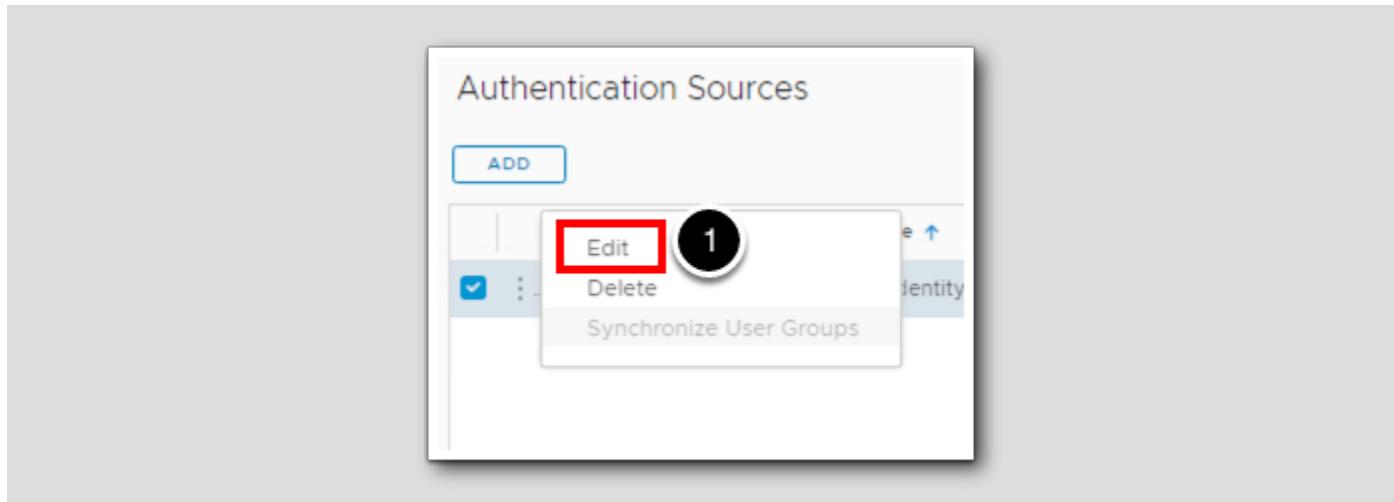
The screenshot shows the vRealize Operations Manager interface. The title bar includes the 'vm' icon, 'vRealize Operations Manager', and tabs for Home, Dashboards, Alerts, Environment, and Administration (which is highlighted with a red box and circled with a black circle labeled '1'). A 'BACK' button is on the left. The main pane is titled 'Authentication Sources'. On the left, a sidebar has 'Access' expanded (circled with a black circle labeled '2'), with 'Authentication Sources' selected (circled with a black circle labeled '3'). The main pane shows a table with columns: Source Display Name, Source Type, Host, and Port. One row is highlighted with a red box and circled with a black circle labeled '4': 'viDmAAuthSource' (Source Display Name), 'VMware Identity Man...' (Source Type), 'identity-manager.cor...' (Host), and '443' (Port). An 'ADD' button is at the top left of the table area. A small number '5' is inside a circle near the bottom center of the table.

To configure or view authentication sources within vRealize Operations Manager:

1. Click on **Administration**, in the title bar.
2. Expand Access Menu by clicking on **Access**.
3. Select **Authentication Sources**.
4. Highlight **VMware Identity Manager** in the list of configured Authentication Sources in the main pane.
5. Click on the 3 dots to show the actions menu.

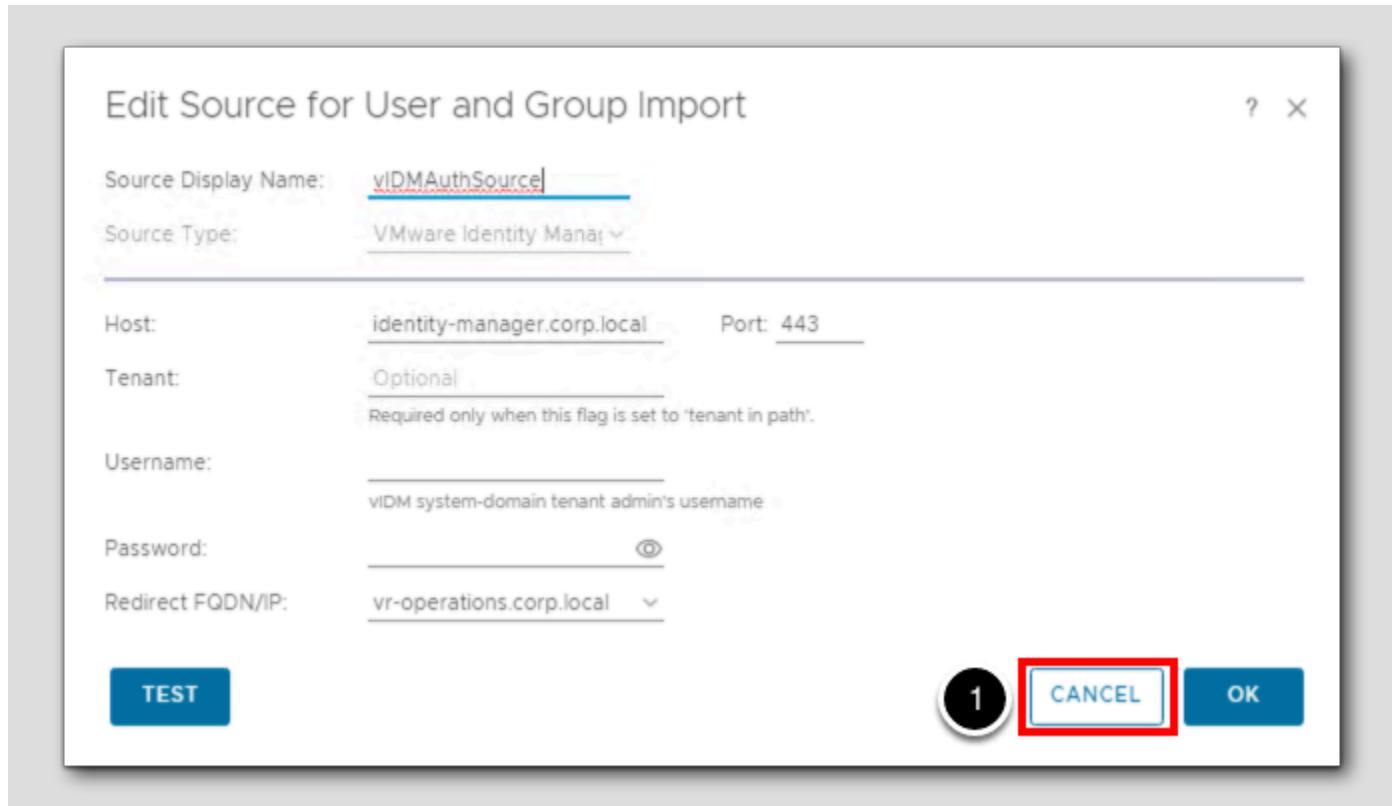
Additional sources can be added here, but this lab has only one - a viDM identity source.

## Edit Authentication Source



1. In the actions menu, click **Edit** to bring up the edit dialog for this Authentication Source.

## Configuration Options



Here you can see the configuration settings that have been set up for the vIDM identity source in the lab. Further configuration is done on the vIDM appliance itself, including the AD or LDAP sources and users, groups and application entitlements. Once you have reviewed the options, cancel out of this screen:

1. Click CANCEL.

## Access Control

The screenshot shows the 'Access Control' page in the vRealize Operations Management interface. The left sidebar has a tree view with 'Solutions' expanded, showing 'Cloud Accounts', 'Other Accounts', and 'Repository'. Under 'Access', 'Access Control' is selected and highlighted with a red box, and a black circle with the number '1' is placed next to it. The main pane title is 'Access Control' with tabs for 'User Accounts', 'User Groups', 'Roles', 'Password Policy', and 'Login Message'. Below the tabs are 'ADD' and '...' buttons. The 'User Accounts' table has columns for 'User Name', 'First Name', 'Last Name', and 'Email'. There are five rows of user data, with the last four rows (holadmin, holdev, configadmin, holuser) highlighted with a red box, and a black circle with the number '2' is placed next to it. The data is as follows:

	User Name	First Name	Last Name	Email
<input type="checkbox"/>	migrationAd...			
<input type="checkbox"/>	maintenance...			
<input type="checkbox"/>	hol-retired	Retired	HOL	
<input type="checkbox"/>	automationA...			
<input type="checkbox"/>	admin			
<input type="checkbox"/>	holadmin@cor...	Admin	HOL	holadmin@corp.local
<input type="checkbox"/>	holdev@corp...	Developer	HOL	holdev@corp.local
<input type="checkbox"/>	configadmin	configadmin	configadmin	admin@hol.com
<input type="checkbox"/>	holuser@cor...	User	HOL	holuser@corp.local

Once the identity source is added, users and groups from that source can be granted access to vRealize Operation Manager. Let's take a closer look at some account configurations.

1. Select Access Control.
2. Note the list of users in the corp.local domain that were imported from AD.

These users are Active Directory (AD) users that have access to vRealize Operations Manager via the following configurations:

- There is an AD server for this lab environment.
  - The domain is corp.local
  - In the corp.local domain there are users named holadmin, holuser and holdev.
- The corp.local domain was added as an Identity source in VMware Identity Manager (standalone virtual appliance).
- vIDM was configured as an identity provider in vRealize Operations.
- The users and/or security groups were then imported into vRealize Operations Manager, and permissions were configured.

## Group-Based Security

vRealize Operations Manager provides user group-based security. With group-based security, you control the access privileges for each user group. You add users to user groups, and assign access privileges to user groups. For example, one user group might be able to view only dashboards and another user group might be able to configure objects. This simplifies privilege management significantly.

You must have privileges to access specific features in the vRealize Operations Manager user interface. The roles associated with your user account determine the features you can access and the actions you can perform. Roles are covered in the next lesson.

## Lab Work

In this module we are going to create a user with access to a single dashboard and no other area in the tool. Let's pretend we have a summer intern, who's role it will be to check the Operations Overview dashboard each day to check the number of running VMs in the environment.

The steps for this lesson will be:

1. Create a new local user group.
2. Create a new local user (the intern).

## Add the Interns Group

The screenshot shows the 'Access Control' interface with the 'User Groups' tab selected. The 'User Groups' tab has a red box around it, and the 'ADD' button below it also has a red box around it. A black circle with the number 1 is positioned above the 'User Groups' tab, and a black circle with the number 2 is positioned above the 'ADD' button. The table below lists existing user groups:

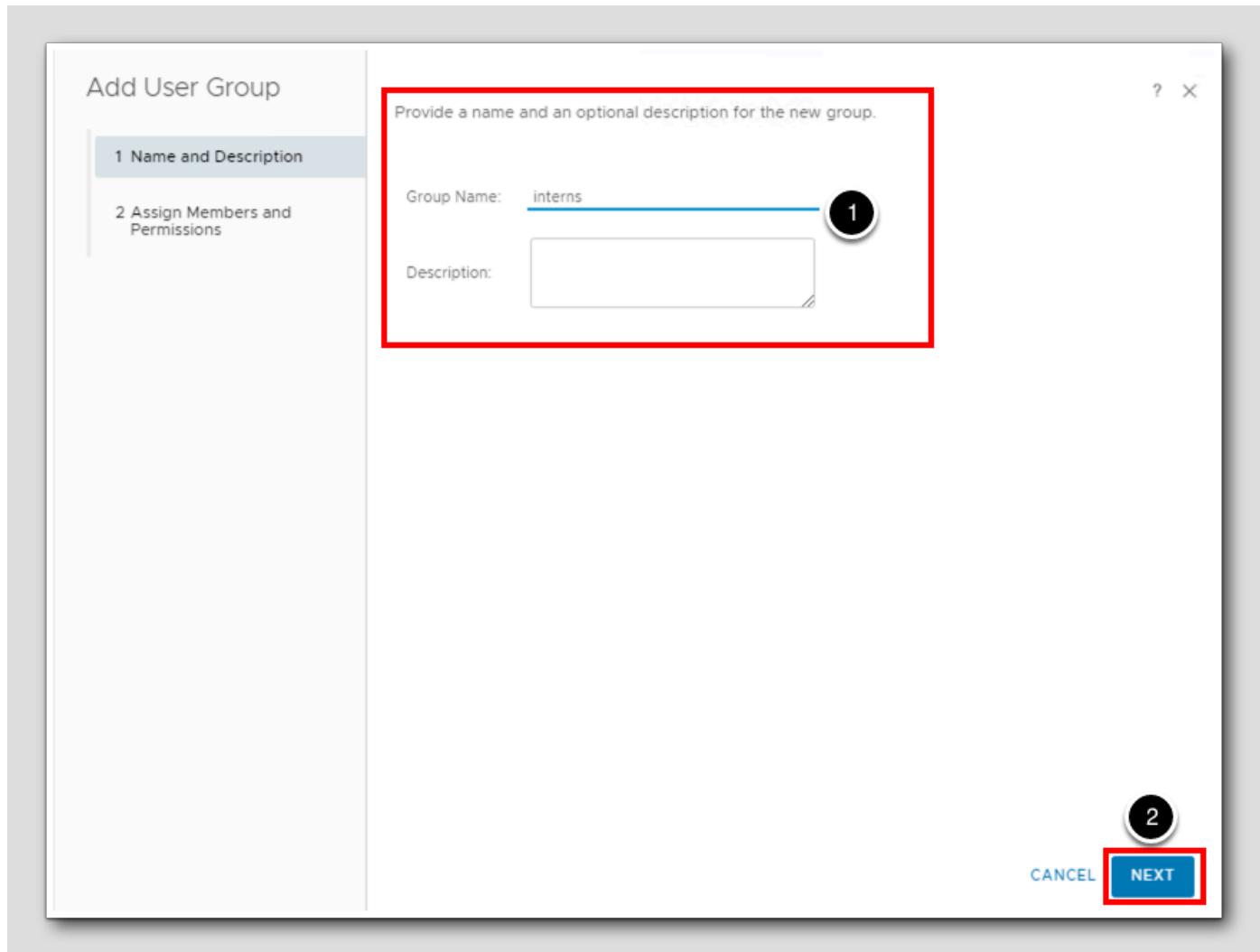
Group	Description	Members	Type
Everyone	All Users in the system	10	Local
HOL Admin Group		1	Local
viDM	VMware Identity Manag...	1	VMware
web-admin-team@corp....		0	VMware

Now we will create a User Group. Again, for simplicity sake, we will create a local group. This could have been done in Active Directory and then imported into vRealize Operations.

1. Select the User Groups tab in the main pane.
2. Click ADD to add a new Group.

## Group Details

[317]



Create the new user with the following properties:

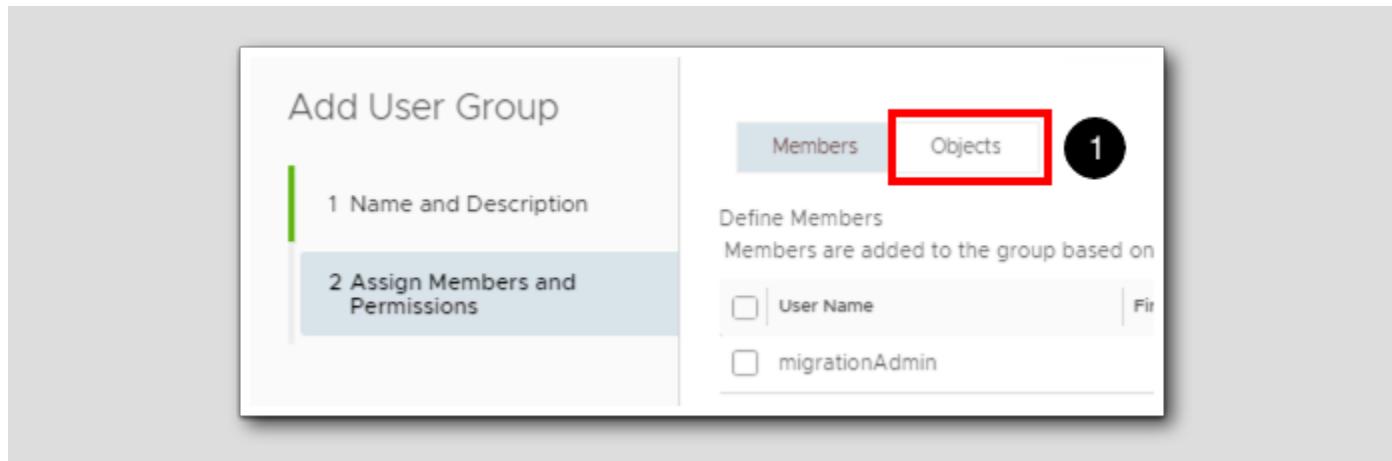
1. Group Details:

- Group Name: interns
- Description: You can leave blank or you can type a description for the group

2. Click **NEXT**.

## Group Members

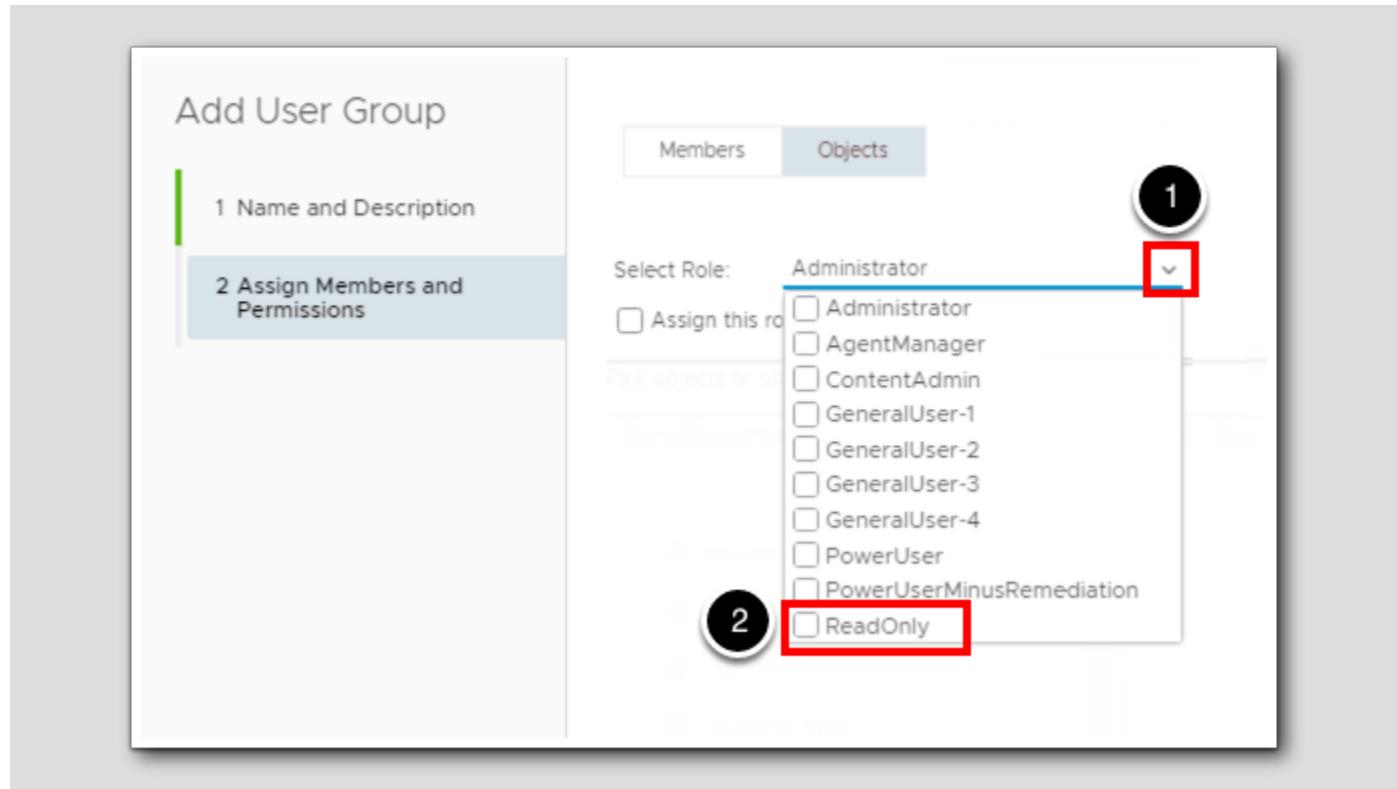
[318]



From the **Members** tab, we could select local or directory-based users. However, we have not yet created our new intern user so we will skip this for now.

1. Click the **Objects** tab to assign a role and objects to this group.

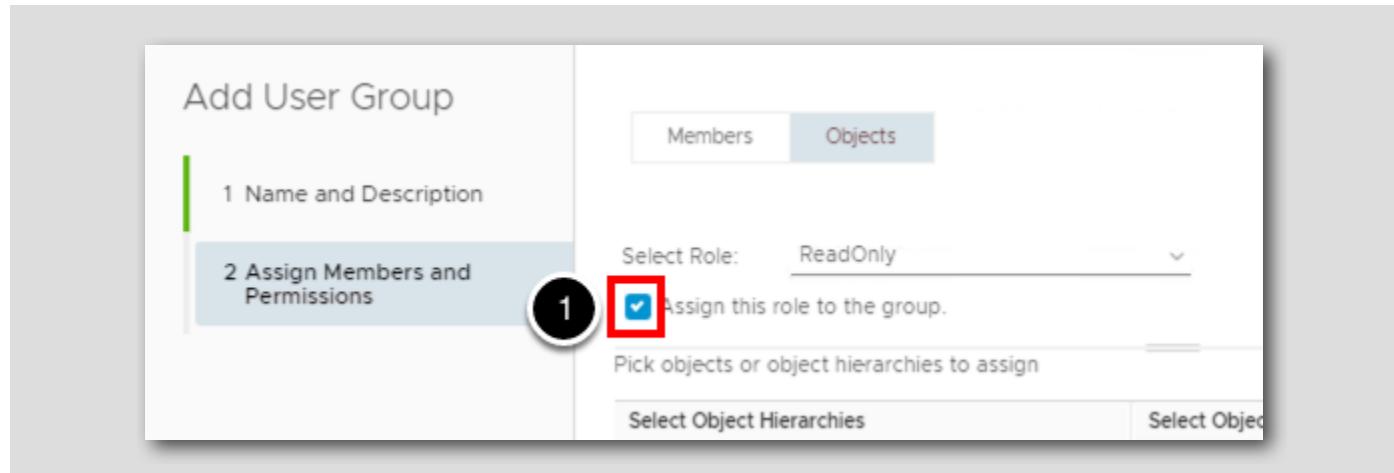
## Group Objects Tab



The objects tab is where we assign roles and objects to the group. There are a number of pre-defined roles in vRealize Operations. You can edit, clone or delete these roles or you can create new roles from scratch. For now we will use the pre-defined ReadOnly role for this group.

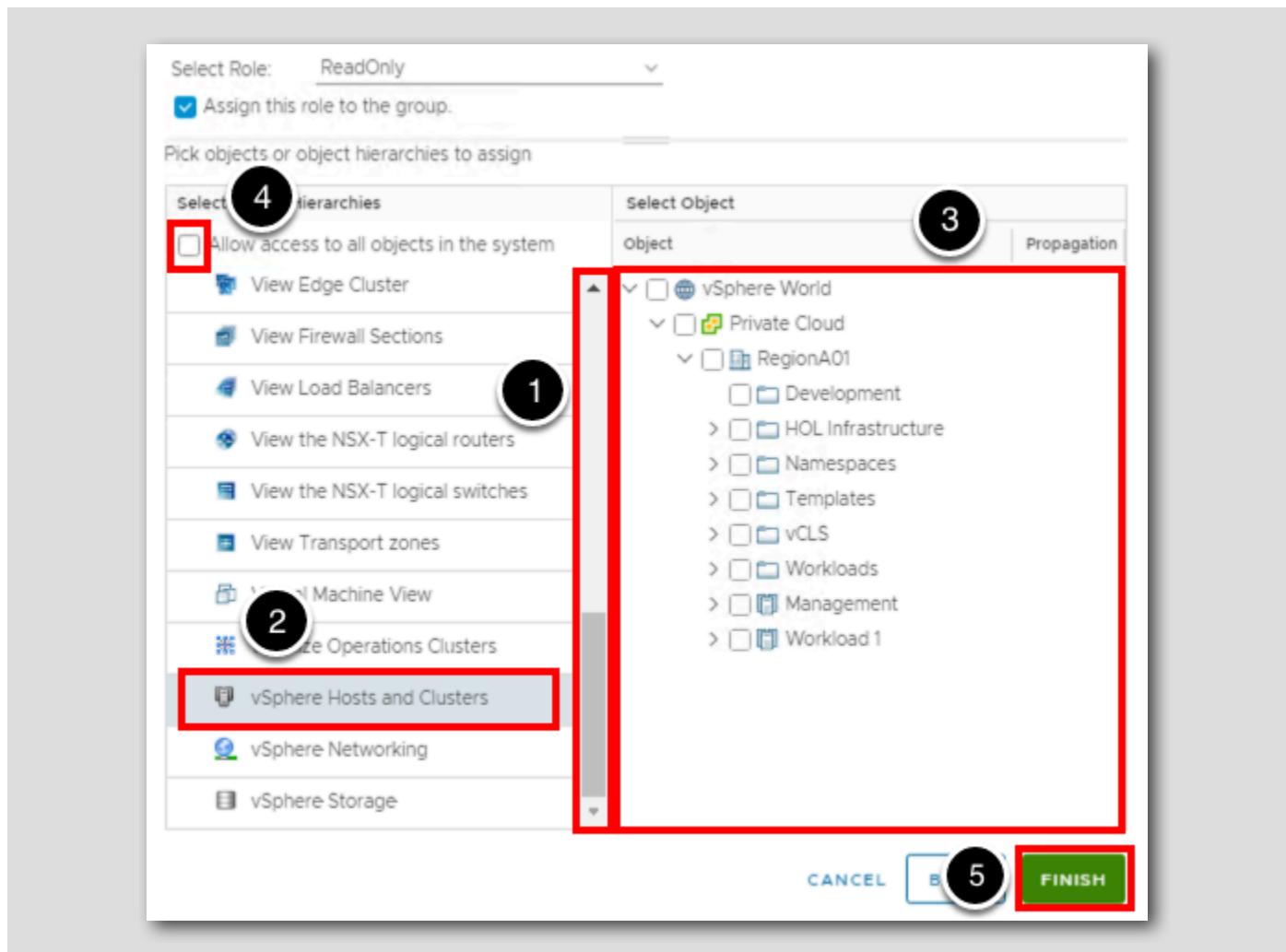
1. Click the drop-down for Select Role.
2. Click to select the ReadOnly role.

## Assign the Role to the User Group



1. Check the box to assign the selected ReadOnly role to the group.

## Explore Object Assignment



This is where you can assign permissions for this user group to have access to objects in vRealize Operations.

Notice in the left pane you will see all of the different hierarchies that are defined within vRealize Operations. If the environment had additional management packs installed (such as the Dell EMC storage management pack or the Blue Medora management pack for Microsoft SQL) you would see hierarchies for the objects that were discovered and imported into vRealize Operations from those management packs.

1. Scroll down to the bottom of this object list.
2. Click the **vSphere Hosts and Clusters** hierarchy.
3. Use the > icons to expand out this hierarchy a bit. Notice that you can select any object or objects that you want to allow this user group to have access to in vRealize Operations.
4. In this case, we are going to let this group have access to all objects in the system so **Click the box to Allow access to all objects in the system.**
5. Click **FINISH** to complete the user group creation.

Note that if you are using vCenter as the authentication source for your vRealize Operations users, the object-level permissions set in vCenter for those users will override any object-level permissions set here for the vSphere hierarchies.

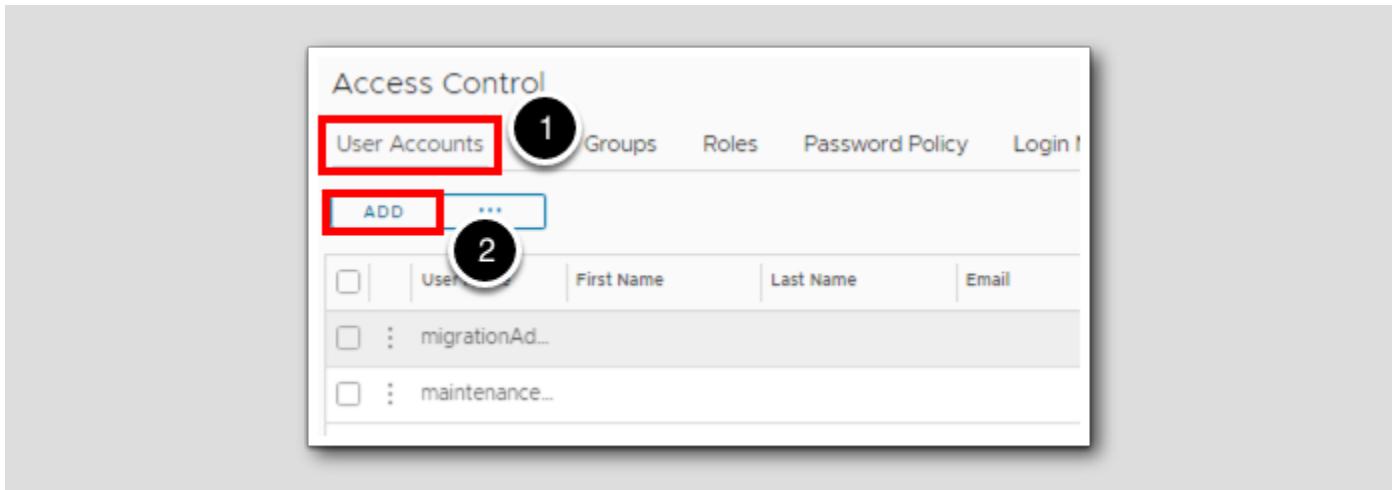
## Verify the Group Creation

[322]

Access Control				
User Accounts	User Groups	Roles	Password Policy	Login Message
<a href="#">ADD</a>	<a href="#">...</a>			
	Group Name ↑	Description	Members	Group Type
<input type="checkbox"/>	Everyone	All Users in the system	10	Local Group
<input type="checkbox"/>	HOL Admin Group		1	Local Group
<input type="checkbox"/>	interns		0	Local Group
<input type="checkbox"/>	viDM	VMware Identity Manag...	1	VMware Identity Manag...
<input type="checkbox"/>	web-admin-team@corp...		0	VMware Identity Manag...

Here you can see that there is now an "interns" group. It has no members. It is a Local group. It has access to all objects in the inventory.

## Add the intern1 User



Now that we have a user group defined, let's add the user. Note that you could have defined the user first and assigned the user to a group at the time of group creation. In this case we have already created the group so we will assign this user to that group as part of the user creation process.

1. Click the User Accounts tab.
2. Click ADD to add a new user.

## User Details

Add User

1 User Details

2 Assign Groups and Permissions

Enter basic information about this user.

User Name: intern1

Password: \*\*\*\*\*

Confirm Password: \*\*\*\*\*

First Name: Summer

Last Name: Intern

Email Address: intern@acme.com

Description: Summer intern working on rightsizing project

Disable this user

Require password change at next login

1

2

CANCEL

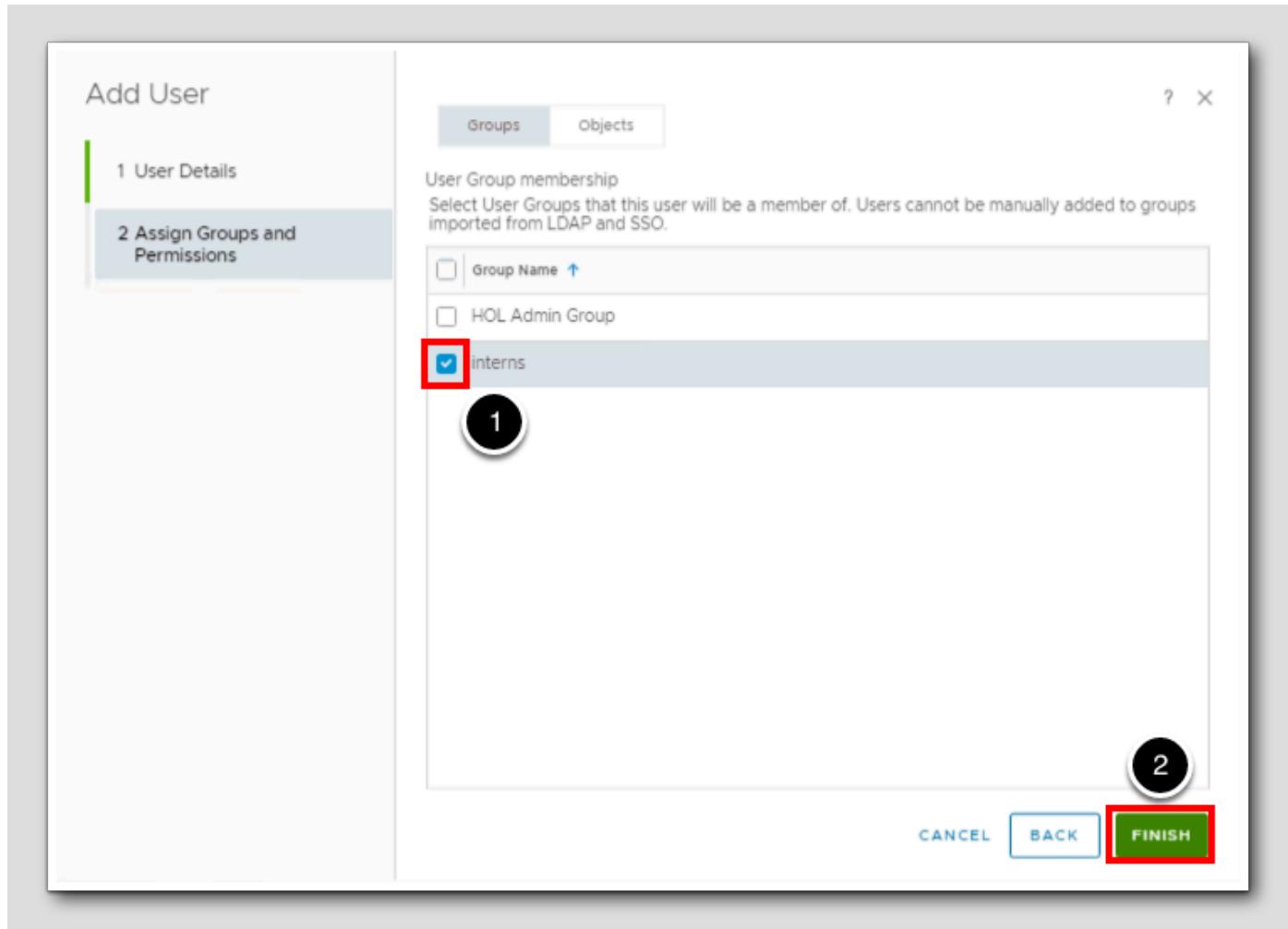
NEXT

Create the new user with the following properties:

1. User Details:
  - User Name: intern1
  - Password: VMware1!
  - First Name: Summer
  - Last Name: Intern
  - Email Address: intern@acme.com
  - Description: Summer intern working on rightsizing project
  - Do not disable or require password at next login

2. Click NEXT.

## Assign the User to a Group



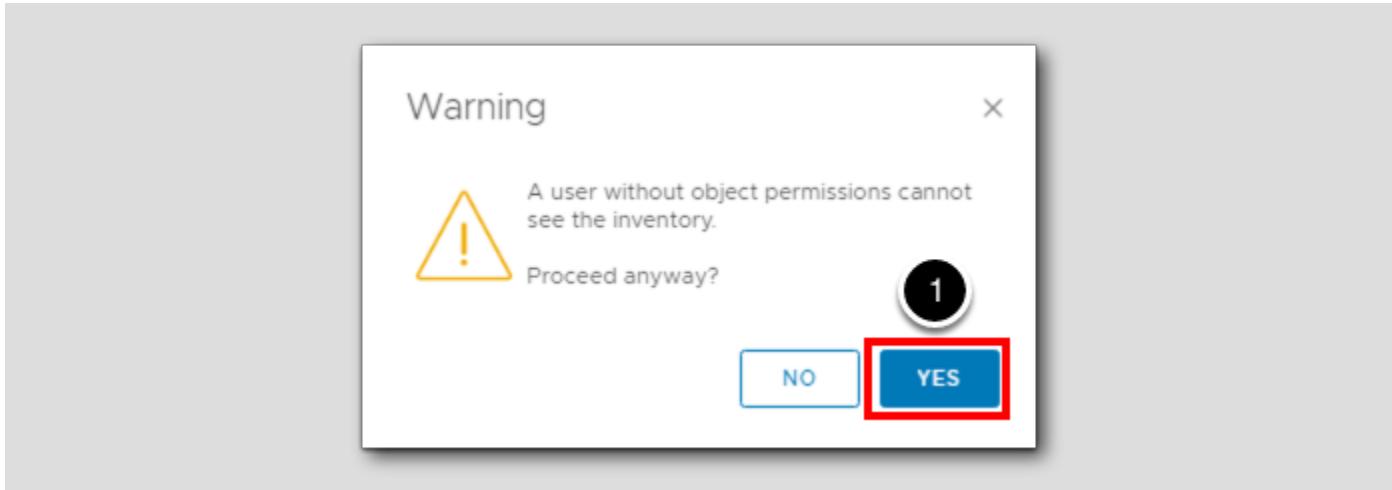
Since we have already created a user group for this user, we just need to make the group assignment here.

Note that we could directly assign a role and object-level access on the Objects tab of this wizard but you will typically want to do that at a group level and then just assign the user to a group like we are doing here.

1. Check the box in front of the **interns** group.
2. Click **FINISH**.

What you don't see here is that the user (and all users) is also assigned to a local group called "Everyone". That is important from a dashboard sharing perspective as we will see later.

## User Warning



Because you didn't assign any object permissions directly to this user, you will get a warning message about that. However, since you added them to the group that we created earlier, the user will inherit the role and object permissions from that group so you can ignore this warning.

1. Proceed anyway by clicking YES.

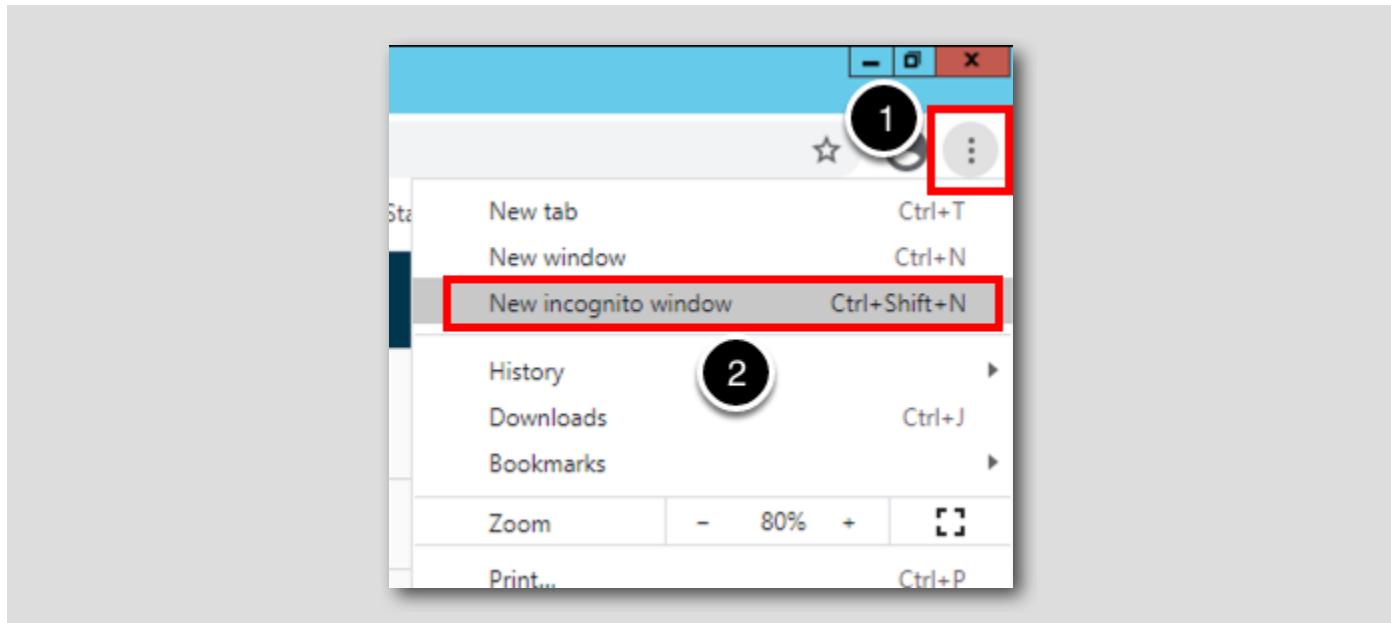
## User Details

The screenshot shows the 'User Details' page in the vRealize Operations Management Service. A user named 'intern1' is selected, indicated by a red box and a circled '1'. Below the list of users, a detailed view for 'intern1' is shown. In this view, the 'User groups' tab is selected (indicated by a red box and a circled '2'), showing two groups: 'interns' and 'Everyone'. The 'Permissions' tab is also visible (circled '3').

User	Role	Object	Email
intern1	Summer	Intern	intern@acme.com
hol-retired	Retired	HOL	
automationA...			
admin			
holadmin@c...	Admin	HOL	holadmin@corp.local
holdev@corp...	Developer	HOL	holdev@corp.local
configadmin	configadmin	configadmin	admin@hol.com

1. Click to select the new intern1 user.
2. Note that the user is a member of two groups - the interns group that you created and the built-in Everyone group.
3. If you want, you can click the Permissions tab to see which role and objects the user is associated with.

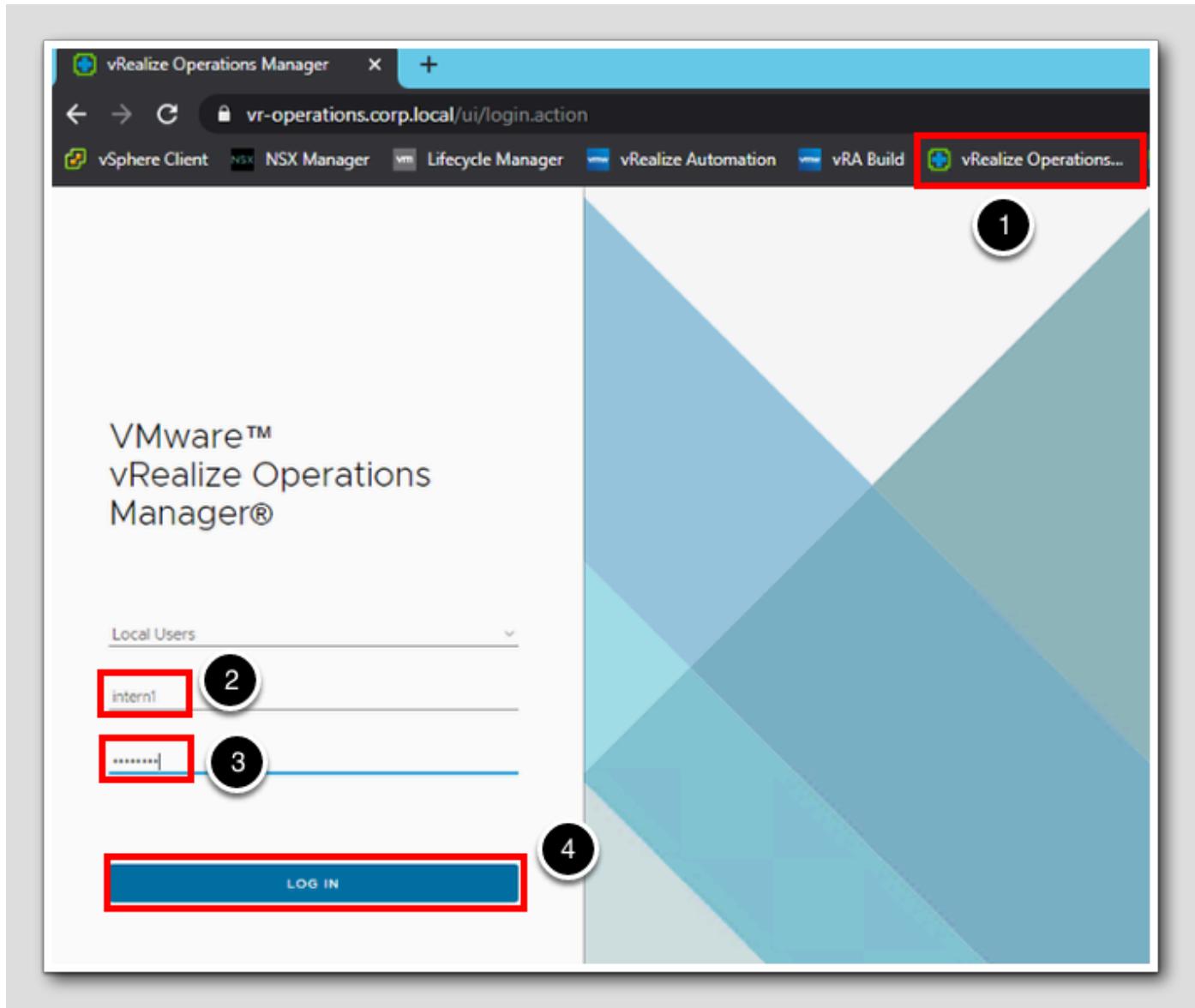
## Verify The Permissions



An incognito window in the Chrome browser allows us to create a new session that does not have any browser session cookies from the existing login. We want to test logging in as the new user without having to log out of our main session.

1. In the top-right corner of the Chrome browser, click the 3-dot icon.
2. Click **New incognito window**.

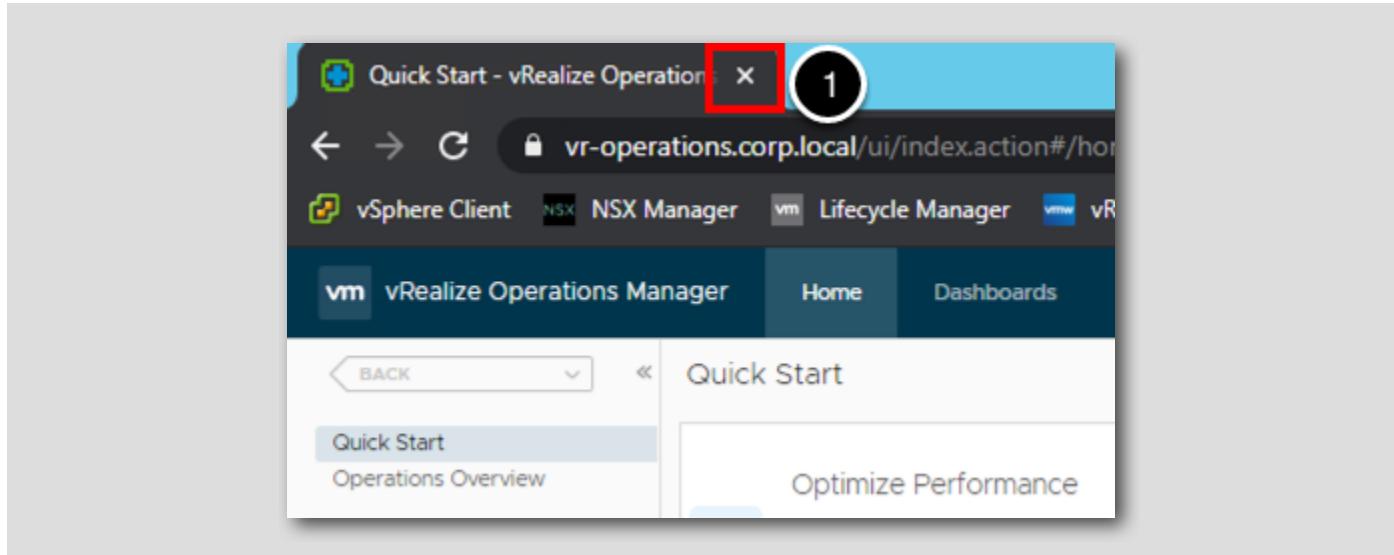
Log In as "intern1"



In the new private browser window, log in as the user we just created.

1. Click the vRealize Operations Manager bookmark.
2. For the user name type intern1
3. For the password type VMware1!
4. Click LOG IN.

## Explore the User Permissions



The new user is able to log in with read-only access. You will find that the user can't create or edit content or do many of the things on the Administration page. Feel free to explore the UI and see what this user can and cannot do. We will look at further restricting this user's access in a little while.

When you are ready to proceed,

1. Click the X in the browser tab to close the incognito session.

## Lesson Conclusion

In this lesson we touched on the different authentication sources that are supported in vRealize Operations Manager. We also created a new user group and a new user then added the user to the group.

In the next lesson, to illustrate the power of role based access in vRealize Operations Manager, we will look at modifying some of the permissions for this group and user. We will also look at dashboard management, and how to share dashboards with users.

## Roles and Privileges

vRealize Operations Manager provides several predefined roles to assign privileges to users. You can also create your own roles.

You must have privileges to access specific features in the vRealize Operations Manager user interface. The roles associated with your user account determine the features you can access and the actions you can perform.

Each predefined role includes a set of privileges for users to perform, create, read, update, or delete actions on components such as dashboards, reports, administration, capacity, policies, problems, symptoms, alerts, user account management, and adapters.

When we created the interns user group, we chose the pre-defined ReadOnly role. Here we will explore roles a bit more.

## Predefined Roles

There are several pre-defined roles in vRealize Operations. In addition, you can create your own roles. Roles are an efficient way to configure a standard set of privileges to a user or group of users.

Predefined Roles:

- **Administrator:** Includes privileges to all features, objects, and actions in vRealize Operations Manager.
- **PowerUser:** Users have privileges to perform the actions of the Administrator role except for privileges to user management and cluster management. *vRealize Operations Manager maps vCenter Server users to this role.*
- **PowerUserMinusRemediation:** Users have privileges to perform the actions of the Administrator role except for privileges to user management, cluster management, and remediation actions.
- **ContentAdmin:** Users can manage all content, including views, reports, dashboards, and custom groups in vRealize Operations Manager.
- **AgentManager:** Users can deploy and configure Point Operations Management agents.
- **GeneralUser-1 through GeneralUser-4:** These predefined template roles are initially defined as ReadOnly roles. vCenter Server administrators can configure these roles to create combinations of roles to give users multiple types of privileges. Roles are synchronized to vCenter Server once during registration.
- **ReadOnly:** Users have read-only access and can perform read operations, but cannot perform write actions such as create, update, or delete.

For more detailed information on these roles and the privileges assigned to them, refer to the documentation for vRealize Operations.

## Access Control

The screenshot shows the vRealize Operations Manager interface. The top navigation bar includes Home, Dashboards, Alerts (with a red dot), Environment, and Administration (which is highlighted with a red box and has a circled '1' next to it). Below the navigation is a secondary menu with BACK, Solutions, Inventory, Policies, Access (which is expanded and has Access Control highlighted with a red box and circled '2'), and Configuration. The main content area is titled 'Access Control' and contains tabs for User Accounts (which is selected and has a blue underline), User Groups, Roles, Password Policy, and Login Message. There is an 'ADD' button and a '...' button. A table lists user accounts with columns for checkbox, User Name, First Name, Last Name, Email, and Description. The table entries are:

	User Name	First Name	Last Name	Email	Description
<input type="checkbox"/>	migrationAd...				
<input type="checkbox"/>	automationA...				
<input type="checkbox"/>	admin				
<input type="checkbox"/>	hol-retired	HOL	Retired		

To configure or view User Accounts and Roles within vRealize Operations:

1. Click on **Administration**, in the title bar.
2. Select **Access Control** (under Access).

## Explore Permissions

The screenshot shows the 'Access Control' interface in vRealize Operations. The 'Roles' tab is selected (1). The 'ContentAdmin' role is highlighted with a red box and a circled number 2. The 'User Accounts' section (3) shows no assigned users. The 'User Groups' section (4) shows no assigned user groups. The 'Permissions' section (5) lists various categories with some checked and some dashed.

Role Name	Role Description
Administrator	System administrator
AgentManager	Deploy and configure EP Ops Management agents
<b>ContentAdmin</b>	Manage all the contents in the product
GeneralUser-1	Configurable out of the box role
GeneralUser-2	Configurable out of the box role
GeneralUser-3	Configurable out of the box role
GeneralUser-4	Configurable out of the box role
PowerUser	All the Privileges except the ones related to User Management and Cluster Management, typically vCenter Adminis

**Details for Role: ContentAdmin**

- User Accounts**: No Users Assigned
- User Groups**: No user groups assigned.
- Permissions**:
  - > Administration
  - > Alerts
  - > **Dashboards**
  - > Environment
  - > Home

We will use one of the pre-defined roles to explore how permissions are managed in vRealize Operations.

1. Select the **Roles** tab.
2. Click the **ContentAdmin** role.
3. Note that there are no user accounts that have been assigned to this role, either directly or through user group membership.
4. Note that there are no user groups that have been assigned to this role.
5. This is where the permissions for the role are managed. In this case we can see that the role includes all of the permissions for Dashboards (check mark) but only some of the permissions for the other categories (dash).

## View the ReadOnly Role

The screenshot shows the 'PowerUserManagement' dashboard with the 'ReadOnly' role selected. The interface includes a header with the role name, a timestamp (5/14/21 11:00 AM), and a user (admin (LOCAL)). Below the header, there are five numbered callouts pointing to specific elements:

- 1**: Points to the 'ReadOnly' role entry in the list, which is highlighted with a red box.
- 2**: Points to the 'User Accounts' section, which also contains a red box.
- 3**: Points to the 'User Groups' section, which also contains a red box.
- 4**: Points to the 'Permissions' section, which also contains a red box.
- 5**: Points to the 'EDIT' button located in the top right corner of the 'Permissions' section.

Details for Role: **ReadOnly**

User Name	First Name	Last Name	Email
intern1	Summer	Intern	intern@acme.com
configadm...	configadmin	configadmin	admin@hol.com

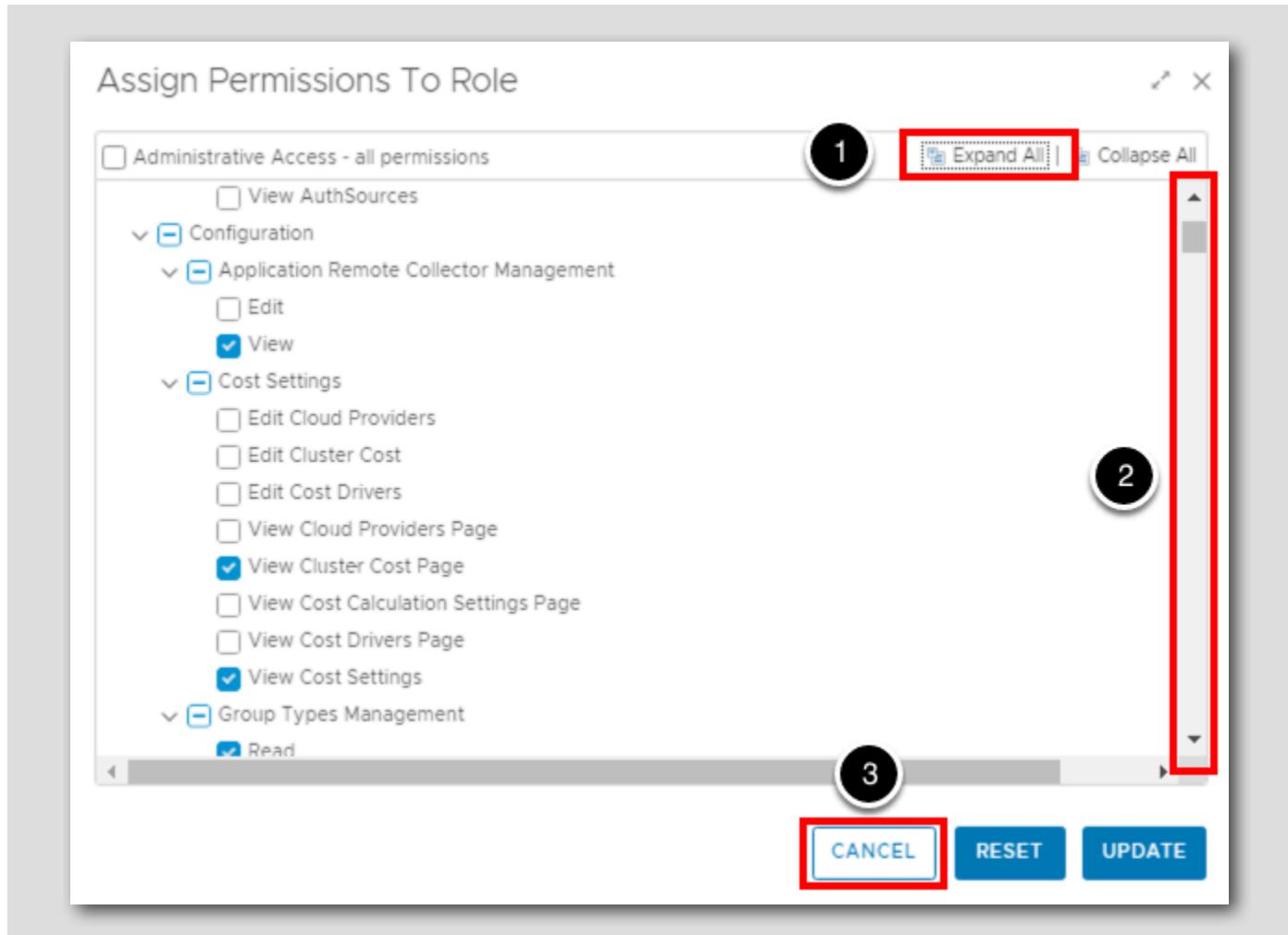
Group Name	Members
viDM	1
interns	1

Permissions	
> Administration	<b>EDIT</b>
> Alerts	
> Dashboards	
> Environment	
> Home	

Now let's look at the **ReadOnly** role:

1. Highlight the **ReadOnly** role in the list (you might have to scroll down).
2. We can see the **intern1** user that we just created in the previous lesson.
3. We can see that the **interns** user groups is assigned to this role.
4. Note that this **ReadOnly** role has some permissions in each of the permission categories.
5. Click the **EDIT** icon to explore the assigned permissions.

## View the ReadOnly Role Permissions



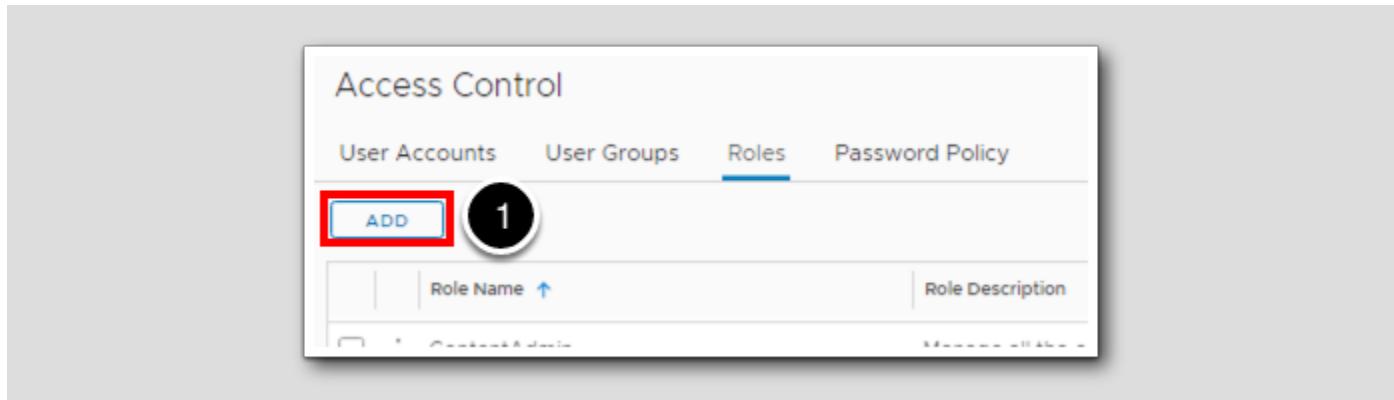
In the Assign Permissions To Role window,

1. Click to **Expand All** permissions.
2. Use the scroll bar to scroll through all of the possible permissions.
3. Click **CANCEL** since we don't want to modify these default **ReadOnly** permissions.

## Lab Work

In the last lesson, User Access and Privileges, we created the user group **interns** and assigned it the **ReadOnly** role, added the user **intern1** and added the user to the group. Now we are going to create a new role that only has permissions to view dashboards within vRealize Operations and then change the **interns** user group to have this new role.

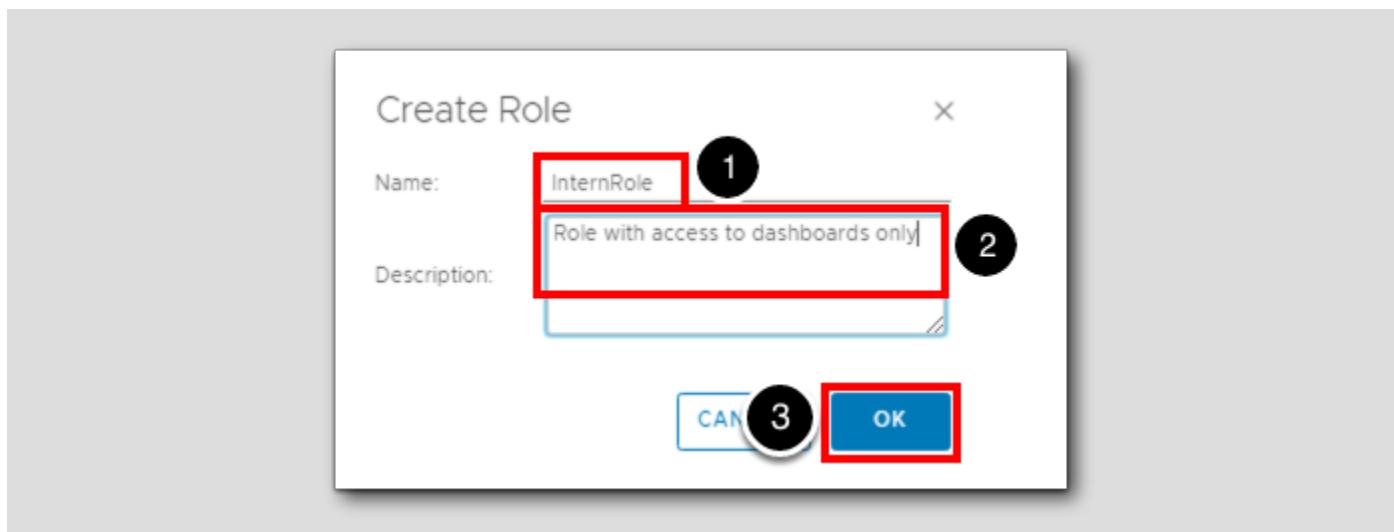
## Create A New Role



First we create a role and assign permissions to it. Make sure you are still on the Roles tab in Access control.

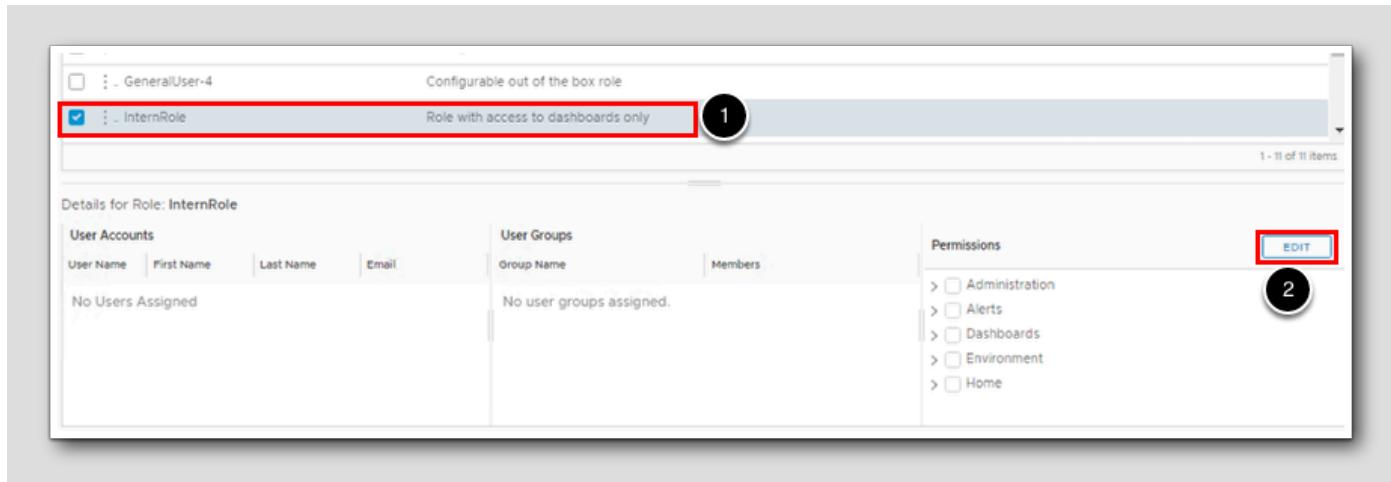
1. Click on ADD to add a role.

## Configure Role



1. Name: InternRole.
2. Description: Role with access to dashboards only.
3. Click OK.

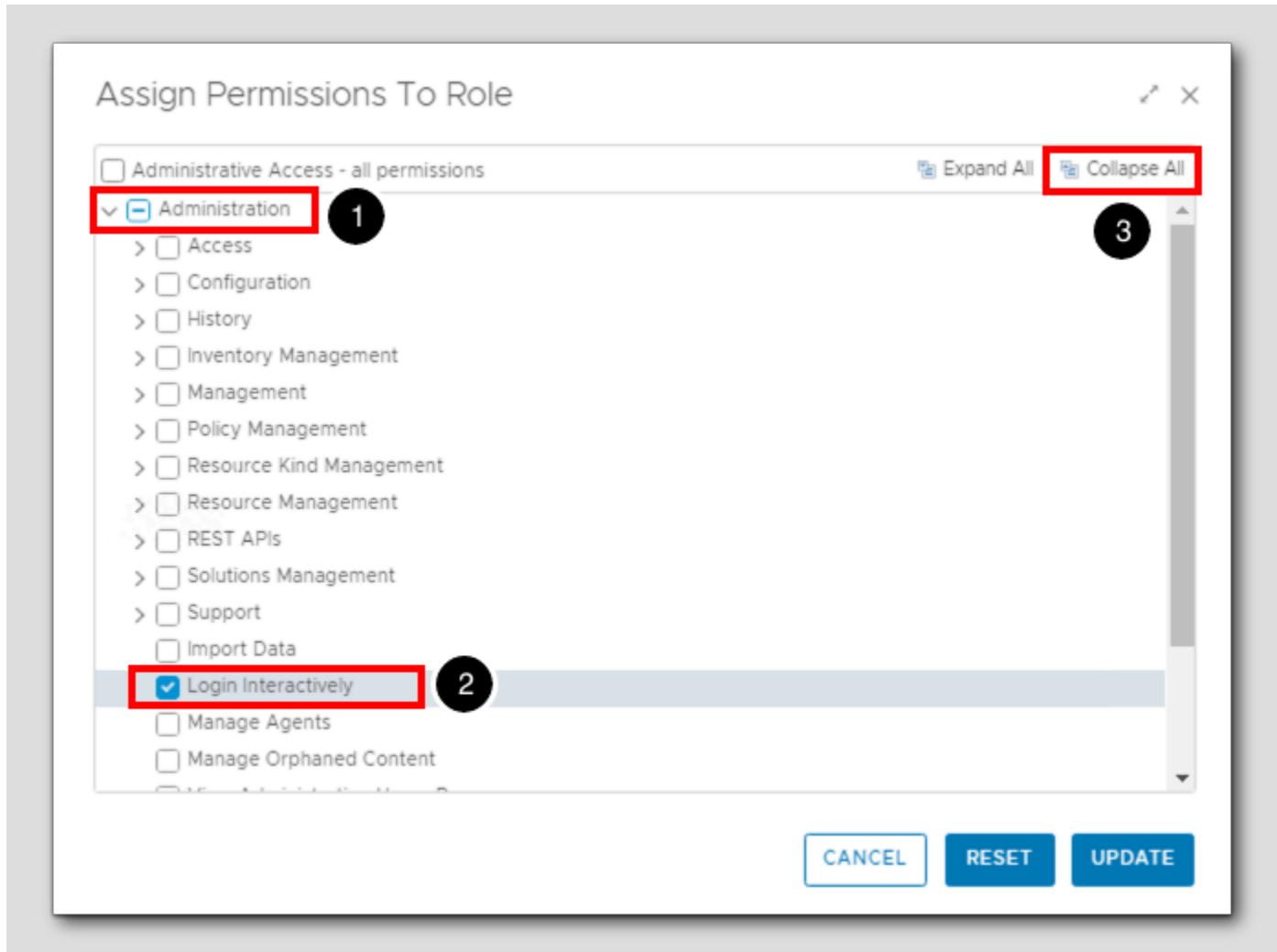
## Edit The New Role



Your new role should be visible in the list of roles now. To see the Users, Groups and Permissions assigned to a role, highlight the role. The information in the bottom pane "Details for Role" will change to the context of the the highlighted role. Let's assign permissions to your new role.

1. Highlight the newly created **InternRole** from the list of configured roles.
2. Click on the **EDIT** icon to edit the role's permissions. There will be no permissions assigned to the role initially.

## Login Interactively

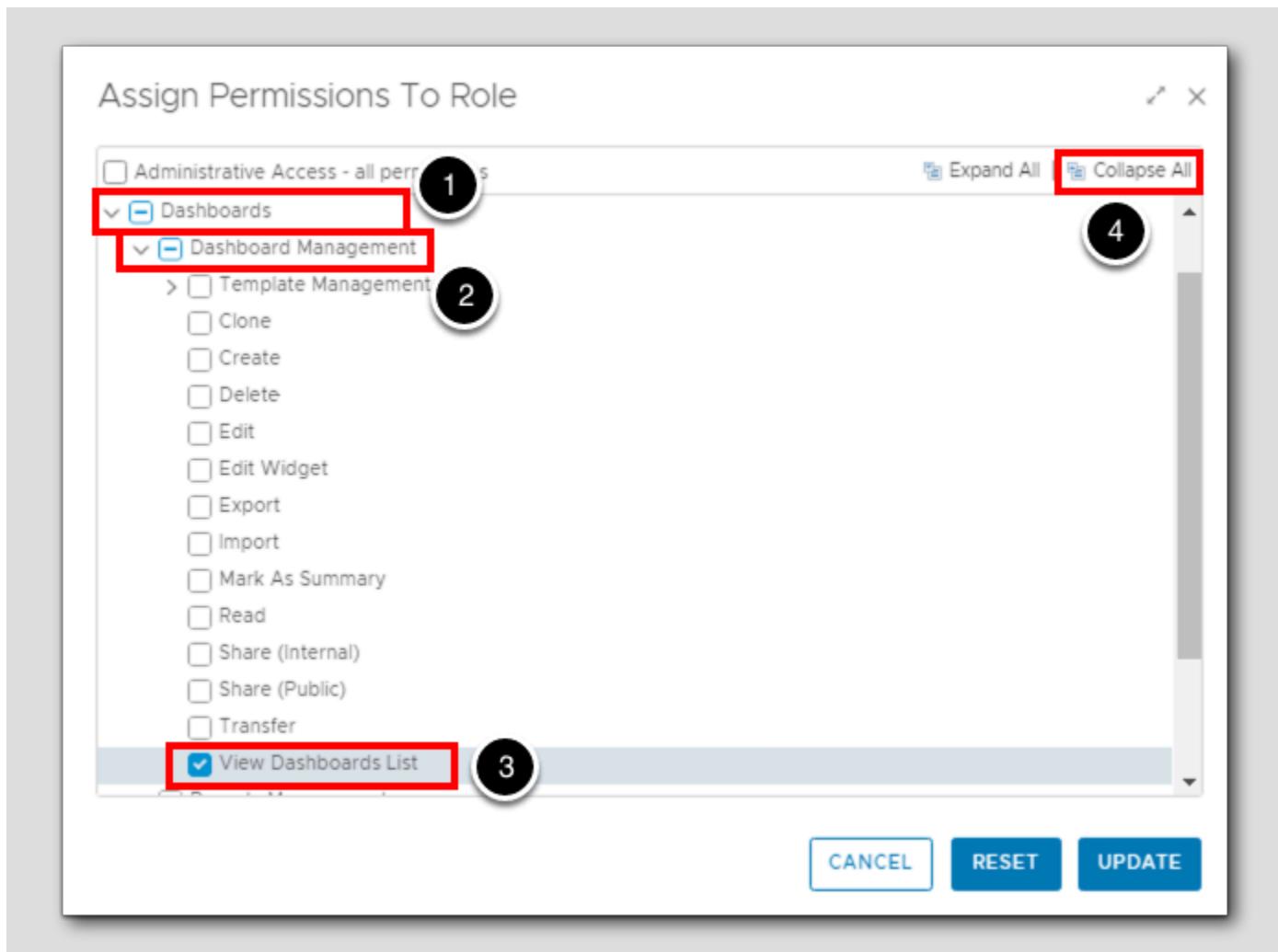


First, we must configure this role to be able to log into vRealize Operations Manager interactively. This permission is under Administration > Login Interactively.

1. Expand Administration.
2. Check the box for Login Interactively.
3. Click Collapse All. Do you see the line by "Administration" to indicate one or more sub-permissions are checked?

Stay in this pane for the next step.

## View Dashboards

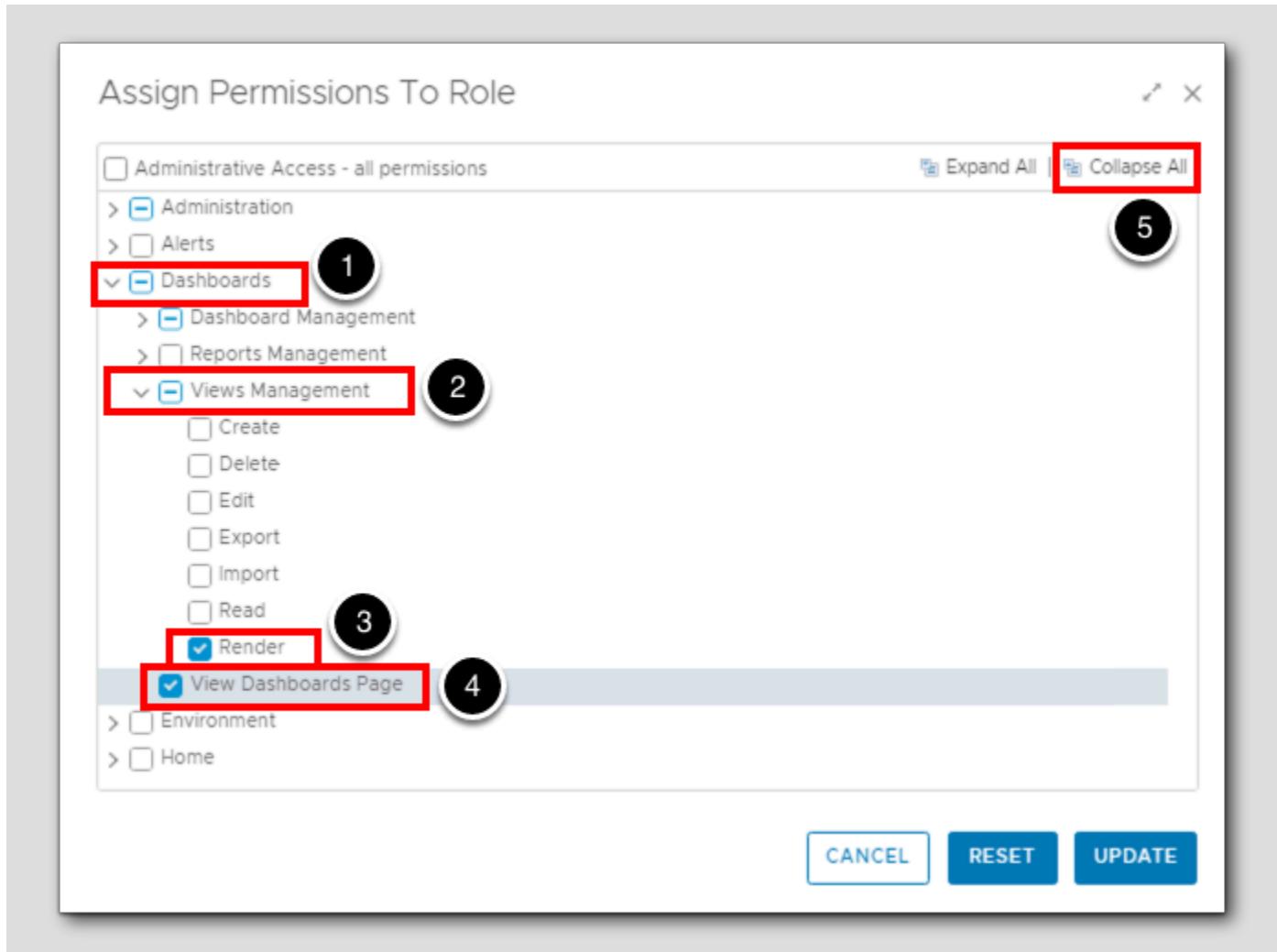


Now, we must configure this role to be able to see dashboards. This permission is under Dashboard > Dashboard Management > View Dashboards List.

1. Expand Dashboards.
2. Expand Dashboard Management.
3. Check the box for View Dashboards List (you may need to scroll down to see it).
4. Click Collapse All.

Stay in this pane for the next step.

## Render

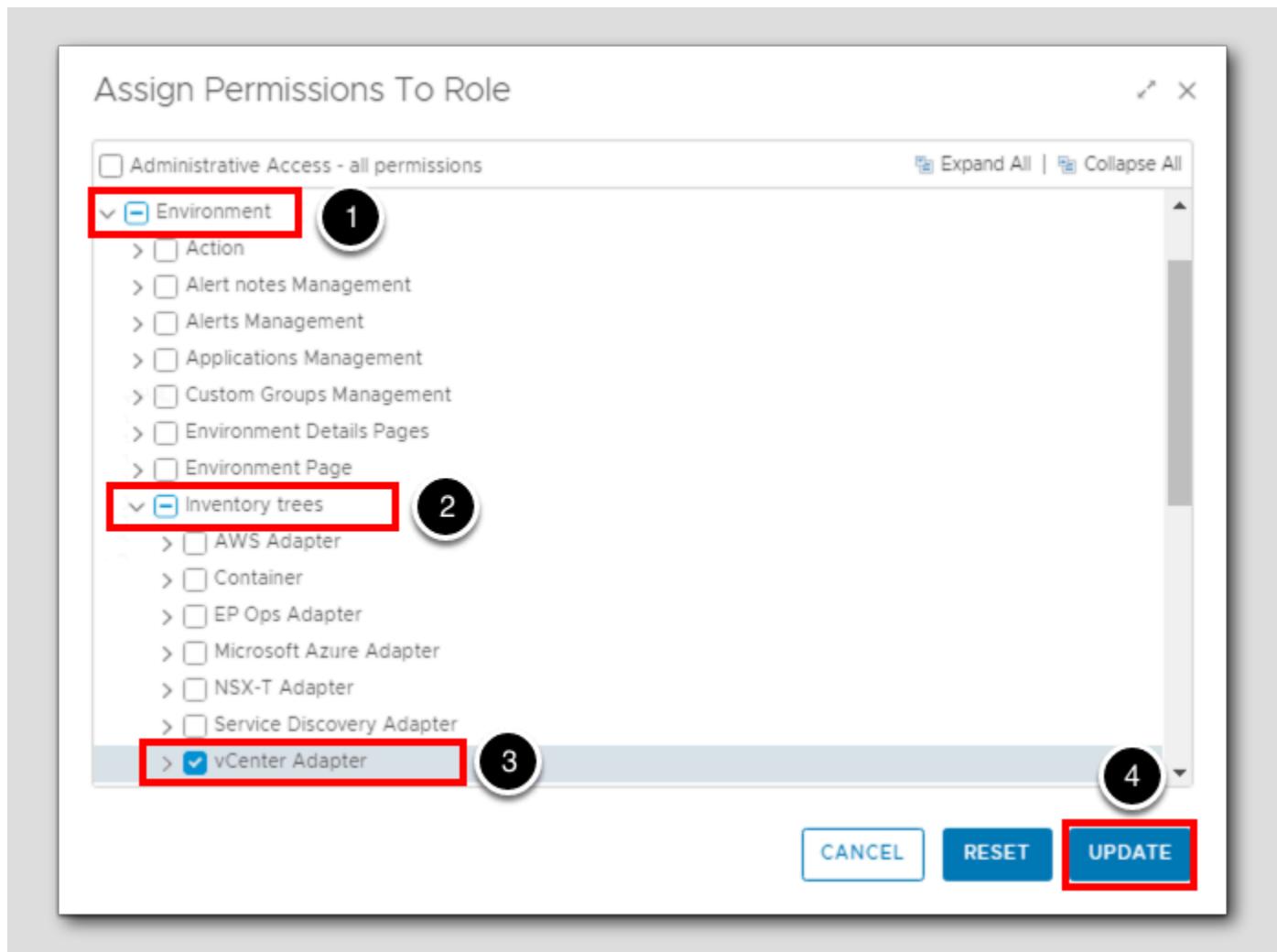


Next, we must allow this role to render views, or the user will not be able to see widgets in the dashboards. This permission is under Dashboards > Views Management > Render.

1. Expand Dashboards.
2. Expand Views Management .
3. Check the box for Render.
4. Check the box for View Dashboards Page.
5. Click Collapse All.

Stay in this pane for the next step.

## Environment



Finally, we must allow this role to have access to the environment, in this case we only want the interns to have access to the vCenter Adapter Inventory Tree. This permission is under Environment > Inventory Trees > vCenter Adapter.

1. Expand Environment.
2. Expand Inventory Trees.
3. Check the box for vCenter Adapter (you may need to scroll down to see it).
4. Click UPDATE.

## Review Updates to Role Permissions

The screenshot shows the 'Details for Role: InternRole' page. On the left, there are sections for 'User Accounts' and 'User Groups'. Under 'User Accounts', it says 'No Users Assigned'. Under 'User Groups', it says 'No user groups assigned.' On the right, there is a 'Permissions' section with a red box around it. A circled '1' is to the left of the red box. The permissions listed are:

- >  Administration
- >  Alerts
- >  Dashboards
- >  Environment
- >  Home

1. Verify that there are now permissions assigned to the role.

## Overview of Updates

It may seem like there were a lot of steps here, but in reality we assigned only 5 permissions:

Login Interactively:

- Administration > Login Interactively

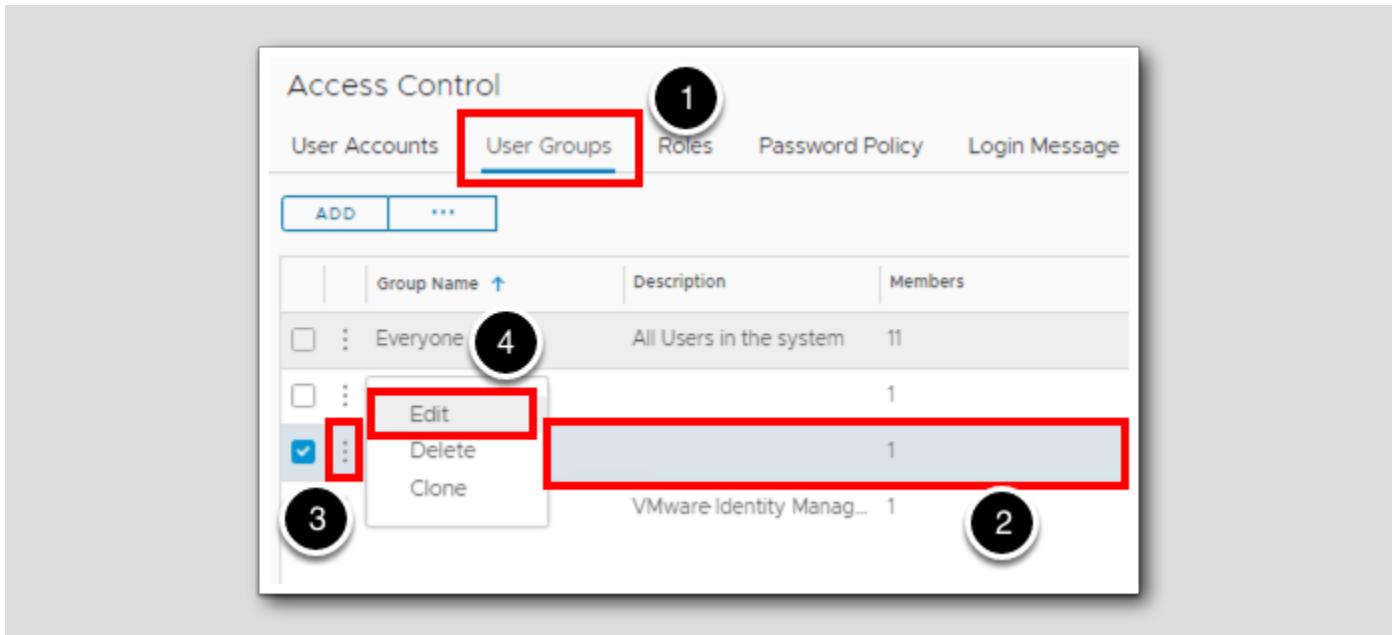
View Dashboards:

- Dashboards > Dashboard Management > View Dashboards List
- Dashboards > Views Management > Render
- Dashboards > View Dashboards Page

Search inventory tree:

- Environment > Inventory trees > vCenter Adapter

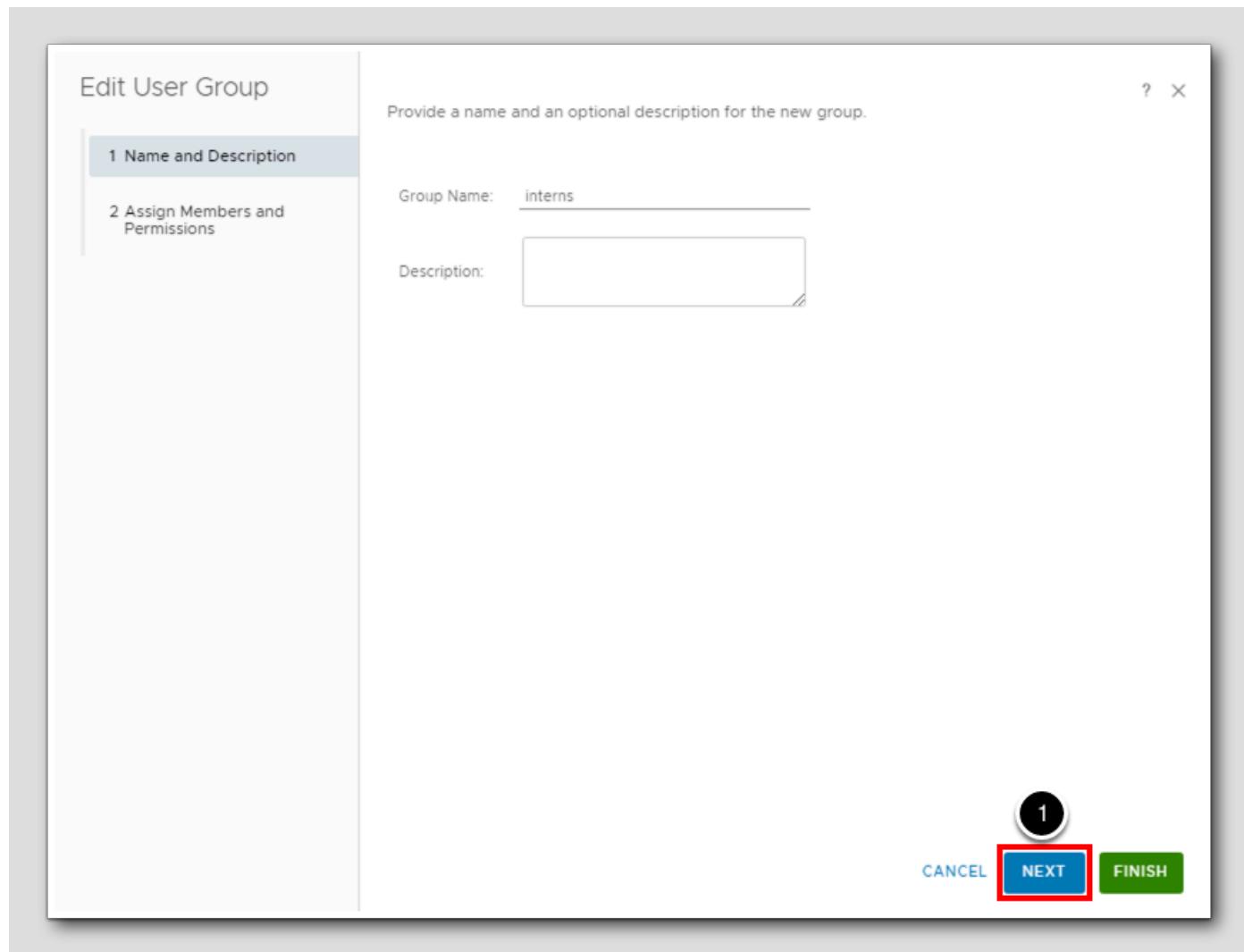
## Assign Role to Group



We are now going to assign the new role to the group that we created earlier.

1. Return to the User Groups tab.
2. Highlight the **interns** group.
3. Click on the 3 dots on the **interns** line to open the actions menu.
4. Click **Edit**.

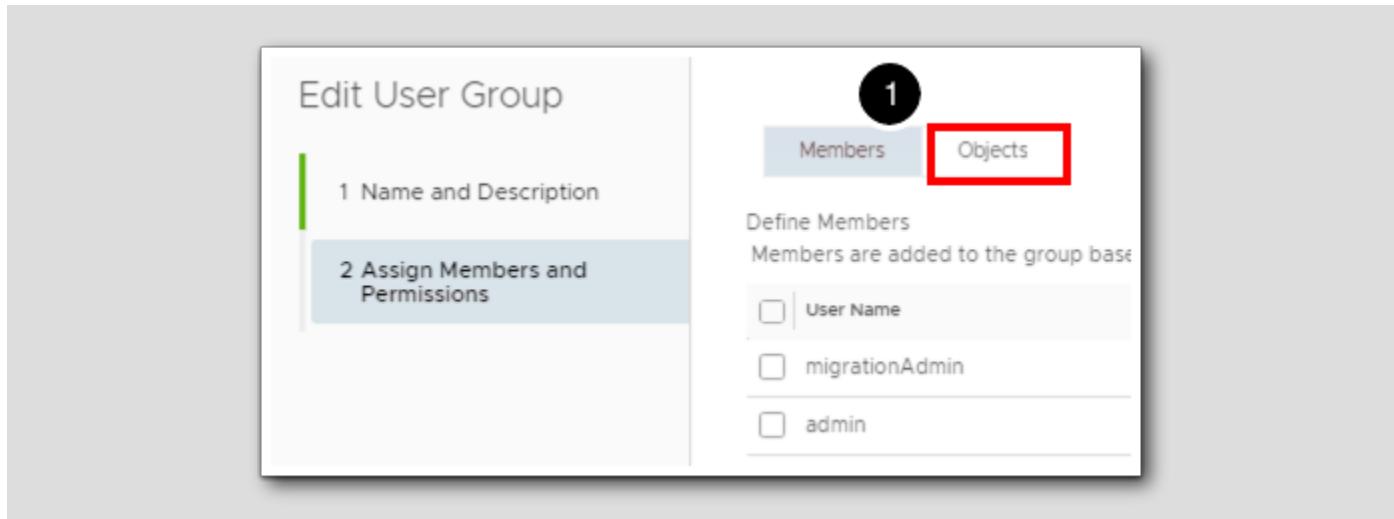
## Group Information



Verify that you are editing the correct group. We are not going to make any changes to the user information, so we can click Next to move to Assign Members and Permissions:

1. Click **NEXT**.

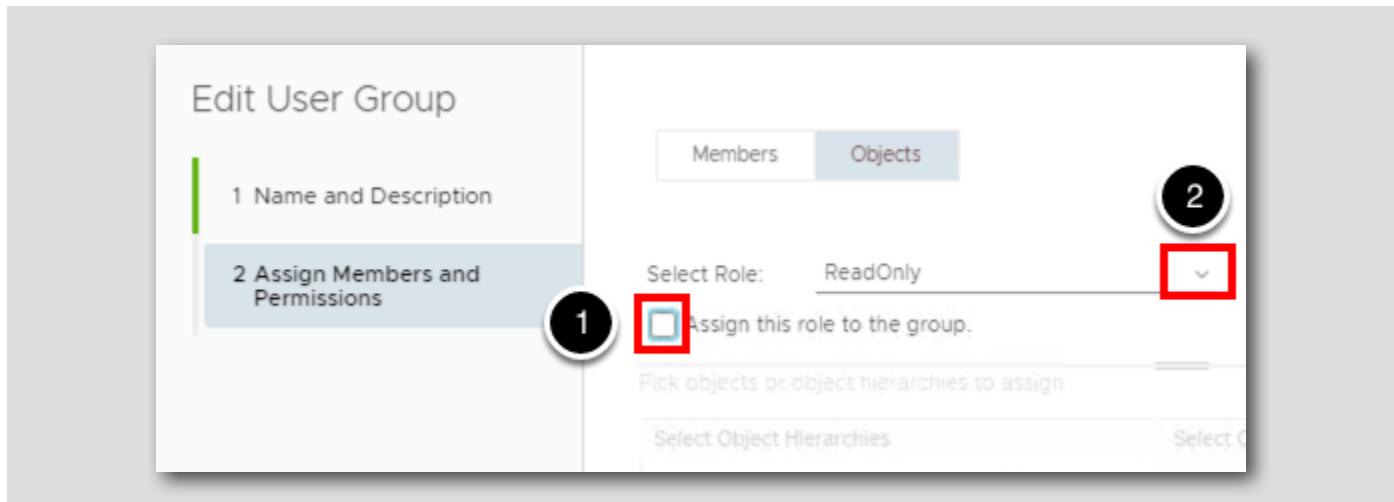
## Edit Groups



We are not going to make any changes to the Members of this group, but you can verify that **intern1** is checked. Select the Objects tab to assign the new role:

1. Click Objects.

## Remove the ReadOnly Role

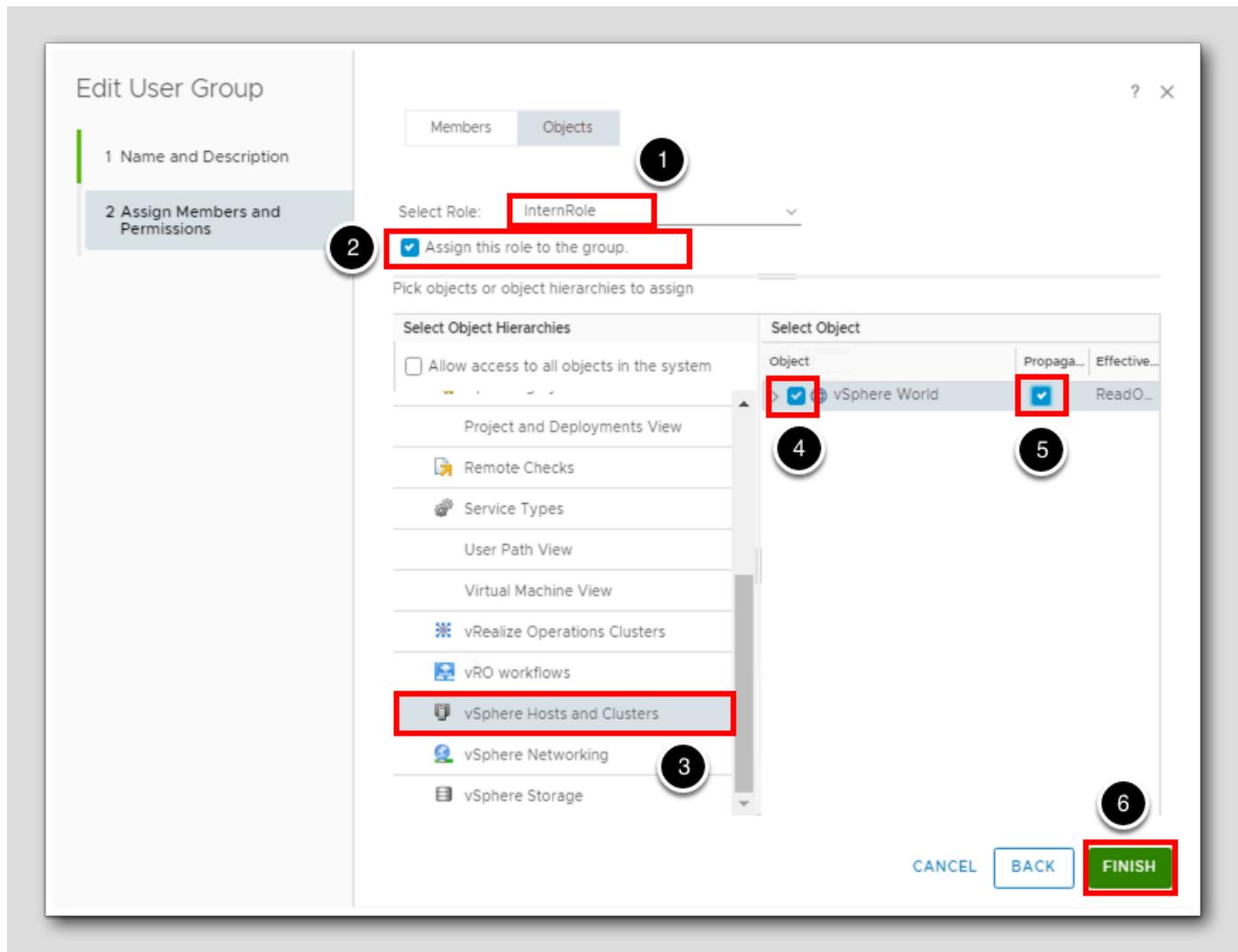


Groups and users can be assigned to multiple roles. When that happens, the effective permissions will be the union of all selected role permission. In this case, we don't want the group to keep the permissions from the ReadOnly role, we only want it to have the permissions from our new InternRole.

1. Click to uncheck the ReadOnly role assignment.
2. Click the Select Roll dropdown.

## Assign The Intern Role

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Now it all comes together! On the Objects tab, we are going to assign the role (the what) and objects (the where) to the user:

1. Select the **InternRole** from the dropdown.
2. Check the box **Assign this role to the group**.
3. Click the **vSphere Hosts and Clusters** hierarchy (you will need to scroll to the bottom of the Object Hierarchy list to see it).
4. Check the box for **vSphere World** (the root of the hierarchy).
5. Check the box to **propagate** the selection to descendant objects in the hierarchy.
6. Click **FINISH**.

## Verify Permissions

The screenshot shows the 'Access Control' interface with the 'User Groups' tab selected (highlighted by a red box). A large black circle with the number '1' is centered over the tab bar. Below the table, a smaller black circle with the number '2' is positioned next to the row for the 'interns' group, which has a checked checkbox.

	Group Name ↑	Description	Members	Group Type	Distinguished Name
<input type="checkbox"/>	Everyone	All Users in the system	11	Local Group	-
<input type="checkbox"/>	HOL Admin Group		1	Local Group	-
<input checked="" type="checkbox"/>	interns		1	Local Group	-
<input type="checkbox"/>	viDM	VMware Identity Manag...	1	VMware Identity Manag...	viDM
<input type="checkbox"/>	web-admin-team@corp...		0	VMware Identity Manag...	web-admin-team@corp...

Below the table, a section titled 'Details for group: interns' is shown. It contains a 'Permissions' tab (highlighted by a red box) and a 'User Accounts' tab. A small black circle with the number '3' is centered over the 'Permissions' tab. The 'Permissions' tab displays a single row for 'InternRole'.

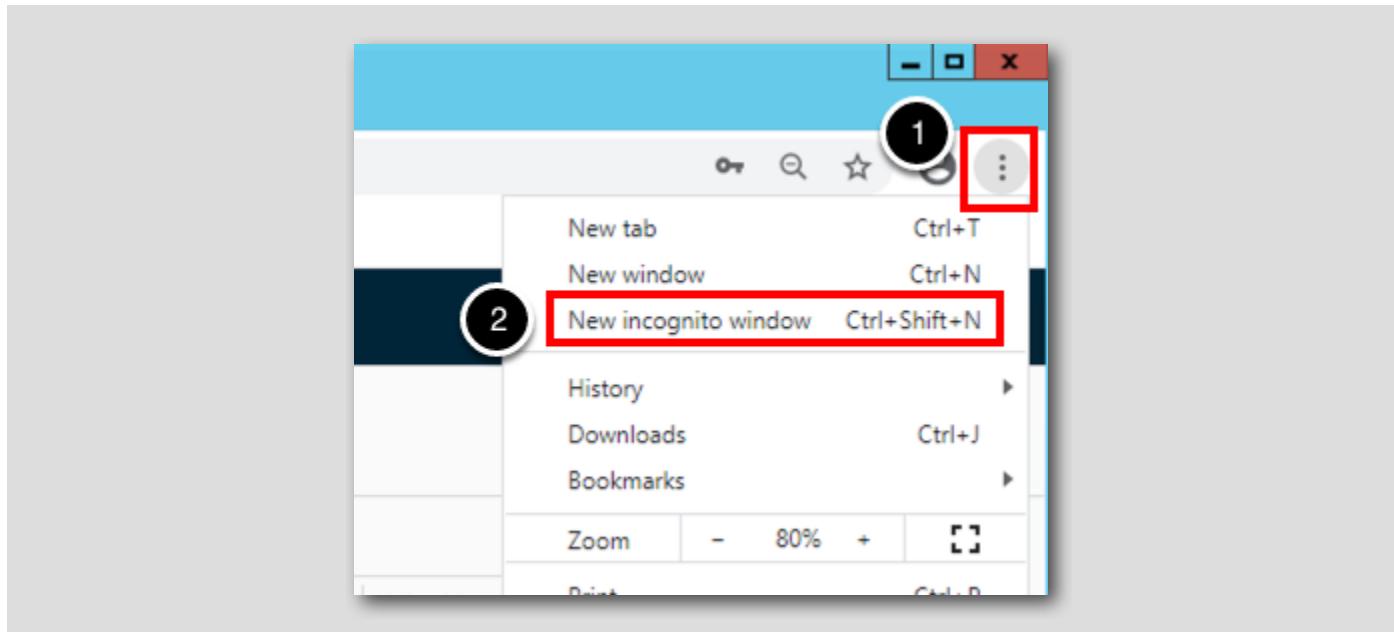
Role	Role Description	Object Hierarchy
InternRole	Role with access to dashboards only	vSphere Hosts and Clusters

A large black circle with the number '4' is centered over the 'InternRole' row in the 'Permissions' table.

While still on the User Groups tab, select the interns user and verify that the Intern Role was applied and that the group now has permissions to objects:

1. Verify you are on the User Groups tab.
2. Highlight the interns group.
3. Select the Permissions tab from the Details pane.
4. Verify that the interns group now has Permissions associated, inherited from the InternRole.

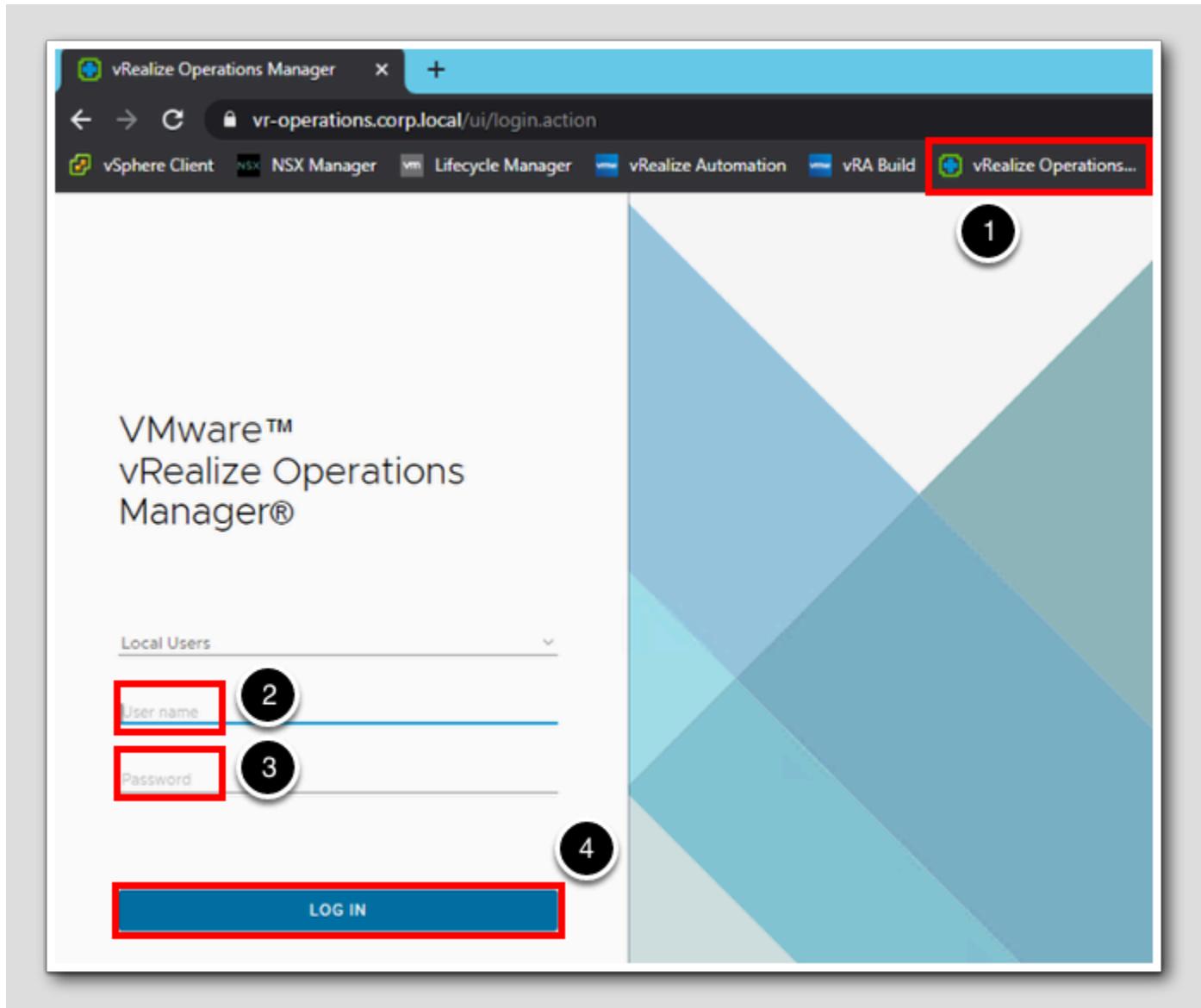
## Verify The Permissions



An incognito window in the Chrome browser allows us to create a new session that does not have any browser session cookies from the existing login. We want to test logging in as the new user without having to log out of our main session.

1. In the top-right corner of the Chrome browser, click the 3-dot icon.
2. Click **New incognito window**.

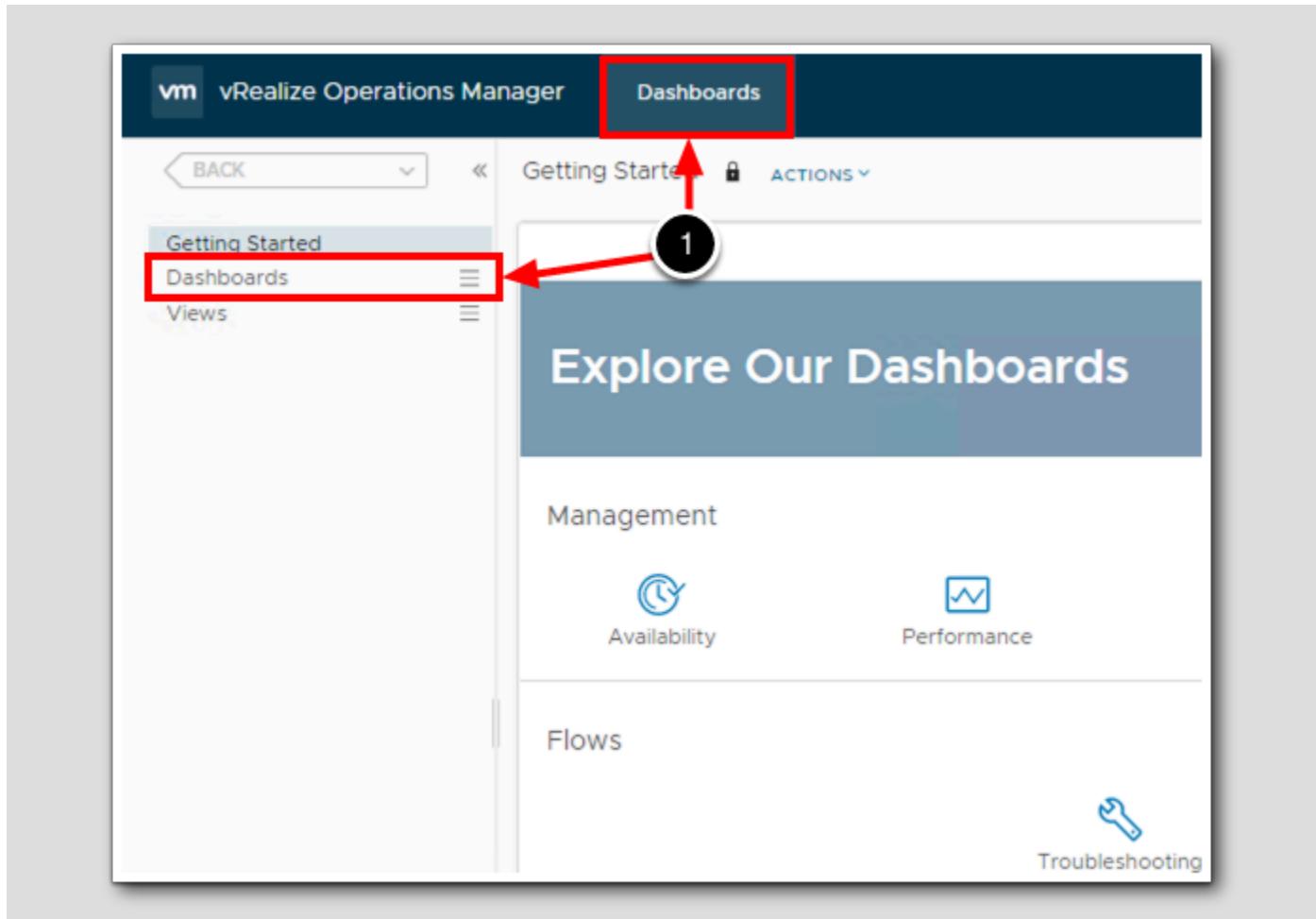
Log In as "intern1"



In the new private browser window, log in as the user we just created.

1. Click the vRealize Operations Manager bookmark.
2. For the user name type intern1
3. For the password type VMware1!
4. Click LOG IN.

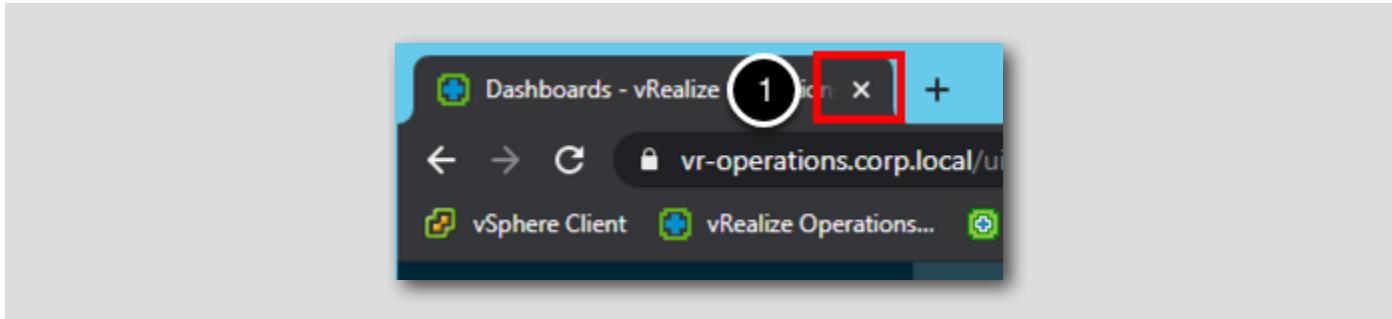
## Dashboard only access



If we configured the role correctly, the intern1 user should only see dashboards.

1. Note that now the intern1 user can only see the Dashboard main menu.
2. Click Dashboards.

## Close the Incognito Session



When you are ready to proceed,

1. Click the X in the browser tab to close the incognito session.

## Lesson Conclusion

In this lesson we discovered how granular we can get with the vRealize Operations permissions, using roles to determine which content and objects a user can access.

In the next lesson we will look at dashboard sharing, and how it can be used to target specific content to user groups.

## Ensuring That Users In A Group Only See Specific Dashboards

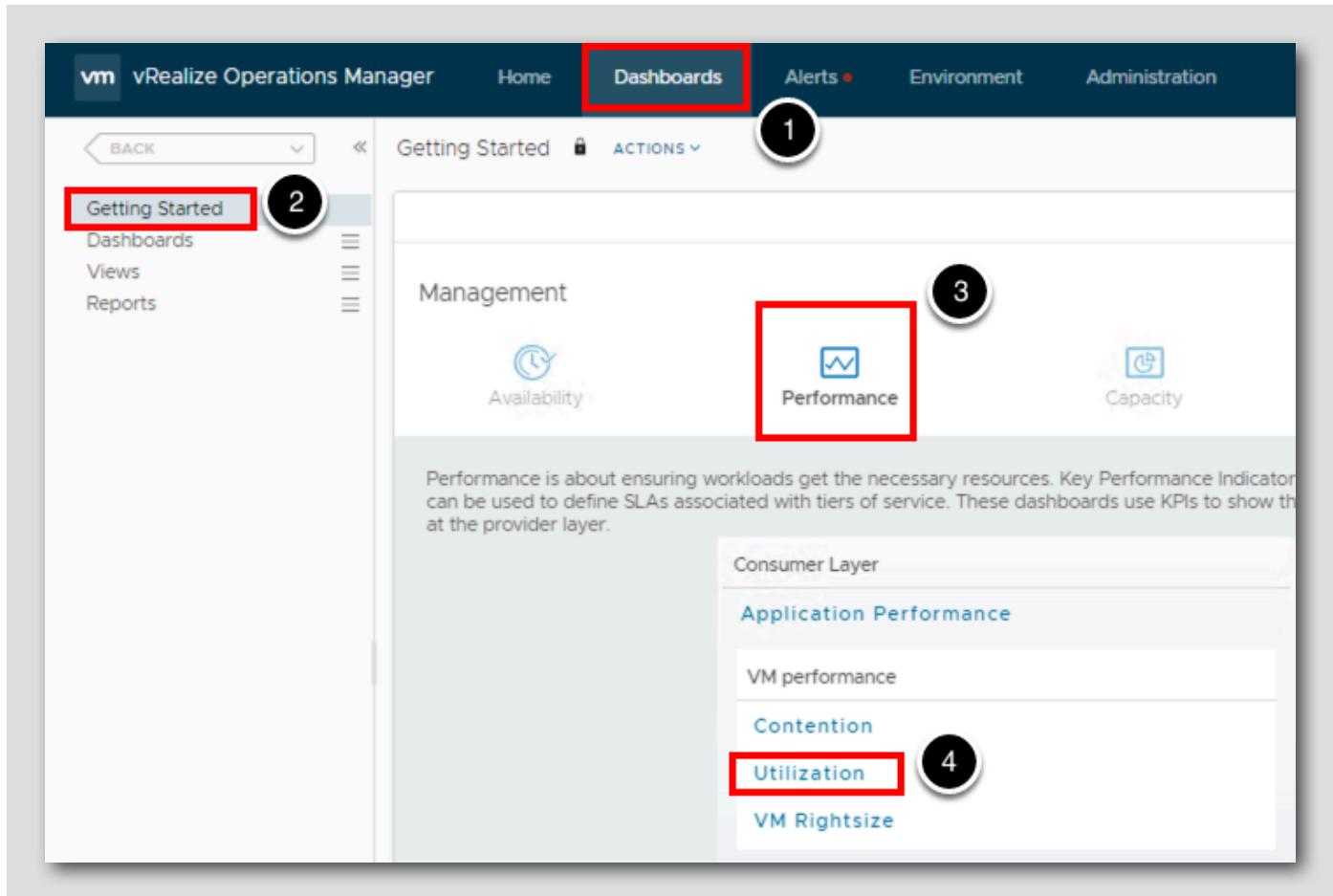
In vRealize Operations you can share a dashboard with one or more user groups. When you share a dashboard, it becomes available to all of the users in that group. This is very useful when creating custom content for specific groups.

Most out-of-the-box dashboards are shared to the Everyone user group so all users see them when they log in to vRealize Operations. A very common use case, however, is that a vRealize Operations administrator will want some users to only see some dashboards but not others. Maybe they want to share high-level operational dashboards with the management team but not allow that team to see the detailed infrastructure troubleshooting dashboards. Another scenario might be to share application-specific dashboards with a line of business team but not give that team visibility to the infrastructure or to dashboards for other lines of business.

To share dashboards with all users, they should be shared to the Everyone group. To restrict access to dashboards, they should not be shared to the Everyone group. Out of the box, vRealize Operations has dozens of dashboards that are shared with the Everyone group so the first step if you decide to have some logged in users not see all dashboards is to first unshare all dashboards from the Everyone group. You will then need to selectively share various dashboards with different user groups. This is the process we will follow in this lesson.

*Note: Some content packs will share their dashboards to the Everyone group on install. If you do decide to limit content to certain users, you will need to keep track of what you expect to be shared and to whom, and verify those sharing settings after adding additional content or upgrading vRealize Operations.*

## Sharing Dashboards Without Requiring User Login

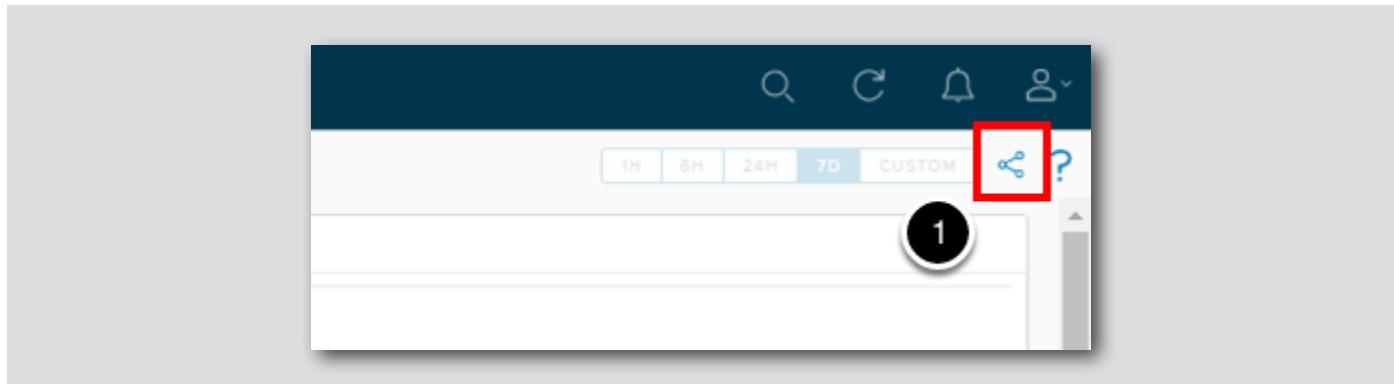


Before going down the path of configuring dashboard sharing, it is worth noting that in vRealize Operations versions 7 and later, you can share dashboards via direct link without requiring users to have an account or log into vRealize Operations. This makes for an easy way to give access to dashboards either via a URL or an iframe for embedding in a web page outside of vRealize Operations.

Let's take a quick look at how you can do that.

1. Click **Dashboards** in the main navigation bar.
2. Click on **Getting Started**.
3. Click the **Performance** tile.
4. Click **Utilization** under VM Performance to open that dashboard.

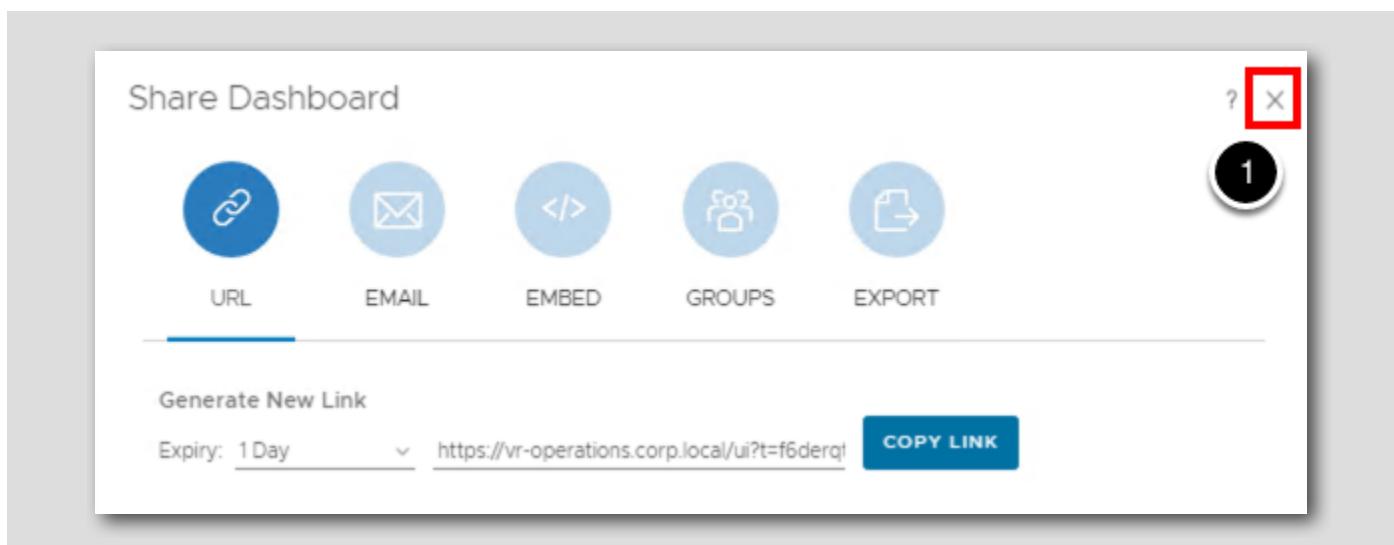
## Dashboard Sharing



In the upper-right corner of the dashboard,

1. Click the **share** icon.

## Share Dashboard Dialog



From this Share Dashboard pop-up you can:

- Generate a URL with or without an expiration date, copy it to your computer's clipboard and unshare or invalidate existing URLs.
- Have vRealize Operations directly email a link to someone.
- Generate iframe code that can be used within a web page outside of the vRealize Operations UI such as a team intranet site.
- Share the dashboard with one or more vRealize Operations user groups (we will return to this later).
- Export the dashboard configuration as a .zip file so that it can be imported into another vRealize Operations instance.

For now we are not going to use this feature but it's worth knowing about to provide options other than having users log into vRealize Operations to see dashboards.

1. Click the X to close this window.

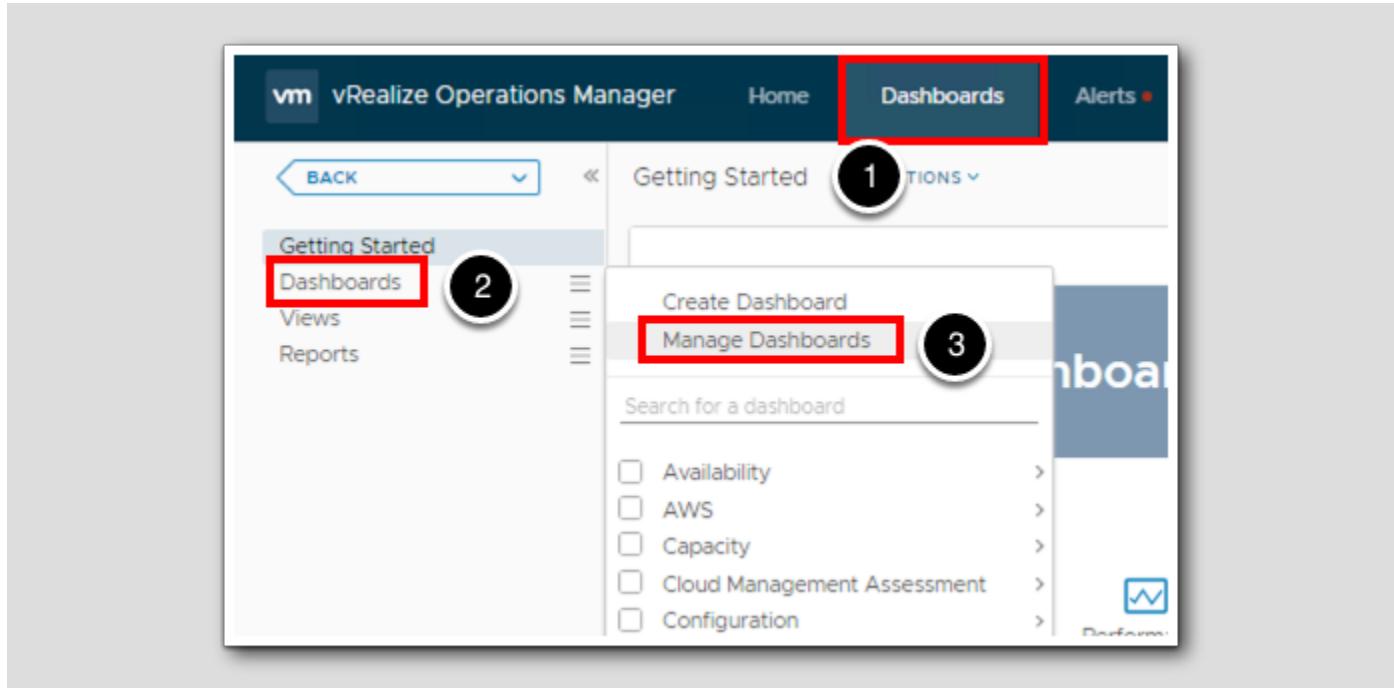
## Lab Work

[363]

Before unsharing all of the dashboards from the Everyone group, you will first want to make sure that those dashboards are shared with your infrastructure team. Typically this would be an already-imported AD group but for simplicity, we are going to use the local user group called **HOL Admin Group**. Our holadmin@corp.local user is a member of this group already.

We are going to use our already logged in local admin user and assign all relevant dashboards to our HOL Admin Group and then remove all dashboards from the Everyone group. Finally, we will share a dashboard with the interns group and then verify that when the intern1 user logs in they will only see the dashboard that has been shared with their group.

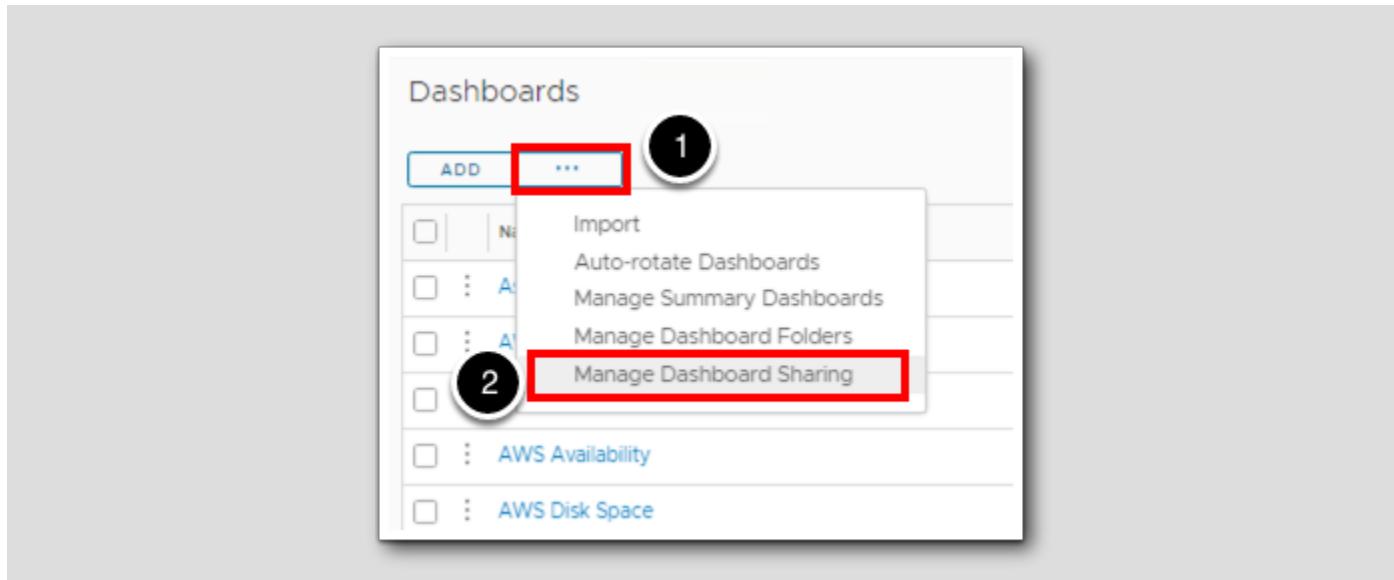
## Manage Dashboards



Select the Dashboards tab and then select the Actions dropdown, and the Manage Dashboards menu item:

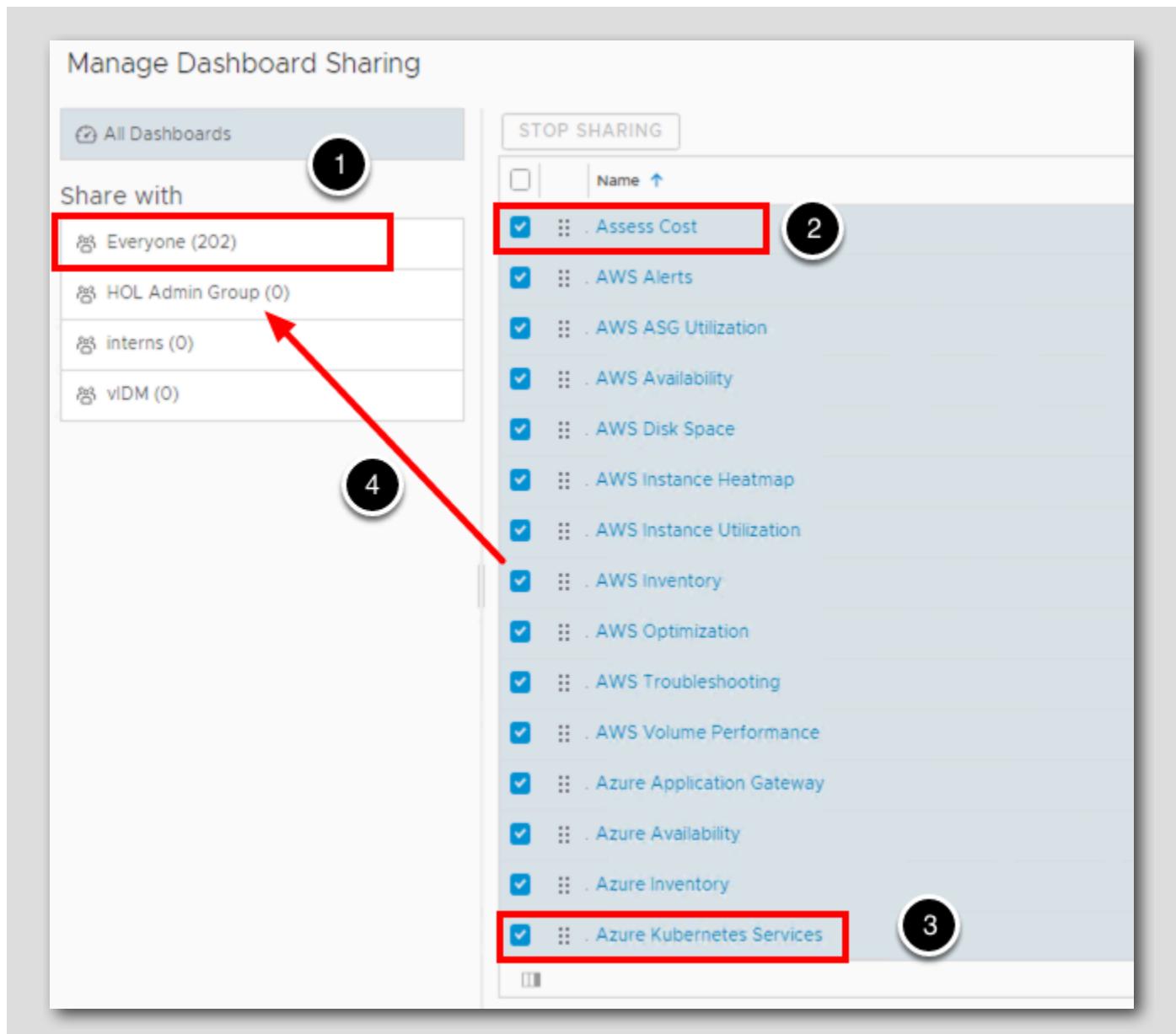
1. Select Dashboards in the main navigation bar.
2. Click Dashboards to open the Dashboards Menu.
3. Select Manage Dashboards.

## Share Dashboards Menu



1. From the Dashboards content pane, click on the 3 dots to open the action menu.
2. Select Manage Dashboard Sharing.

## Share Dashboards with the HOL Admin Group

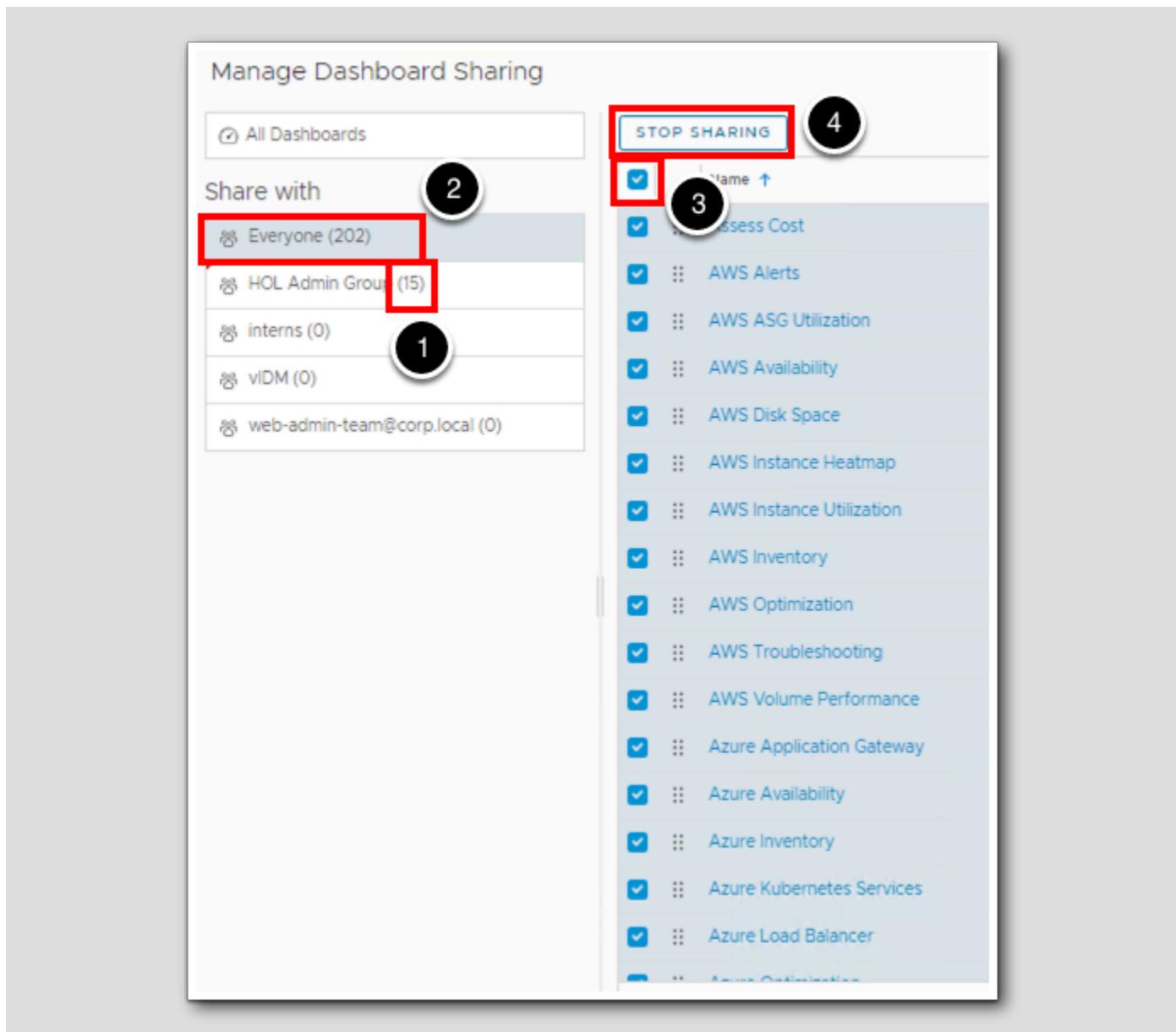


As mentioned above, if you just unshare all of the dashboards from the Everyone group, then nobody will see any dashboards when they log in. So you will first want to share the dashboards at least with your own team (HOL Admin Group in this case).

1. Click the **Everyone** group to list all of the dashboards that are currently shared with that group.
2. Click the first dashboard in the page to select it.
3. Holding down the Shift key on the keyboard, click the last dashboard on the page to select it and all dashboards between the two.
4. Click on the highlighted list of dashboards and while holding down the mouse button, drag the list to the **HOL Admin Group**.

You should now have about the first 15 dashboards shared with the HOL Admin Group. For the purposes of this exercise, you can just share that first group of dashboards with the HOL Admin Group. In a real-world environment you would want to scroll down and repeat the process of selecting about 15 dashboards at a time and dragging them to the group you want to share with until you have shared all of them.

## Unshare from Everyone Group

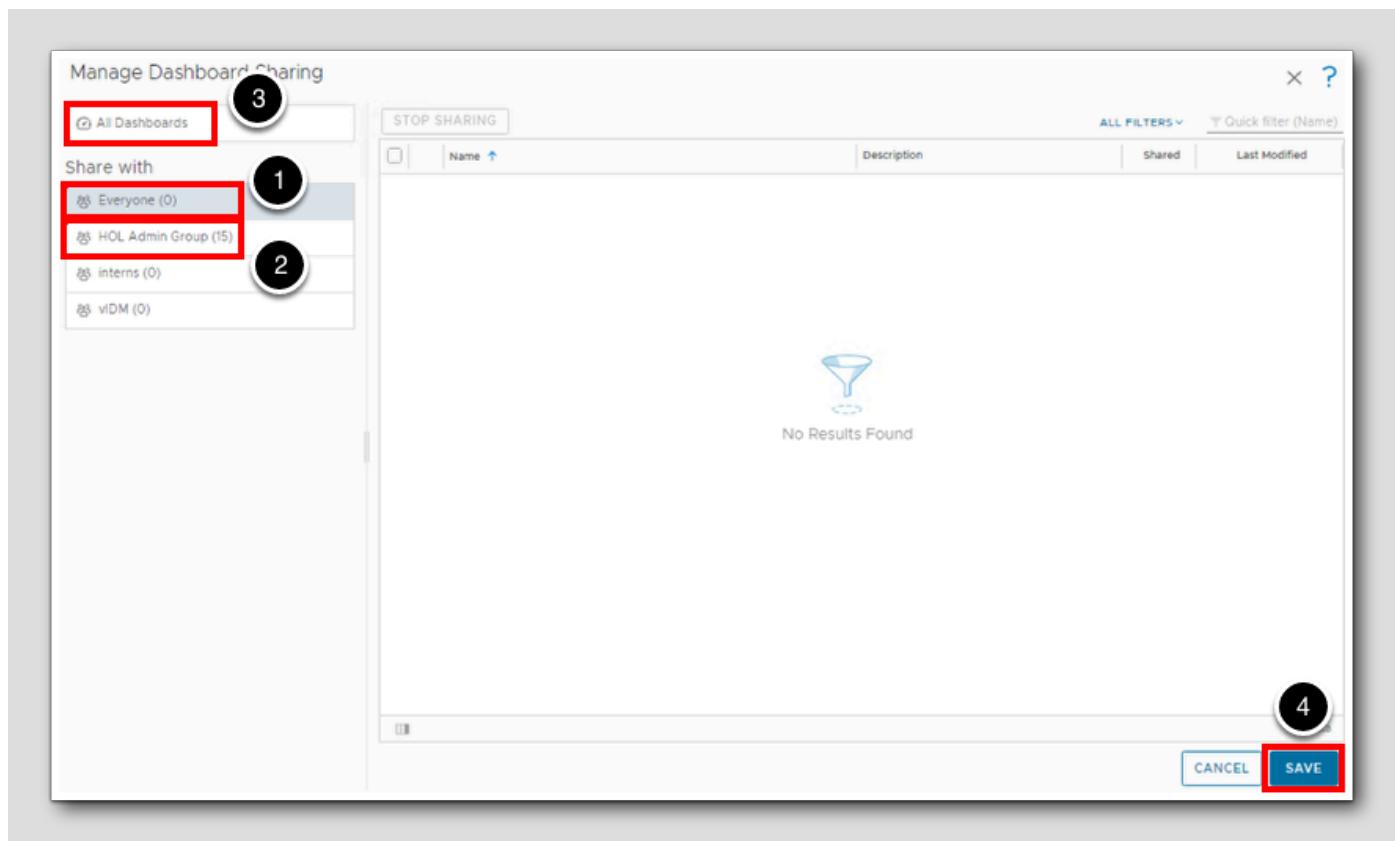


Now that you have shared some (or all) of those dashboards with your infrastructure team's group, it's time to unshare all of them from the Everyone group.

1. Note that the HOL Admin Group now has 15 (or however many you did) shared dashboards.
2. Be sure the Everyone group is still selected/highlighted. If not, click it again.
3. Click the **check box** to select all dashboards in the list. (You could also just select just a portion of the dashboards by following steps similar to the ones in the previous step).
4. Click the **STOP SHARING** button.

### Verify That Everyone Group Has No Dashboards

[368]

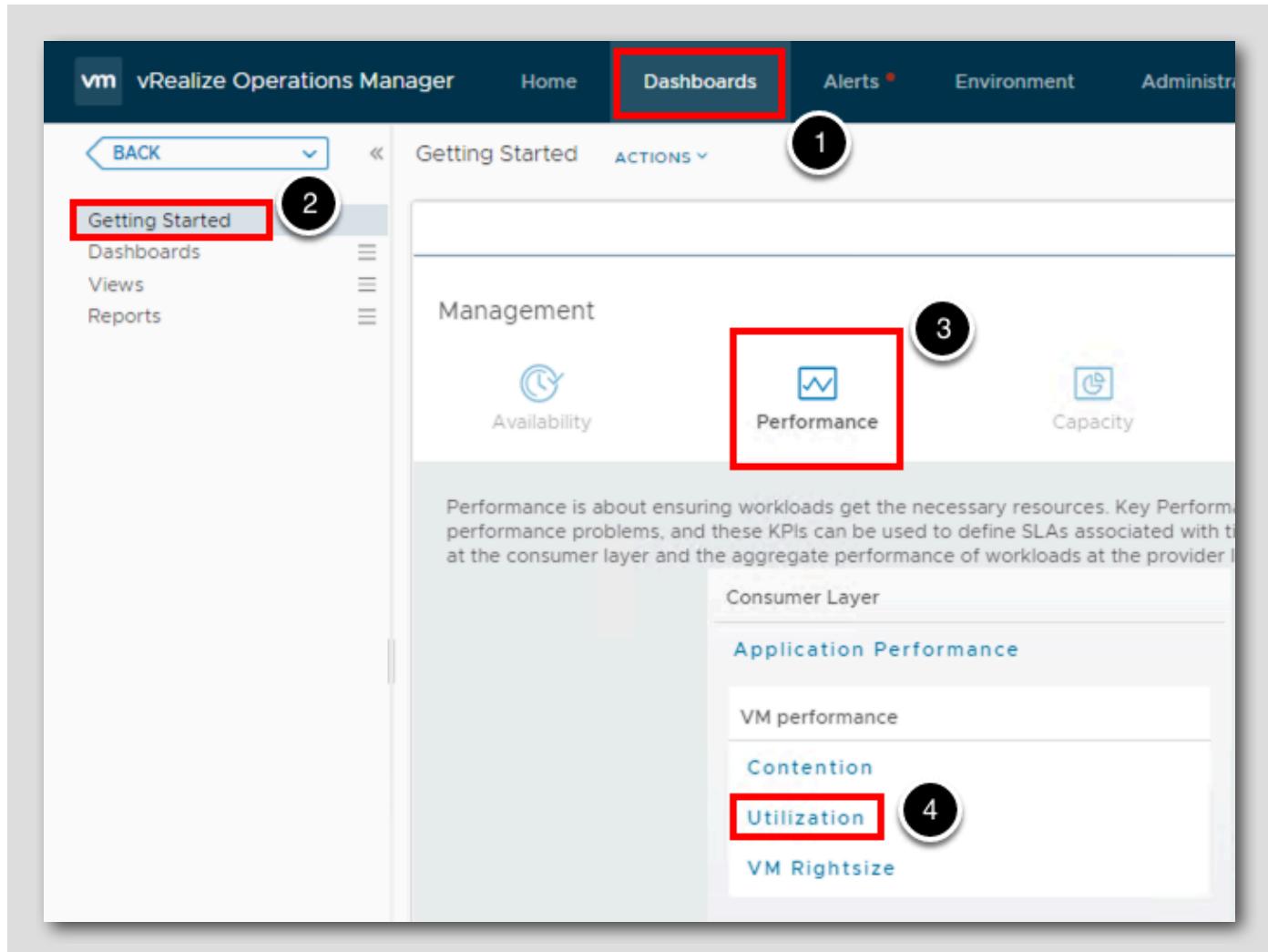


Verify your work.

1. Verify that the **Everyone** group has 0 dashboards assigned - note the small red triangle in the corner by the zero - this means that the changes have not yet been saved.
2. Verify that the **HOL Admin Group** has some dashboards assigned.
3. If you want to de-select the group name to see all available dashboards you can do that by clicking the **All Dashboards** button.
4. Click **SAVE** to save your changes.

Note that we could have used this same Share Dashboards dialog box to share the individual dashboard(s) with our interns group but unless you are sharing multiple dashboards at the same time, it is much easier to do that sharing from the dashboards themselves.

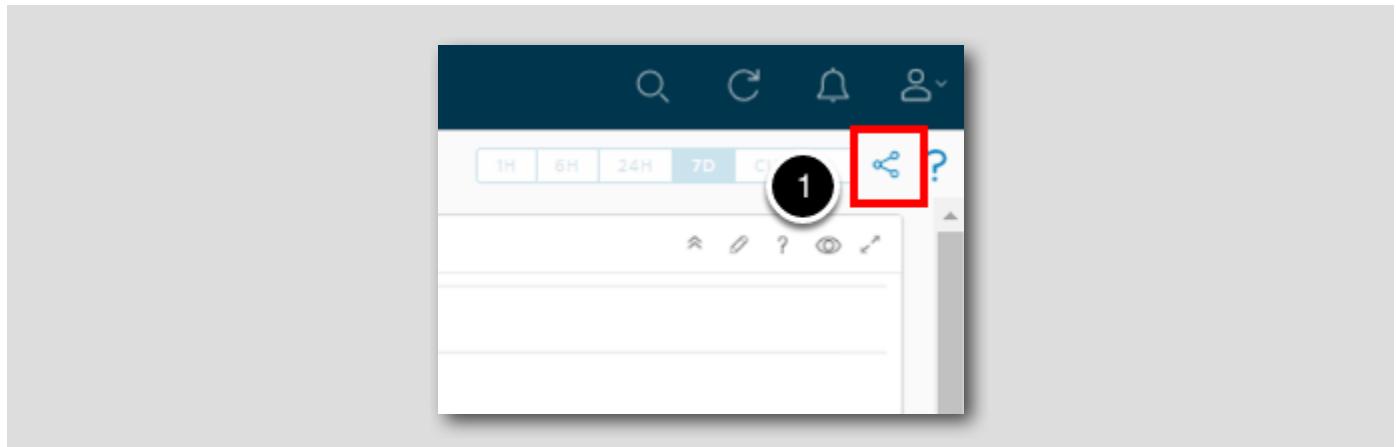
## Share a Dashboard With the Interns Group



Let's find a dashboard to share.

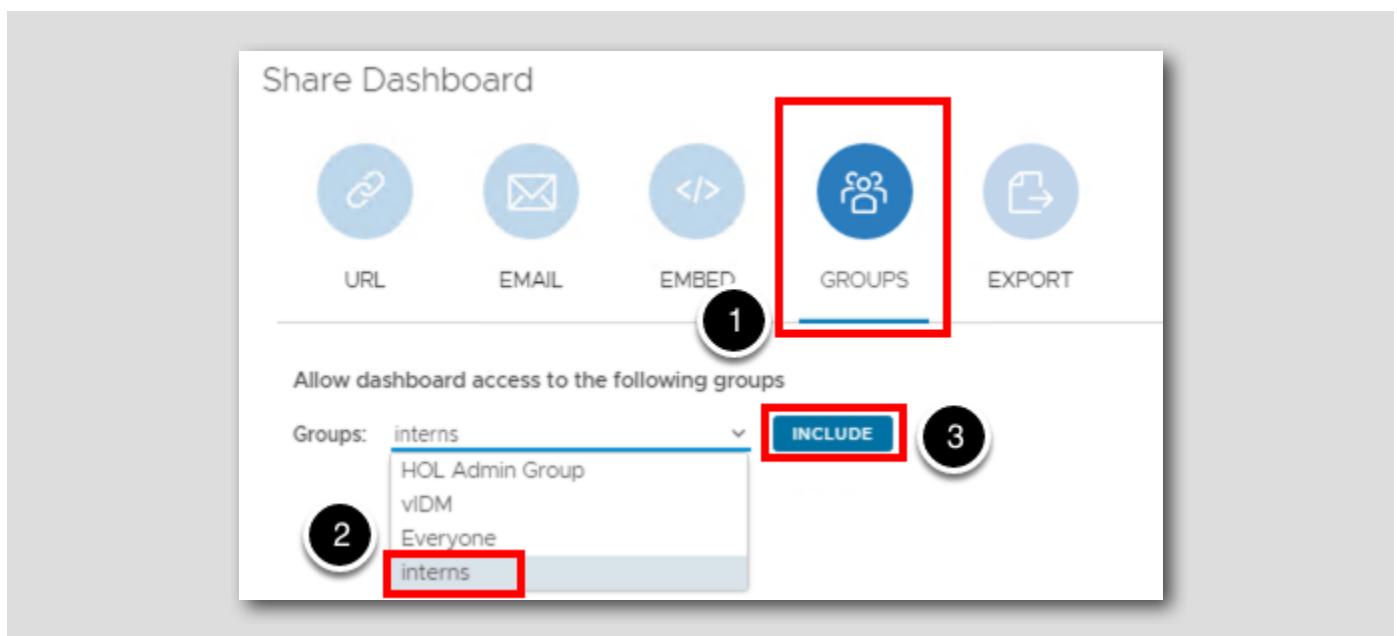
1. Click Dashboards to return to the main dashboards page.
2. Click Getting Started.
3. Click the Performance tile.
4. Click Utilization under VM performance to open that dashboard.

## Share



1. Click the **share** icon in the top-right corner of the dashboard.

## Share With Groups

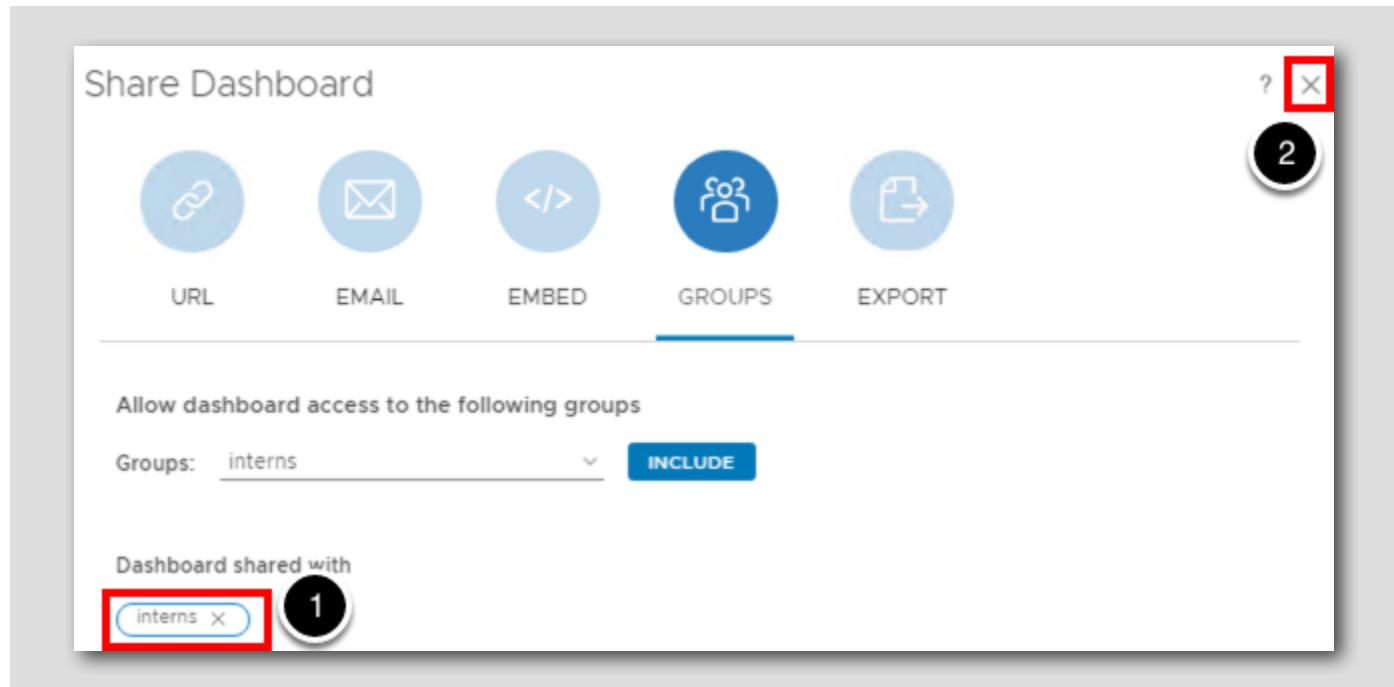


As we saw earlier, the first three options here allow you to share the dashboard with people without requiring them to log in to the vRealize Operations UI. In this case we want to share the dashboard with a user group in vRealize Operations so when an associated users logs in, the dashboard will be visible to them.

1. Click the GROUPS tile.
2. From the drop-down, click the **interns** group.
3. Click **INCLUDE**.

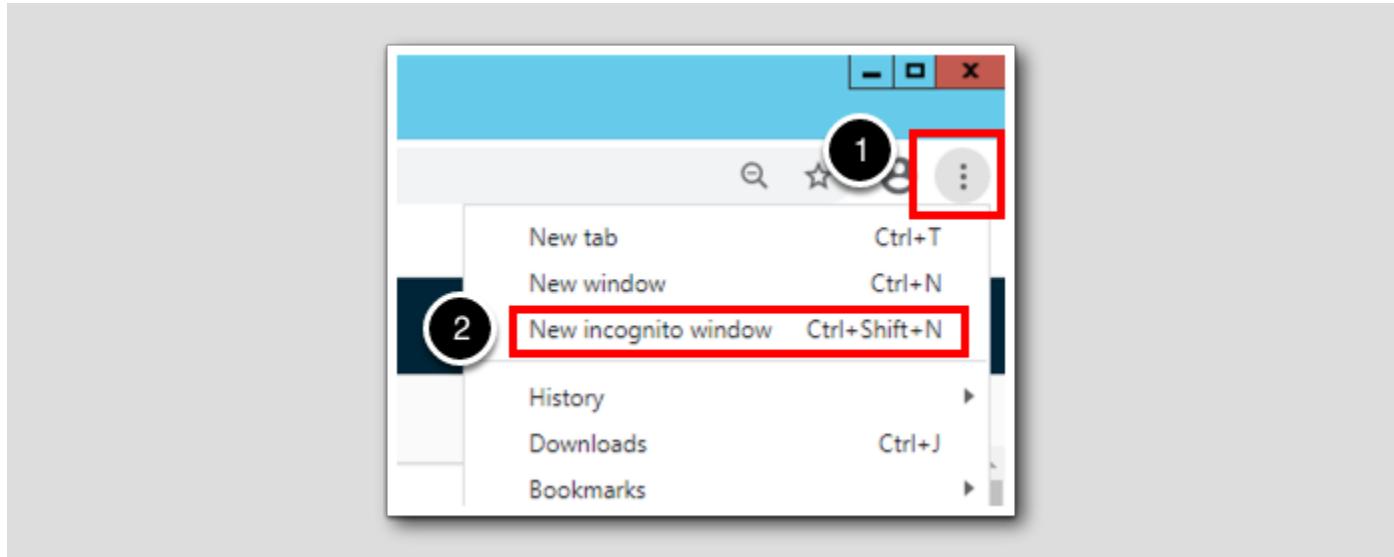
## Verify the Sharing Configuration

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1. Verify that the **interns** group has been allowed access.
2. Click the X to close the sharing box.

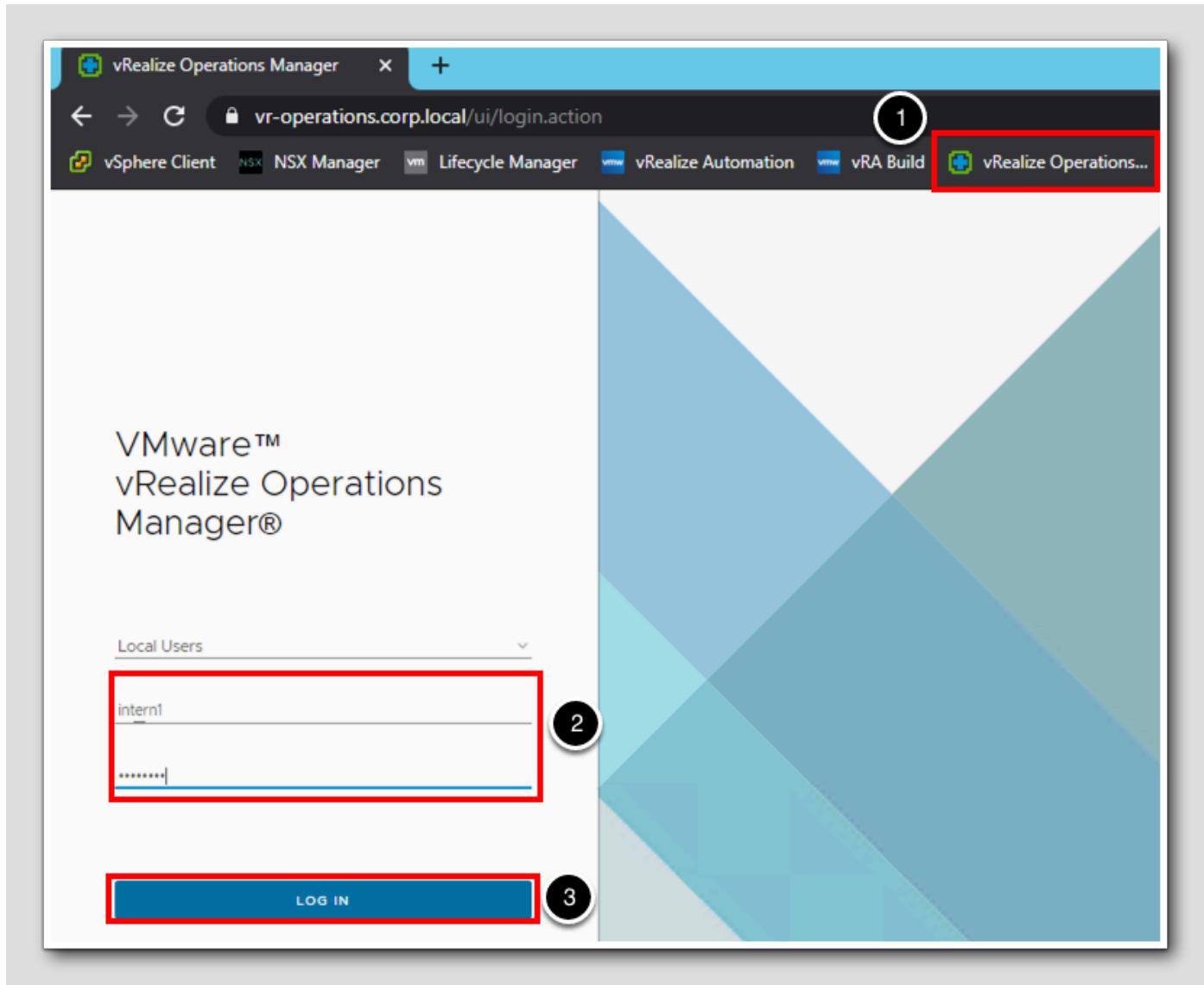
## Test It Out



Log out as the admin user so we can test shared dashboards:

1. Click the 3 dots in the top right corner of Chrome.
2. Click New incognito window.

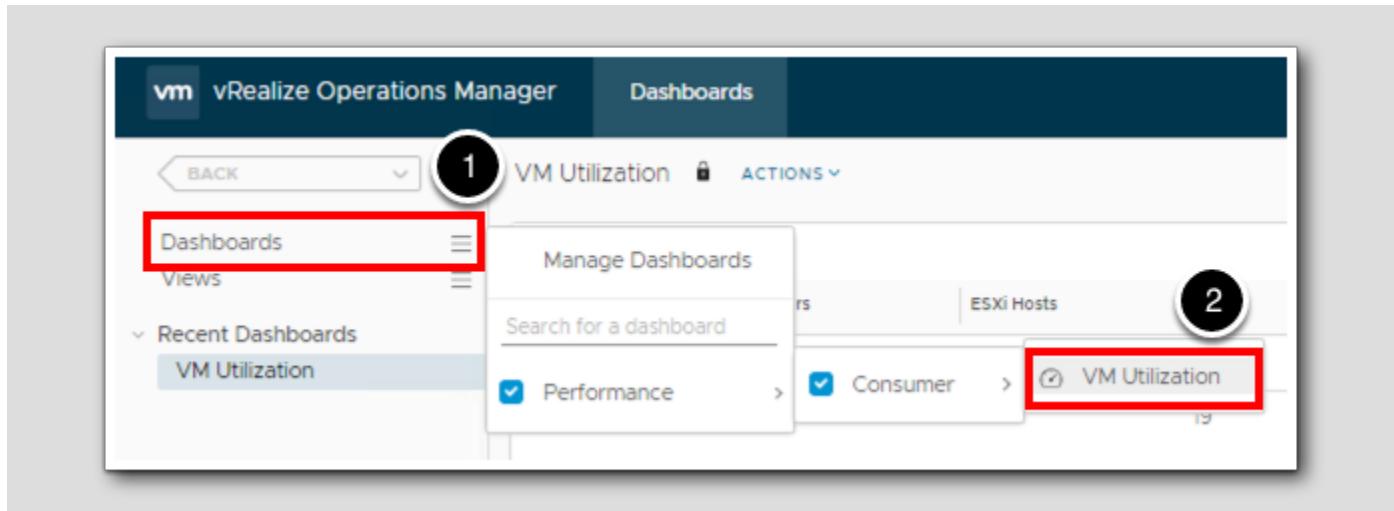
Log in as intern1



Log into vRealize Operations as intern1:

1. Click the vRealize Operations Manager link in the bookmark bar.
2. Enter the credentials for intern1:
  - User Name: intern1
  - Password: VMware1!
3. Click on LOG IN.

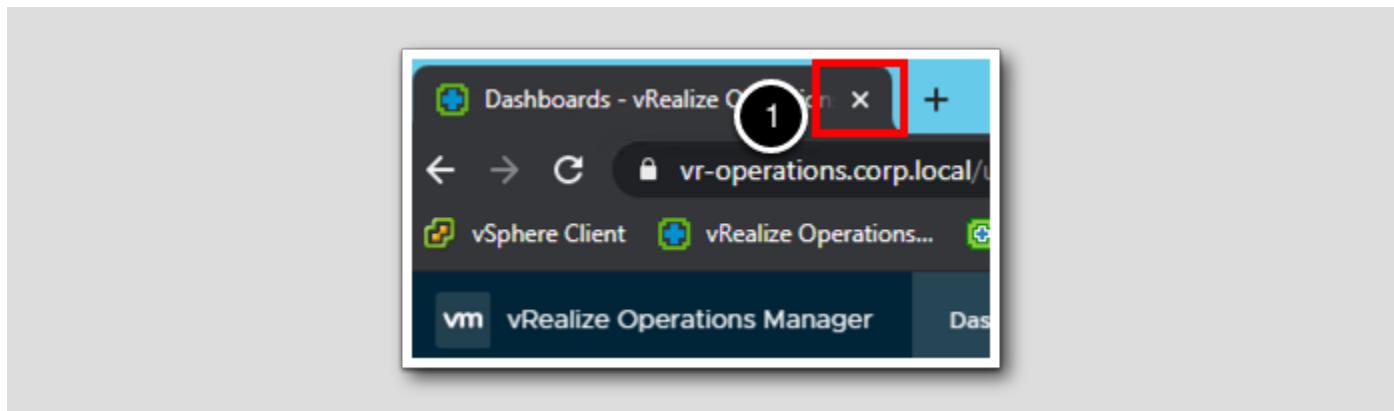
## Validate intern1 User Dashboard



Now when the intern1 user logs in, they only see the one dashboard that has been shared with them.

1. Select Dashboards.
2. Here we see that the only Dashboard available to the intern1 user is the 1 VM Utilization Dashboard that we shared in the previous steps.

## Close incognito Browser Window



Log out as the intern1 user:

1. Click the x in the Chrome incognito tab to close this window.

## Conclusion

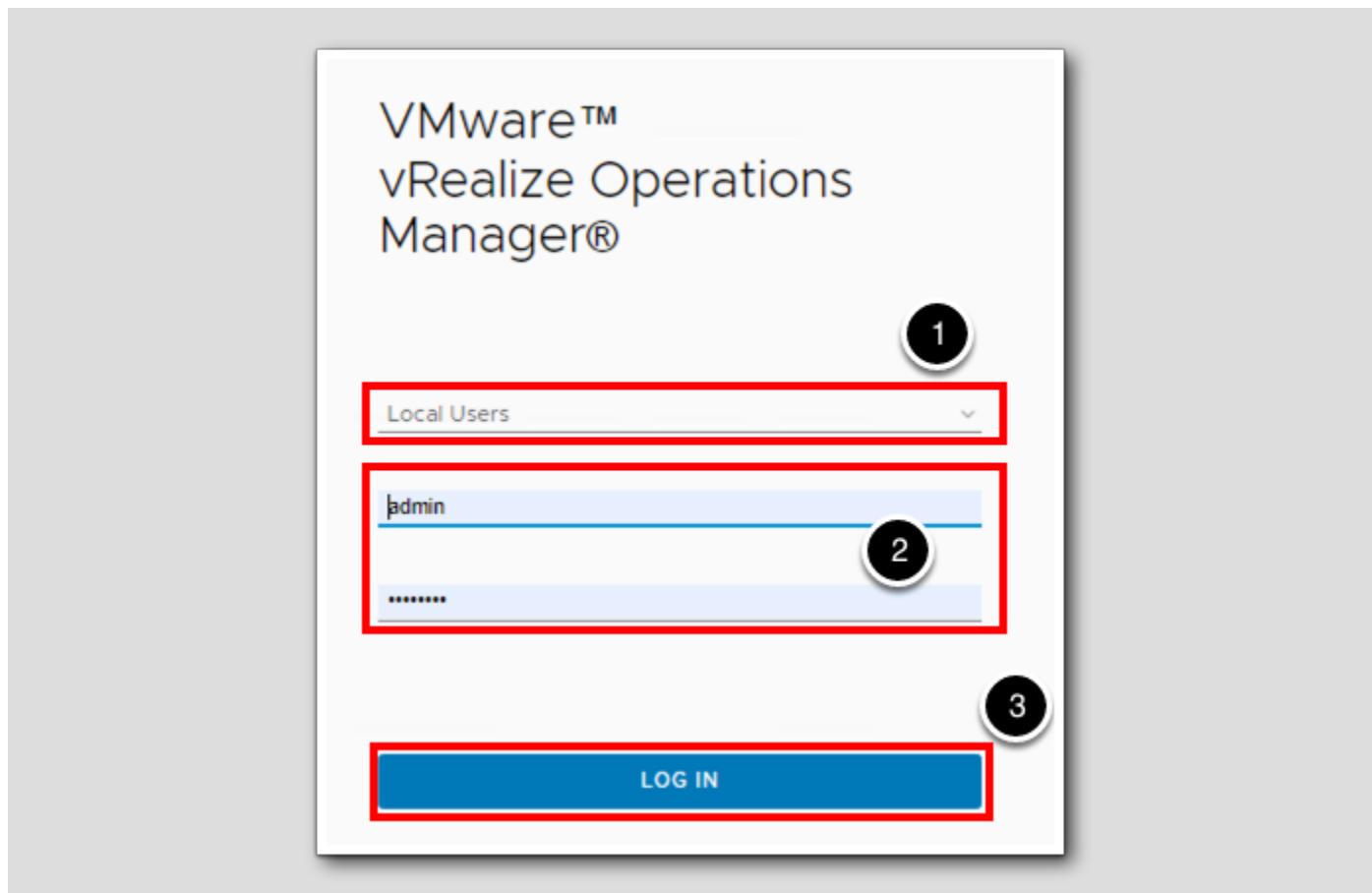
In this lesson we touched on dashboard sharing - how to share or unshare dashboards to a user group. Most customers use the sharing feature to share new, custom created content with groups of users. We are also starting to see more administrators using the feature to restrict content to users.

## Recovering Orphaned Content When A User is Removed

Dashboards and report schedules that are created by a user are owned by that user object in vRealize Operations. If a user leaves the organization or is otherwise removed from vRealize Operations that content becomes orphaned and can't be managed until it is assigned a new owner.

Orphaned content can only be managed by the local admin user.

### Log in as local admin user



If you are already logged in as the local admin, you can skip this step.

1. Verify the Local Users authentication source is selected.

2. Enter the credentials for the local admin account:

- User name: admin

- Password: VMware1!

3. Click on LOG IN.

## Orphaned Content Page

[380]

The screenshot shows the vRealize Operations Manager Administration interface. A red box highlights the 'Administration' tab in the top navigation bar. A red box also highlights the 'Deleted Users' section in the main content area, which displays a message: 'You are the new owner of dashboards and report schedules that belonged to deprecated users.' Below this message is a table with columns for 'Deleted Users', 'Dashboards', and 'Report Schedules'. A red box highlights the 'Dashboards' tab in the table header. A red box also highlights the 'Content Management' section in the left-hand navigation menu, which contains a link to 'Orphaned Content'. Numbered callouts point to specific elements: '1' points to the 'Administration' tab; '2' points to the 'Management' section in the left menu; '3' points to the 'Content Management' section in the left menu; and '4' points to the 'Dashboards' tab in the table header.

Let's view the orphaned content page.

1. On the **Administration** page,
2. Expand the **Management** section by clicking the chevron.
3. Click **Orphaned Content**.
4. Note that there is currently no orphaned content in this environment.

## Delete A User

[381]

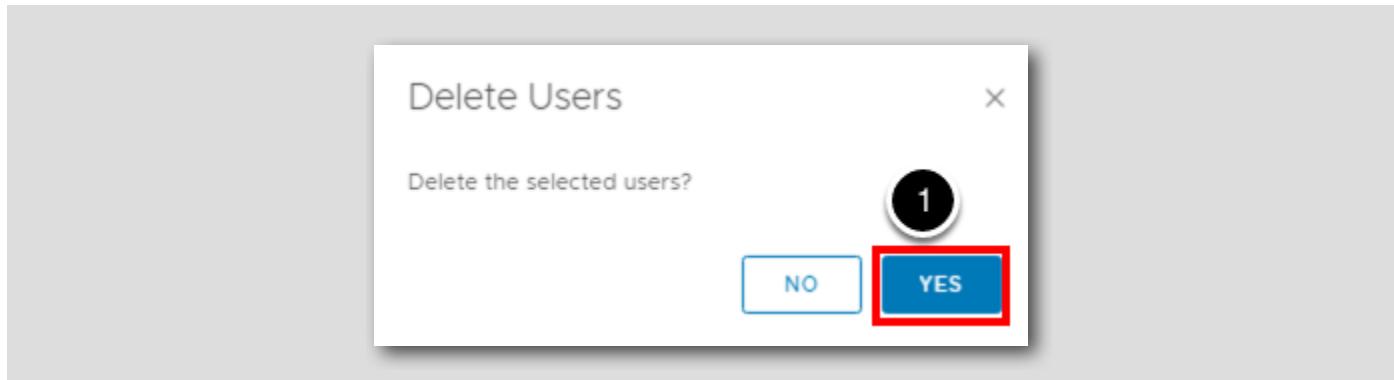
The screenshot shows the 'Access Control' page in vRealize Operations Manager. The left sidebar has 'Access' expanded, with 'Access Control' selected. The main area shows a table of users. A user named 'hol-retired' is highlighted with a red box and circled with number 5. To its left, a row of three dots is circled with number 3. An arrow points from circle 3 to circle 4, which is also circled. The 'Delete' option in the menu is circled with number 5. The table columns are 'User Name', 'First Name', 'Last Name', 'Email', 'Role', and 'Status'.

User Name	First Name	Last Name	Email	Role	Status
migrationAd...					
maintenance...					
intern1	Summer	Intern			
hol-retired	HOL	Retired			
automation...					

Let's delete a user. The user hol-retired has left the company. As the vRealize Operations administrator you want to delete his account.

1. Expand the **Access** section.
2. Click **Access Control**.
3. Click the **hol-retired** user to select it.
4. Click the 3 dots to open the user action menu.
5. Click **Delete** to delete the user **hol-retired**.

## Confirm the Deletion



Confirm the user deletion by,

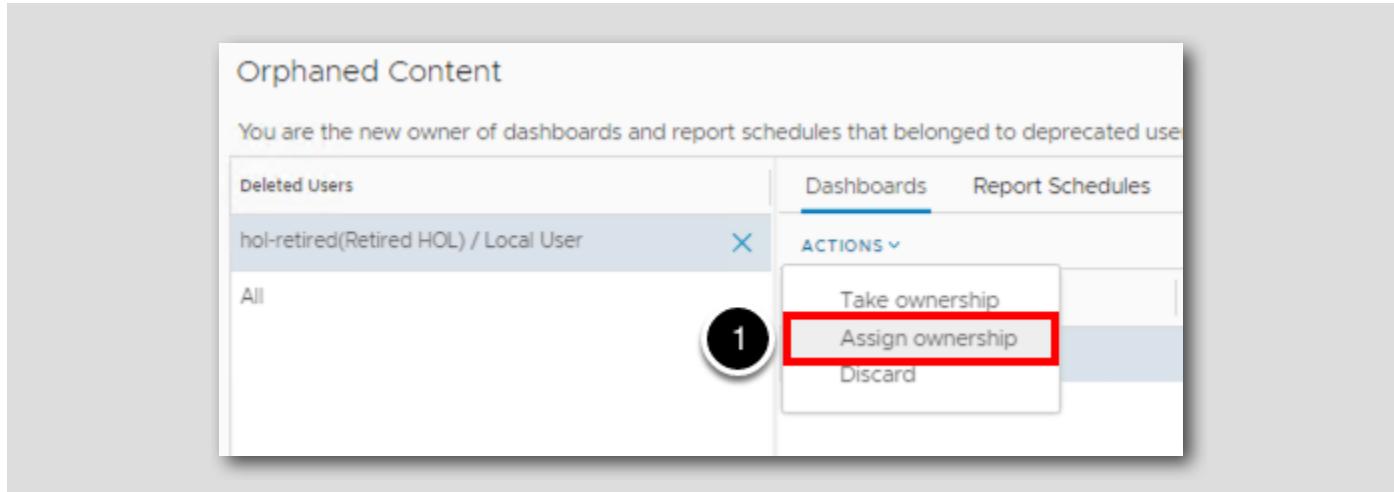
1. Click YES.

## View the Orphaned Content

The screenshot shows the vRealize Operations Management interface. On the left, there's a navigation sidebar with several sections: Solutions (Cloud Accounts, Other Accounts, Repository), Inventory, Policies, Access (Access Control, Authentication Sources), Configuration, Management (Integrations, Certificates, Cluster Management, Cloud Proxies, Collector Groups, Collection Status, Credentials, Global Settings, Licensing, Log Forwarding, Outbound Settings, Content Management), and finally Orphaned Content (which is highlighted with a red box and the number 1). The main content area is titled 'Orphaned Content' and contains a message: 'You are the new owner of dashboards and report schedules that belonged to deprecated users'. Below this is a table with three columns: Deleted Users, Dashboards, and Report Schedules. The first row in the table is highlighted with a red box and the number 2. It shows a user named 'hol-retired(Retired HOL) / Local User'. To the right of this row is an 'X' button and an 'ACTIONS' button with a dropdown arrow (highlighted with a red box and the number 4). The second column of the table has a header 'Name' and a single entry 'VM KPIs' (highlighted with a red box and the number 3).

1. Return to Orphaned Content and we now see our deleted user hol-retired in the list.
2. Click on the deleted user hol-retired.
3. Click on the dashboard VM KPIs. This was a dashboard that was created and owned by hol-retired.
4. Click Actions above the dashboard name and let's reassign that dashboard to another user.

## Assign ownership

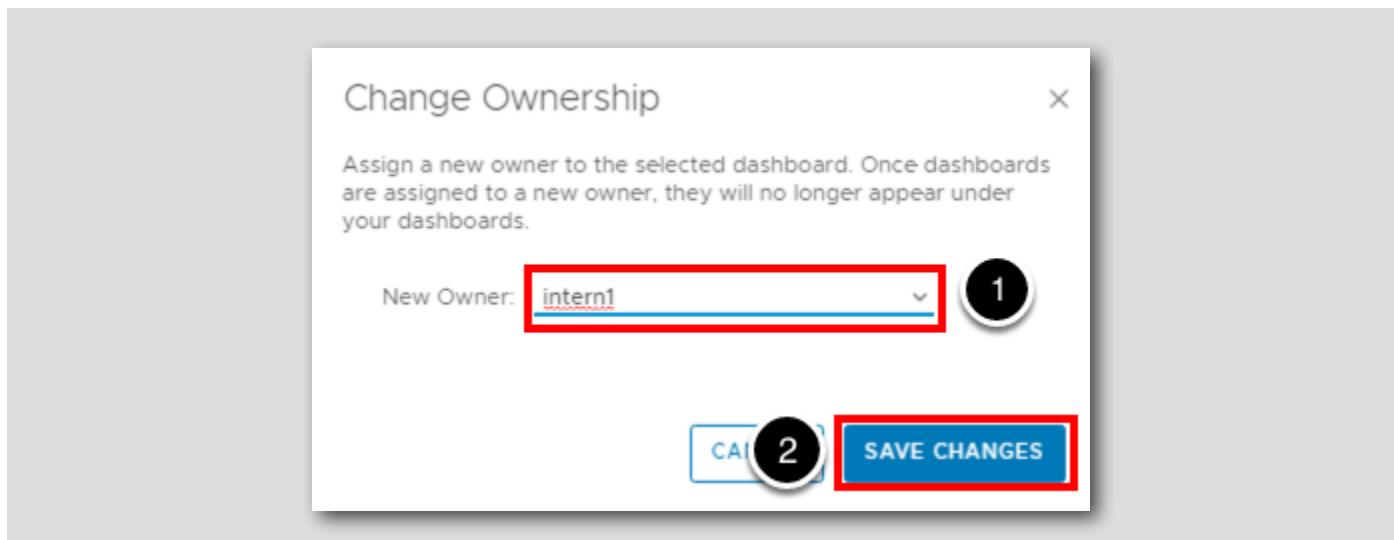


Let's assign hol-retired's dashboard ownership to our intern1 user.

1. Click Assign ownership.

Note that you can also take ownership of the dashboard as the admin user or you can discard (delete) the dashboard.

## Transfer Dashboard Ownership

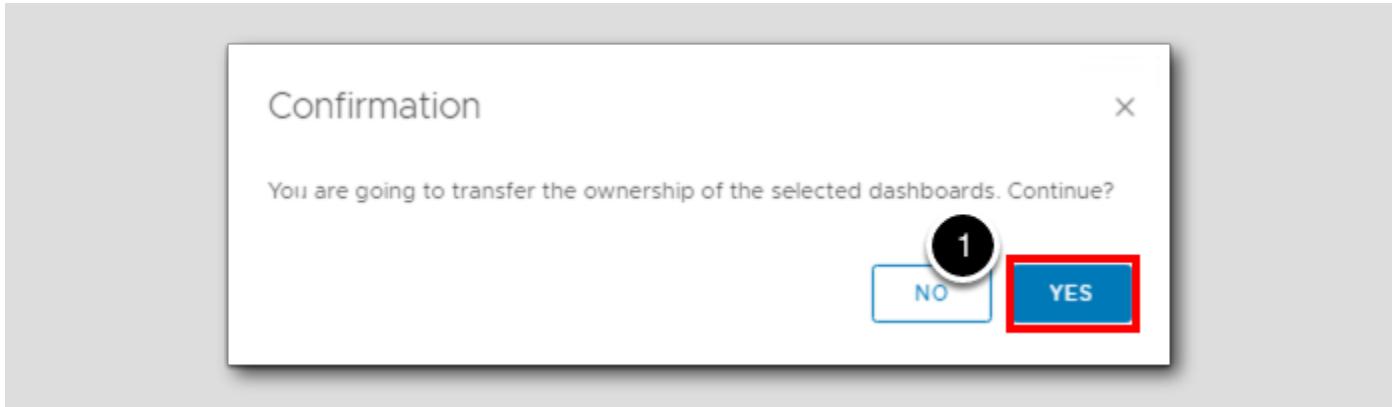


To assign ownership to the intern1 user:

1. Click the **New Owner** drop-down and select intern1 (Local User) from the list of users.
2. Click **SAVE CHANGES**.

## Confirm Change of Ownership

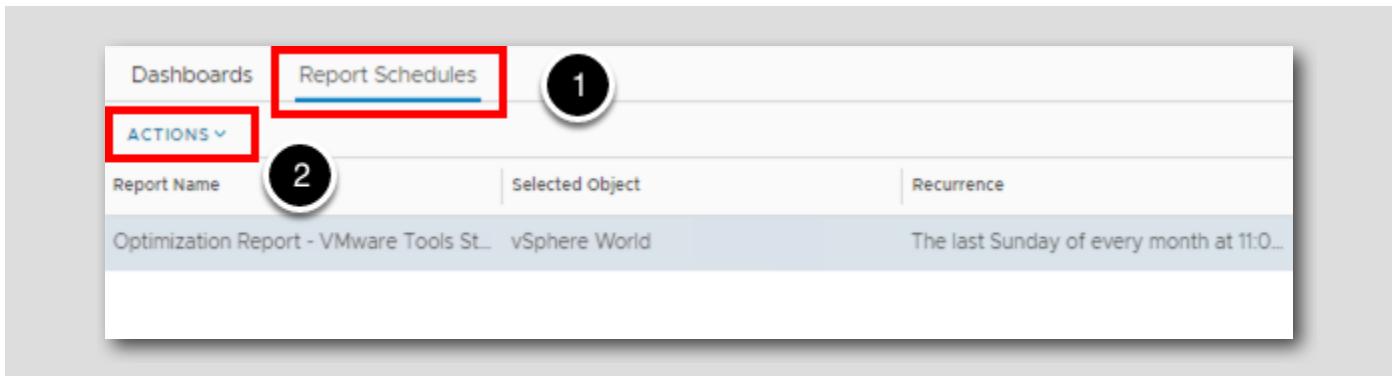
[386]



1. Confirm the transfer by clicking **YES**.

## View Report Schedules

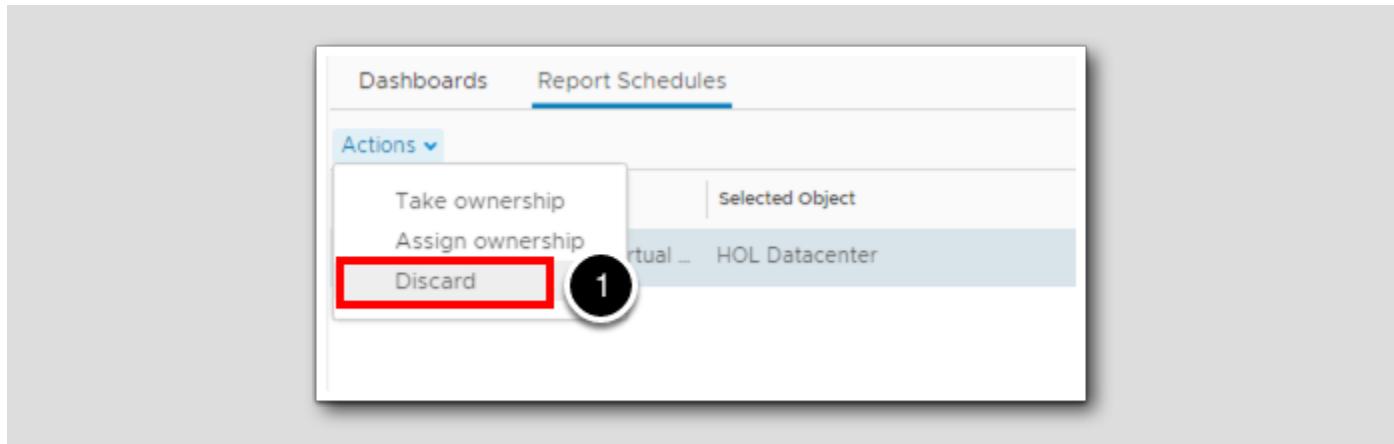
[387]



The hol-retired user's dashboard no longer shows up as orphaned content and that dashboard has been reassigned to the user intern1. However, hol-retired also had scheduled a report to be run monthly.

1. Click **Report Schedules**.
2. Click **Actions**.

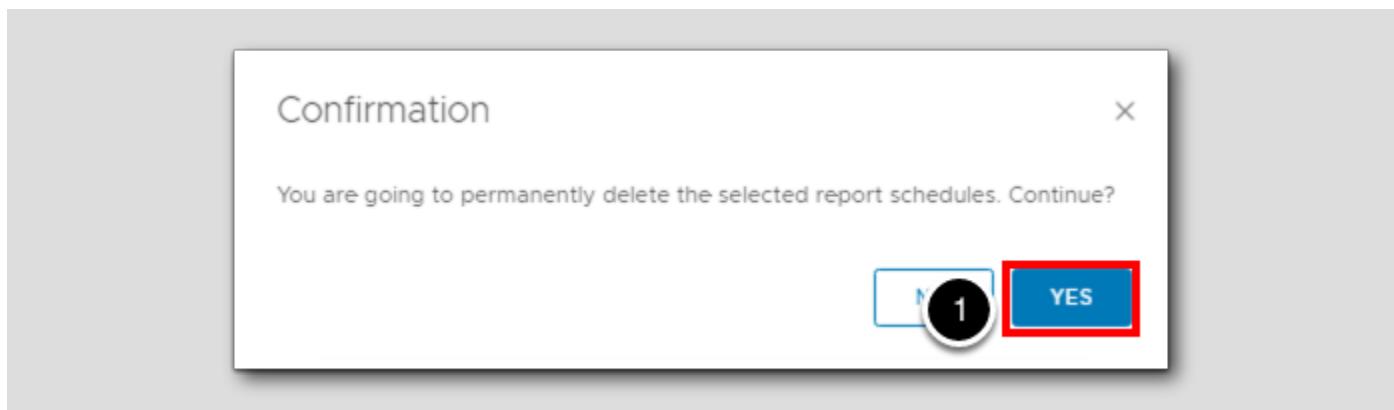
## Delete the Report Schedule



Let's assume that we don't need to keep any of hol-retired's report schedules.

1. Go ahead and click **Discard** to delete the report schedule.

## Confirm Deletion



1. Click **YES** to confirm the deletion.

## Lesson Conclusion

You just went through the process of deleting a user in vRealize Operations. Since that user owned some content when the account was deleted (a dashboard and a report schedule), the content was "orphaned". You learned how to manage that orphaned content.

## Auditing Users and the Environment

At times you might need to provide documentation as evidence of the sequence of activities that took place in your vRealize Operations Manager environment. Auditing allows you to view the users, objects, and information that is collected. To meet audit requirements, such as for business critical applications that contain sensitive data that must be protected, you can generate reports on the activities of your users, the privileges assigned to users to access objects, and the counts of objects and applications in your environment.

Auditing reports provide traceability of the objects and users in your environment.

## Audit Reports

There are 4 preconfigured audit reports in vRealize Operations Manager to provide documentation to support traceability of objects and users in your environment:

1. System Audit
2. Users Permissions Audit
3. User Activity Audit
4. System Component Audit

They can all be found under **Administration > History > Audit**. We are going to look at each of these reports in this lesson.

## User Activity Audit

The screenshot shows the vRealize Operations Manager interface. The top navigation bar has tabs for Home, Dashboards, Alerts, Environment, and Administration (which is highlighted with a red box and circled with number 1). Below the navigation is a secondary menu with tabs for System Audit, User Permissions Audit, User Activity Audit (highlighted with a red box and circled with number 3), and System Component Audit. The main content area displays a log of user activity with a starting line of 1 and 1000 lines. The log entries include timestamps, user IDs, names, and log categories like AUTHENTICATION\_LOGIN and AUTHENTICATION\_LOGOUT. A sidebar on the left shows navigation sections like Solutions, Inventory, Policies, Access, Configuration, Management, History (with Audit selected), and Recent Tasks.

The User Activity Audit report shows user related logging activity such as login, actions run, changes made and log out.

1. Click Administration
2. Select History > Audit from the navigation pane.
3. Select the User Activity Audit tab.

## Report Options

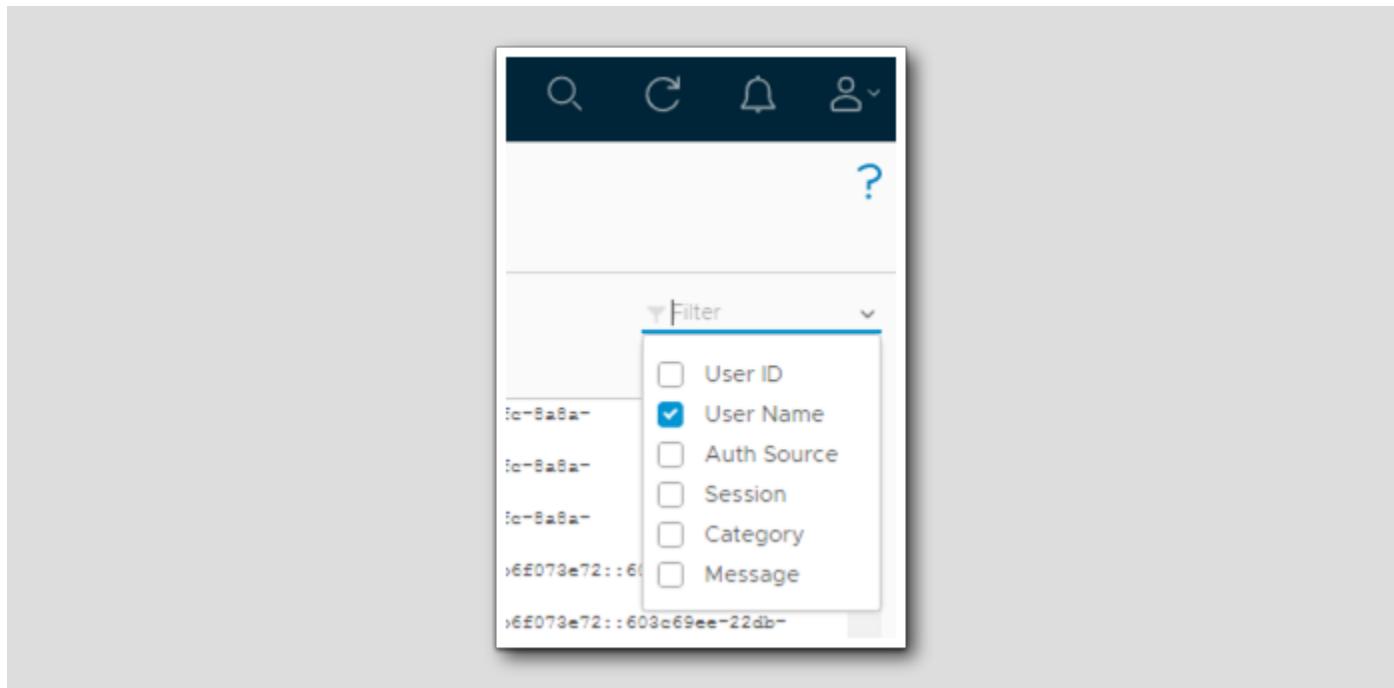
This screenshot shows the report options for the User Activity Audit. It includes fields for 'Starting Line' (set to 1) and 'Number of Lines' (set to 1000), along with standard export icons (CSV, PDF, XML) and a 'GO' button.

The options available from the options bar (from left to right) are:

- Download - download report to PDF or XLS
- Configure - Output log to external syslog server
- Data range - Configure the start and end dates for the report
- Starting Line - Start the report at the specified line
- Number of Lines - Truncate the report to the specified number of lines

## Filter

[395]



You can filter the log entries by various fields, including User ID, User Name, Auth Source, Session, Category and Message. The filter is in the top right of the window.

## User Permissions Audit

The screenshot shows the 'Audit' interface with four tabs: 'System Audit', 'User Permissions Audit' (which is highlighted with a red box and has a circled '1' above it), 'User Activity Audit', and 'System Component Audit'. Below the tabs is a table with two columns: 'User' and 'Role'. One row is visible, showing 'holadmin@corp.local' in the User column and 'Administrator' in the Role column. A green download icon is located at the top left of the report area.

The User Permissions Audit report shows permissions assigned to a user.

1. Select the User Permissions Audit tab

The only option for this report is to download it, to PDF or XLS format.

The report will show the following information about a user:

- Username
- Role
- Access Group(s)
- Access Right(s)

Scroll down to see the bottom of the report to see the user we created in the last lesson, **intern1**. Do the permissions look correct?

## System Audit

Object	Count
Objects Configured	943
Objects Being Collected	786
Object Types	112
Adapters	
AWS Adapter	373
DynamoDB	2
AWS Region	21
AWS Region per Account	42

The System Audit report shows object types, metrics, super metrics, applications and custom groups in your environment, including counts of each. This report can help you to understand the scale of your environment.

1. Select the System Audit tab

The only option for this report is to download it, to PDF or XLS format.

## System Component Audit

The screenshot shows the 'Audit' interface in vRealize Operations Manager. The 'System Component Audit' tab is selected and highlighted with a red box. The report displays a list of components and their associated open source license files. A circled '1' is shown in the top right corner.

**vFabric Postgres**

open\_source\_licenses.txt  
VMware vFabric Postgres 11.10.0 GA

The following copyright statements and licenses apply to various open source software packages (or portions thereof) that are distributed with this VMware Product.

The VMware Product may also include other VMware components, which may contain additional open source software packages. One or more such open\_source\_licenses.txt files may therefore accompany this VMware Product.

The VMware Product that includes this file does not necessarily use all the open source software packages referred to below and may also only use portions of a given package.

TABLE OF CONTENTS

The following is a listing of the open source components detailed in this document. This list is provided for your convenience; please read further if you wish to review the copyright notice(s) and the full text

**vR Ops Operating System**

open\_source\_licenses.txt

The System Component Audit report shows every component installed in the system, including version information.

1. Select the System Component Audit tab

The only option for this report is to download it in plain text format.

## Lesson Conclusion

In this lesson we looked at the different audit reports included with vRealize Operations Manager, and looked at them in the context of our new user. These reports provide an easy way to provide documentation of activities that have taken place in your environment and user permission levels. Auditing reports provide traceability of the objects and users in your environment.

## Conclusion

In this module we walked through the Users and Roles in vRealize Operations. Access Control is an important part of a robust operational environment, and you should now be comfortable using users, groups, roles and object permissions to make sure users only have access to the content and objects needed.

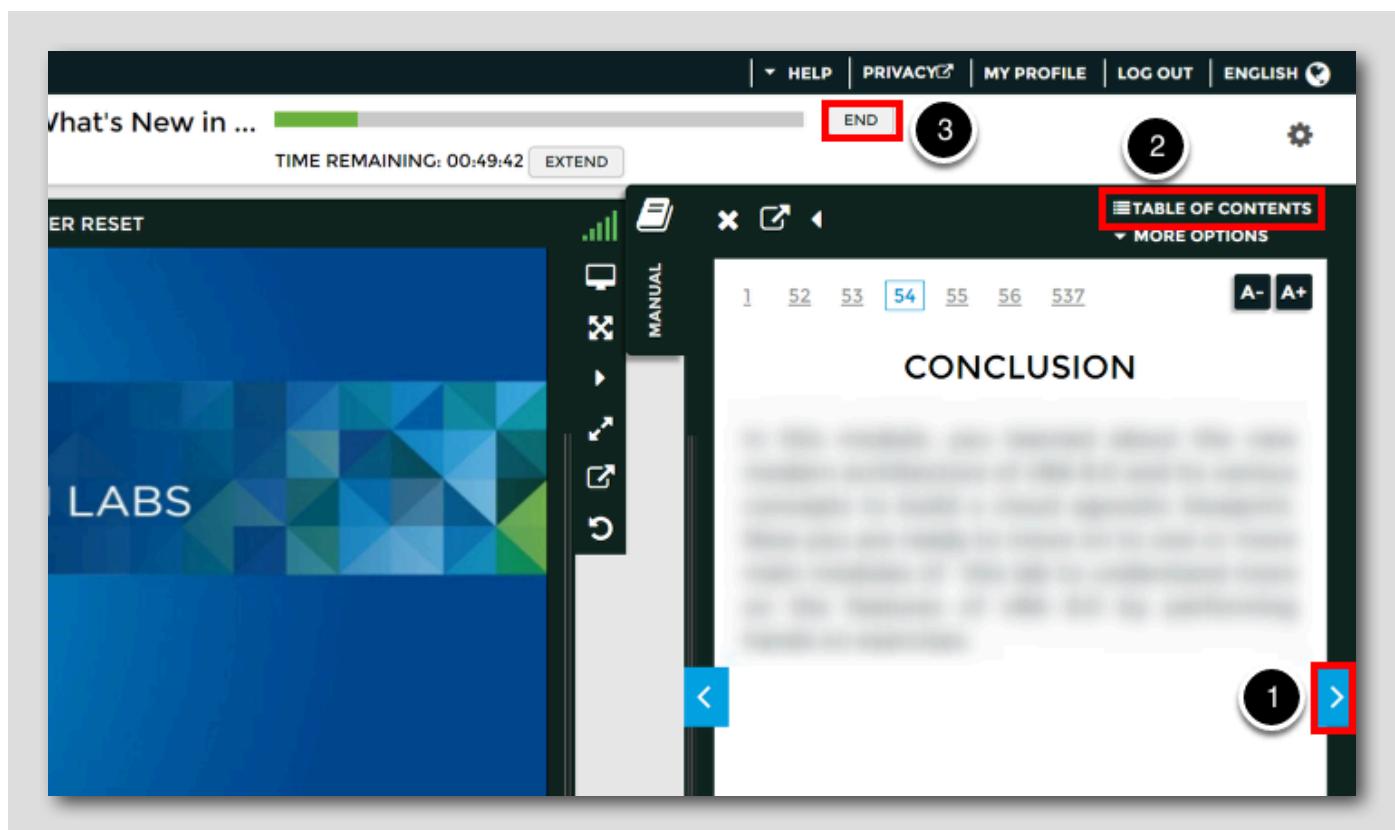
We then looked at dashboard sharing- how to control which users see which dashboards.

We saw how you can manage content that is orphaned when the owner of the content is removed from vRealize Operations.

Finally, we reviewed how to audit user actions and configured permissions as well as some system configurations.

You've finished Module 4

[401]



Congratulations on completing the lab module.

If you are looking for additional general information on vRealize Operations 8.4, try one of these:

- VMware Product Public Page - vRealize Operations: <https://www.vmware.com/products/vrealize-operations.html>
- vRealize Operations 8.4 - Release Notes: <https://docs.vmware.com/en/vRealize-Operations-Manager/8.4/rn/vRealize-Operations-Manager-84.html>
- vRealize Operations 8.4 - Documentation: <https://docs.vmware.com/en/vRealize-Operations-Manager/8.4/com.vmware.vcom.core.doc/GUID-7E6B5805-3D2F-41C4-ADFF-B7248386E7AC.html>
- VMware Cloud Management Blog - What's New in vRealize Operations 8.4 and Cloud: <https://blogs.vmware.com/management/2021/04/whats-new-in-vrealize-operations-8-4-and-cloud.html>

From here you can:

1. Click to advanced to the next page and continue with the next lab module
2. Open the TABLE OF CONTENTS to jump to any module or lesson in this lab manual
3. Click on the END button if you are done with the lab for now and want to exit

## Module 5 - Create Super Metrics Using the Super Metric Editor (30 minutes)

### Introduction

[403]

In this module you will learn about super metrics in vRealize Operations - how to create them and how to choose where they are calculated.

Super metrics have been available in vRealize Operations since the first version of the product. However, in newer versions VMware introduced a new way in the user interface to create, edit and apply super metrics to object types.

#### What is a Super Metric?

In vRealize Operations a super metric is a mathematical formula that contains one or more metrics or properties. It is a custom metric that you design to help track combinations of metrics or properties, either from a single object or from multiple objects. If a single metric does not inform you about the behavior of your environment, you can define a super metric.

After you define it, you assign the super metric to one or more object types. This action calculates the super metric for the objects of that object type and simplifies the metrics display. For example, you define a super metric that calculates the average CPU usage on all virtual machines, and you assign it to a cluster. The average CPU usage on all virtual machines in that cluster is reported as a super metric for the cluster.

You can define whether or not super metrics are calculated for a given group of objects by enabling or disabling them in the policy that is applied to that group of objects.

Because super metric formulas can be complex, plan your super metric before you build it. The key to creating a super metric that alerts you to the expected behavior of your objects is knowing your own enterprise and data.

### Log in to vRealize Operations

[404]

To begin this exercise, we will log in to vRealize Operations.

If your browser isn't already open, launch Google Chrome

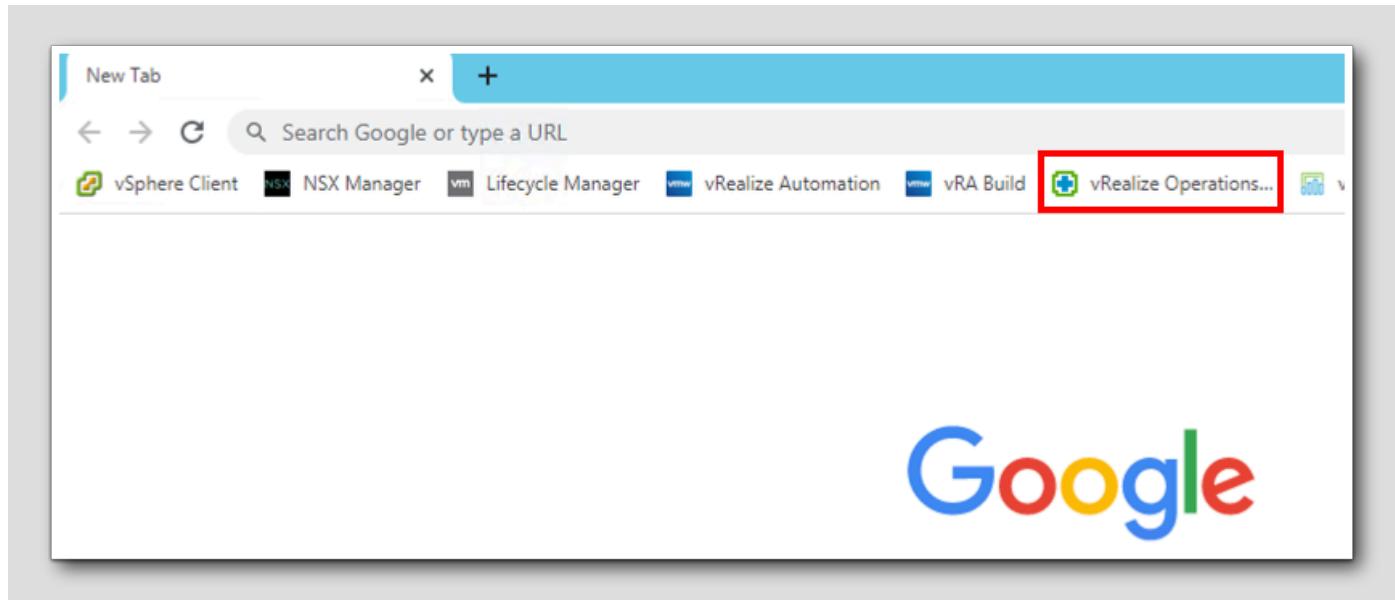
1. Click the **Chrome** icon on the Windows Quick Launch Task Bar
  
1. For username, type **admin**
2. For password, type **VMware1!**
3. Click **LOG IN** to log in

### Open the Chrome Browser from Windows Quick Launch Task Bar

[405]

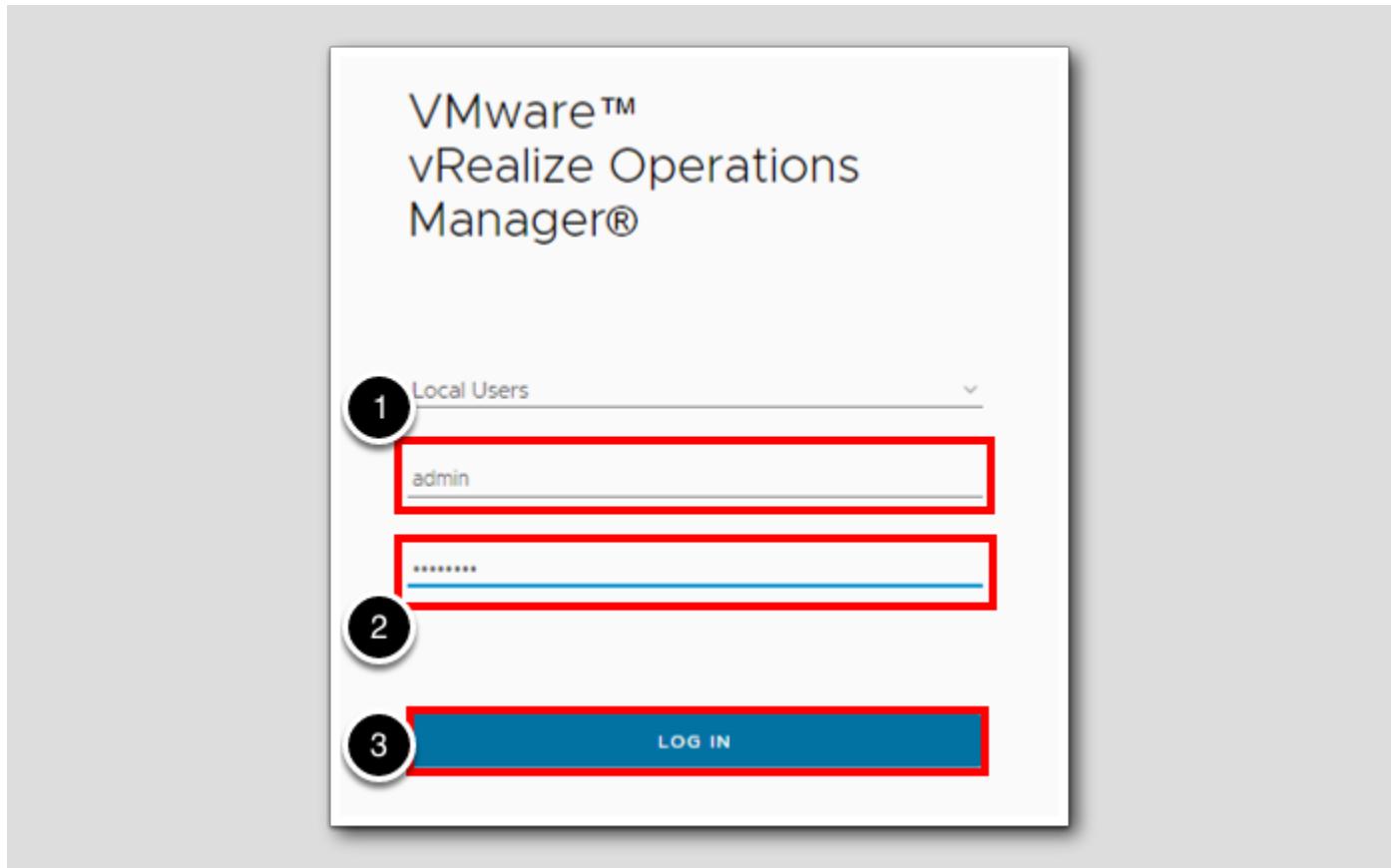


## Navigate to vRealize Operations



1. Click the vRealize Operations Manager bookmark to navigate to vRealize Operations.

## Log in to vRealize Operations

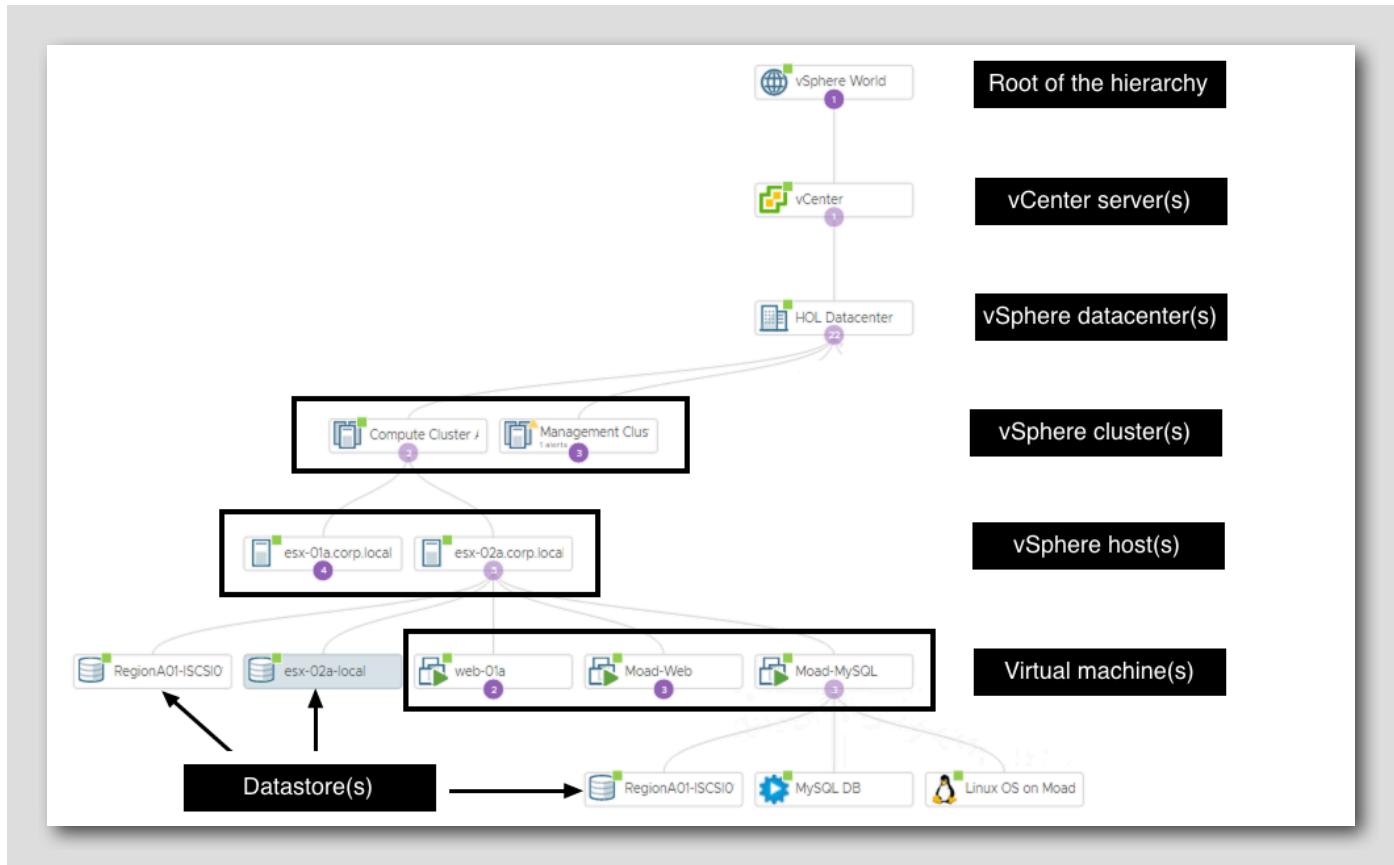


## Understanding Hierarchical Relationships in vRealize Operations

Before we jump into creating super metrics, it is first important to understand that vRealize Operations maintains several hierarchical relationship trees. And whenever you install additional management packs for extensibility, each management pack will add at least one additional hierarchy in vRealize Operations.

This is important to understand in the context of super metrics because unless you are creating a new metric on an object or object type that is based only on metrics from that same object/object type you will need to know where in the hierarchy the related object types are. For example, in the vSphere Hosts and Clusters hierarchy, a virtual machine is a child of a host. If you want to create a super metric for hosts that shows the average CPU usage across all virtual machines that are running on a given host, you need to write your super metric formula with the proper syntax to look one level down from the host to the virtual machines for the metric inputs to the super metric.

## vSphere Hosts and Clusters Hierarchy



We will focus here on the vSphere Hosts and Clusters hierarchy because that's the one we will be using for the examples in this lab module. The hierarchy is shown in the graphic. There would also be other object types in the hierarchy if they existed in our lab vCenter server (for example, resource pools).

For this hierarchy you can see that virtual machines are two levels below clusters. And that vSphere hosts are one or two levels above datastores (this dual relationship can be found in other places as well). In the super metric formulas, the relationship distance (number of hops) is represented by the **depth** parameter and we will use that parameter in some examples later in this module.

## Environment Tab

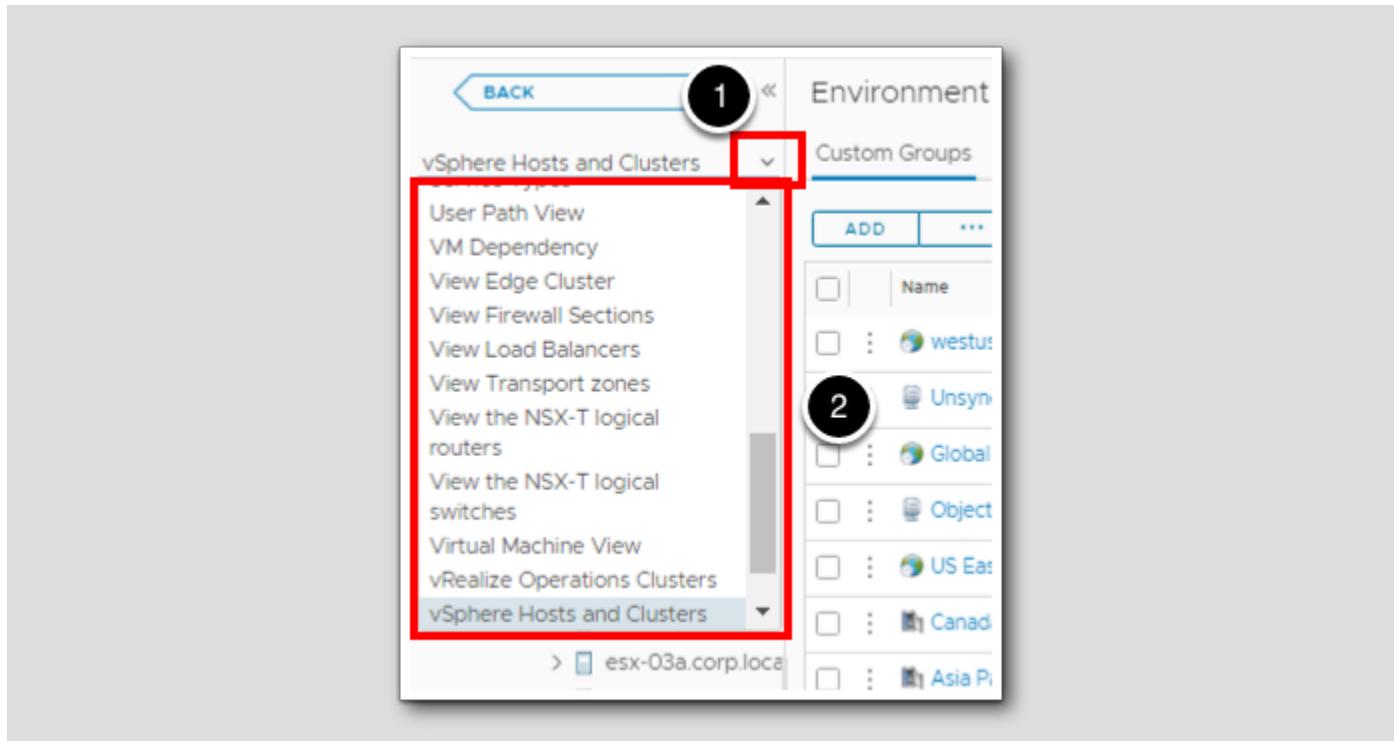
The screenshot shows the vRealize Operations Manager interface. The top navigation bar has tabs for Home, Dashboards, and Environment, with Environment highlighted by a red box and circled with a number '1'. Below the navigation is a search bar with a user icon and the text 'CK'. The left sidebar has a dropdown menu and a 'vSphere Hosts and Clusters' section, which is also highlighted by a red box and circled with a number '2'. Under 'vSphere Hosts and Clusters' is a tree view of 'vSphere World' objects, including 'Private Cloud', 'RegionA01', 'Workload 1', and several specific hosts like 'esx-03a.corp.loc'. This tree view is also highlighted by a red box and circled with a number '3'. The main content area is titled 'Environment Overview' and contains tabs for Custom Groups, Custom Datacenters, Cloud Zones, and Applications. Below these tabs is a table with columns for Name, Status, and Actions, listing various objects like 'westus - 306a111a-668b-4250-8b8f-79cc18a62a6a', 'Unsynchronized Agents', and 'Global - 260598382744'.

To see another way of looking at the vSphere Hosts and Clusters hierarchy within vRealize Operations:

1. Click Environment on the main navigation bar
2. Click vSphere Hosts and Clusters (not shown) to show the vSphere World object
3. Expand the vSphere Hosts and Clusters hierarchy by clicking the > arrows

The levels of indentation in this view indicate the relative depth of each object type.

## Object Hierarchies



To see the available hierarchies within vRealize Operations:

1. Click the v to expand the list of hierarchies
2. Note all of the available hierarchies in this vRealize Operations instance

As stated earlier, if additional management packs were installed for extensibility (for example, NetApp or Dell EMC storage) hierarchies for those objects would also be here.

## Create Your First Super Metric

In this first example, we will create a simple super metric and explore the depth parameter in a super metric formula.

Your first assignment is to create a super metric that will calculate the average memory utilization across all virtual machines running on a vSphere host or in a vSphere cluster. This is an example of creating a metric on an object (host or cluster) that is based on metrics from related objects (virtual machines).

## The Hierarchical Relationship



If you recall from a previous lesson, we learned that virtual machines are children of hosts and "grandchildren" of clusters in the vSphere Hosts and Clusters hierarchy. So if we create a super metric on the cluster object type and on the host object type and have it look one or two levels down the hierarchy to create the sum of the metric representing memory usage on virtual machines, we will have completed the assignment for this lesson.

## Which Metric Will We Be Using?

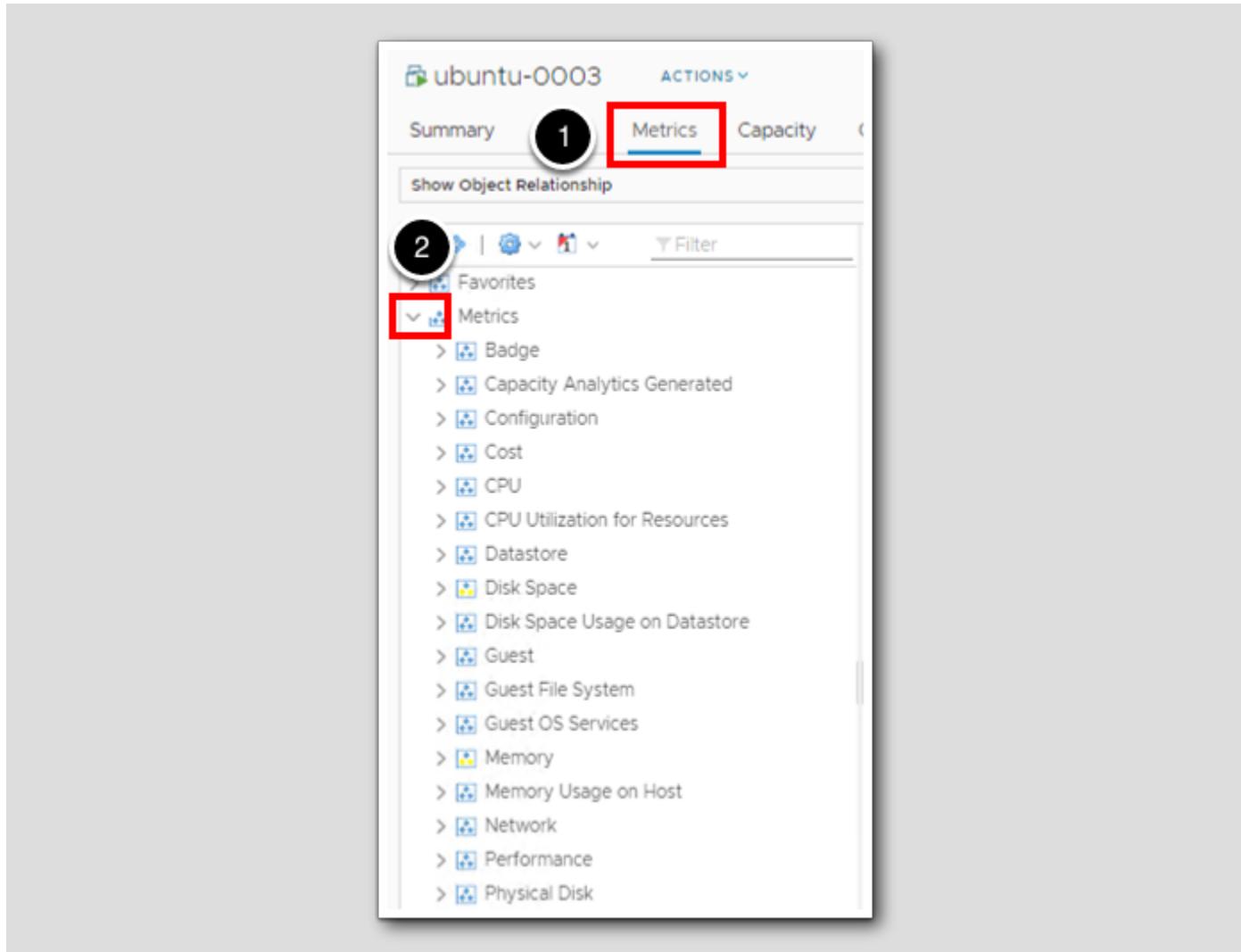


Before we get started with the super metric, let's understand which virtual machine metric we will be using for this lesson. Since we want to average a vm metric (memory utilization), let's go find a vm to see what metrics are available. We will take a look at the ubuntu-0003 virtual machine.

1. Click the global search magnifying glass icon in the navigation bar (not shown) to expand the search box
2. In the search box, type **ubuntu**
3. Click the **ubuntu-0003** link under the Virtual Machine object type

Expand the All Metrics Tree

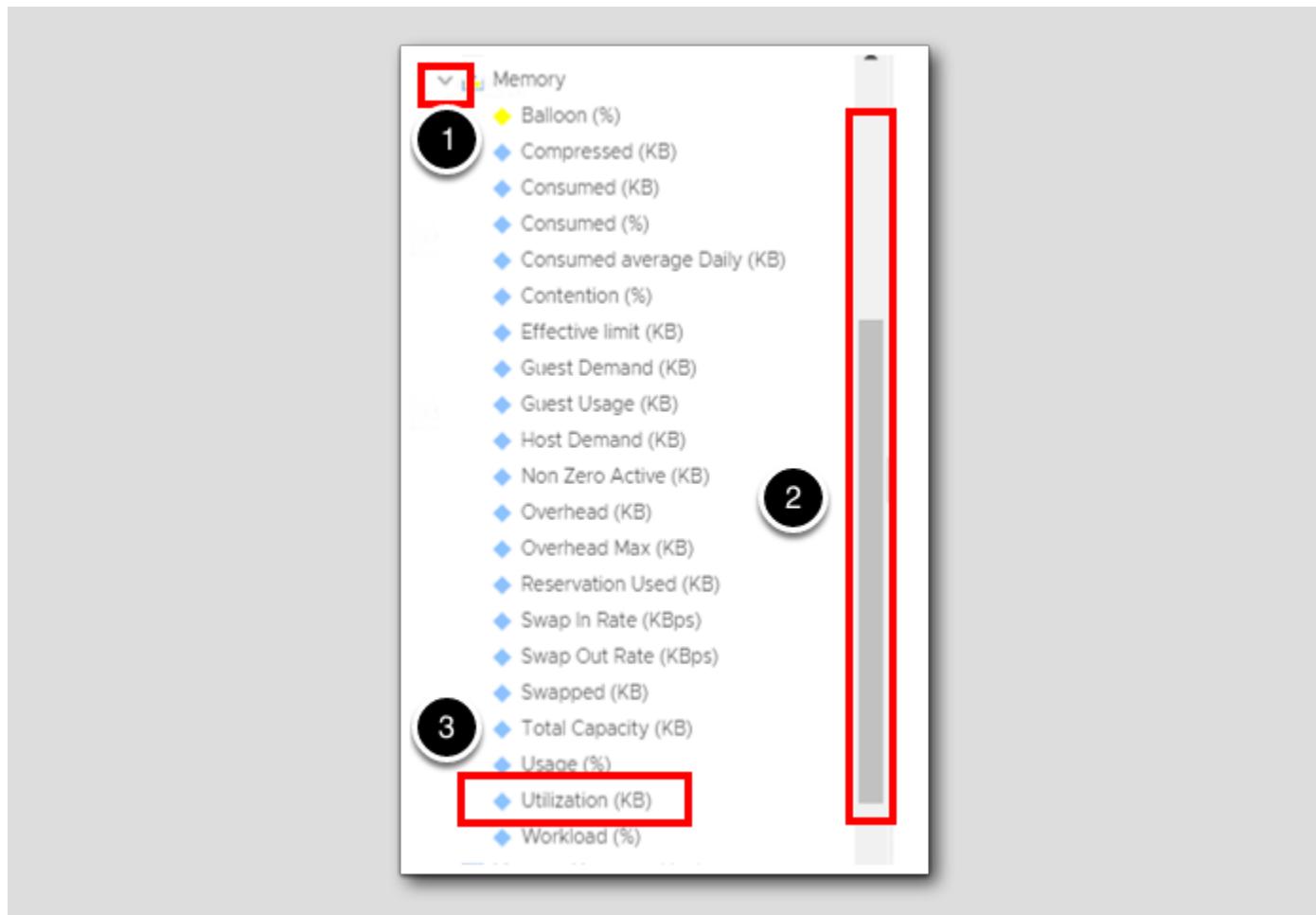
[415]



1. On the ubuntu-0003 object page, click the Metrics tab
2. Click the > to expand the Metrics section

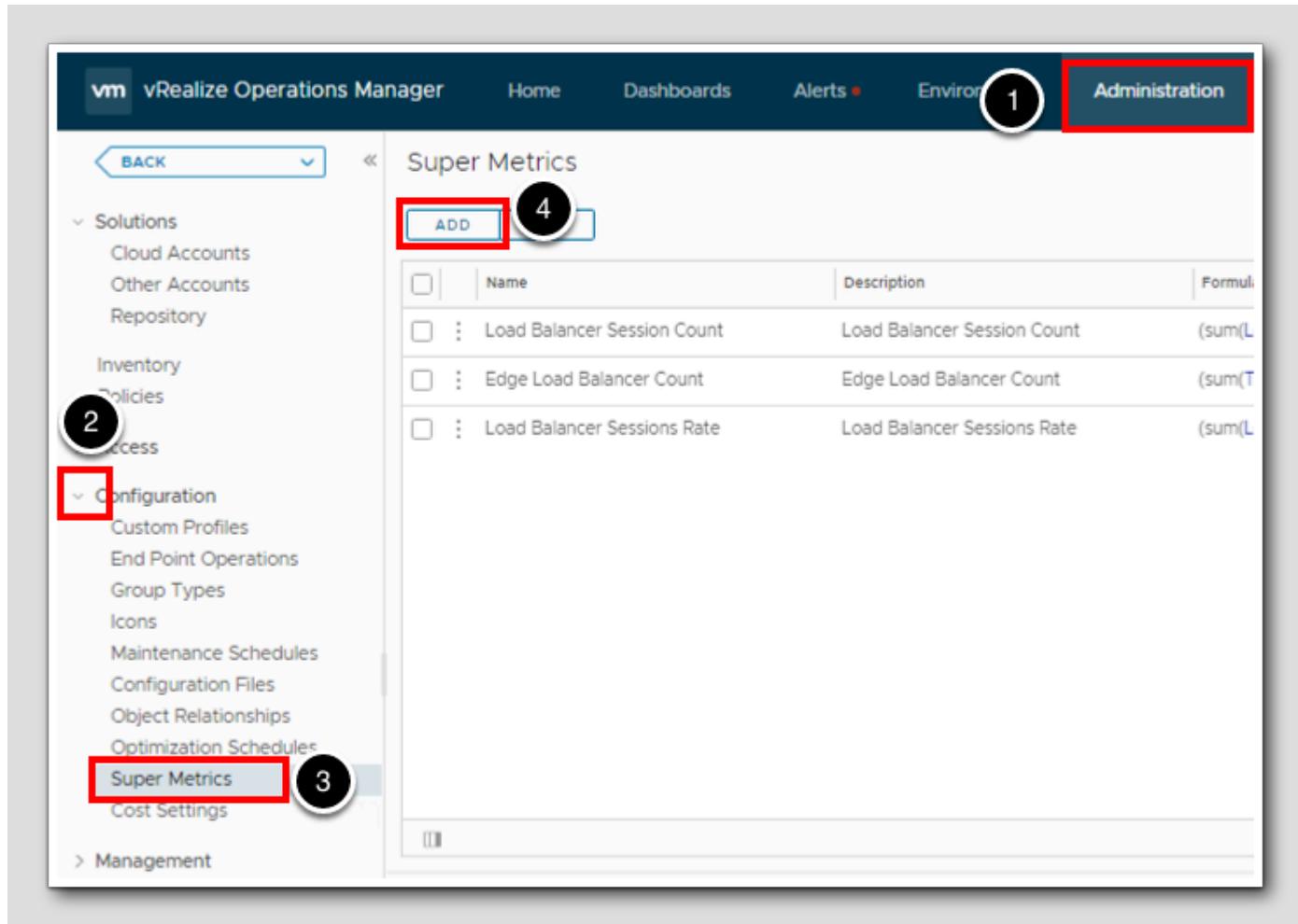
### Expand the Memory Metric

[416]



1. Click the > to expand the Memory section
2. Scroll down to see the list of available memory metrics
3. Note the Utilization (KB) metric - this is the metric we will be using to create our super metric.

## Create The Super Metric



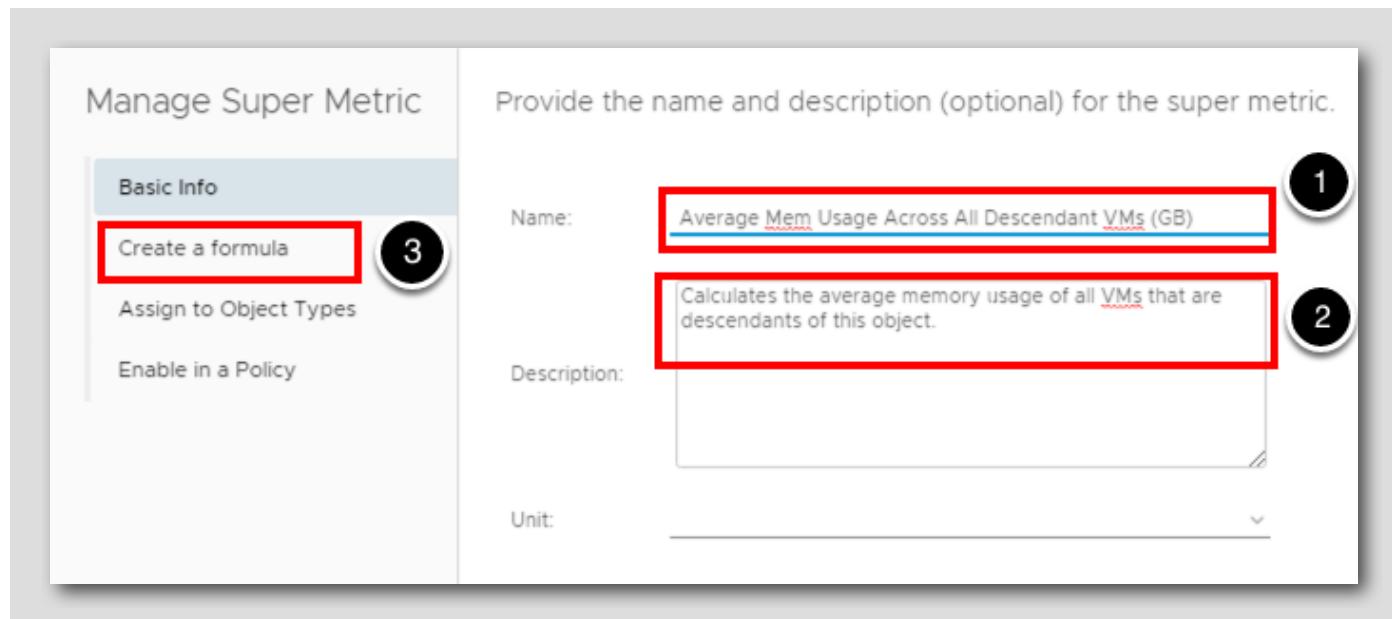
Now that we know which virtual machine metric we will be using, let's navigate to the new super metric editor window. The new super metric workspace can be found in the Administration section of vRealize Operations.

1. Click **Administration** in the main navigation bar
2. Expand the **Configuration** group
3. Click **Super Metrics**

Note that some super metrics already exist. These have been added by management packs.

4. Click **ADD** to create a new super metric

## Basic Info



Let's enter some basic information about the super metric. You want to create a name that is descriptive enough so you or others will understand what it is calculating when you use it later in dashboards or reports or alert definitions. It is also a good idea to include the unit of measure in the metric name - in this case we will calculate the value in gigabytes (GB).

1. In the Name field, type Average Mem Usage Across All Descendant VMs (GB)
2. In the Description field, type Calculates the average memory usage of all VMs that are descendants of this object.
3. Click either the next step in the wizard, Create a formula, or click the NEXT button (not shown) in the lower right corner of the wizard.

## The vRealize Operations Super Metric Formula Editor

Manage Super Metric

Basic Info

Create a formula

Assign to Object Types

Enable in a Policy

Create a formula

Formula

Functions Operators THIS

Type your formula here. For hints use **ctrl + space.**

1

2

If you haven't used a recent version of vRealize Operations this screen may look a little different. We'll cover some of newer features and differences as we build out our super metric.

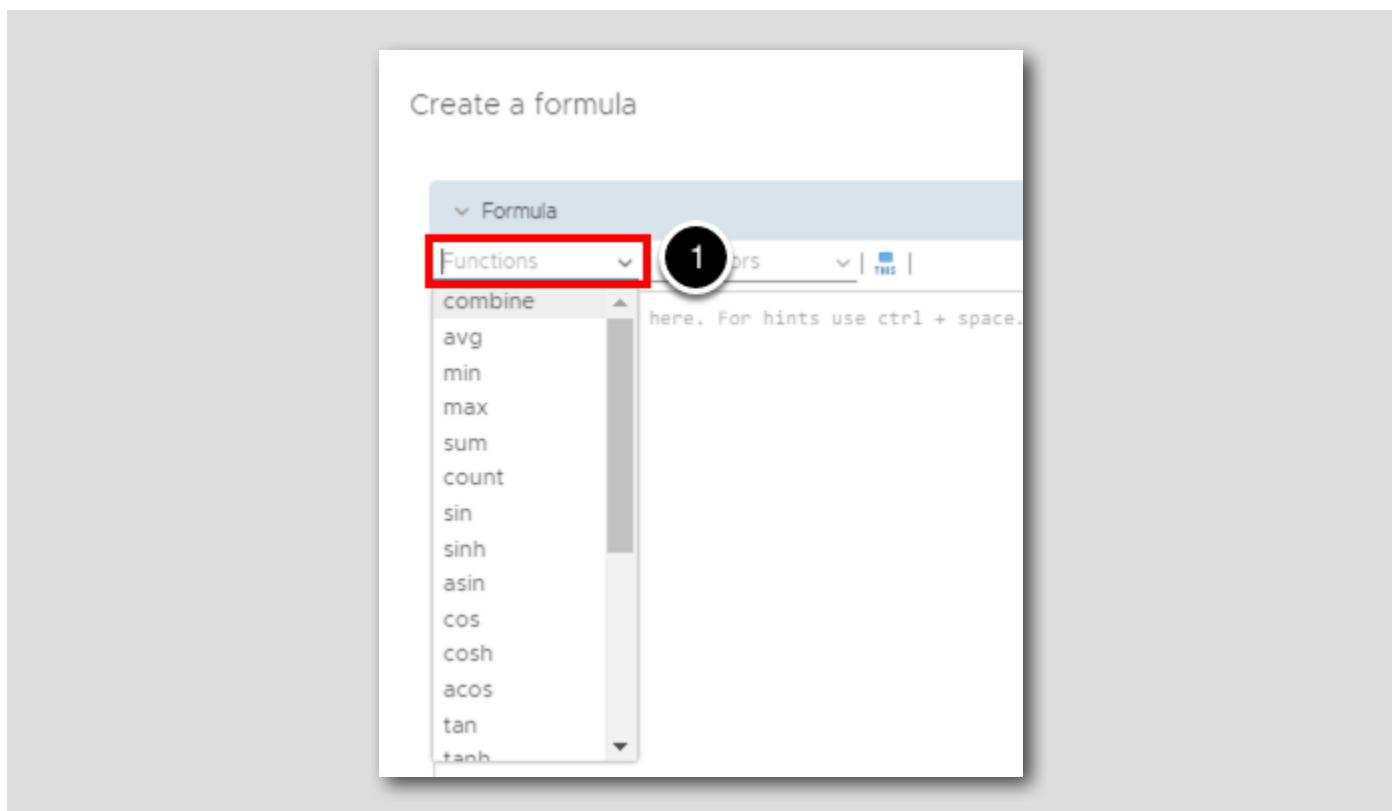
The previous editor workspace had buttons above for Show Formula Description and for Preview.

1. You will see that Preview is now its own expandable section that we will use later in this lesson.
2. If you are familiar with the legacy editor and want to use it to create your formula, you can expand the Legacy section and the UI will revert to that legacy editor.

Note that if you do expand the Legacy section and want to get back to the new editor, just click the arrow on the Legacy header to minimize it.

## Formula Functions

[420]



1. Click the **Functions** drop-down to see a list of all available functions

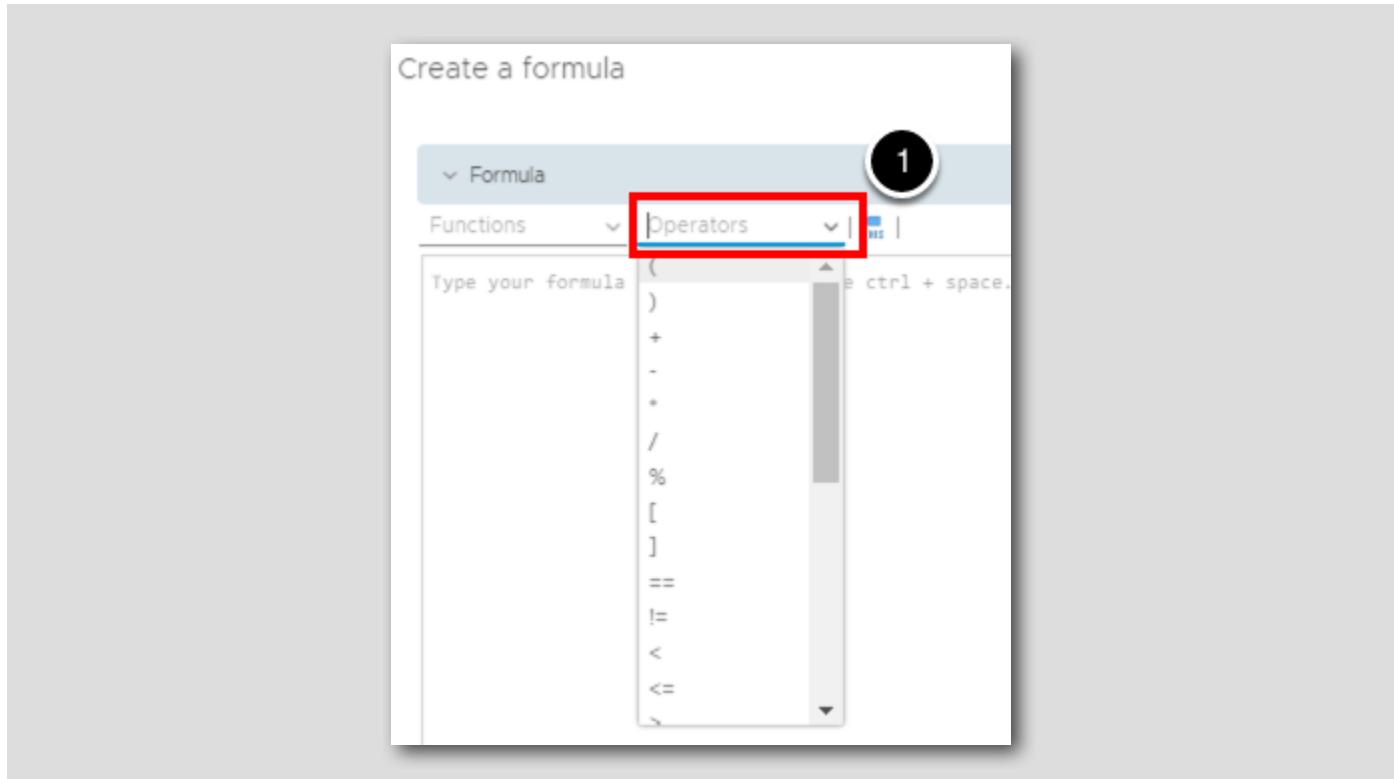
The list includes looping functions (avg, combine, count, max, min and sum) that work on more than one input value and can return either a single value or a set of values depending on the formula syntax. The remainder of the functions are single functions. They work on only a single value or a single pair of values.

To better understand the concept of looping functions, think about the example metric we are going to create in this lesson. We want to look for all descendant virtual machines (could be one or could be many), get the value for memory usage for each of those virtual machines, and then calculate an average of those values which we will then store a single super metric on our object (in this case a vSphere host or cluster). In the process, we will use a looping function to "loop through" all of the descendant virtual machines to get the memory usage metric value for each one.

Note: The product documentation for super metric functions and operators can be found [here](#).

## Formula Operators

[421]

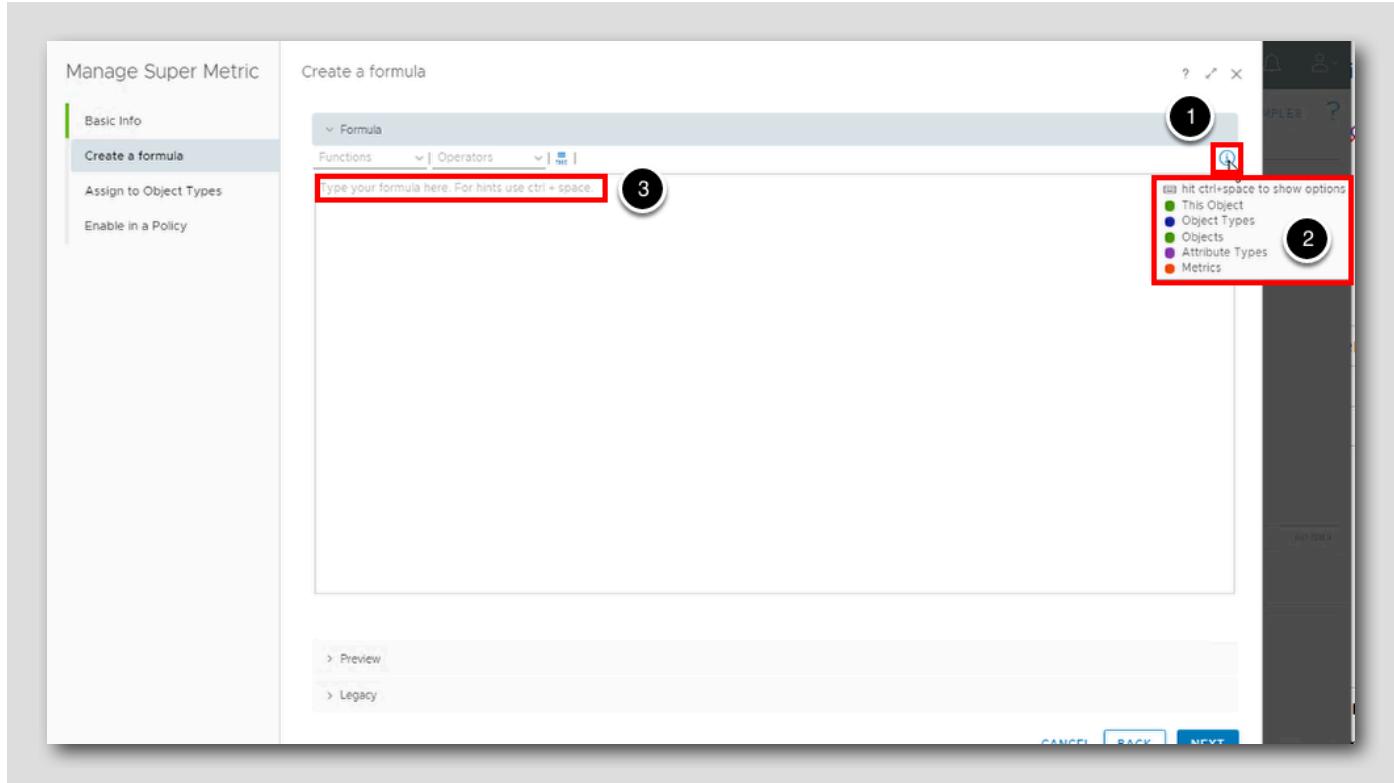


Operators are mathematical symbols and text to enclose or insert between functions. There are numerical operators and string operators

1. Click the **Operators** drop-down to see a list of all available operators.

Note that string operators are only valid in 'Where' condition clauses. We will take a look at some different operators in the upcoming pages.

## New Way To Interact With The Formula Editor

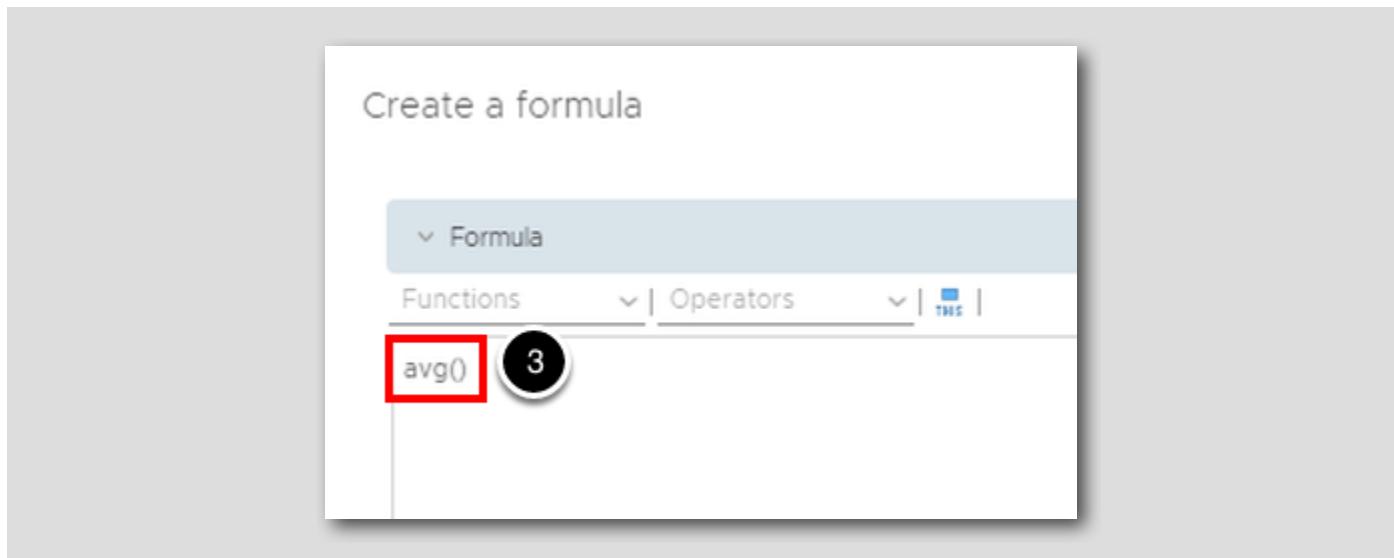
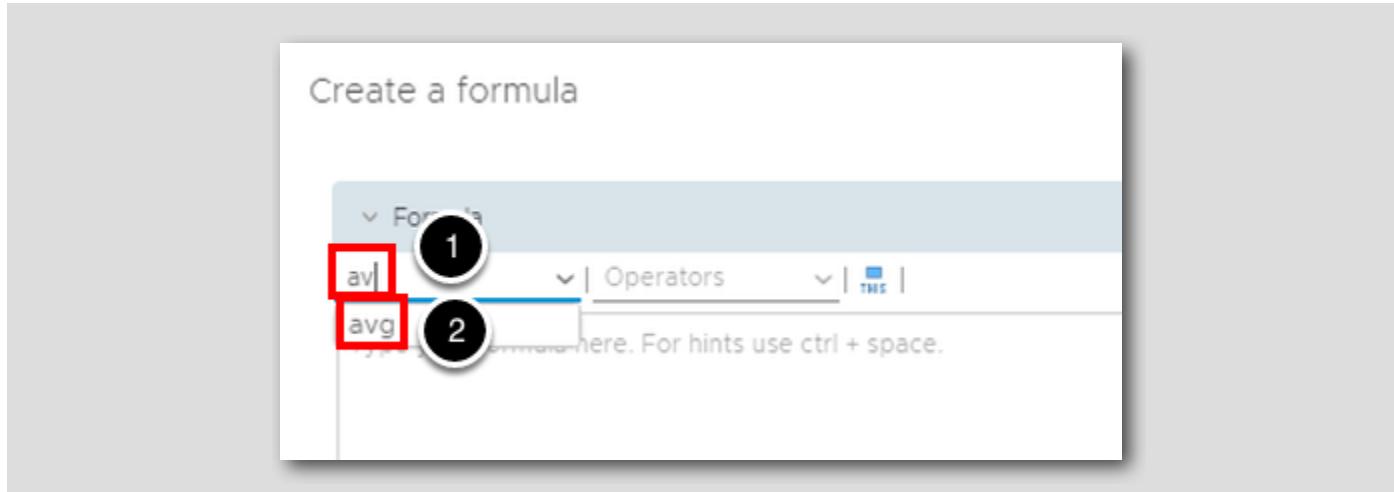


The editor is context sensitive and has hints to help guide you when creating a formula. To see some helpful hints,

1. Hover your mouse over the information icon.
2. Note the hint that you can use the **ctrl+space** keyboard combination (hold the Ctrl key then press the Space key) to show options whenever you are creating a super metric formula. Also note that various components will be color-coded according to the legend shown.
3. In the formula workspace, you see the tip that you can either start typing your formula or use the **ctrl+space** key combination for hints.

We will be making use of the **ctrl+space** combination in the following steps.

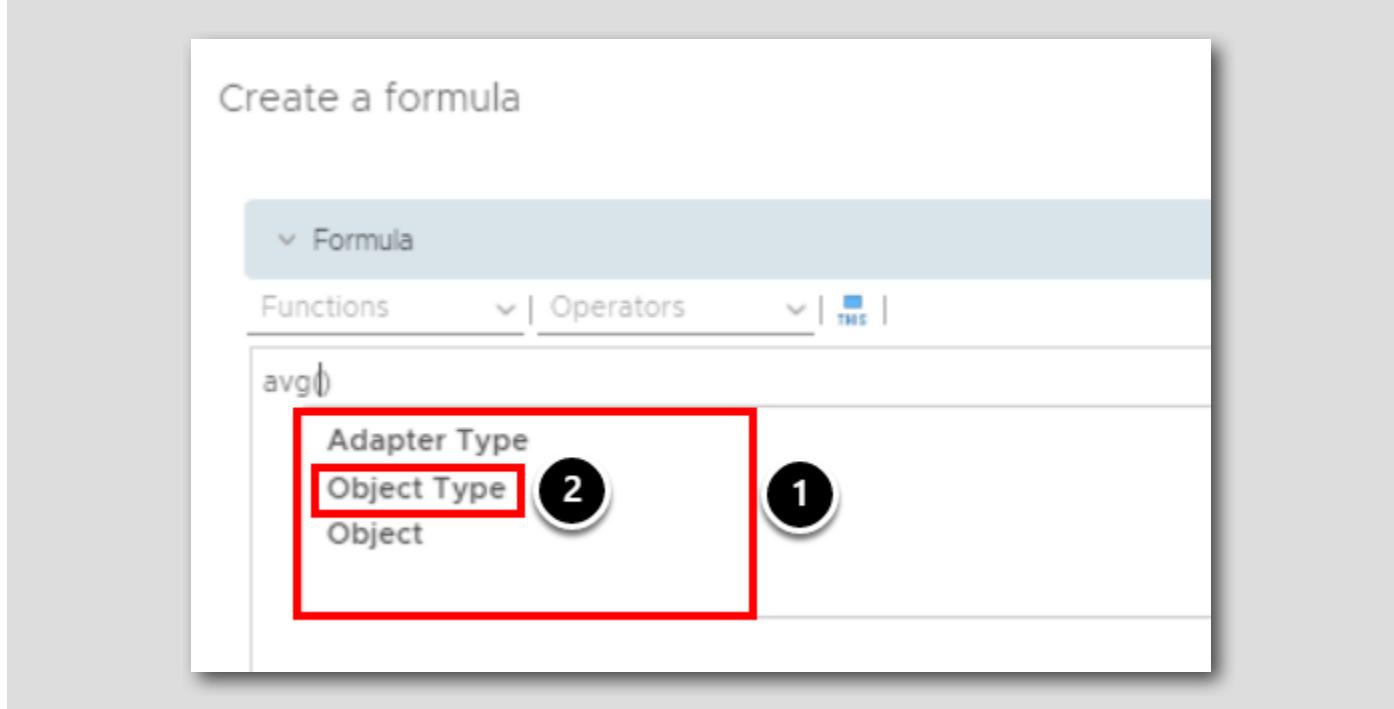
## Start Creating the Super Metric Formula



Recall that we want to create an average of the memory usage across all virtual machines on hour host or in our datacenter so let's start by adding the **avg** function to our formula.

1. You can either click the drop-down list and select your function or you can start typing the function. Type **av** (avg will be presented as a match to what you typed).
2. Click on **avg** to add it to your formula line below.
3. Note that the function is added to your formula line, it includes the parentheses and your cursor is placed between the two parenthesis.

## Continue Creating the Formula



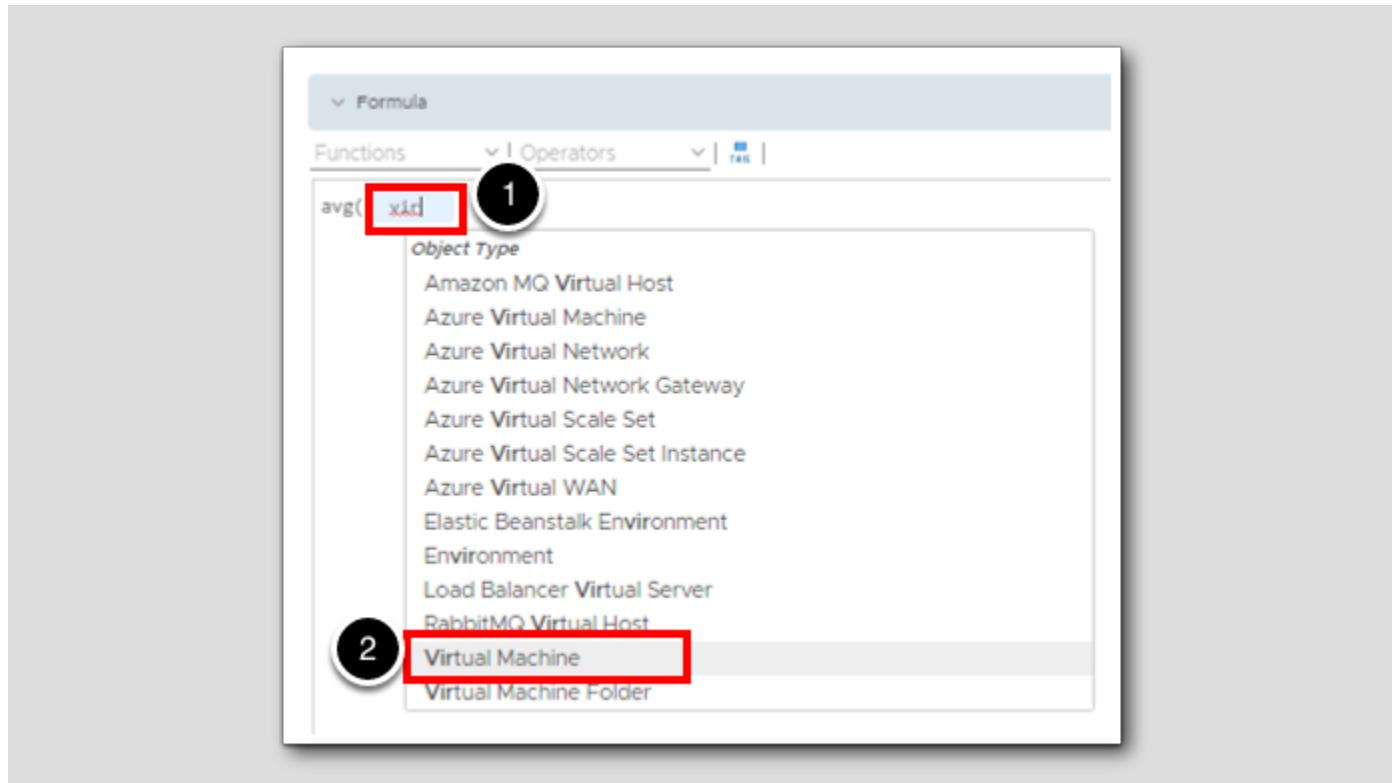
1. Let's get a hint about what we can do next. Use the **ctrl+space** key combination on the keyboard.

Note you are presented with three choices here:

- Adapter Type. Use this if you aren't sure what object type (for example virtual machine, host, etc.) to use but you know what adapter type (for example vCenter, NetApp, MS SQL, etc.) is it defined by. Once you select the adapter type you can drill from there to the object type an ultimately to the attribute, property or metric.
- Object Type. Use this if you know the object type.
- Object. Use this if you want to get an attribute from a specific object (for example the ubuntu-0003 virtual machine).

2. In this case, we know we want to average the memory usage metric across one or more virtual machines (an object type) so click **Object Type**

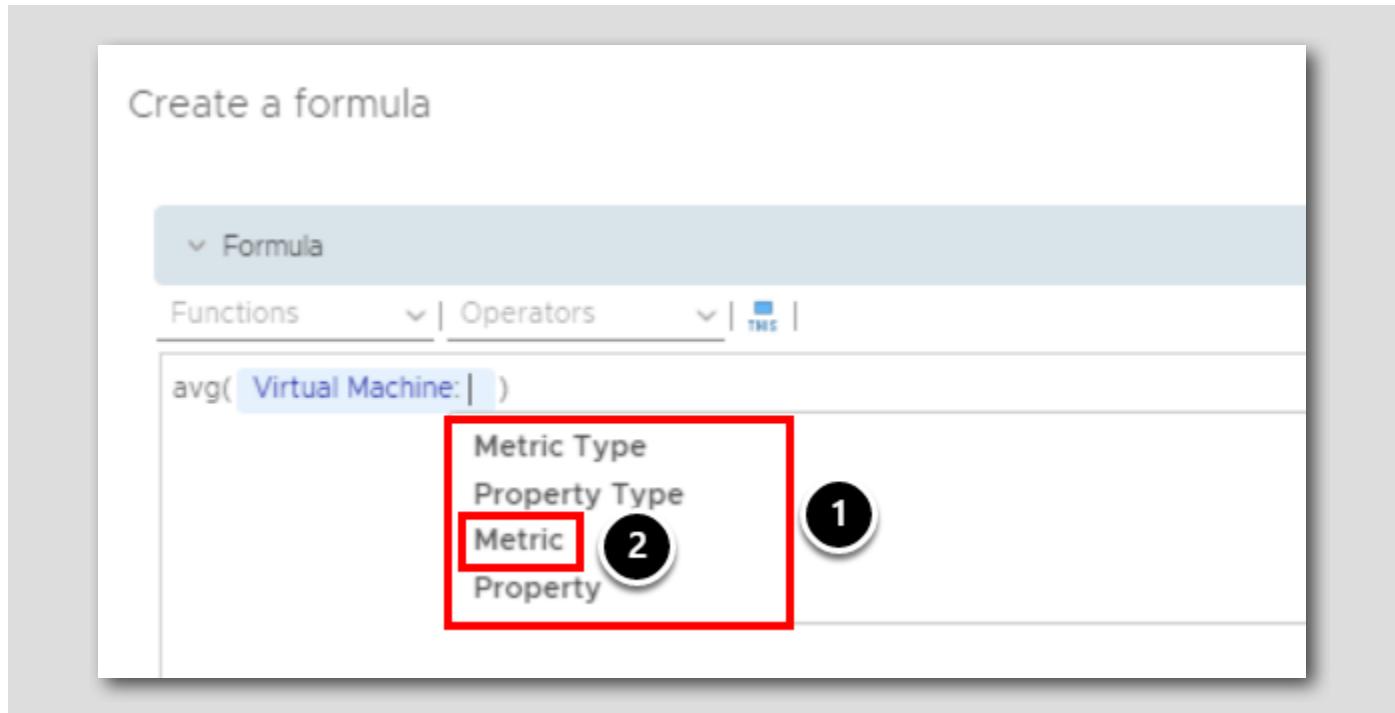
## Select the Virtual Machine Object Type



You could scroll down the list of object types until you see Virtual Machine but let's make use of some filtering to make things easier.

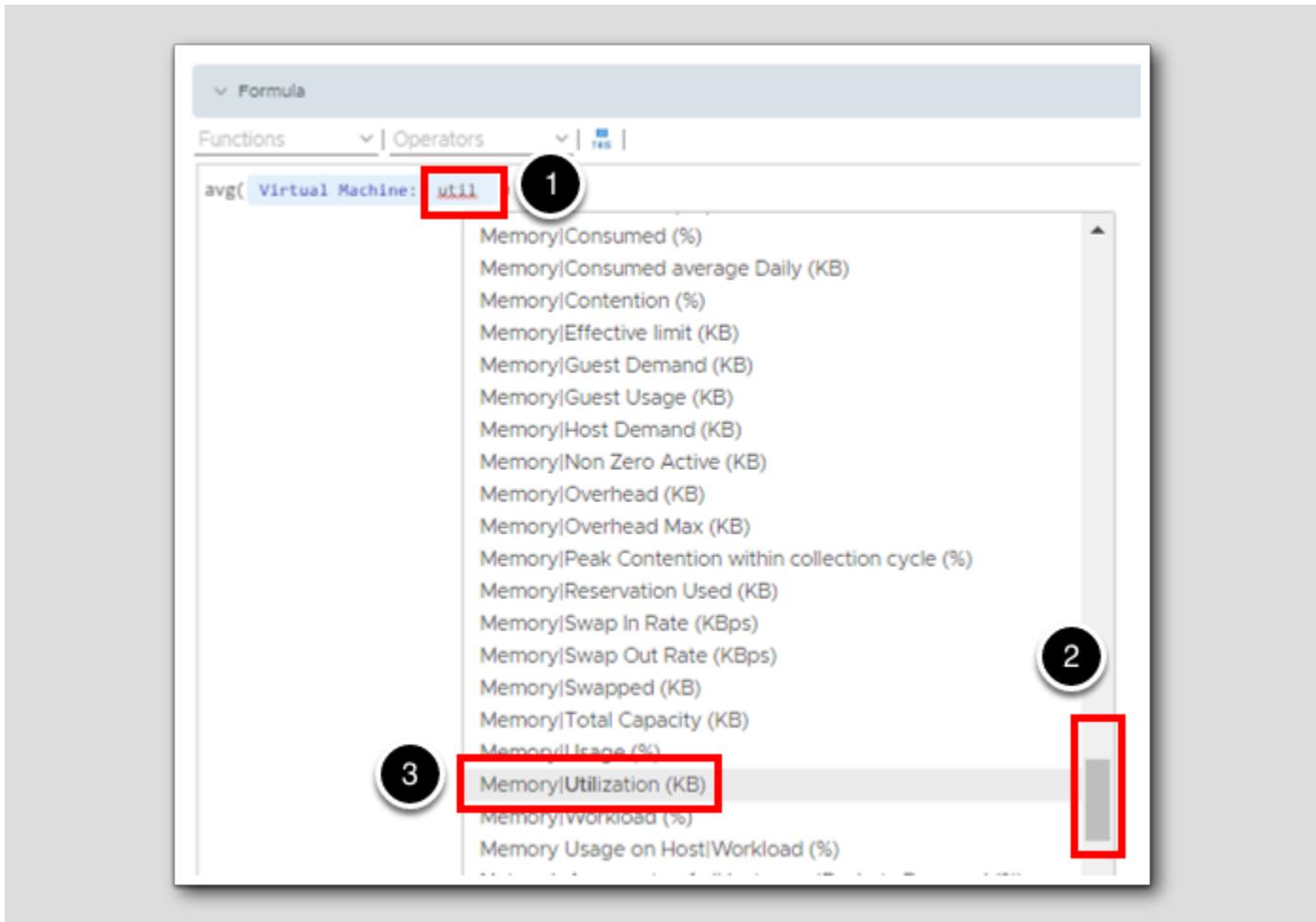
1. Type the first few letters of the object type: vir
2. Click to select Virtual Machine

## Add the Attribute



1. Let's once again get a hint about what to do next. Use the **ctrl+space** key combination on the keyboard.
2. Since we want to average a specific metric from all of the virtual machines, click **Metric**

## Select the Metric

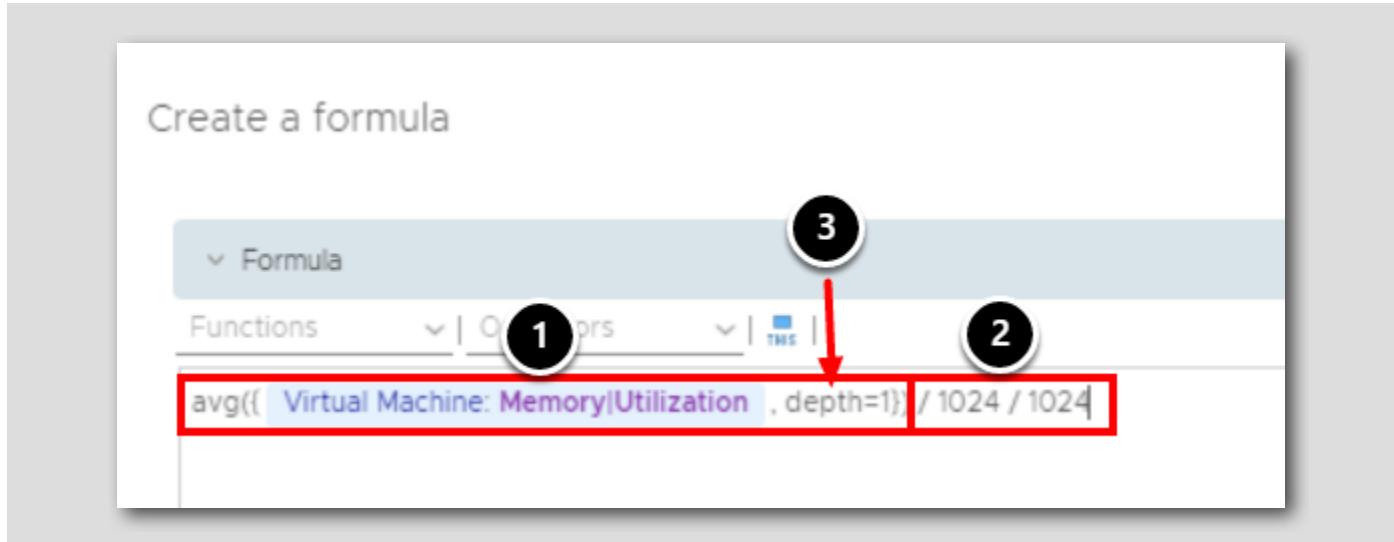


Recall that we want to create an average of the memory utilization across all virtual machines on our host or in our datacenter.

1. Start typing some text from the metric name if you know it. Type **util**
2. Note that the results for this step are not filtered. Scroll down until the group of memory metrics appears.
3. Click **Memory|Utilization (KB)** (note the highlighted portion of the metric.) You should remember this metric from the beginning of the lesson.

Note that the units of memory utilization are in KB but we want our super metric value to be in GB. That's OK because we can just add the additional math to the formula to do the conversion from KB to GB.

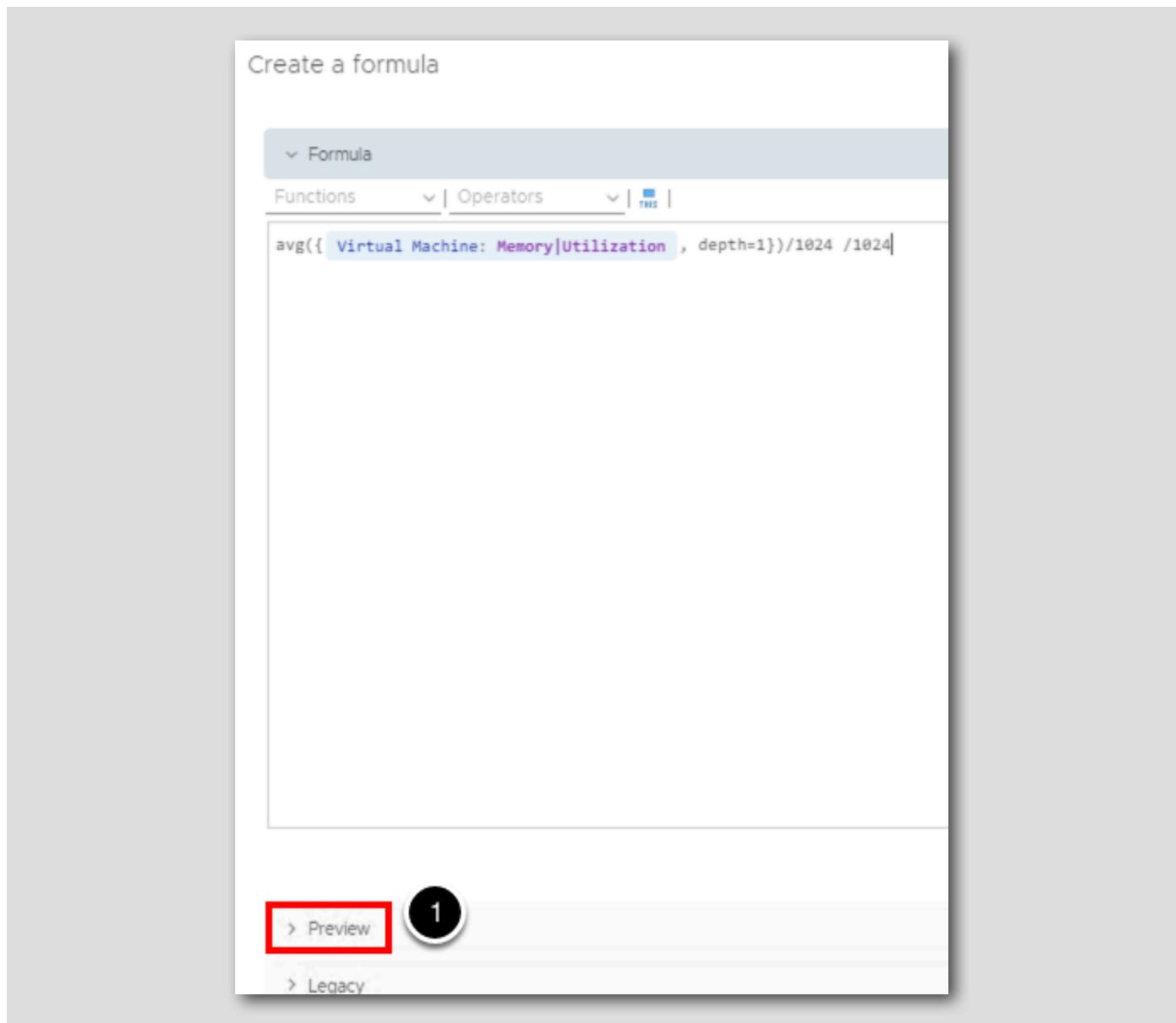
## Convert from KB to GB



In order to convert our resulting value in kilobytes (KB) to gigabytes (GB), we need to divide the resultant average by 1024 to get to megabytes (MB) and then divide again by 1024 to get to GB.

1. Note the super metric formula that you have created so far using the wizard.
2. To convert from MB to GB, move your cursor to the end of the text and type `/ 1024 / 1024` at the end of the formula. Note that you could have selected the divisor (/) from the Operator drop-down list but it's quicker to type it.
3. You may have noticed that the `depth` parameter was automatically added to your formula. We will explain more about that in a bit.

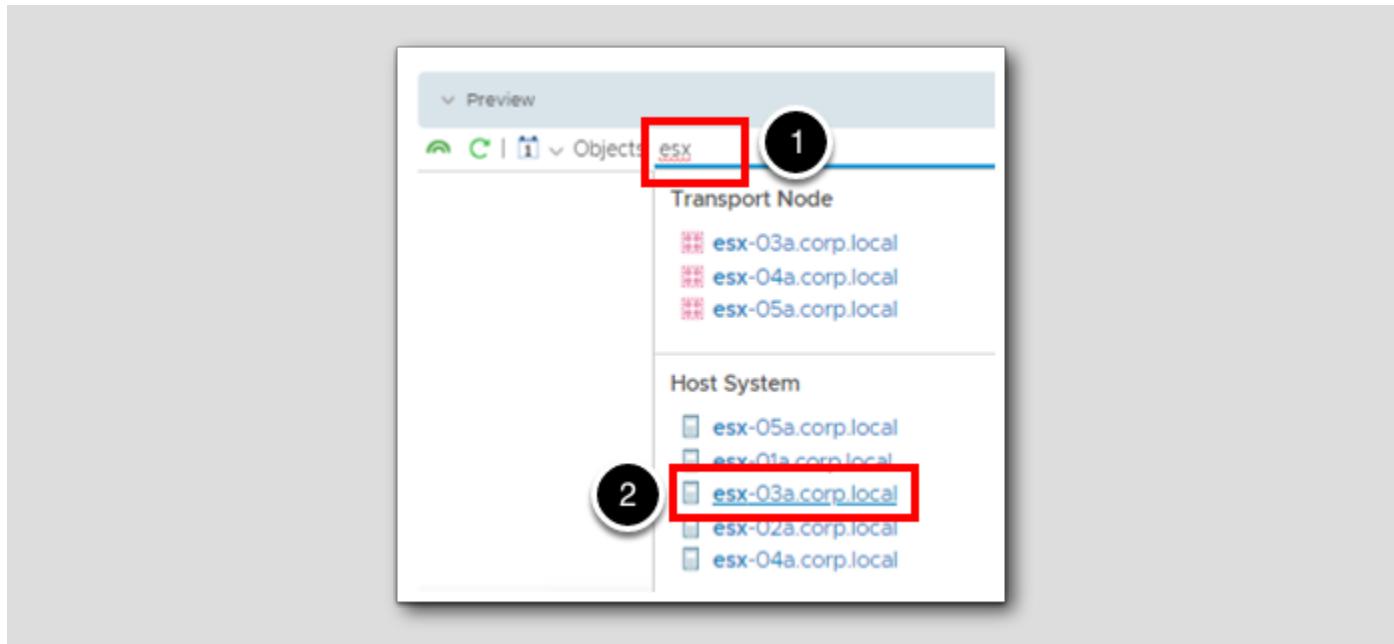
## It Is Time to Preview The Metric



Here you can see your super metric definition. Now we want to see if it calculates as expected. Luckily, the wizard allows you to preview the metric applied to any object.

1. Click > Preview to expand the preview section.

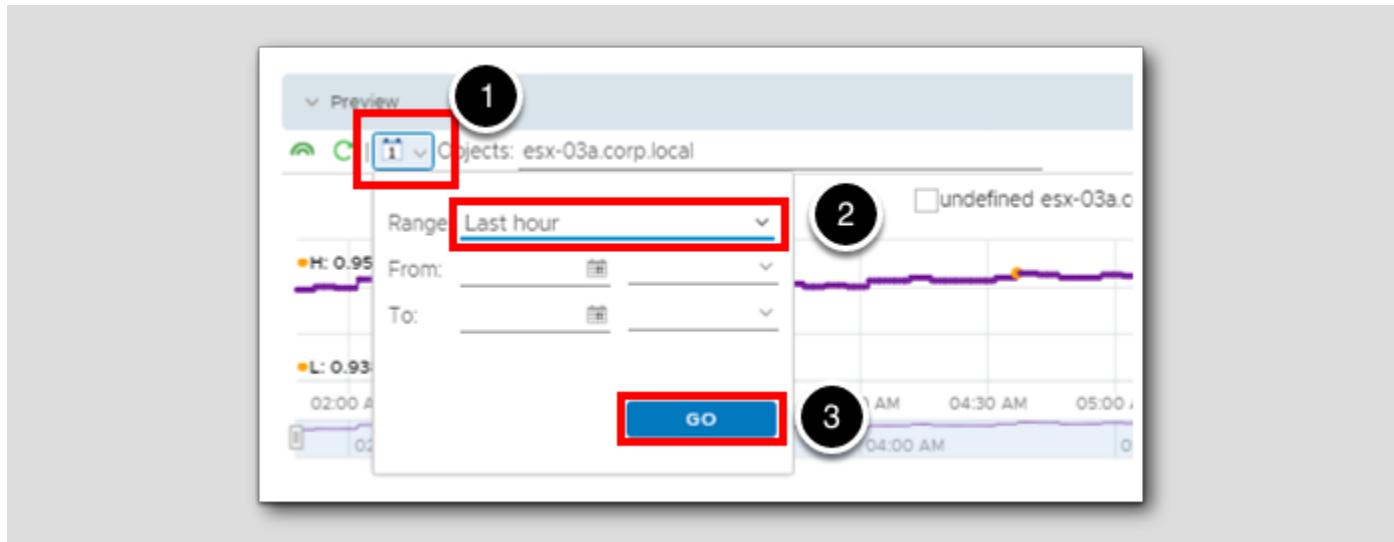
## Select The esx-03a Host



Let's test our metric on the esx-03a.corp.local vSphere host. There are two VMs running on that host so we should see the average memory utilization across the two VMs.

1. Type the first few letters of your host: **esx**
2. Select the **esx-03a.corp.local** host from the Host System section. Note that the order of hosts in the list in your lab might be different.

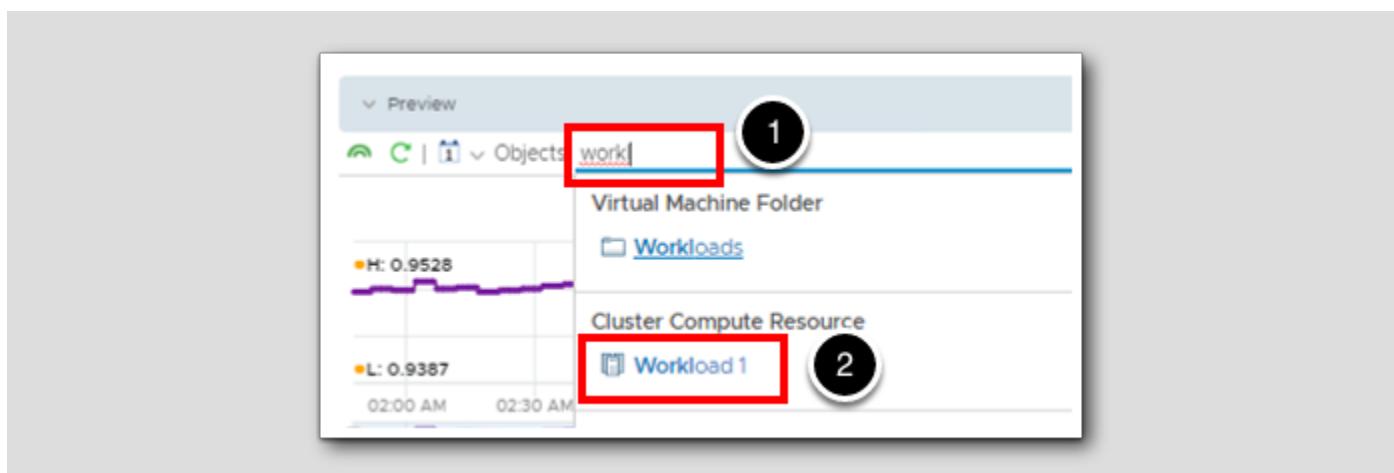
## View the Host Preview



You should see a preview of your super metric on the esx-03a.corp.local host. Note that your values will likely be different and you may or may not see the graph cover the entire time period depending on how long your lab environment has been running before you started this lesson.

1. You can change the time period of the preview if desired. Click the calendar icon.
2. Click the **Range** drop-down and change the option from Last 6 hours to Last hour.
3. Click **GO** to apply the changes.

## Select the Workload 1 Cluster For Preview

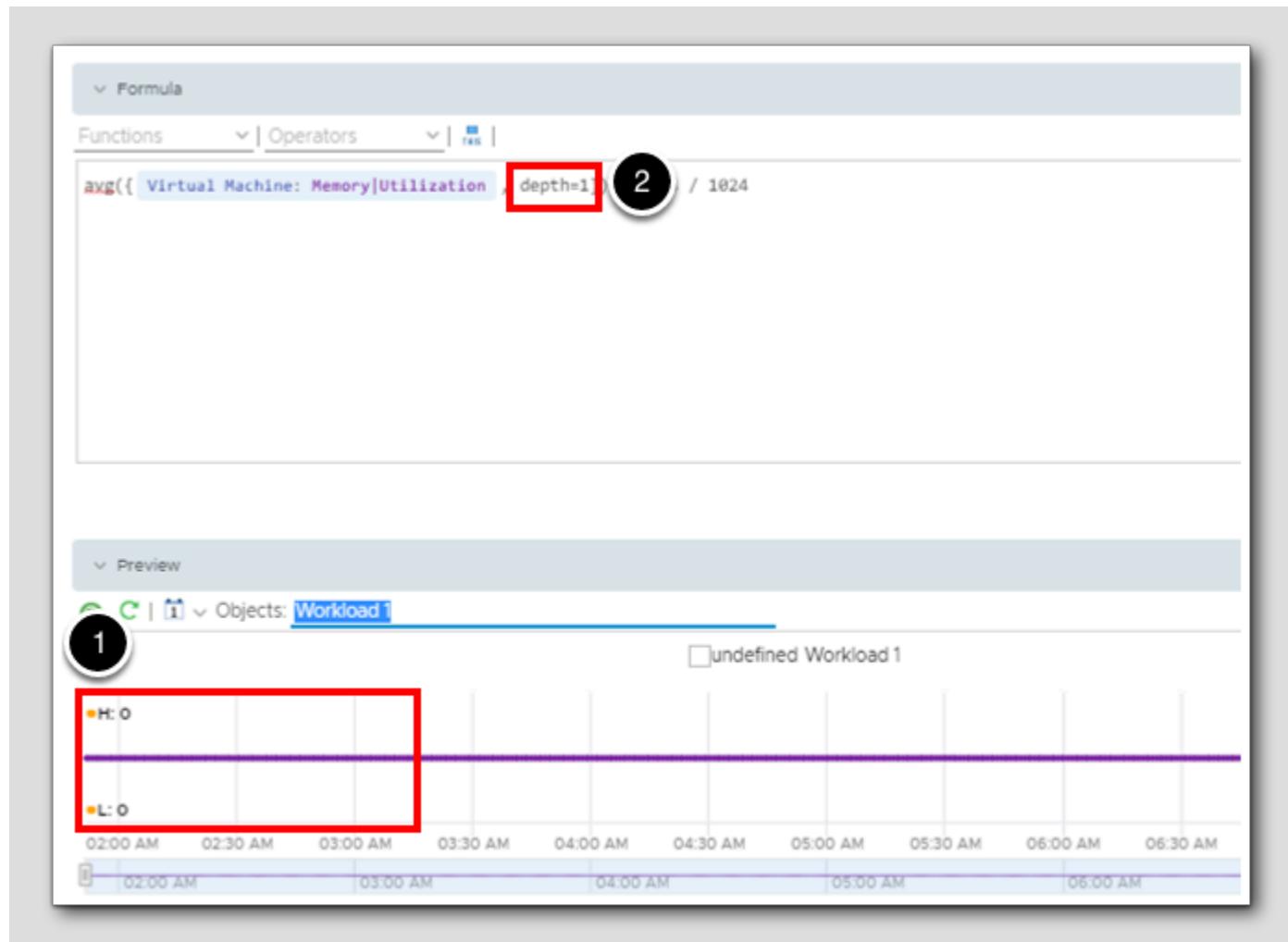


Since we wanted our super metric to show the average vm memory utilization for hosts and clusters, let's test our metric on the Workload 1 vSphere cluster. There are five VMs running in that cluster so we should see the average memory utilization across the five VMs, right?

1. Delete the esx-03a entry, and type the first few letters of your cluster: **workl**
2. Select the **Workload 1** cluster

## View the Cluster Preview

[433]



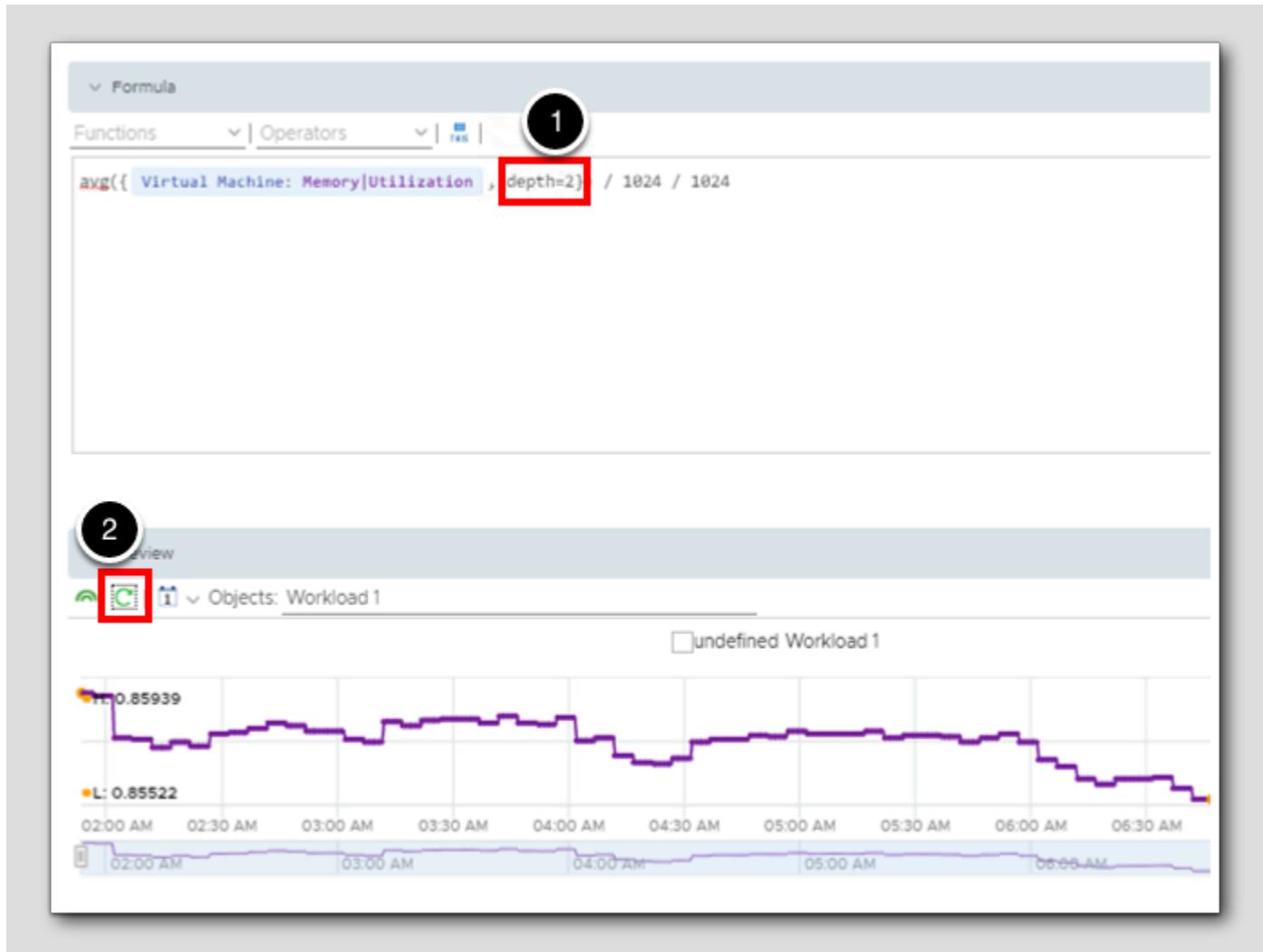
1. Now our preview shows zero. What's going on? That cluster has five VMs running and certainly the average memory utilization is not 0 GB per vm.
2. It's time to discuss the **depth** parameter.

The depth parameter in a super metric formula is used to tell vRealize Operations how far down (or up) the object hierarchy to look for the objects and their metrics when performing the calculation. As mentioned earlier, within vRealize Operations there are multiple hierarchies (or traversal specs). Each adapter type will usually have at least one hierarchy. For example, the vCenter adapter creates vSphere Hosts and Clusters, vSphere Networking and vSphere Storage hierarchies.

If we look at the vSphere Hosts and Clusters hierarchy, it goes (from top to bottom): vSphere World --> vCenter Server(s) --> vSphere Datacenter(s) --> vSphere Cluster(s) --> vSphere Host(s) --> Virtual Machines --> Datastores. So in our case we want to calculate our super metric based on one (host --> vm) or two (cluster --> host --> vm) levels down the hierarchy. If you look at our super metric formula, you see that **depth=1** was added automatically which is why the preview worked on the esx-03a host (the vms were one level below the host) but not for the Workload 1 cluster (the vms were two levels below the cluster).

Something else you might notice about the **depth** parameter is that a positive value (1 in this case) will look down the hierarchy. If we wanted to look up the hierarchy, we would need to use a negative value for the depth parameter. That might seem opposite from what you would expect but you just need to remember that rule: positive depth = look down, negative depth = look up.

## Fix the Super Metric Formula

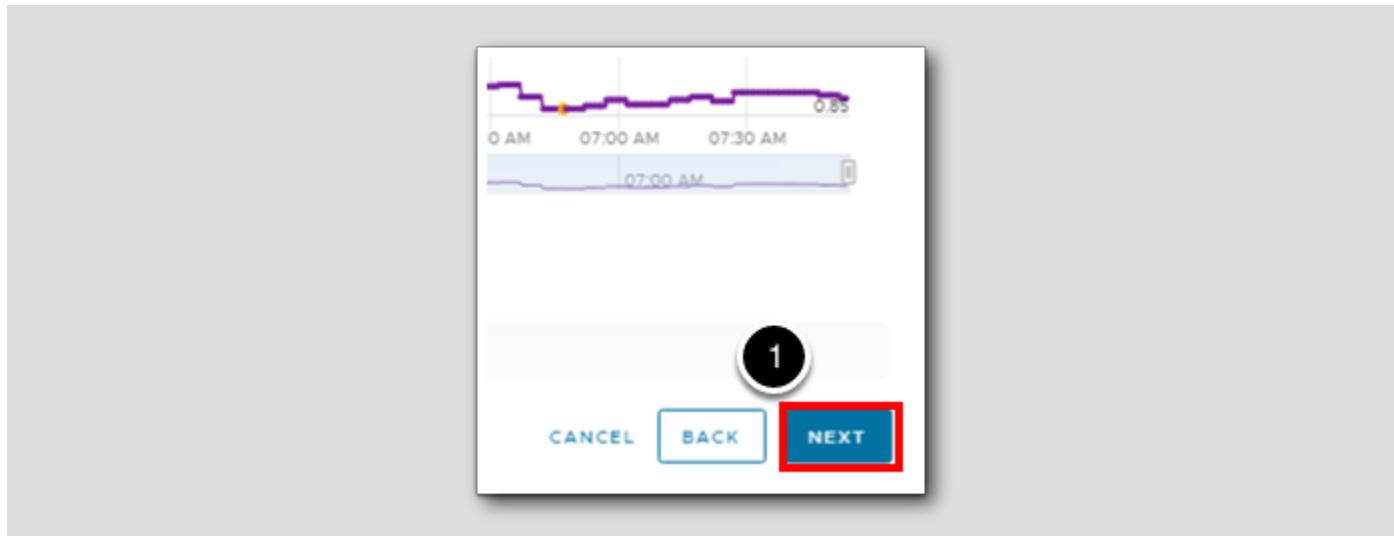


So let's update our formula to get it to look two levels down the hierarchy.

1. Delete the '1' and replace it with a 2 for the depth parameter
2. Click the refresh icon to update the graph

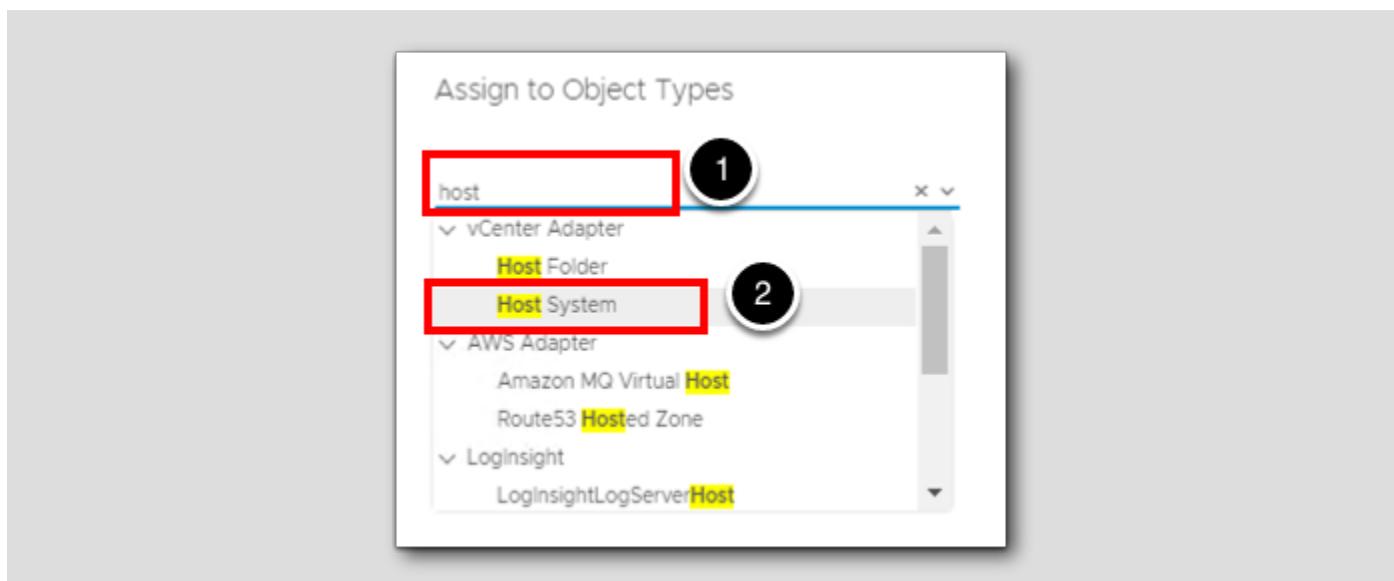
Now the formula is calculating the average VM memory utilization for our cluster. But does that mean it won't work for hosts any longer? Since it is looking down two levels down in the hierarchy for vms will it look past the vms when applied to a host? The good news is that it will still work for hosts. In fact, a depth of 2 means it will look down one level and two levels. A depth of 5 would look down one, two, three, four and five levels for vms (or whatever object type is in the formula).

## Advance The Wizard



1. Click **NEXT** to advance (you may need to scroll down to see the button)

## Assign to Object Types



Next we need to tell vRealize Operations what are the valid object types that our new super metric can be assigned to. This will limit the scope of available object types where the super metric can be calculated.

You can click the **Select an Object Type** drop-down and traverse through the hierarchies to find your object types or to save time, filter the list of object types and then select what you want.

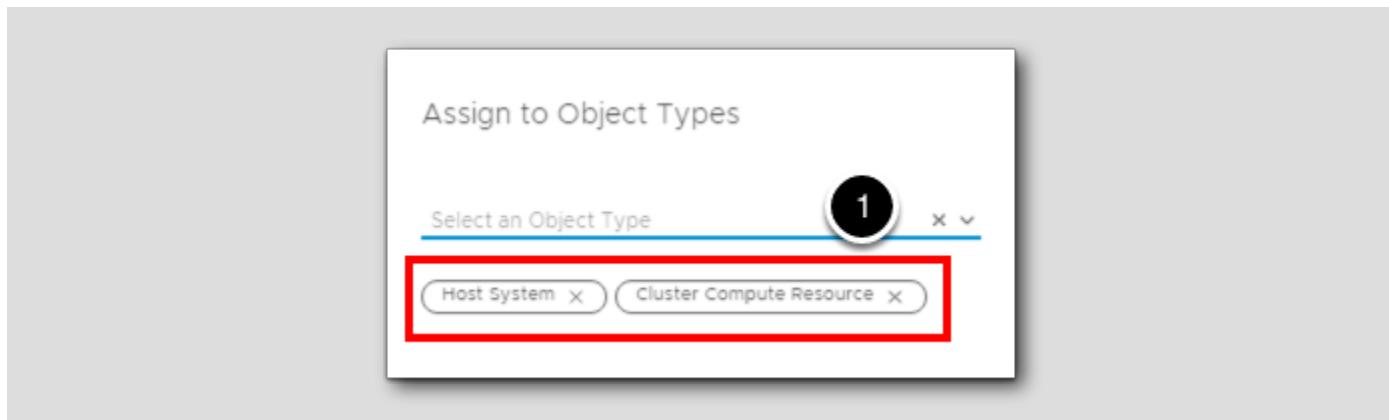
1. Click in the Select an Object Type field and type **host**
2. Click **Host System** under vCenter Adapter to select it.

Follow similar steps (not shown) to select the Cluster Compute Resource type as well:

1. Type **cluster co**
2. Click **Cluster Compute Resource** to select it.

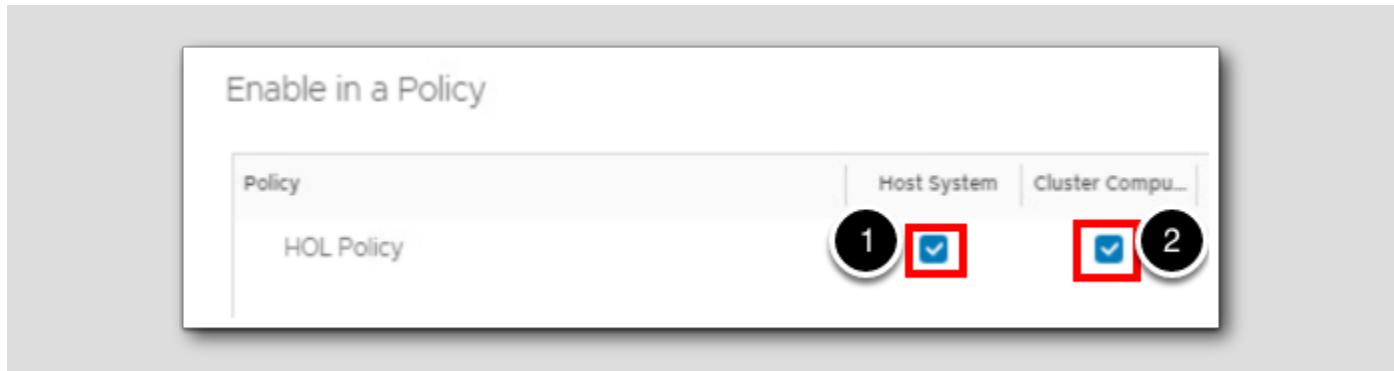
## Confirm Your Object Types

[437]



1. Verify that both **Host System** and **Cluster Compute Resource** object types are shown.
2. Now in the bottom right corner of the window, click **NEXT** (not shown) to advance to the final step in the wizard.

## Assign The Super Metric To One or More Policies



The final (optional) step is to enable the super metric for the object types in one or more policies. If you don't enable the metric calculation in a policy here, you will have to go edit the policy(ies) where you want to enable the calculation later in the policy editor.

In our lab we only have one policy that is being used (the HOL Policy policy.) In a production environment you might have several or more policies active in vRealize Operations. If you have multiple active policies you will see all of them listed on this screen and you can select which policies you want to activate the super metric calculation in for each object type.

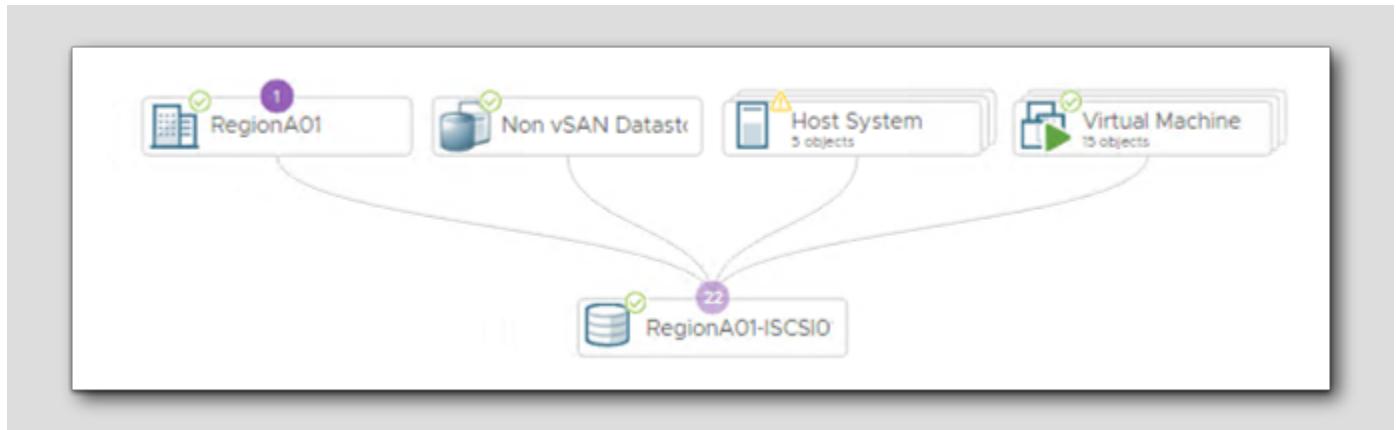
1. Check the **box** to enable the metric on hosts in the policy.
2. Check the **box** to enable the metric on clusters in the policy.
3. Click **FINISH** (not shown) to save your super metric.

Congratulations! You have created your first super metric and applied it to two object types in the active policy in your lab environment. There are a few more lessons ahead where we will explore creating other super metrics to learn about some additional super metric features. If you want to skip ahead and see the results of your work, use the Table of Contents at the top of the lab manual to jump past the other super metric creation lessons.

## Using 'This' and Negative Depth Parameters in Super Metric Formulas

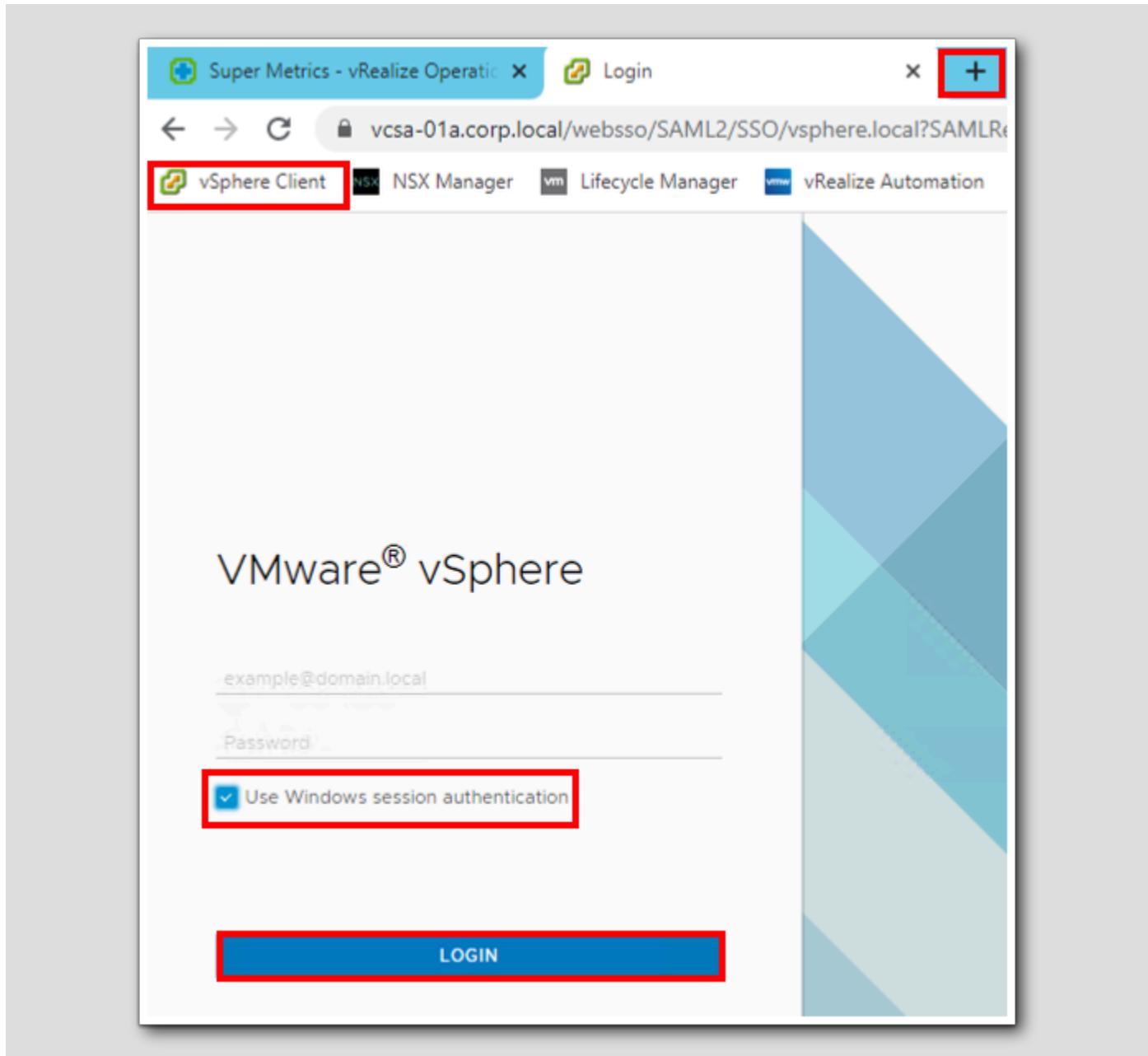
Let's create another super metric. For this example, the assignment is to use a super metric to calculate the percentage of a datastore's capacity that is being used to store virtual machine snapshots.

## The Hierarchical Relationship



If you recall from a previous lesson, we learned that a datastore is a child of hosts and of virtual machines in the vSphere Hosts and Clusters hierarchy. In this case, we will be using the VM <--> datastore relationship. Note in the graphic (and in our lab environment) that the RegionA01-ISCSIO datastore supports fifteen virtual machines and five hosts (5 objects in the Host System graphic). So if we create a super metric on the datastore object type and have it look one level up the hierarchy to create the sum of the metric representing snapshot space on virtual machines, we will have completed the assignment for this lesson.

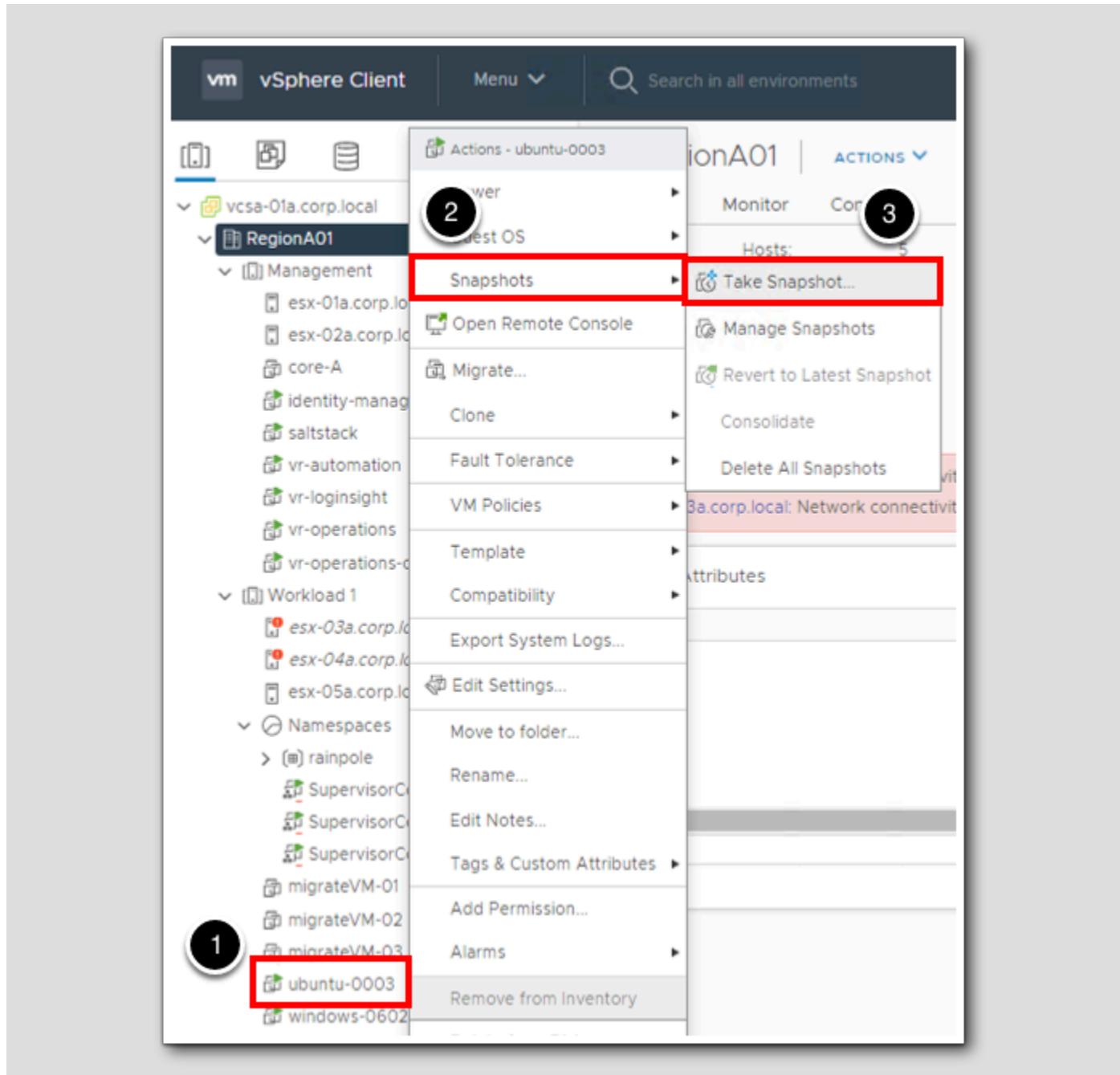
## Preparing the Lab Environment



Before we begin this exercise, we must prepare the lab environment. None of the VMs in this lab currently have snapshots, so we will take one quickly.

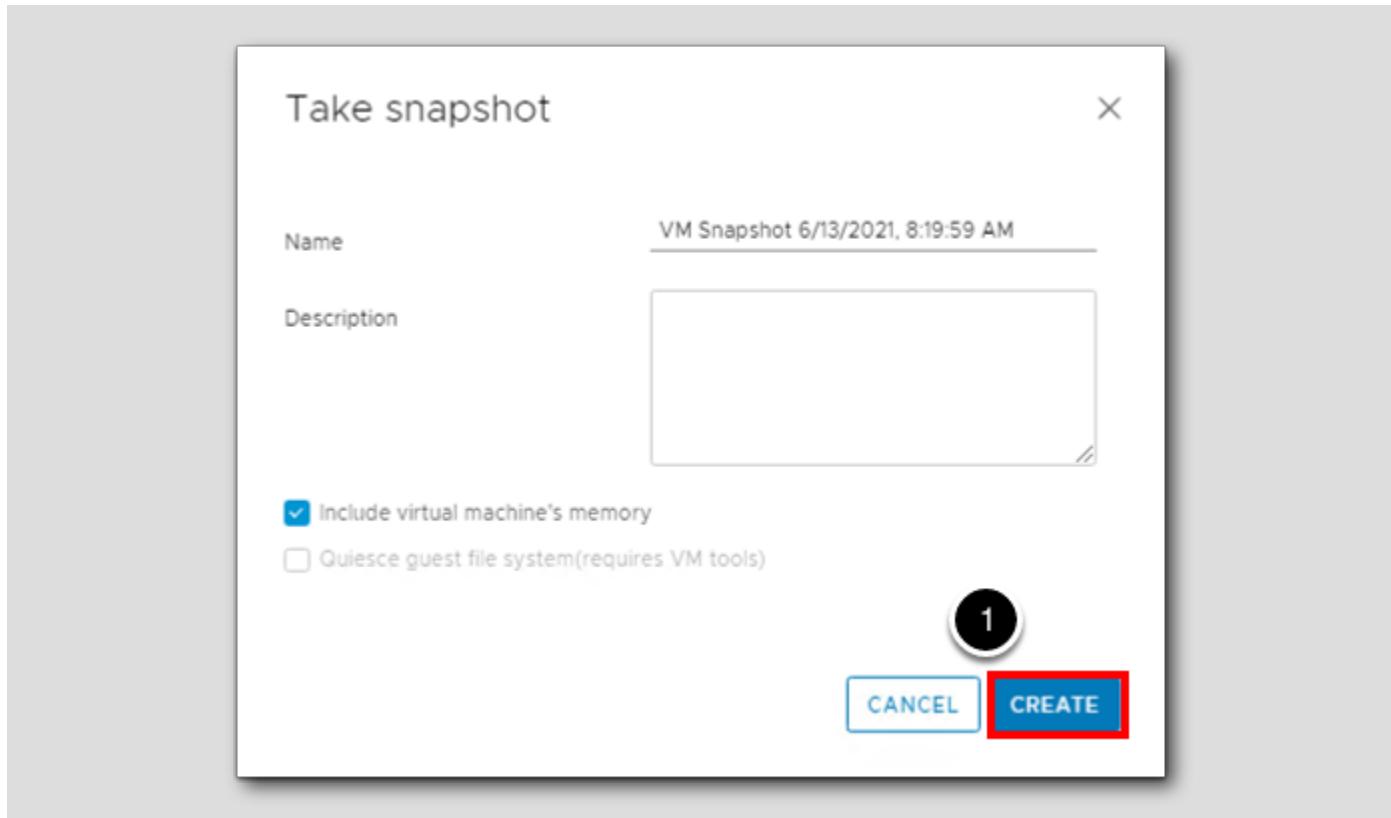
1. Click the + sign in the Chrome title bar to open a new browser tab
2. Click the **vSphere Client** bookmark to navigate to the vSphere Client login
3. Click the **checkbox** next to Use Windows session authentication
4. Click **LOGIN**

## Take a Snapshot of the ubuntu-0003 Virtual Machine



1. Right click on the ubuntu-0003 VM in the vSphere inventory to open the Actions - ubuntu-0003 menu
2. Mouse over Snapshots to open the sub-menu
3. Click on Take Snapshot...

## Take a Snapshot of the ubuntu-0003 Virtual Machine



The default snapshot name and settings will suffice for this exercise.

1. Click **CREATE** to create the snapshot
2. Click the Super Metrics - vRealize Operations Manager browser tab (not shown) to return to vRealize Operations

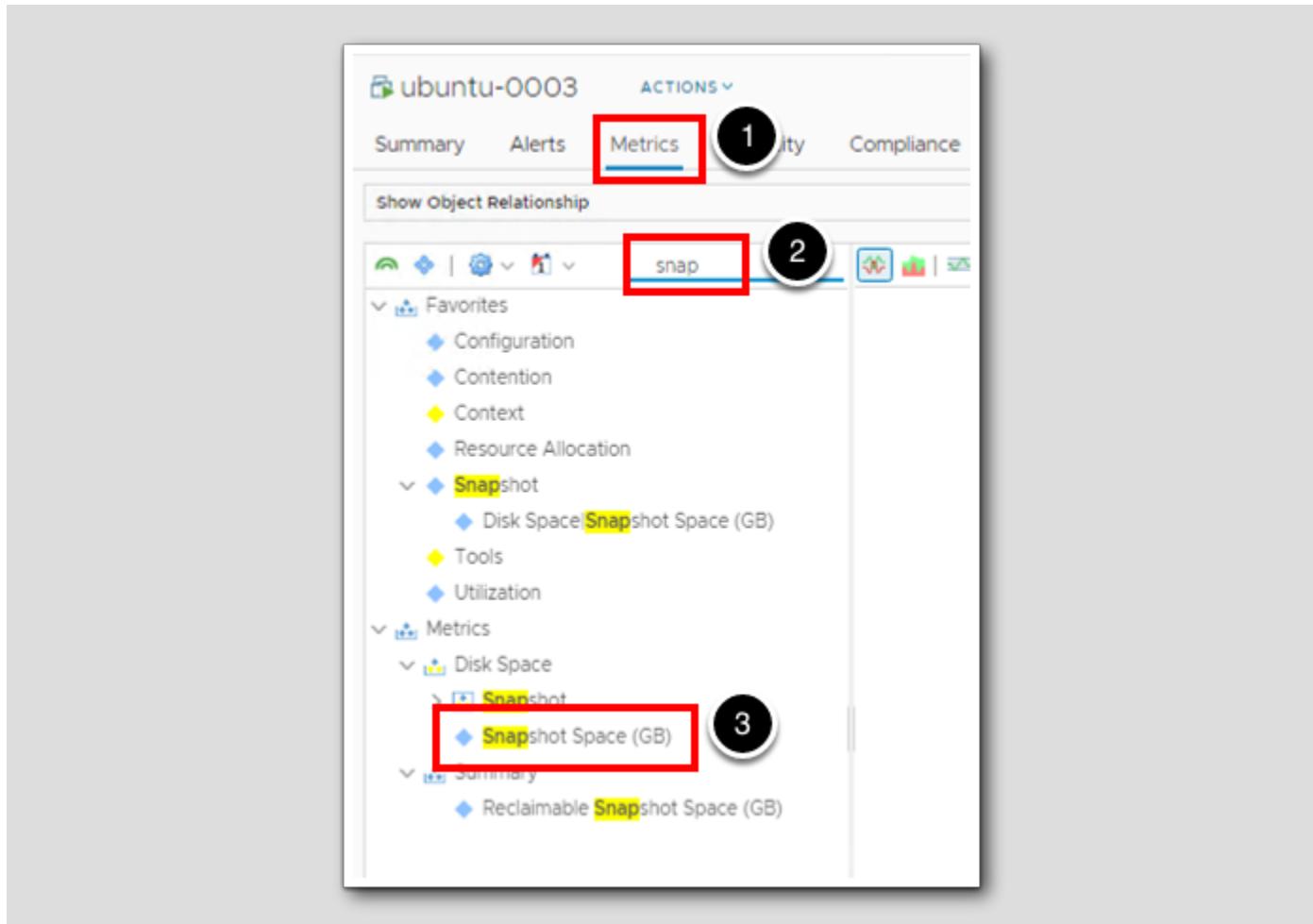
## Which Metric Will We Be Using?



Before we get started with the super metric, let's understand which virtual machine metric we will be using for this lesson. Since we want to average a vm metric (disk snapshot space), let's go find a vm to see what metrics are available. We will again take a look at the ubuntu-0003 virtual machine.

1. Click the global search magnifying glass icon in the navigation bar (not shown) to expand the search box
2. In the search box, type **ubuntu**
3. Click the **ubuntu-0003** link under the Virtual Machine object type

## Expand the All Metrics Tree



1. On the ubuntu-0003 object page, click the **Metrics** tab.
2. In the filter field, type **snap** and press the **Enter** key to filter the metric results.
3. Metrics --> Disk Space --> **Snapshot Space (GB)** is the metric that represents the total space on the disk consumed by snapshots on this virtual machine.

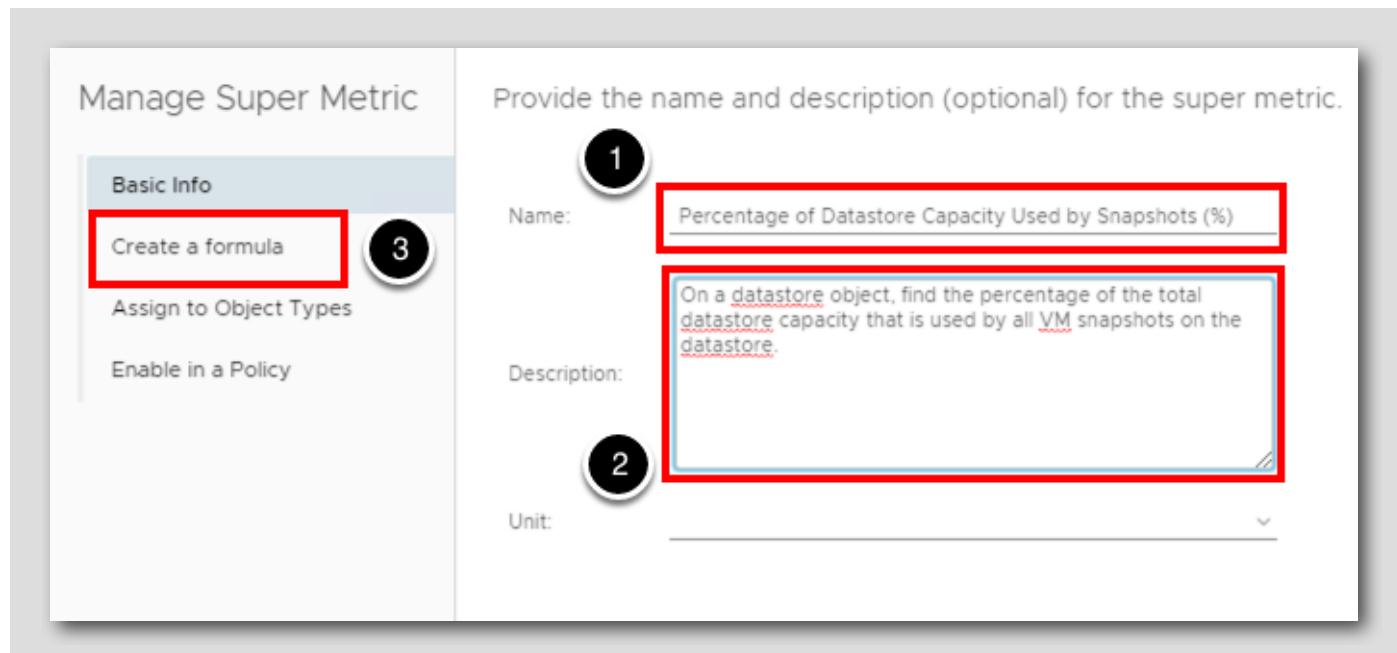
## Create the Super Metric

The screenshot shows the vRealize Operations Manager interface. The top navigation bar includes Home, Dashboards, Alerts, Environment, and Administration. The left sidebar has sections for Solutions (Cloud Accounts, Other Accounts, Repository), Inventory, Policies, Access, Configuration (Custom Profiles, End Point Operations, Group Types, Icons, Maintenance Schedules, Configuration Files, Object Relationships, Optimization Schedules), Super Metrics (which is selected and highlighted in blue), and Cost Settings. The main content area is titled "Super Metrics" and contains a table with four rows. The first row has an "ADD" button highlighted with a red box and a circled '1'. The table columns are Name, Description, and Formula. The rows show metrics: Load Balancer Session Count, Edge Load Balancer Count, Load Balancer Sessions Rate, and Average Mem Usage Across All Descen... (with a truncated formula). A back arrow and a three-dot menu are also visible.

Repeat the process to launch the wizard for creating a new super metric. From Administration --> Configuration --> Super Metrics:

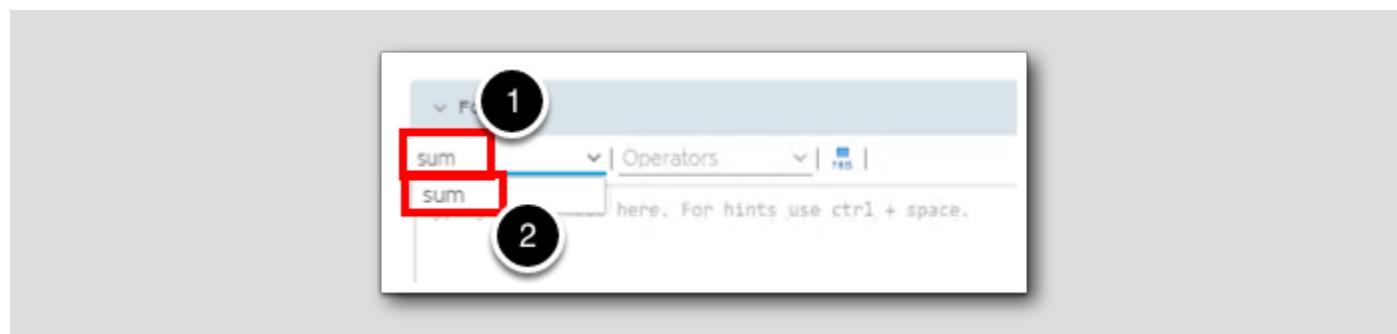
1. Click ADD to create a new super metric.

## Basic info



1. Type the super metric Name: Percentage of Datastore Capacity Used by Snapshots (%)
2. Type a description for the metric (optional).
3. Click Create a formula or the NEXT button (not shown) to advance the wizard.

## Start the Formula



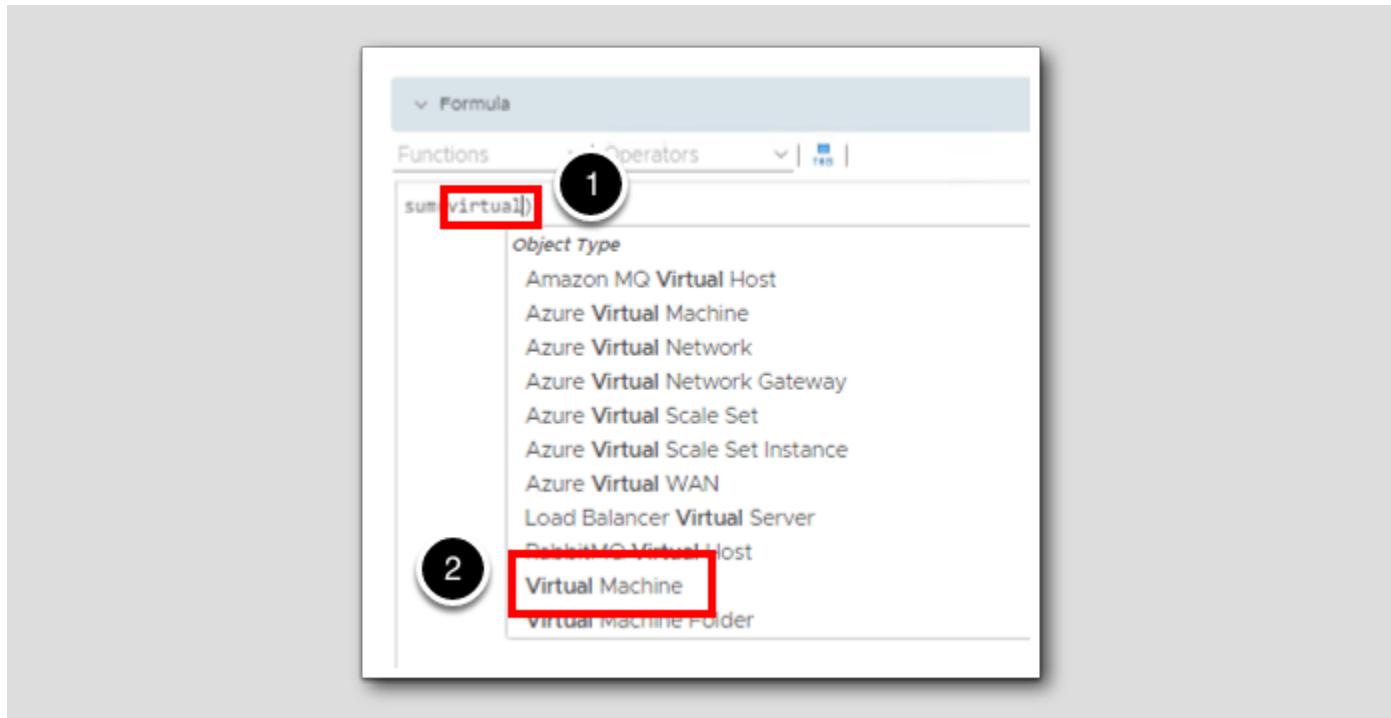
The formula will be: The sum of the snapshot space from all VMs on the datastore divided by the total capacity of the datastore.

Start typing your formula - let's find the sum of the snapshot space from all VMs on the datastore that this super metric will be calculated on. Or you can select the function from the Functions drop-down.

1. Type **sum**
2. Click **sum** in the resulting list of suggestions.

## Add the Virtual Machine Object Type

[449]

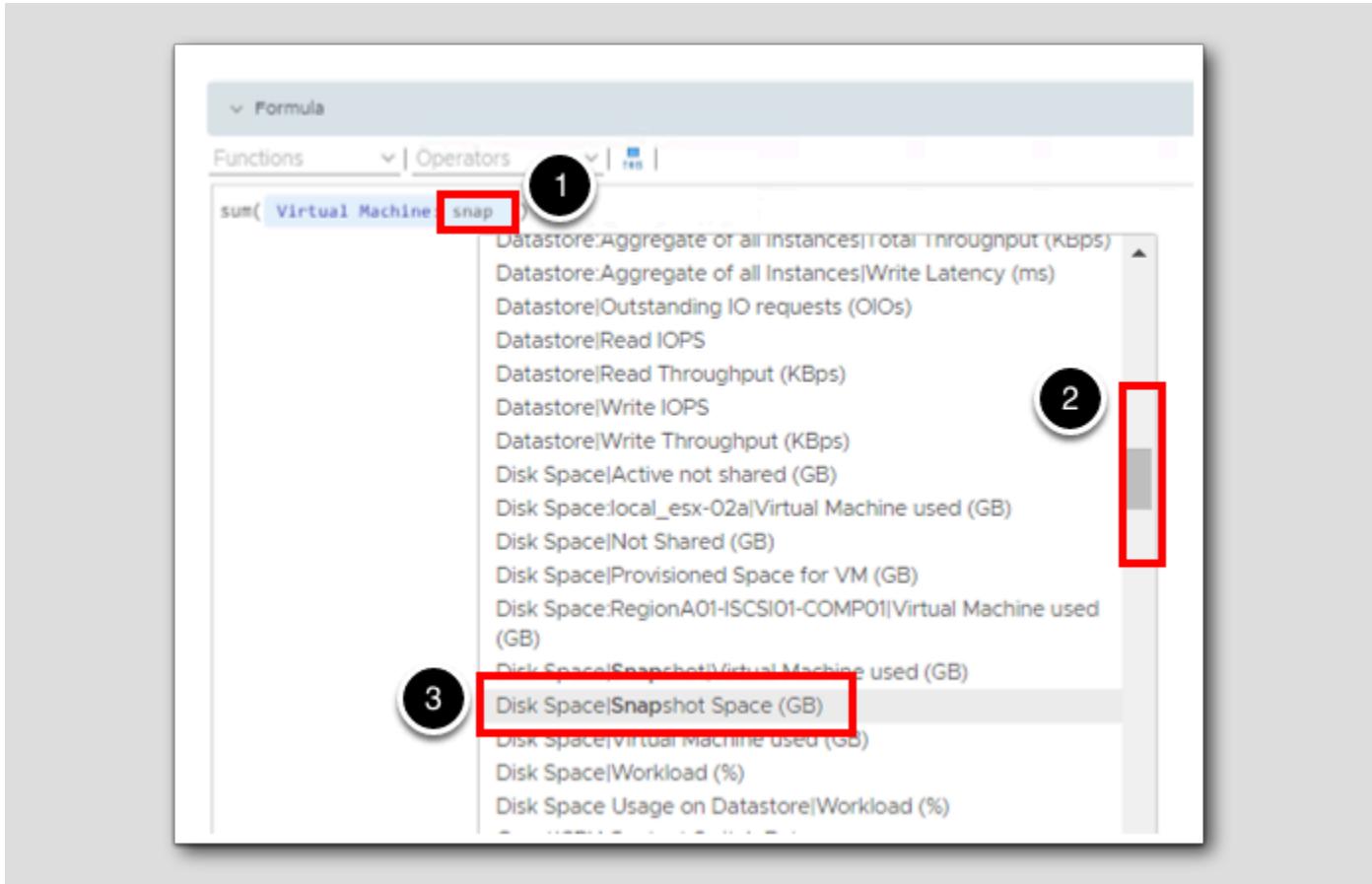


We need the virtual machine object type.

1. With the cursor between the parenthesis, type **virtual**
2. Click **Virtual Machine** from the resulting list of suggestions.

Remember if you need hints during the formula creation, use the **ctrl+space** key combination.

## Add the Metric



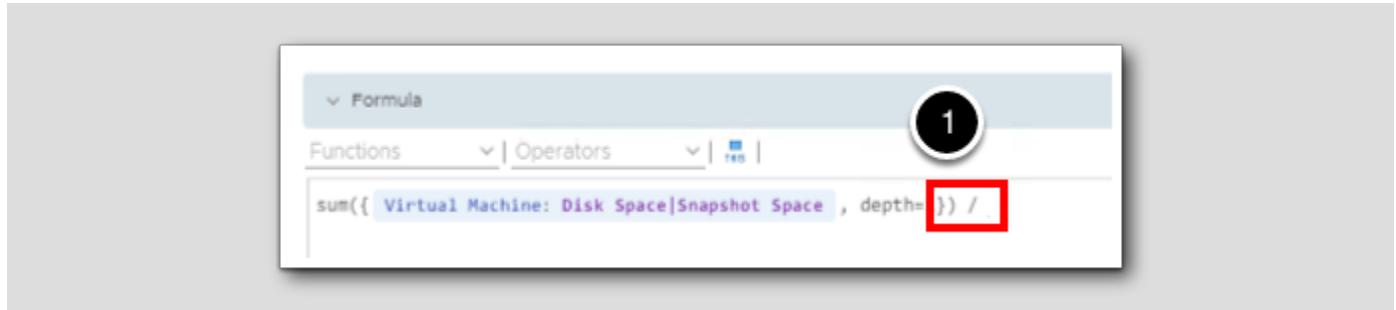
Let's select the metric. Remember from earlier in this lesson that we will be using the Disk Space|Snapshot Space (GB) metric

1. Type snap

Note that the metric we want to use shows up both in the Metric Type category and the Metric category. Metric Type is a general attribute and should be used any time there might be more than one instance of the metric on an object (for example a CPU core's usage where there are multiple cores in the host. Or the space used by individual snapshots when there are multiple snapshots on the virtual machine). In this case, the Disk Space|Snapshot Space is just a single metric that represents the total snapshot space used by the VM across all snapshots (if there are more than one).

2. Scroll down to find the list of Disk Space metrics in the Metrics section
3. Click Disk Space|Snapshot Space (GB) under the Metric section

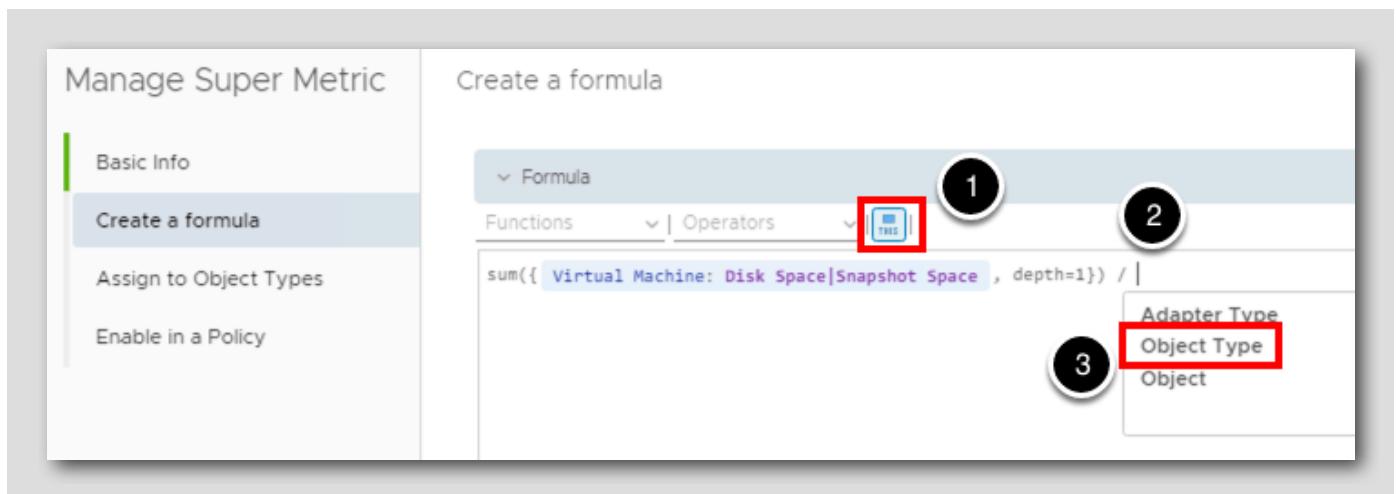
## Continue Creating the Formula



We have the numerator of our formula (the sum of the snapshot space from all VMs on the datastore). Let's add the division operator and get ready to add the denominator.

1. Move your cursor to the end of the formula and type a space followed by a / and then another space (note that the spaces are optional but they make the formula easier to read).

## Specifying 'This Object'



What happens when depth=0?

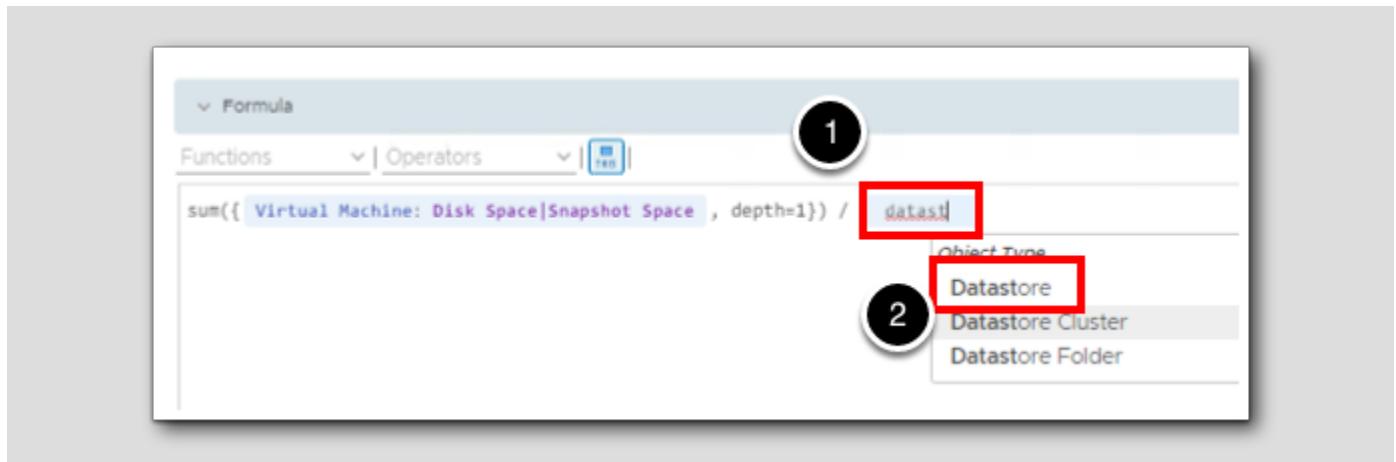
Let's take the example we are working on from the perspective of the datastore. The metric will be applied to datastore objects and we want to know for each datastore, what is the sum of the disk snapshot space from all of the VMs attached to that datastore (VMs are the parents) and then divide the sum by a metric on the datastore itself (the total capacity of the datastore). So if we are going to create a metric that will be attached to datastore objects and one of the calculation inputs is a metric from the datastore object itself, can we just say object type = datastore and depth = 0 in the super metric formula? Actually, there is special syntax for this type of situation ... instead of saying depth=0, it entails prefacing the metric or metric attribute with 'This Resource' and there is a special way of building that into the metric definition - the THIS button in the editor.

Let's see how it works.

1. Click the **THIS** button - you won't see anything on the metric formula line yet but the **THIS** button will have a box around it.
2. With your cursor at the end of the formula, use the **ctrl+space** key combination to bring up the hints.
3. Click **Object Type** - we are going to want to select the datastore object type on the next page.

## Select the Datastore Object Type

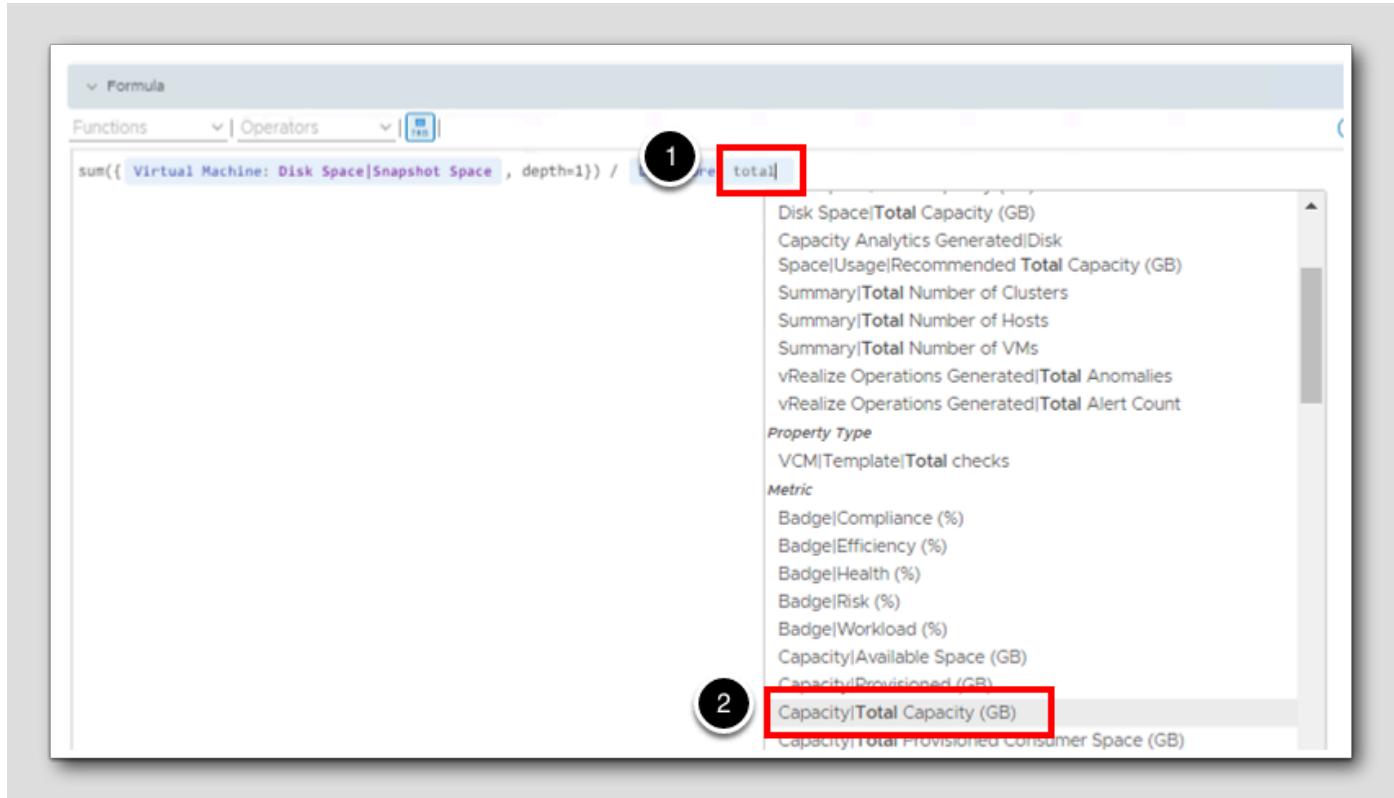
[453]



We know we want the object type to be Datastore.

1. Type **datast** to filter the list.
2. Select **Datastore** from the list of hints.

## Select the Total Capacity Metric



Select the Total Capacity metric.

1. Type **total** to filter the list.
2. Click **Capacity|Total Capacity (GB)** from the Metric section to select the metric. Note that you will likely have to scroll down to find this metric.

## Finish the Formula

Create a formula

Formula

Functions Operators **TABS**

```
sum({ Virtual Machine: Disk Space|Snapshot Space , depth=1}) / { This Resource: Capacity|Total Capacity } * 100
```

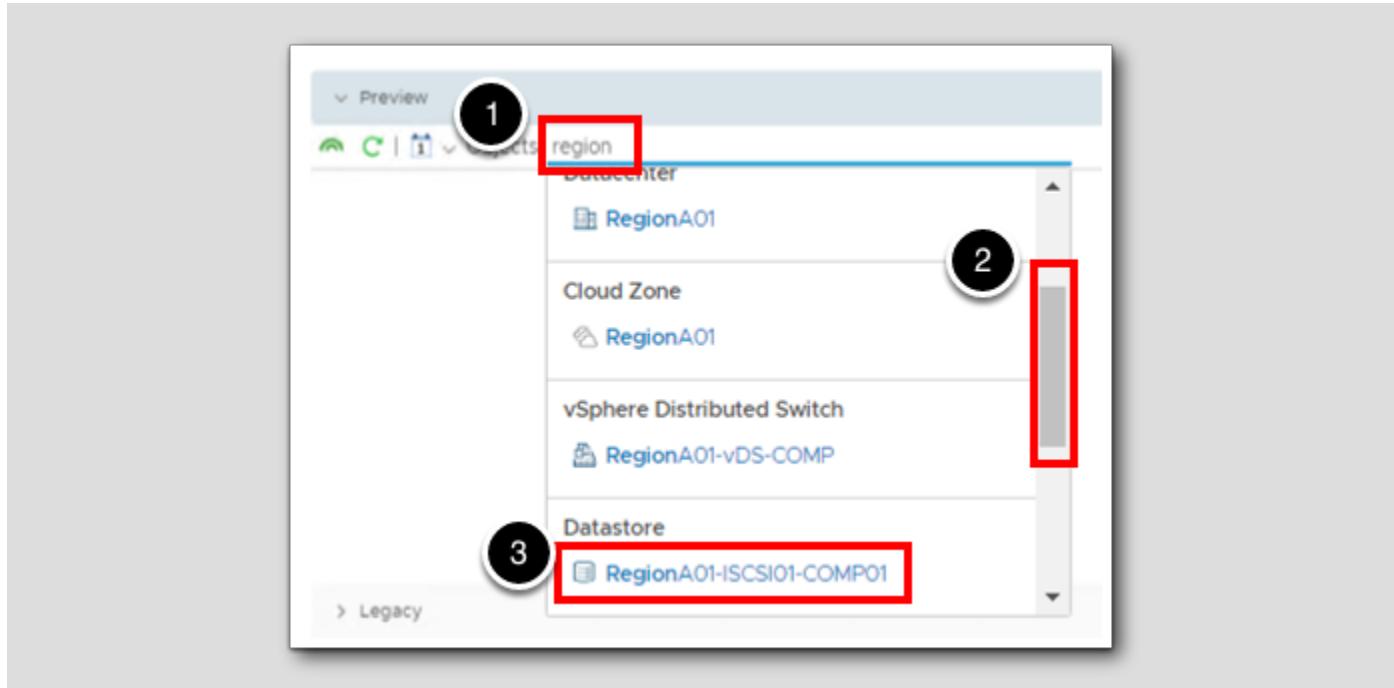
1

> Preview 2

The result at this point will be a ratio of the sum of the snapshot space metric for all of the VMs on a datastore divided by the total capacity of that datastore. To convert it to a percentage, we just need to multiply by 100.

1. With your cursor at the end of the formula, type space then \* then space then 100
2. Click > Preview to open that section.

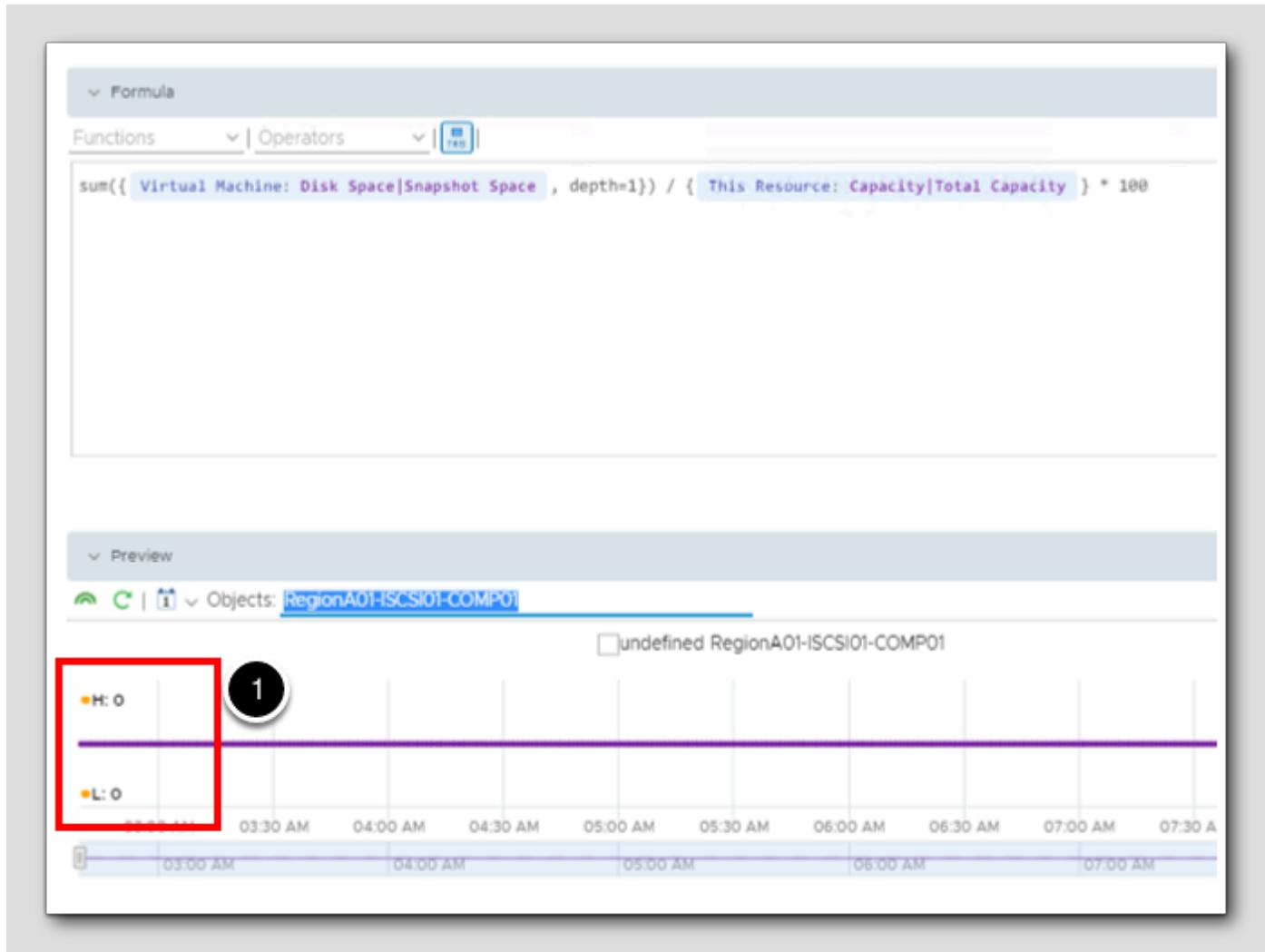
## Preview the Super Metric



Let's see how our super metric looks.

1. In the search field, type region
2. Scroll down so you can see the list of Datastores
3. Click the RegionA01-ISCSI01-COMP-01 datastore object as the preview source.

## View the Preview



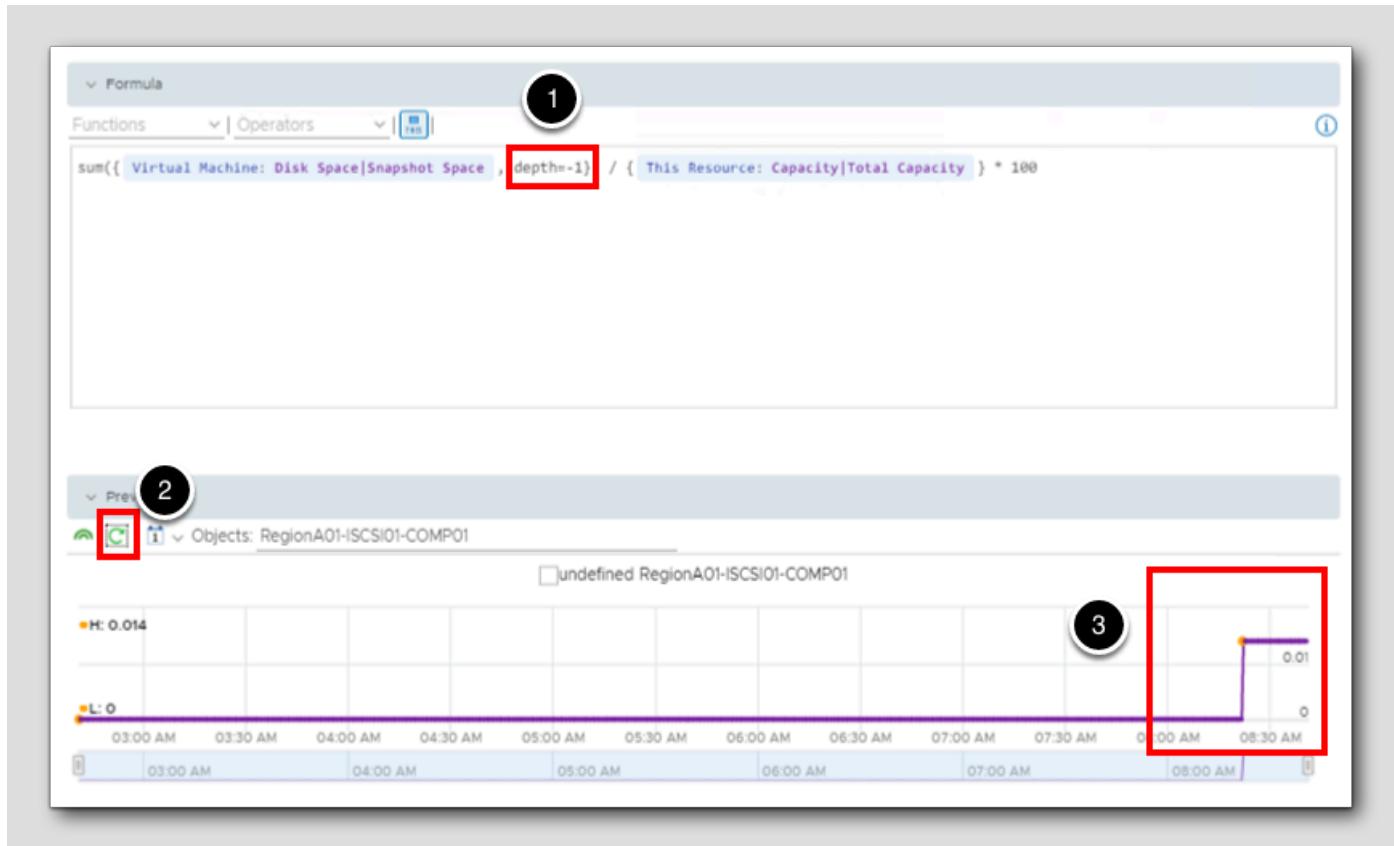
1. The preview shows zero percent of the datastore is used by snapshot storage. In this lab environment that is not the case. So why doesn't our formula work?

Do you remember the relationship hierarchy between datastores and VMs? Do you remember how the depth parameter works in a super metric formula?

In this case, virtual machines are parents of datastores. Our depth parameter on the datastore object is 1. Remember that a depth of 1 means one level down the hierarchy. But here we need to look up the hierarchy one level - from the datastore to the VM. So instead of depth=1, we need to have depth=-1.

Remember? Positive depth means look down the hierarchy. Negative depth means look up the hierarchy.

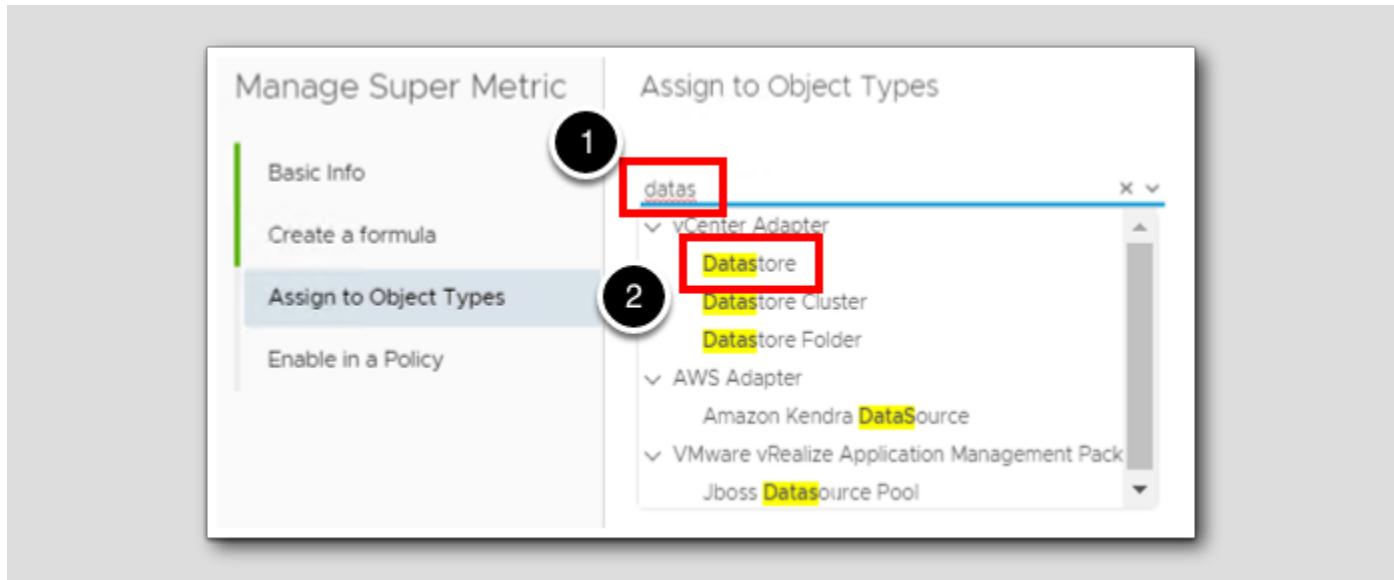
## Fix the Formula



Let's fix the depth parameter and try the preview again.

1. Place your cursor just to the left of the 1 in the depth parameter and type a minus sign (-) to make the depth=-1
2. Click the **refresh** button to recalculate the metric preview
3. Now we see the percentage of datastore space that is used by snapshots
4. Click the **NEXT** button (not shown) to advance the wizard

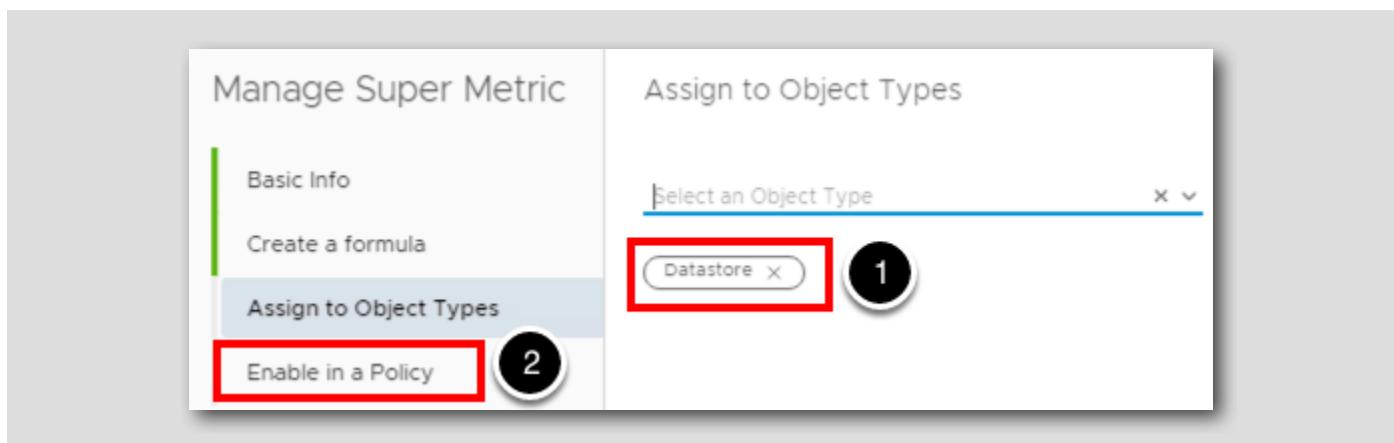
## Assign the Metric to the Datastore Object Type



Assign the super metric to the datastore object type.

1. Type **datas** to filter the list
2. Click **Datastore** under vCenter Adapter to select the object type

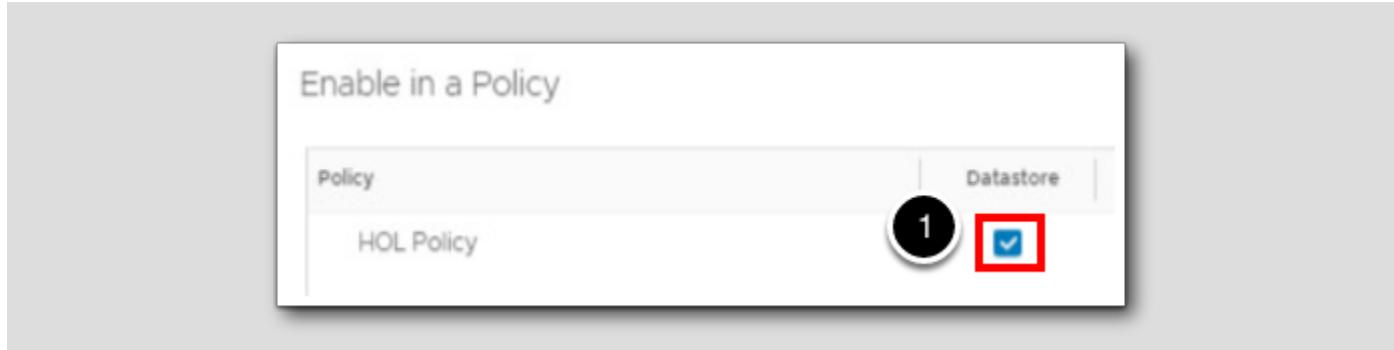
## Verify the Object Type Assignment



1. Verify that the Datastore object type has been selected.
2. Click **Enable** in a Policy or click the **NEXT** button (not shown) to advance the wizard.

## Select the Policy and Finish

[461]



Just like in the last lesson, we need to enable the super metric in one or more policies if we want it to actually be calculated and then we can finish the process.

1. Check the box to enable the metric on Datastore object types in the HOL Policy policy.
2. Click the **FINISH** button (not shown) to complete the wizard.

## Handling Sets of Data Points in a Super Metric Formula

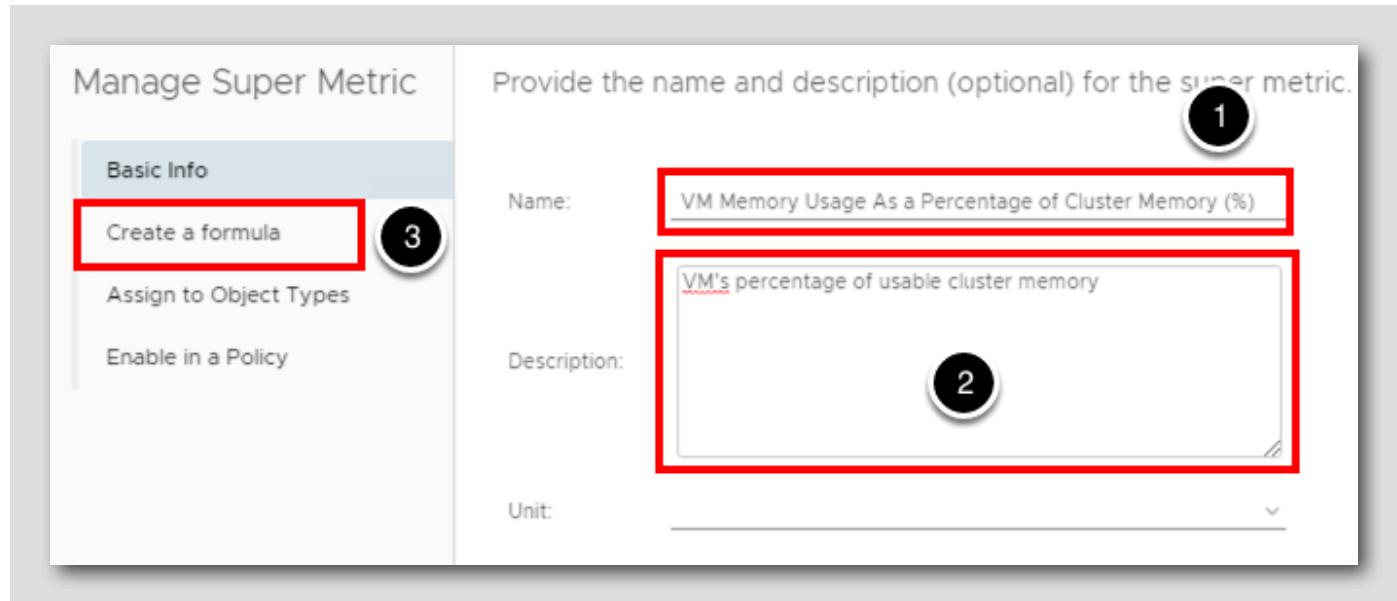
[462]

This topic confounds many people when they first start creating super metric formulas so it's worth spending some time to understand when you might run into this issue and how you can work around it. If you remember back in the lesson where we created our first super metric, there was a discussion about super metric functions and it was stated that the list of available functions includes looping functions (avg, combine, count, max, min and sum) that work on more than one input value and can return either a single value or a set of values depending on the formula syntax. The topic of this lesson centers on that notion of "either a single value or a set of values" depending on the syntax.

If you think back to the discussion about hierarchies in vRealize Operations, you will recall for example that in the vSphere Hosts and Clusters hierarchy, virtual machines are children of hosts and that a virtual machine's parent is a host. We understand that a host can have one or more VMs as children but that a VM can only have a single host as its parent. But if we think about the relationship between hosts and datastores, we realize that a host can have one or more datastores as descendants and a datastore can have one or more hosts as ascendants. We know this because we understand vSphere enough to realize that. However, vRealize Operations really has no way to know whether relationships between particular objects or object types are one-to-one or one-to-many. This is the thing that can cause confusion when creating a super metric formula until you understand the concept and how to work with it.

In this lesson we will explore this concept by creating a super metric that can be applied to virtual machine. It will calculate the percentage of a vSphere cluster's usable memory that the VM is using. For example, if a cluster has 200 GB of usable memory and a VM in that cluster was demanding 4 GB of memory, our value should be  $4/200*100$  (to make the ratio into a percentage). The assignment will require us to use some concepts that we covered in the previous lessons and will address the issue discussed above.

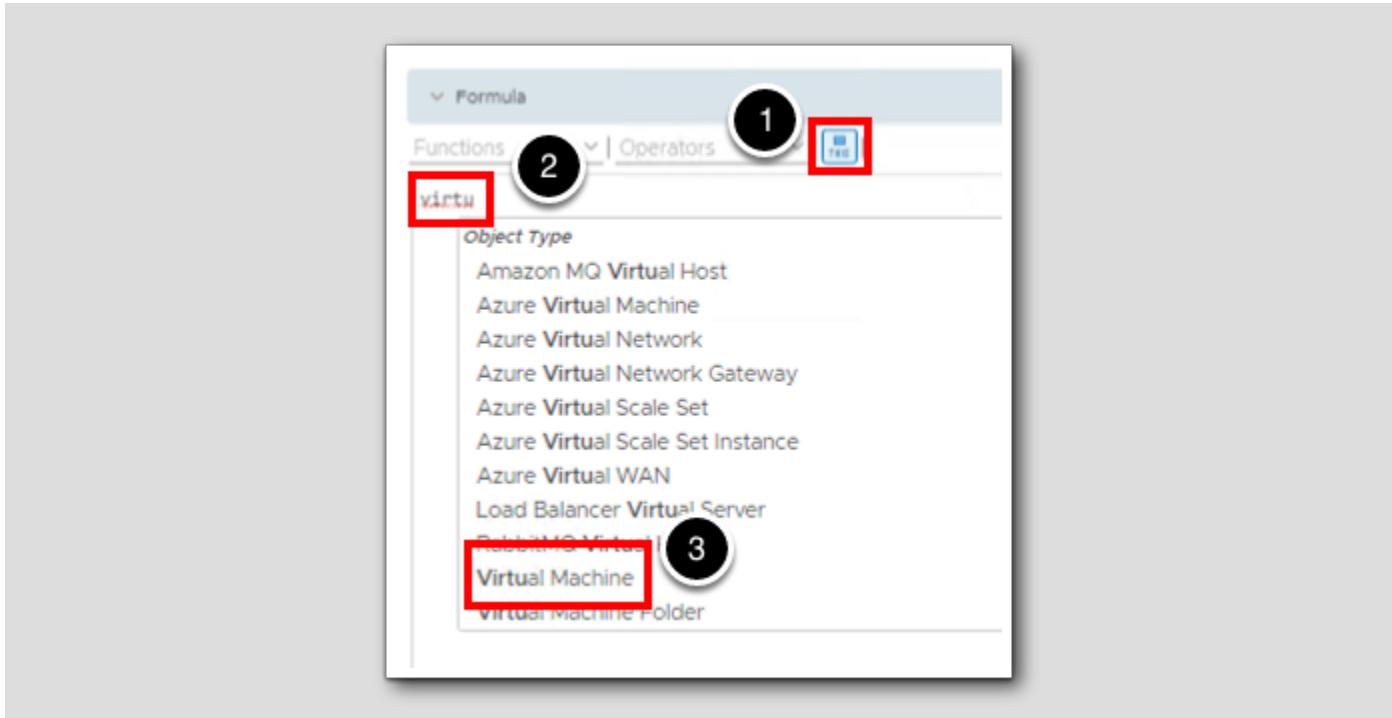
## Launch the Super Metric Wizard



Click ADD to create a new super metric (not shown this time but follow the same procedure as the previous lessons).

1. In the Name field, type VM Memory Usage As a Percentage of Cluster Memory (%)
2. In the Description field, type VM's percentage of usable cluster memory
3. Click either the next step in the wizard, Create a formula or click the NEXT button (not shown) in the lower right corner of the wizard.

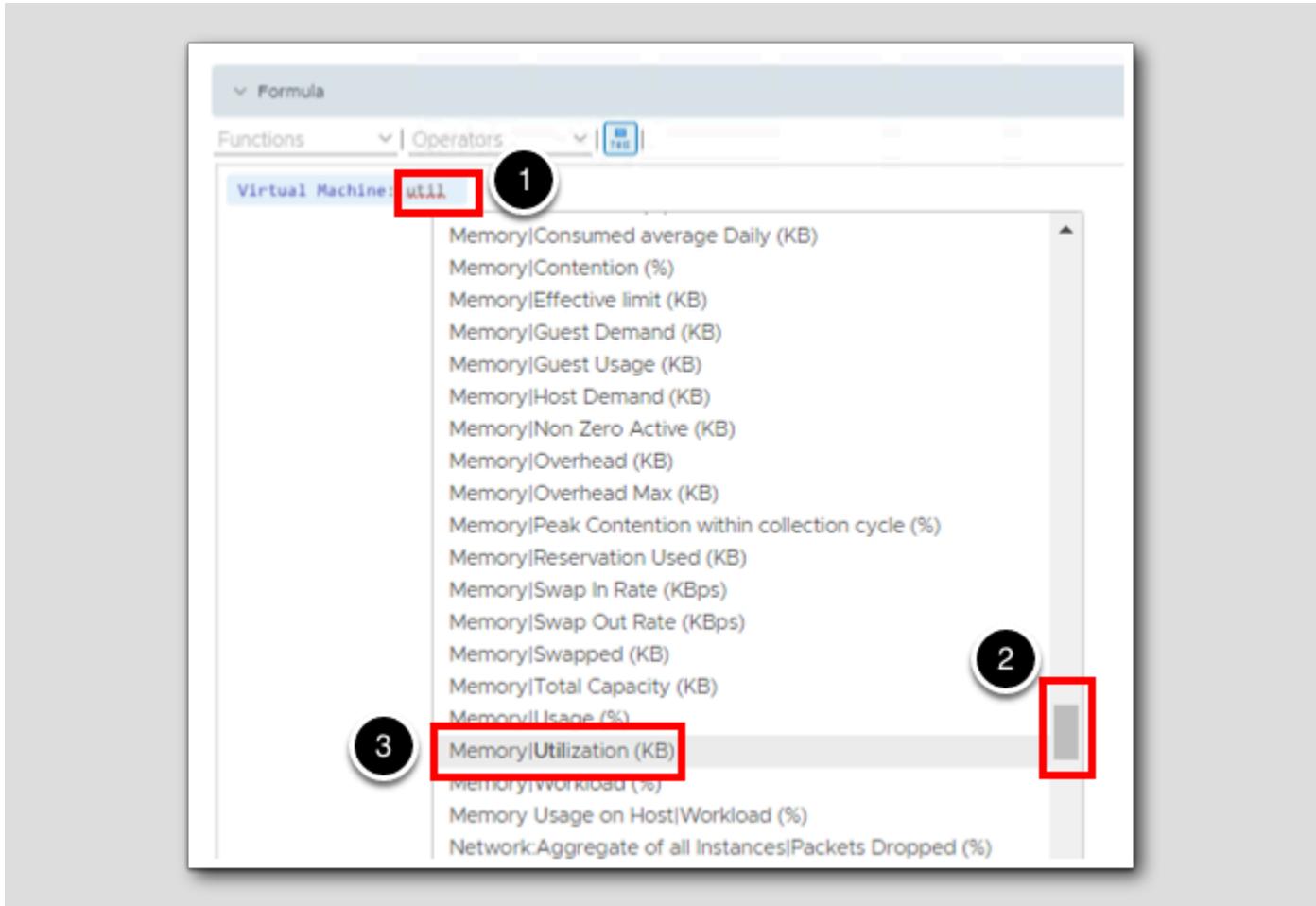
## Start the Formula



Since the super metric will be applied to virtual machines and the first metric (the numerator) in the formula is the vm's memory demand we will again use the THIS button here.

1. Click the THIS button.
2. Click in the formula window, and start typing the object type virtu
3. Click Virtual Machine to add it to the formula.

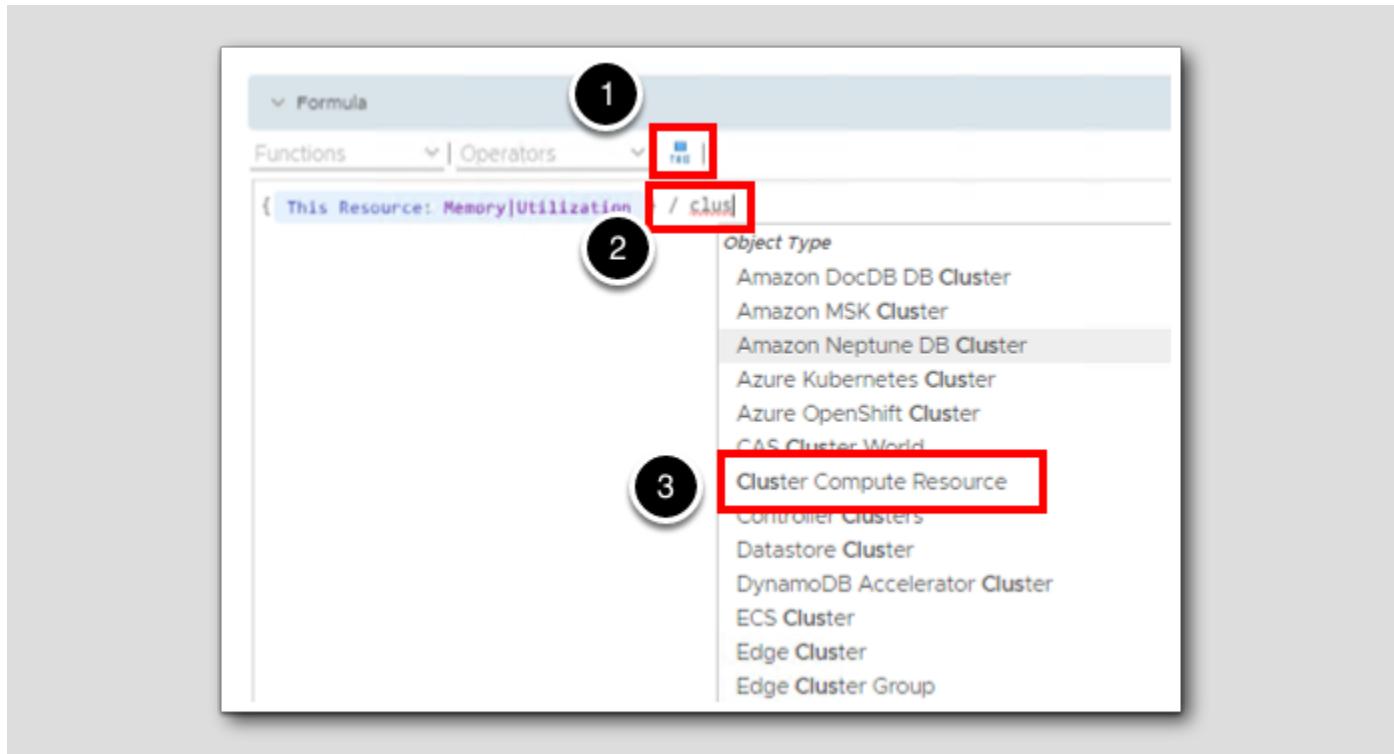
## Add the Metric



Since we want the VM's memory utilization metric,

1. Type util
2. Use the scroll bar to scroll to the bottom of the list. Ensure that you are in the list of Metrics and not Metric Types
3. Click Memory|Utilization (KB) to add it to the formula.

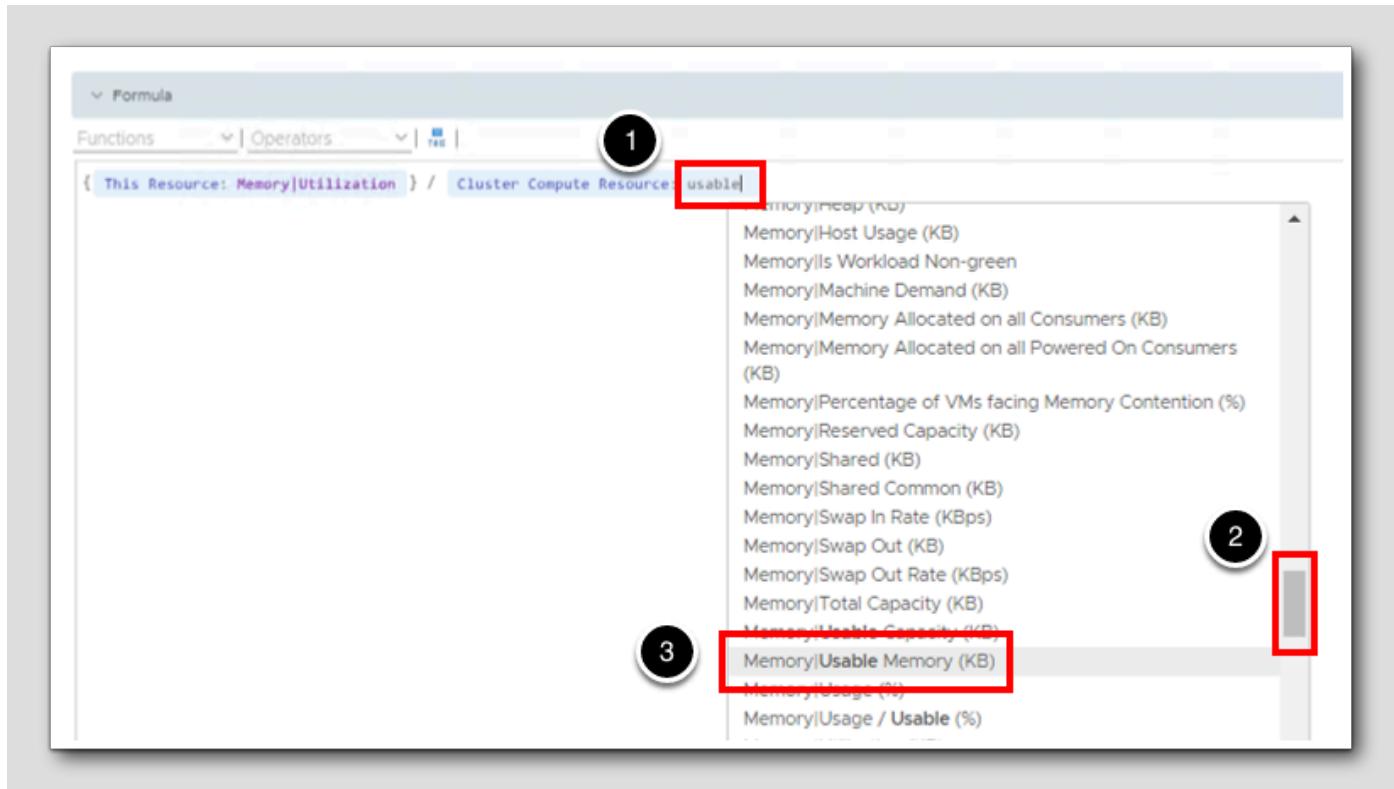
## Choose the vSphere Cluster Object Type



Before continuing, notice that the THIS button is still depressed. If we leave that toggled on and end up with "This Resource: ..." for the cluster metric then the formula isn't going to work because we will be applying it to virtual machines. So we need to remember to toggle that button off when we are done with it.

1. Click THIS to toggle it off.
2. At the end of the formula line, type a space then / then another space then clus (the spaces are not necessary but make the formula easier to read).
3. Click Cluster Compute Resource to select the object type.

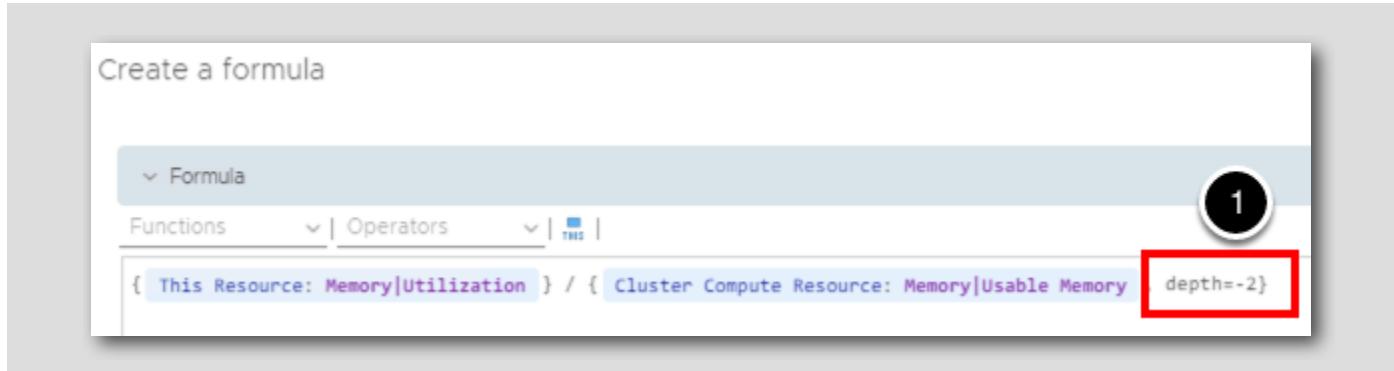
## Select the Metric



Be sure to select the correct metric here. There are a lot of similarly named that are returned by the filter.

1. On the formula line, type **usable**
2. Scroll down into the Metrics section, to the list of Memory metrics
3. Click **Memory|Usable Memory (KB)** in the Metric section to add it to the formula.

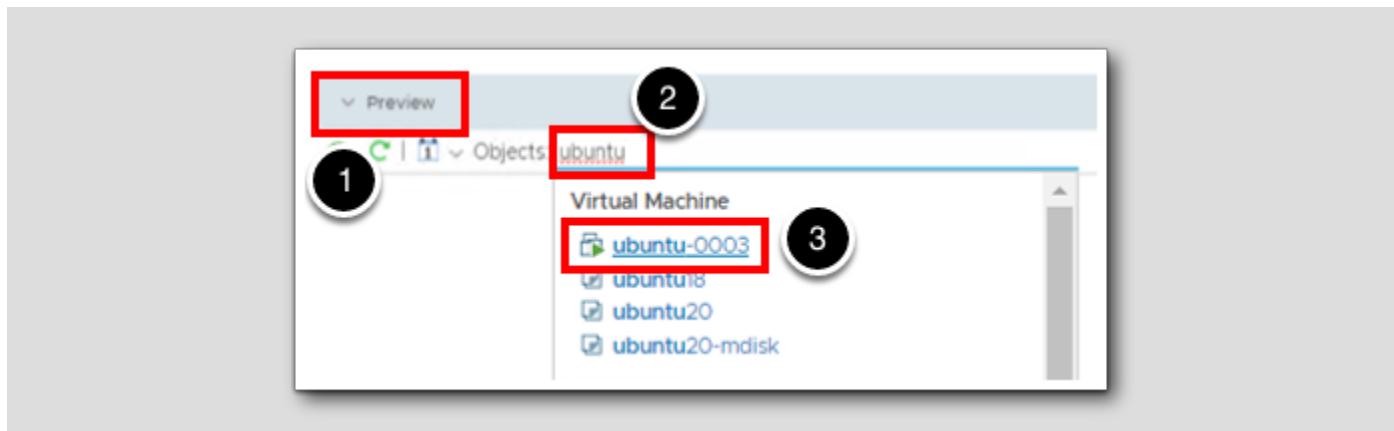
## Adjust the Formula Depth



Remembering what we learned earlier about the depth parameter and knowing that vSphere clusters are two levels above VMs in the hierarchy, we need to adjust the value. Remember for the depth parameter, a positive number means look down the hierarchy while a negative number means look up.

1. On the formula line, delete the "1" and in its place, type -2

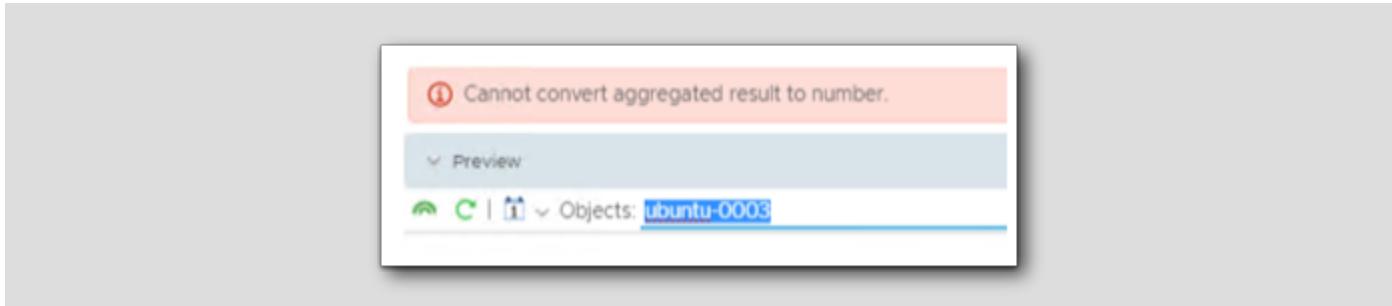
## Preview the Super Metric



OK. We're done, right? Let's preview the super metric by selecting a virtual machine in our inventory. In the Preview section,

1. Click Preview
2. Type ubuntu in the filter field.
3. Click ubuntu-0003 under Virtual Machine to select this VM as our preview object.

Uh Oh!

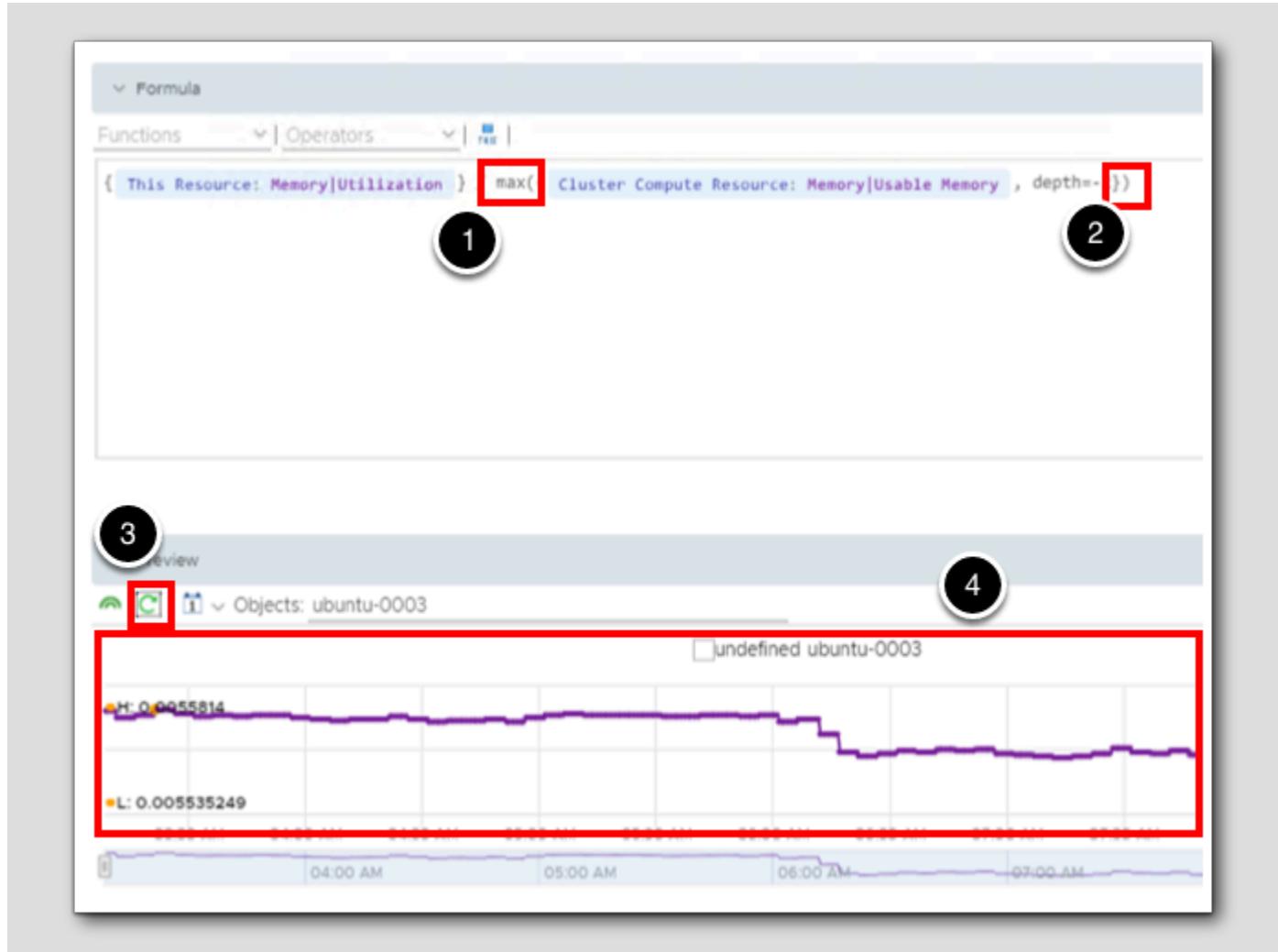


Uh oh. We got an error - Cannot convert aggregated result to number. This is the issue that was discussed at the beginning of the lesson. Remember that while we know there can only be one cluster as an ascendant (2 levels up) from the VM, vRealize Operations doesn't have any way of knowing that. As far as vRealize Operations knows, there could be a set of cluster objects that are two levels above the VM.

So how do we handle this? We need to modify the formula using a looping function. If you recall from the beginning of the lesson, it was reiterated that looping functions (avg, combine, count, max, min and sum) work on more than one input value and can return either a single value or set of values depending on the formula syntax. What does that mean in this context? It means we can use many of those looping functions to convert the results of the cluster portion of the formula to a single value. Essentially we can tell vRealize Operations to take the avg or min or max or sum of the values from all clusters above the VM and return a single number representing the calculation. What is the average or minimum or maximum or sum of a single number? It's that number.

In this case, we will use the max function (to find the maximum value from a set of one).

## Revise the Formula



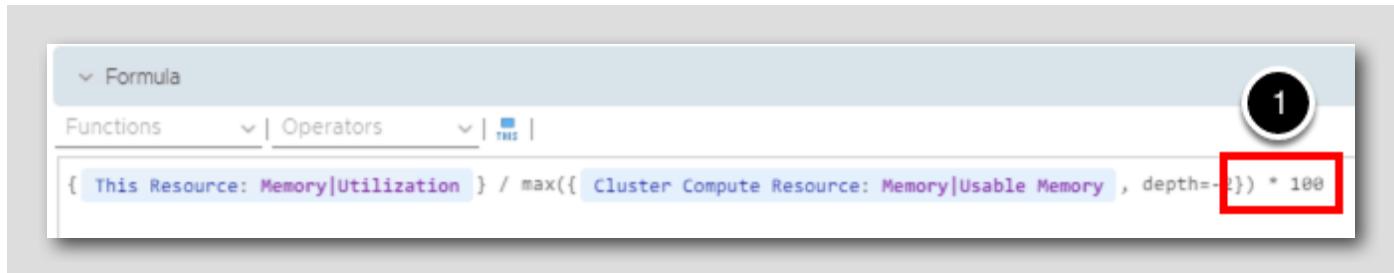
To add the function to the formula,

1. Place your cursor just before "{Cluster..." in the formula and type `max(` (don't click max in the list of suggestions or it will add both parenthesis there)
2. Press the `End` key on your keyboard to move to the end of the line and type a closing parentheses `)`
3. Click the refresh icon in the Preview section
4. Note that a preview is now rendered and the error message is gone

For reference, there is the completed formula so far: `{This Resource: Memory|Utilization} / max({Cluster Compute Resource: Memory|Usable Memory, depth=-2})`

There is only one thing left to do to complete this formula.

## Convert the Ratio to a Percentage

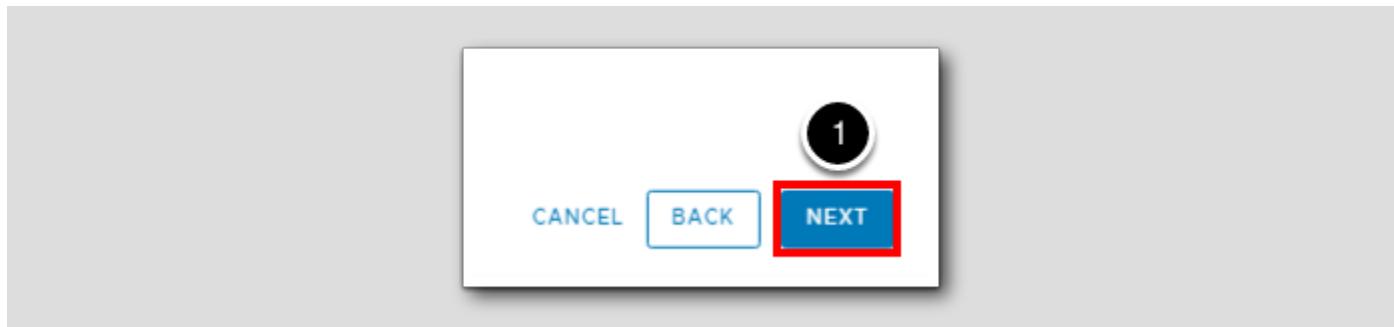


The formula is returning the ratio of vm memory utilization to cluster memory capacity. But the assignment was to calculate the value as a percentage.

1. At the end of the formula type space then \* then space then 100

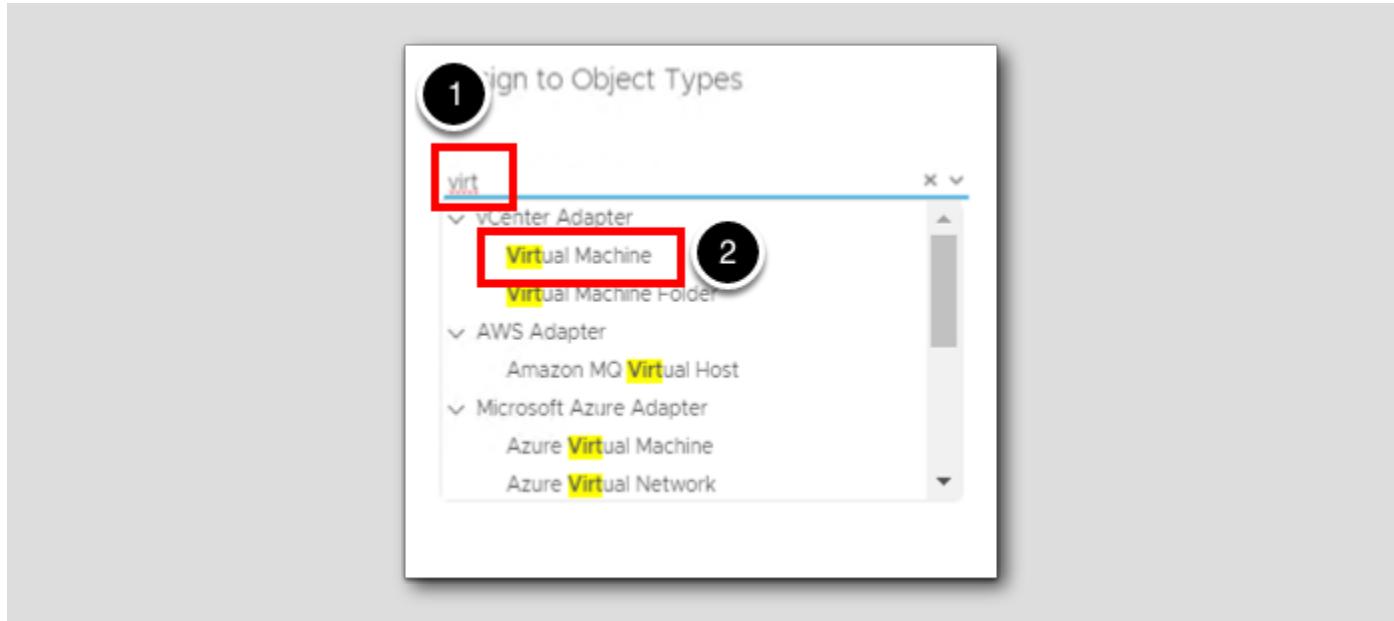
You can refresh the preview below again to see the value as a percentage now.

## Assign to an Object Type



1. Click the NEXT button at the bottom right of the window to advance the wizard.

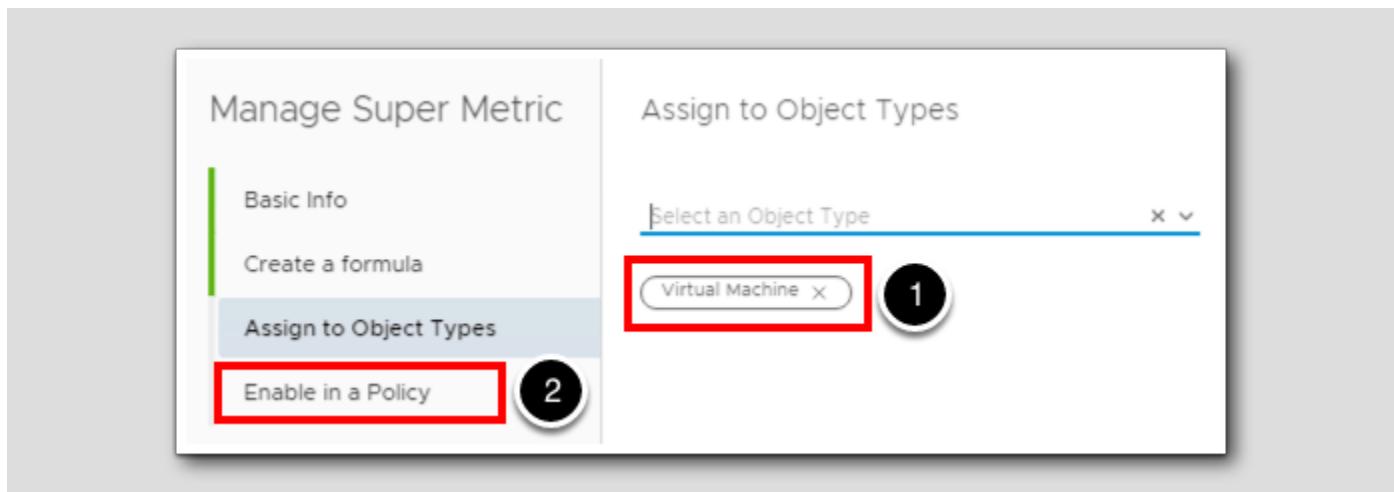
## Assign the Metric to the Datastore Object Type



Assign the super metric to the virtual machine object type.

1. Type **virt** to filter the list
2. Click **Virtual Machine** under vCenter Adapter to select the object type

## Verify the Object Type Assignments



1. Verify that the Virtual Machine object type has been selected.
2. Click **Enable** in a Policy or click the **NEXT** button (not shown) to advance the wizard.

## Select the Policy and Finish

[476]



Just like in the previous lessons, we need to enable the super metric in one or more policies if we want it to actually be calculated and then we can finish the process.

1. Check the **box** to enable the metric on Datastore object types in the vSphere Solution's policy
2. Click the **FINISH** button (not shown) to complete the wizard

## Using String Operators and the "Where" Clause in a Super Metric Formula

[477]

Super metrics can also include some logic in the formula. In this lesson we will look at using the "where" clause and a string operator to evaluate a VM property (the guest OS).

The task this time is to determine the total number of VMs in our datacenter that are running some variant of the ubuntu operating system.

The following string operators are available for use in a super metric formula. Note that string operators are valid only when used in a "where" clause to evaluate whether or not the specified text does or does not exist in the string.

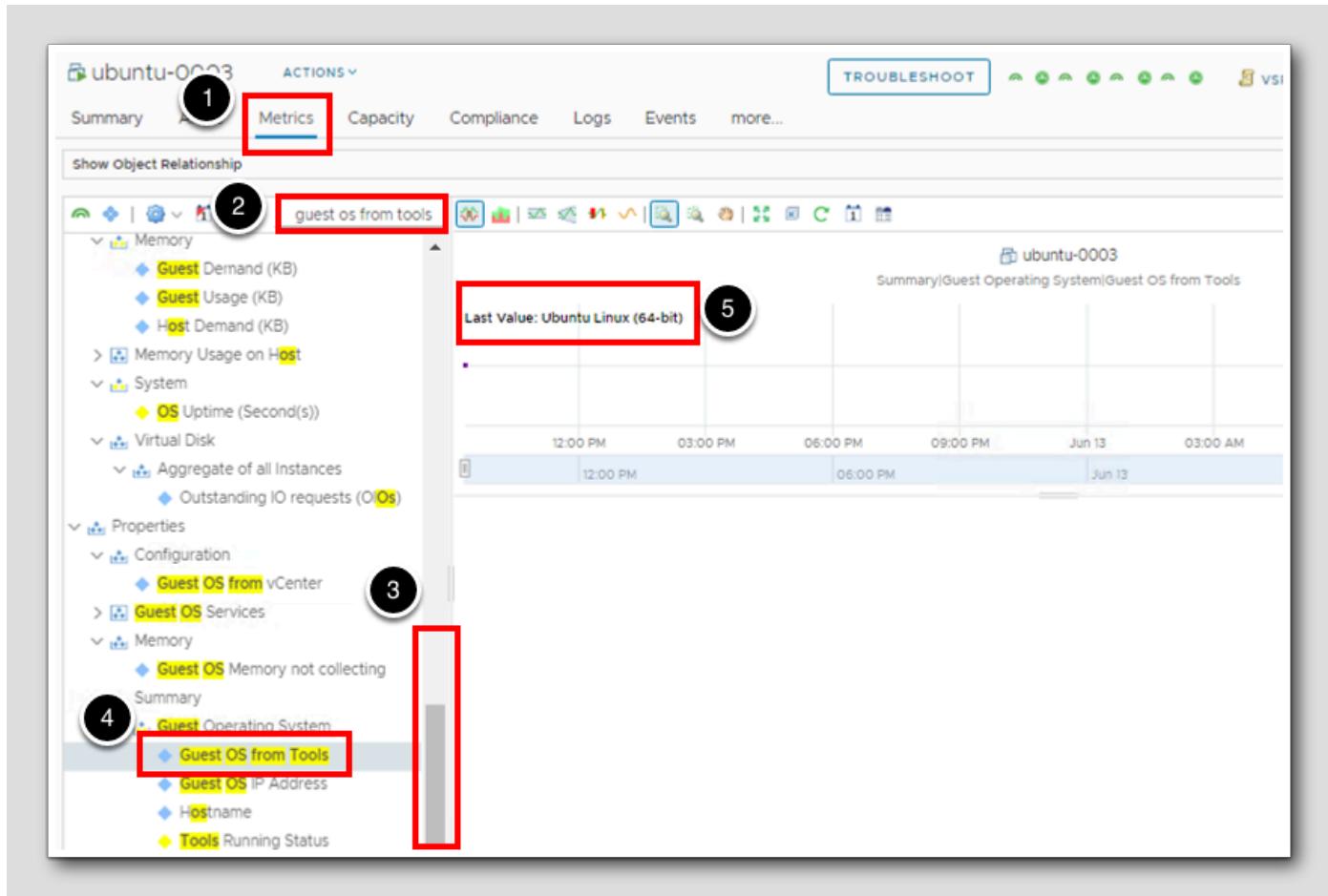
## Examine the Guest OS Full Name Property



Let's first take a look at the VM property we are going to use in this super metric formula.

1. Click the global search **magnifying glass** in the top bar (not shown) to expand the search box
2. In the search box, type **ubuntu**
3. Click to select the **ubuntu-0003** Virtual Machine.

## Select the OS Name Property



The guest operating system name is contained in the Guest OS Full Name property for a vm that is running VMtools.

On the ubuntu-0003 object page:

1. Click the **Metrics** tab.
2. In the filter box, type **guest os from tools** and press the Enter key.
3. Scroll down to the Property section
4. Double-click the property **Guest OS from Tools**.
5. Note the OS name of this VM.

We will create a super metric that counts all of the VMs with the text "ubuntu" in that property field and then we can apply the super metric to our datacenter object type.

## Create the Super Metric

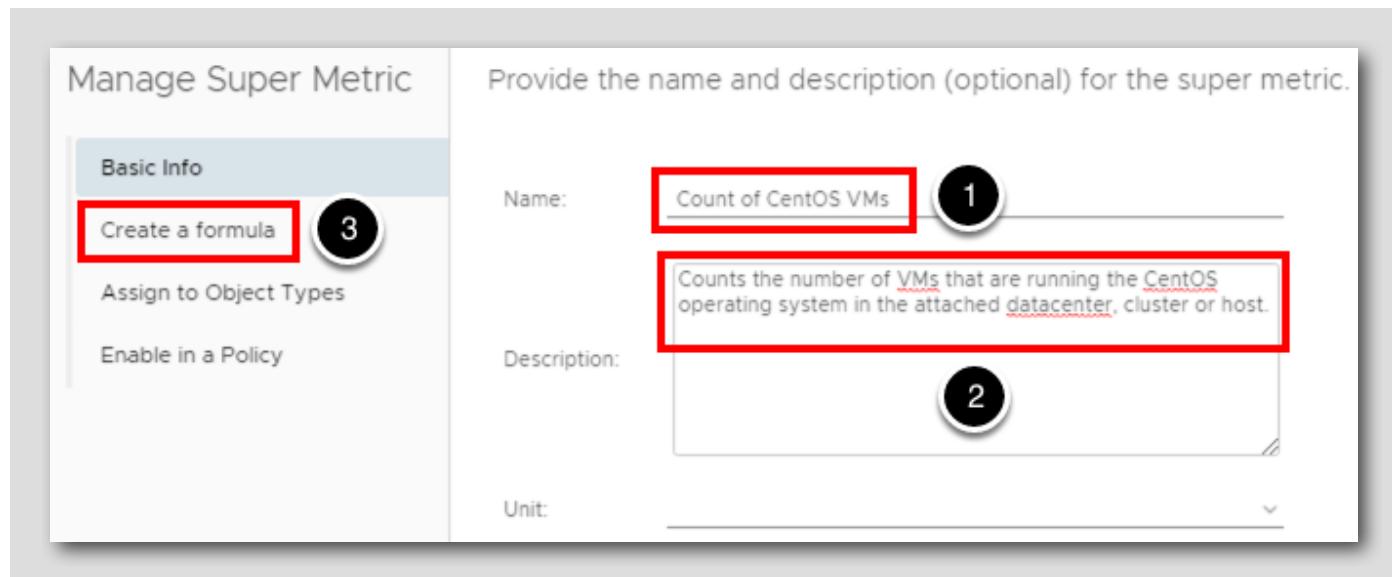
The screenshot shows the vRealize Operations Manager interface. A red box highlights the 'Administration' tab in the top navigation bar. A red circle with the number '1' is placed over the 'Administration' tab. A red box highlights the 'ADD' button in the top right corner of the main content area. A red circle with the number '2' is placed over the 'Configuration' section in the left sidebar. A red box highlights the 'Super Metrics' option under the 'Configuration' section. A red circle with the number '3' is placed over the 'Super Metrics' option. A red box highlights the 'Super Metrics' link in the breadcrumb trail. A red circle with the number '4' is placed over the 'Super Metrics' link in the breadcrumb trail.

Name	Description	Formula
Load Balancer Session Count	Load Balancer Session Count	(sum(Lo...))
Edge Load Balancer Count	Edge Load Balancer Count	(sum(Tra...))
Load Balancer Sessions Rate	Load Balancer Sessions Rate	(sum(Lo...))
Percentage of Datastore Capacity Used...	On a datastore object, find the percenta...	sum(Virt...))
VM Memory Usage as a Percentage of ...	VM's percentage of usable cluster mem...	This Res...
Average Mem Usage Across All Descen...	Calculates the average memory usage o...	avg(Virt...))

Let's go create the super metric using that Guest OS Full Name vm property.

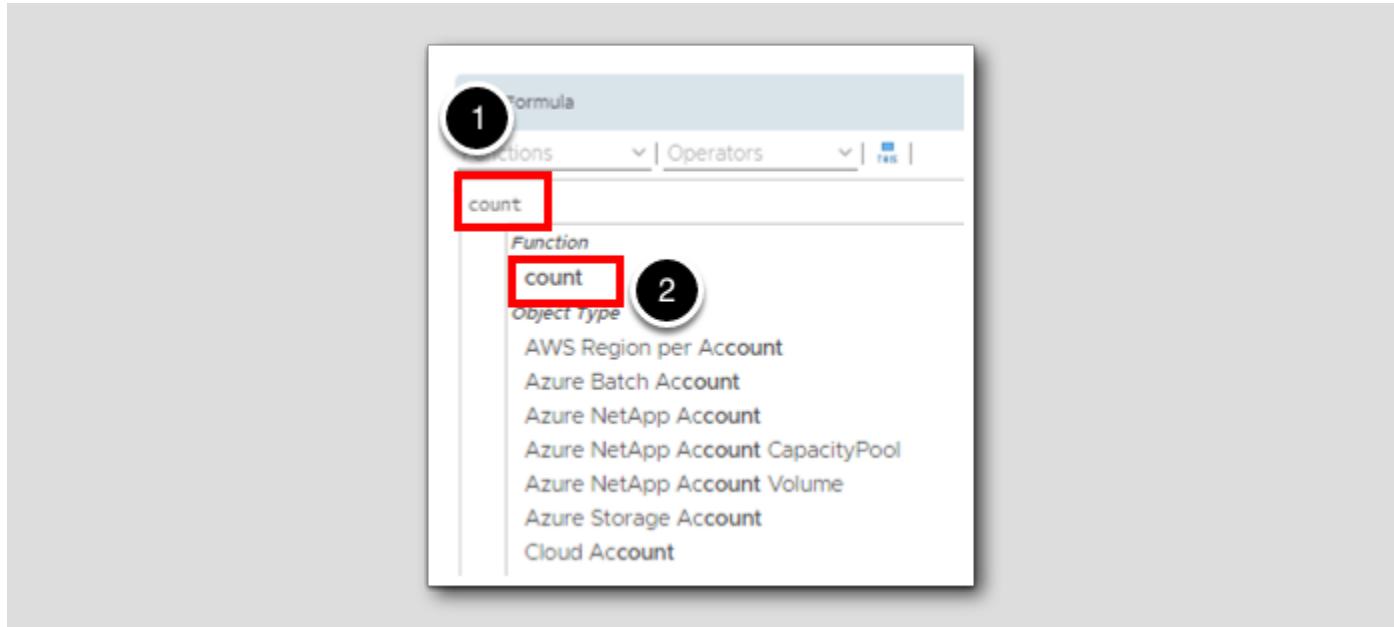
1. Click Administration.
2. Expand the Configuration section.
3. Click Super Metrics.
4. Click ADD to create a new super metric.

## Name the Super Metric



1. Type the name: Count of Ubuntu VMs
2. Type a description.
3. Click Create a formula or the NEXT button (not shown) in the wizard.

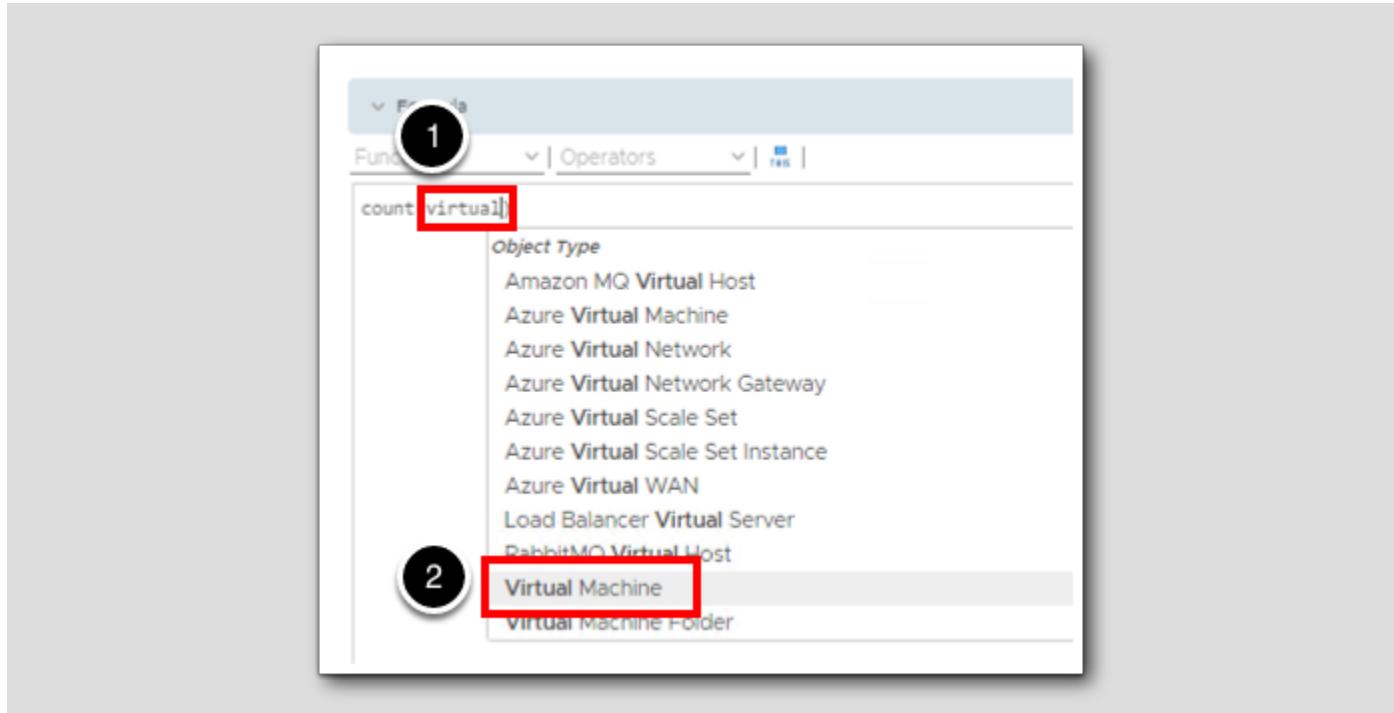
## Start the Formula



Remember that we want to count the number of VMs running the CentOS operating system so we will use the **count** looping function.

1. Type **count** to see a list of matching options.
2. Click the **count** function.

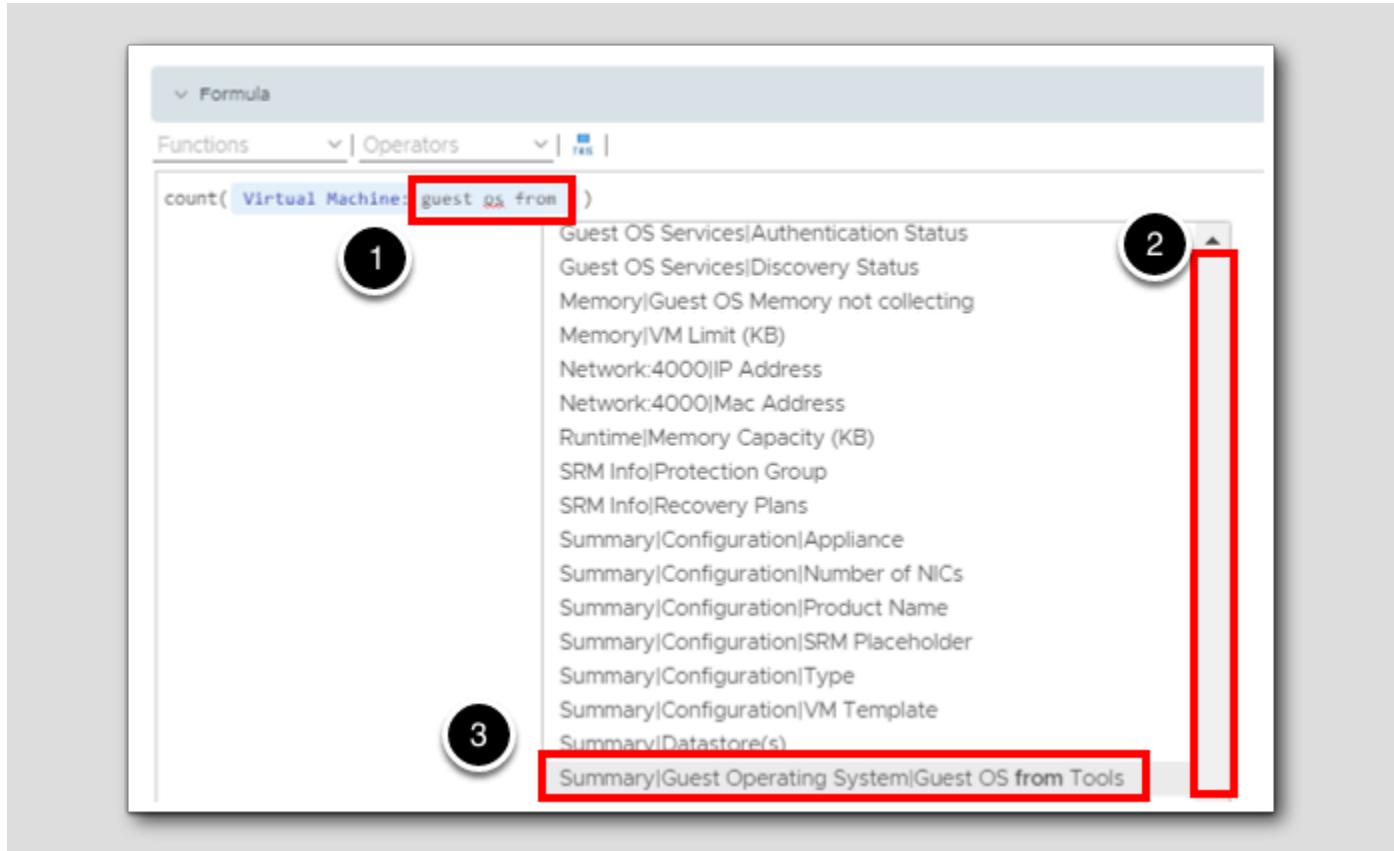
## Select the Virtual Machine Object Type



At the cursor position (between the parenthesis):

1. Type **virtual**
2. From the match list, click the **Virtual Machine** object type to select it.

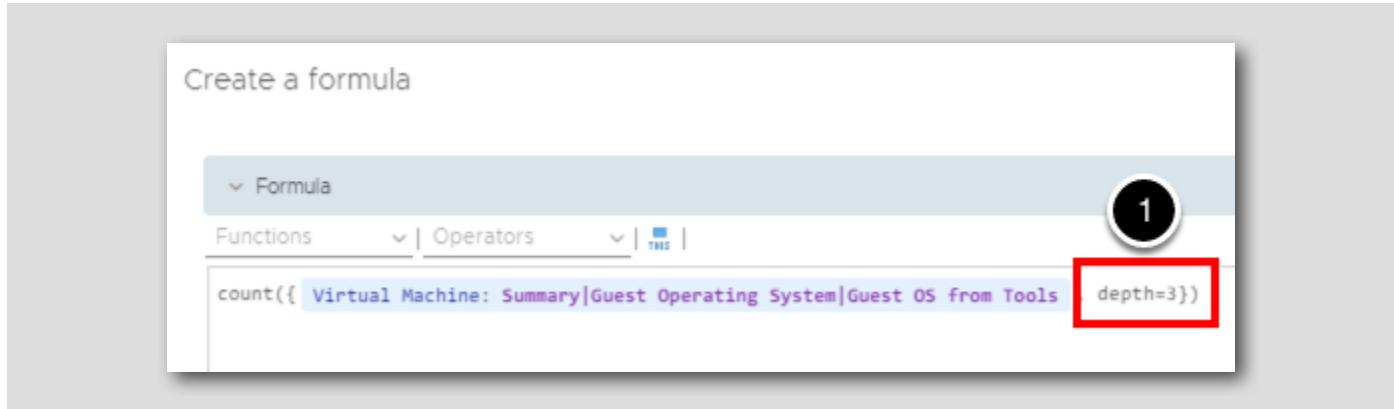
## Select the Guest OS From Tools Property



At the cursor position:

1. Type **guest os from**
2. Scroll down to the **Property** section, and continue scrolling to the list of **Summary** properties
3. From the match list, click the **Summary|Guest Operating System|Guest OS from Tools** property (be sure to scroll all the way to the **Property** section, rather than selecting the **Summary|Guest Operating System|Guest OS from Tools** property type near the start of the list.)

## Adjust the Depth Parameter



Remember that we are going to want to apply this metric at the vSphere Datacenter object level. Going back to our discussion earlier about depth, we will need to set the depth to Datacenter --> Cluster --> Host --> VM or three levels down. Traversing down the hierarchy means a positive depth parameter so:

1. Use the left-arrow key on the keyboard to move back one character in the formula so the cursor is just to the right of the 1.  
Use the Backspace key to delete the 1 and then type 3 in its place.

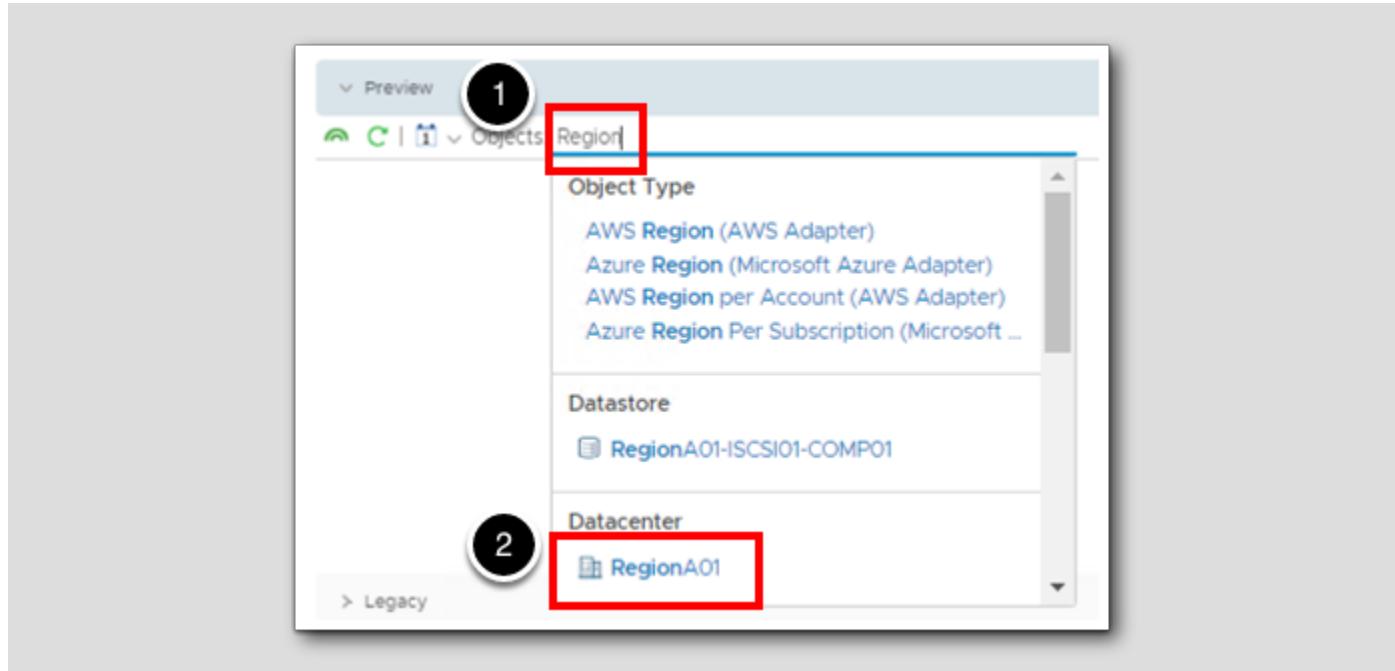
## Add the Where Clause



At the cursor position (just to the right of the 3 you typed), type the following. Note the leading comma, the quotation marks and the exact case. The syntax may not seem intuitive but that is the way it needs to be written. It might be easiest to just highlight the text below and drag it to the HOL console.

1. , where = "contains Ubuntu"
2. Click Preview (not shown)

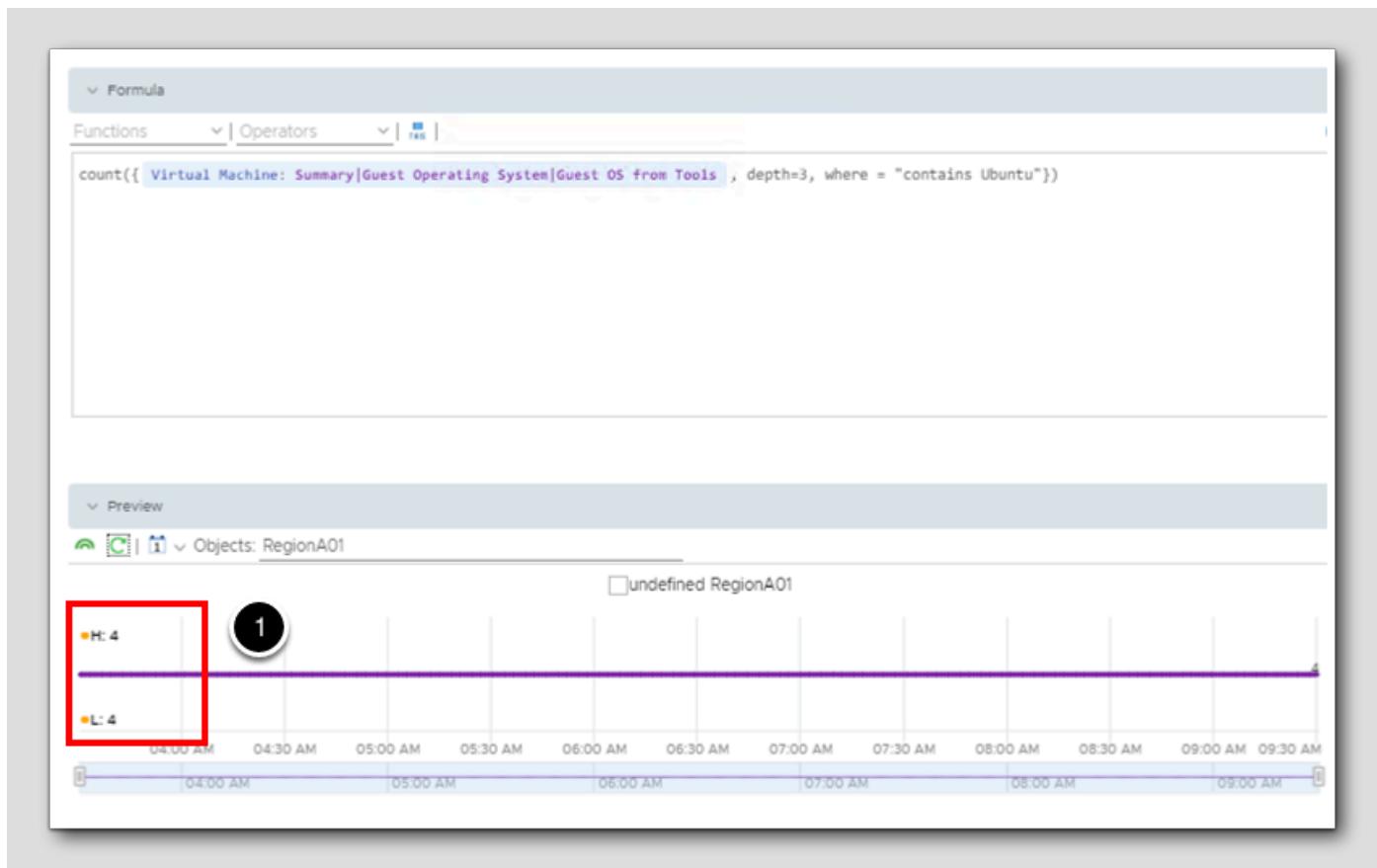
## Select the Regional Datacenter Preview Source



Let's see how this super metric works for our vSphere datacenter.

1. In the Preview Objects filter, type Region
2. Click to select the RegionA01 datacenter object.

## View The Super Metric Preview



Here you can see:

1. Here we see the number of VMs in our datacenter that are running the CentOS operating system.
2. Click NEXT (not shown) to advance the widget.

Assign the super metric to the Datacenter object type and enable it in the HOL Policy policy, and then click FINISH (not shown but follow the same process as our previous lessons).

Note that you can also assign the super metric to Host System and Cluster Compute Resource object types with good results since this formula will look down 1, 2 and 3 levels to find Virtual Machine object types and check the operating system property for Ubuntu.

## Using The Ternary Operator (if/then/else) in a Super Metric Formula - Fix the broken Import

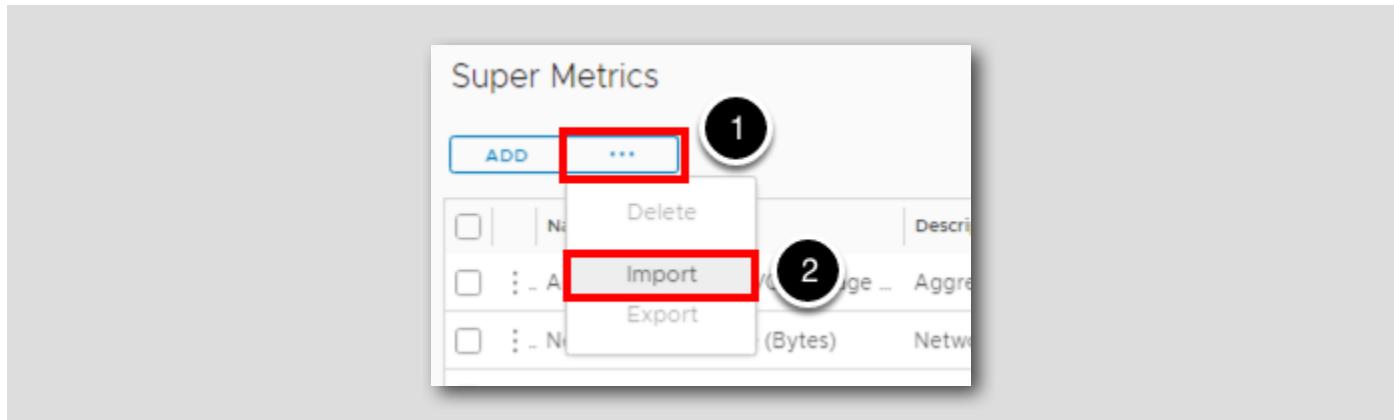
Super metric formulas also support the use of the ternary operator, also known as if/then/else conditional logic. The format for the ternary operator here is `expression_condition ? expression_if_true : expression_if_false`

For this lesson, the assignment will be to define a super metric for host objects that has a value of zero when the sum of allocated memory for all VMs on that host is less than the total memory capacity of the host and one when the sum is greater than total memory capacity. In other words, zero if memory is not over-allocated. One if it is.

Instead of building this super metric formula from scratch, we will look at how the formulas can be imported and exported for portability between different vRealize Operations instances. The super metric for this assignment has already been created and exported in json format. You are going to import it then we will take a look at the syntax of the formula.

### Import the Super Metric

[490]

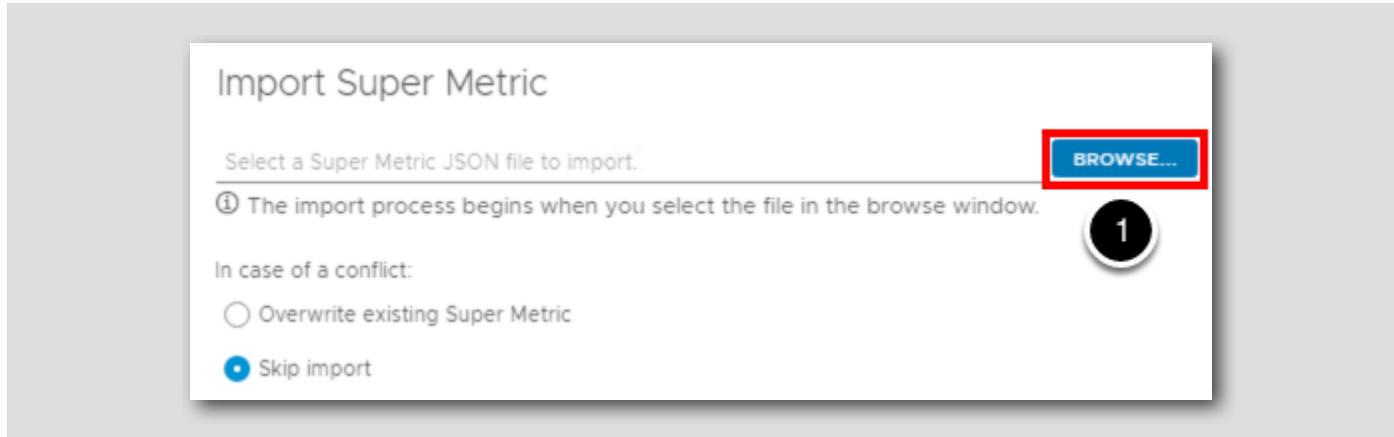


To import a saved or downloaded super metric:

1. Click the 3 dots icon to open the action menu.
2. Click **Import**.

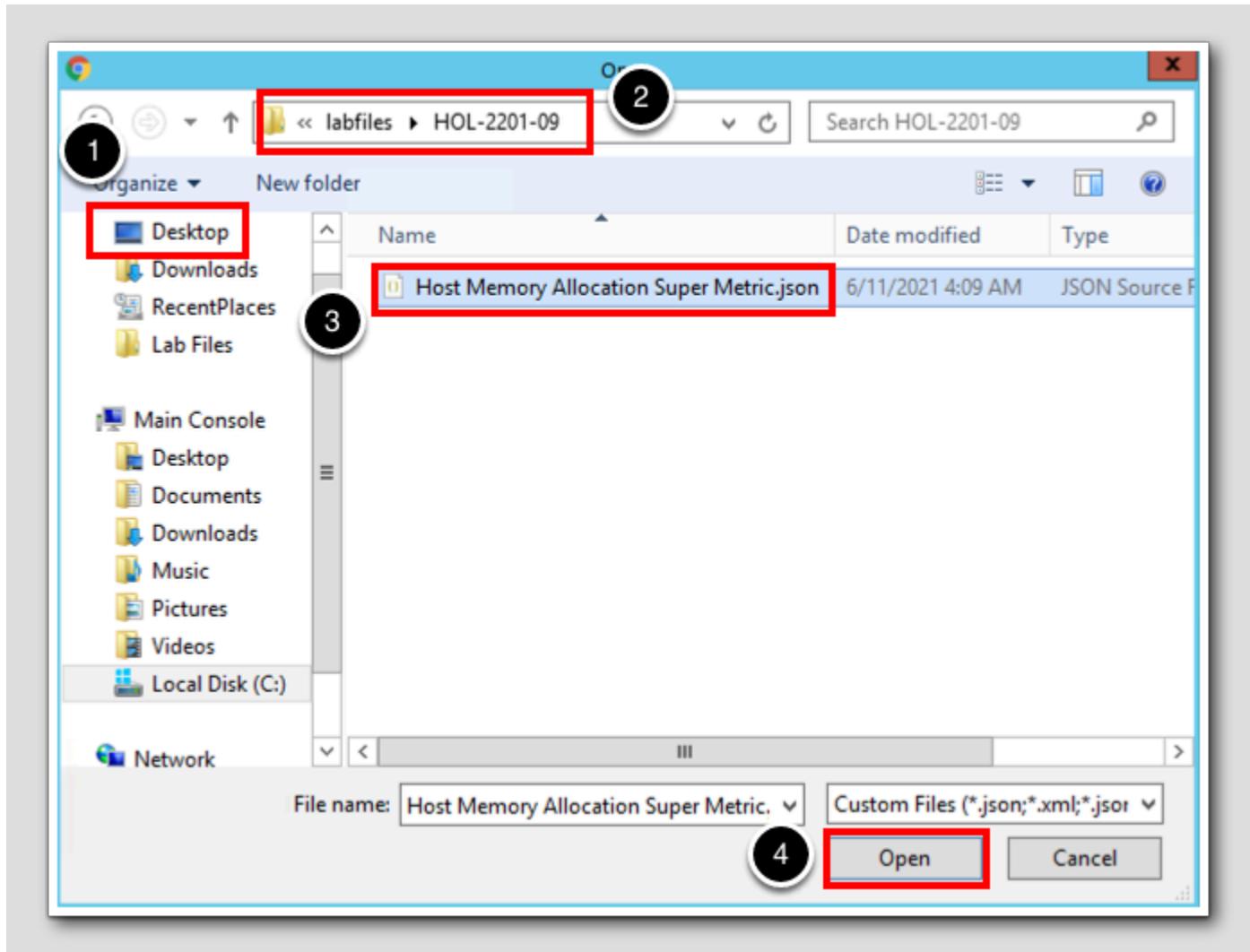
Note that you could also export a super metric here that you have defined if you want to use it in a different vRealize Operations Instance.

## Browse For the Metric Definition



1. Click the BROWSE... button

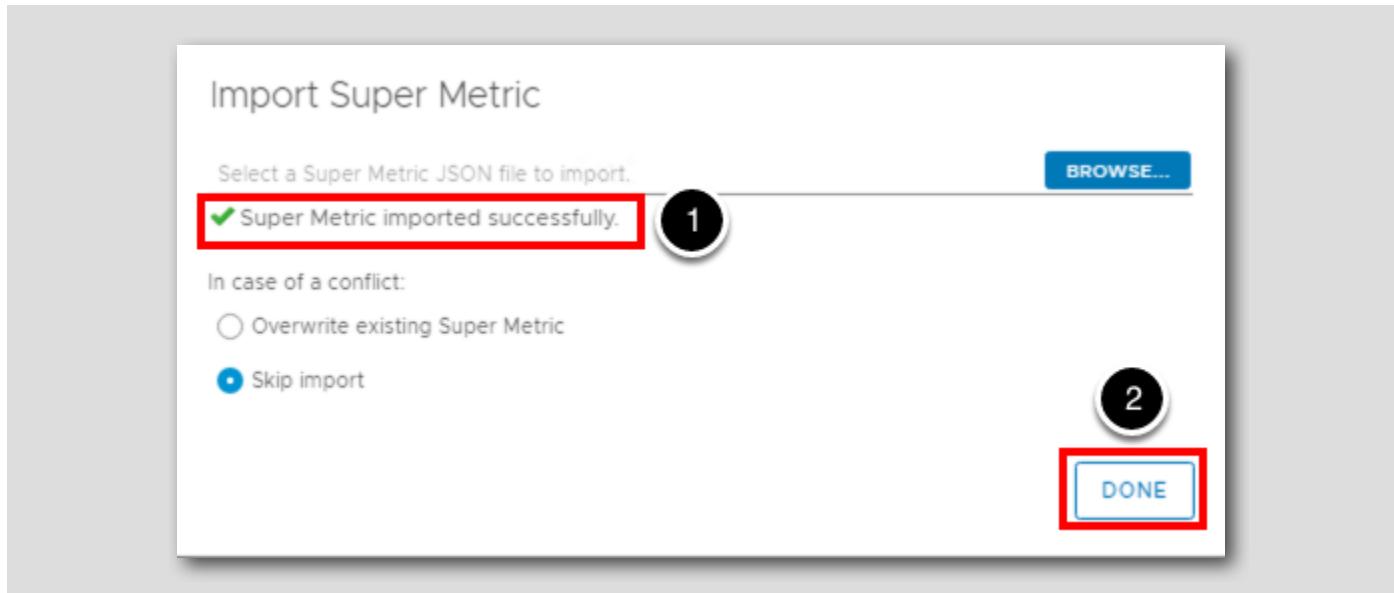
## Select the File



The dialog box should open in the correct directory. If not, you will have to browse to the directory.

1. Click the Desktop link
2. Navigate to the Lab Files -> HOL-2201-09 folder
3. Click the Host Memory Allocation Super Metric.json file to select it
4. Click Open

## Complete the Import



1. You should see that the Super Metric imported successfully

2. Click DONE

## Edit the Super Metric

The screenshot shows a table of 'Super Metrics'. The columns are 'Name', 'Description', and 'Formula'. There are several rows, each with a checkbox in the first column and a three-dot menu icon in the last column. A context menu is open over the third row, with the 'Edit' option highlighted (marked with a red box and circled '2'). A circled '1' points to the three-dot menu icon in the row header of the first row. The rows contain the following data:

	Name	Description	Formula
<input type="checkbox"/>	Count of Ubuntu VMs	Counts the number of VMs that are run...	count(Virtual Machine)
<input type="checkbox"/>	Load Balancer Session Count	Load Balancer Session Count	(sum(Load Balancer Session))
<input type="checkbox"/>	Edge Load Balancer Count	Edge Load Balancer Count	(sum(Transit Session))
<input checked="" type="checkbox"/>	Overallocated	Is one if allocated vMem is greater than ...	(This Resource)
<input type="checkbox"/>	Sessions Rate	Load Balancer Sessions Rate	(sum(Load Balancer Session)) / (Virtual Machine)
<input type="checkbox"/>	Percentage of Datastore Capacity Used...	On a datastore object, find the percenta...	sum(Virtual Datastore Capacity Used) / (Virtual Datastore Capacity)

Notice that there is now a new super metric - Host Memory is Overallocated. Let's take a look at it.

1. Click the **3 dots** to the left of the Host Memory is Overallocated metric name
2. Click **Edit** to edit the super metric

## View the Metric Formula

[495]

Create a formula

Formula

Functions Operators

`(( This Resource: mem|memory_allocated_on_all_vms )/{ This Resource: mem|host_provisioned }) > 1 ? 1 : 0`

1      2

Preview Legacy 3

CANCEL BACK NEXT

As noted in the lesson introduction, the format for the ternary operator here is `expression_condition ? expression_if_true : expression_if_false`. In this case:

`expression_condition` evaluates whether the ratio of the total memory allocated to all VMs divided by the physical memory on the host is greater than 1

1. The `?` operator delineates the expression condition from the value/expression returned if the condition is true

`expression_if_true` is the number 1 in this case. We want the super metric value to be 1 if the allocated VM memory is greater than the physical host memory.

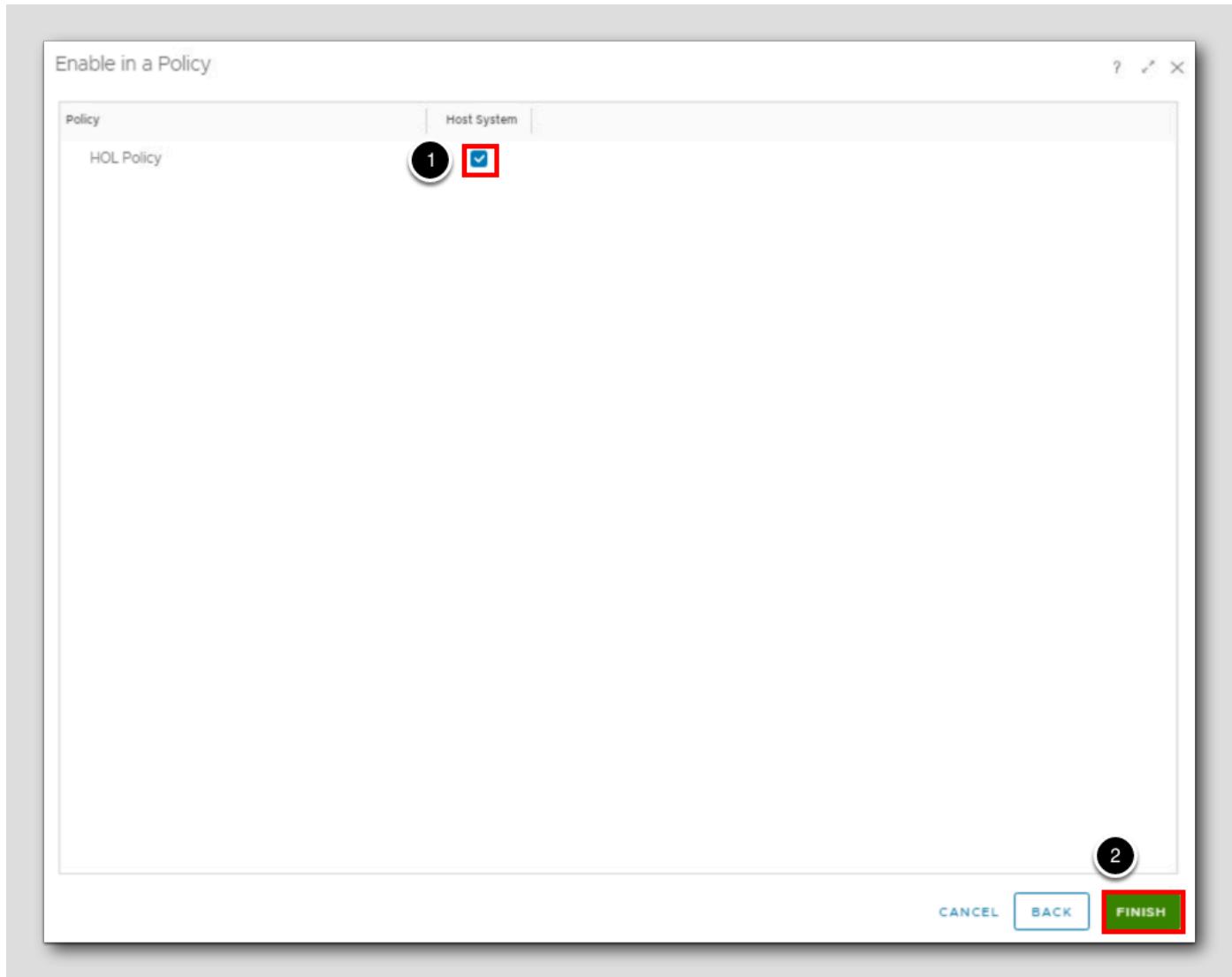
2. The `:` operator delineates the value/expression returned if the condition is true from the value/expression returned if the condition is false

`expression_if_false` is the number 0 in this case. We want the super metric value to be 0 if the allocated VM memory is not greater than the physical host memory.

In our lab environment, none of the four hosts has memory overallocated so the super metric will evaluate to zero for all of them. If you want to, you can open the vSphere client and change the memory allocation on one of the VMs to something that makes the total VM allocated memory on a host greater than 10 GB since that's the configured memory on our hosts. If you do try this, you will need to wait at least one collection/analytics cycle (set at one minute in the HOL pod) before you will see the super metric value change from zero to one.

3. Click **NEXT** in the wizard and then click **NEXT** again (not shown) to get to the **Enable in a Policy** step.

## Enable In the Policy and Save



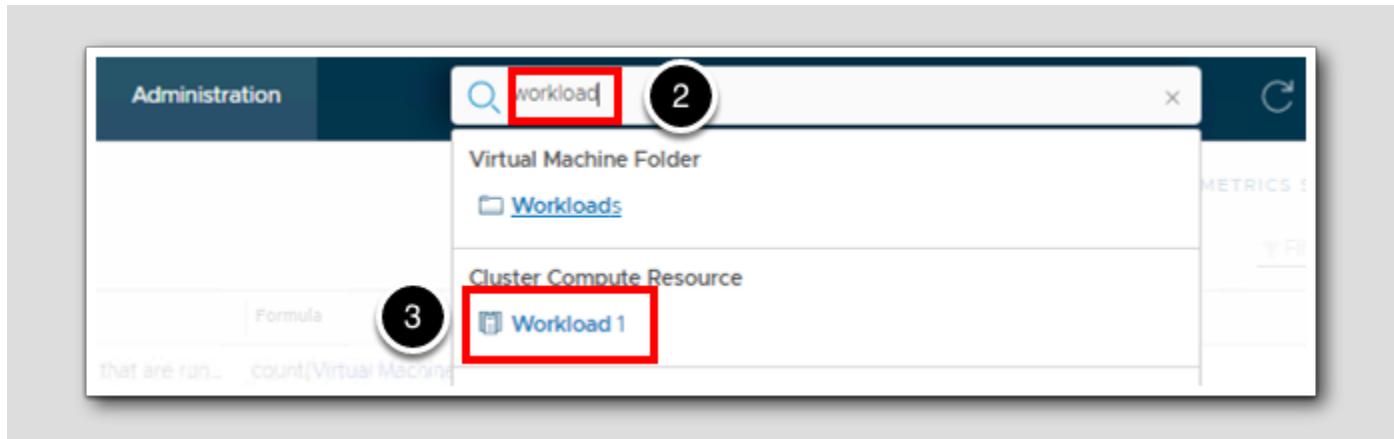
All that's needed now is to enable the super metric in our policy and save it.

1. Check the box to enable the metric in our HOL Policy and any other policies that are under HOL Policy.
2. Click FINISH to save and close the wizard.

## Verifying Super Metric Calculation

We just created several super metrics. Let's check to make sure they are being calculated on the appropriate objects in our environment.

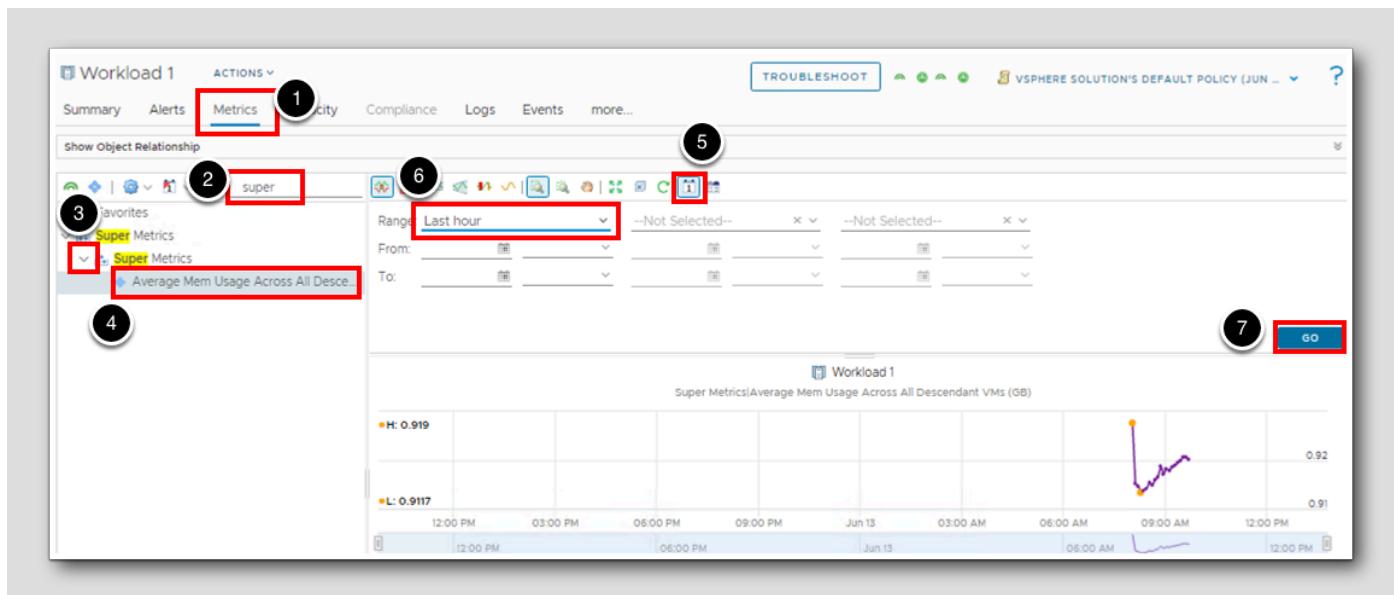
## Search for a Cluster



Let's first take a look at the Workload 1 vSphere cluster's metrics.

1. Click the global search magnifying glass in the top bar (not shown) to expand the search window
2. In the search box, type workload
3. Click to select the Workload 1 vSphere cluster.

## View the Workload 1 Super Metric

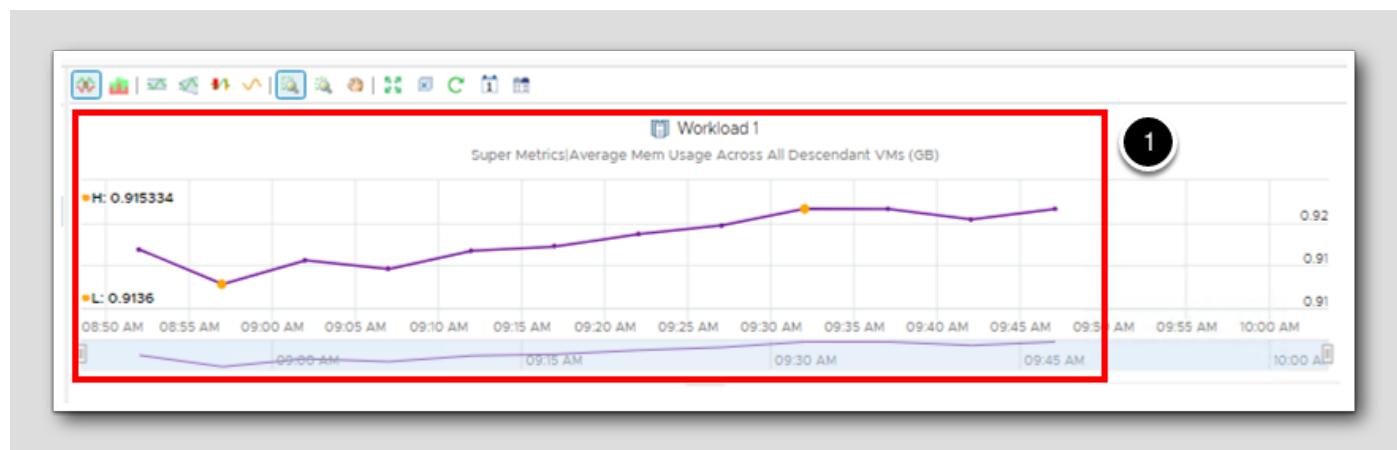


To see the calculated value of the cluster super metric:

1. Click the **Metrics** tab.
2. In the search box, enter **Super** and hit Enter.
3. Note that there is a metric category **Super Metrics**. This will only exist when there are one or more super metrics calculated for the object. Click to expand it.
4. Double-click **Average Mem Usage Across All Descendant VMs (GB)**.
5. Since the metric is new, let's change the time scale. Click the **calendar** icon.
6. Click **Last Hour** to change the time scale.
7. Click **GO**.

## Super Metric Graph

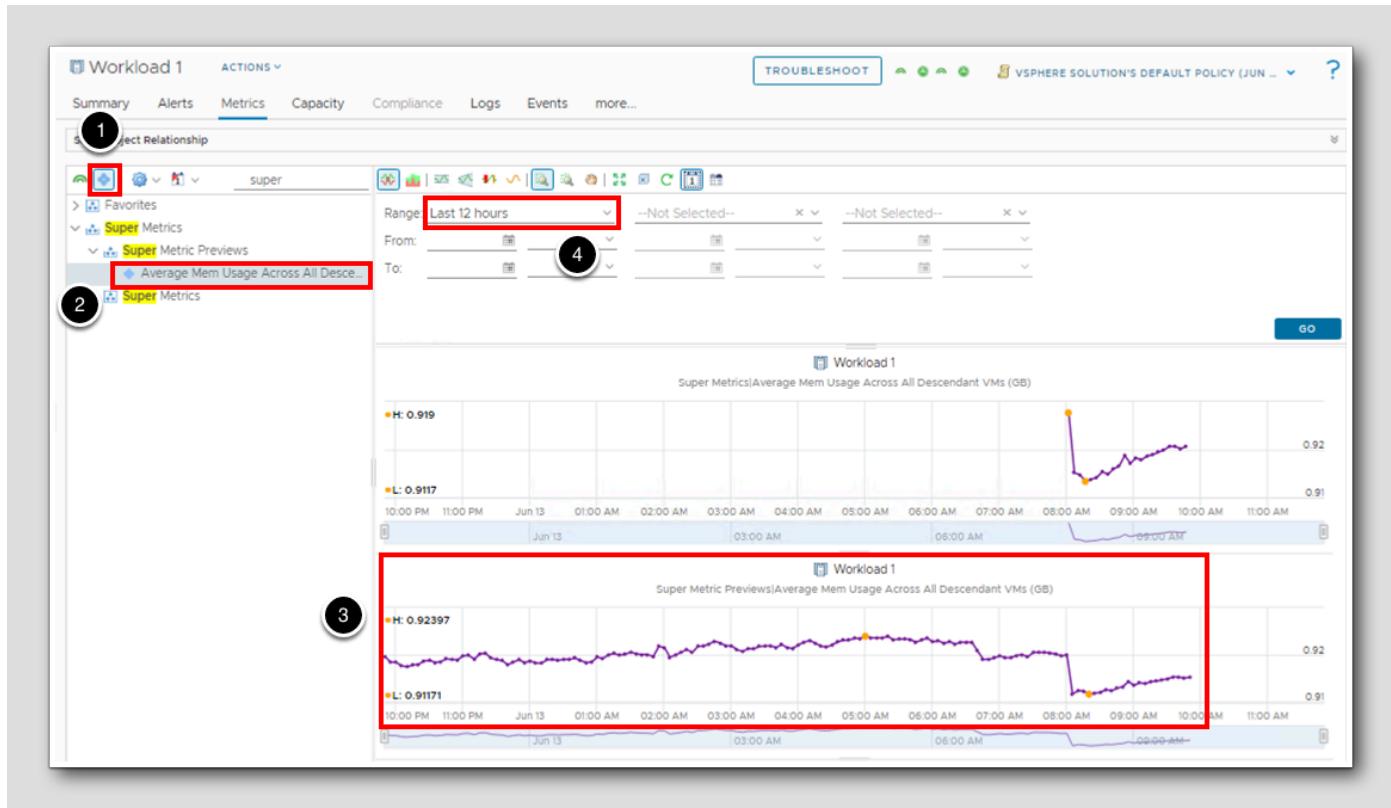
[500]



1. CNote that in this case the super metric has been calculated and stored in the database for several minutes. In your lab environment, the value and number of metric points will vary.

It is important to understand that super metric values will only be stored in the database from the time you create the metric and enable it in the appropriate policy.

## Visualize Historical Super Metric Values



We also have the ability to visualize what a super metric value would have been for time frames prior to when the metric was created.

1. Click the Show previewable supermetrics button. Note that there is now a **Super Metric Previews** category now, and it should be expanded. If it is not, then click to expand it.
2. Double-click the super metric name.
3. You can see that a historical view of the super metric is available.
4. It may help to look further back, so use the calendar icon to select a different time range. In this case, I've set my range to the **Last 12 hours**.

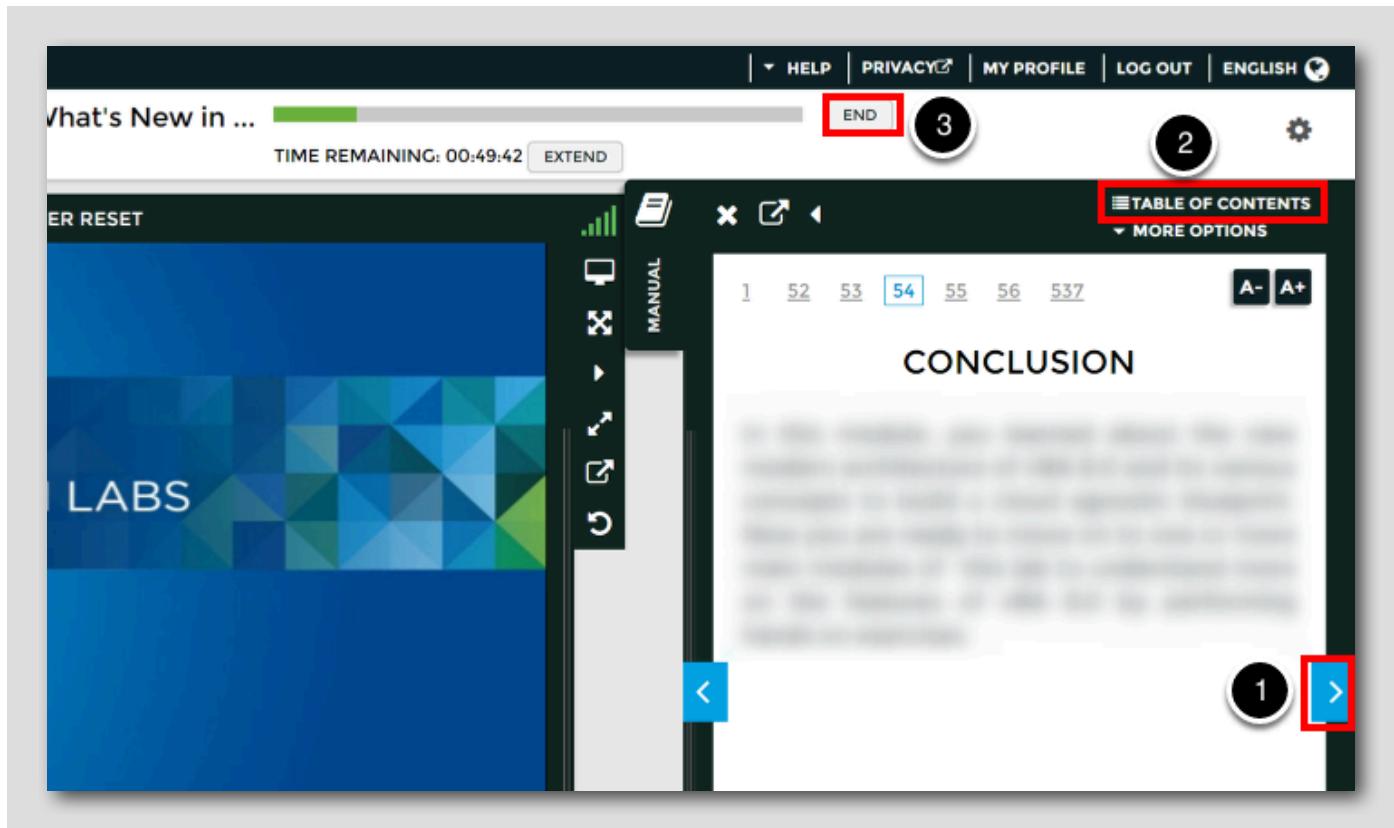
Note that the historical super metric calculation will be limited to the time range available for the metric(s) that are used in the super metric formula. In this lab environment, you may see large gaps in the data because of when the environment was created and the fact that the lab pod sits dormant (powered off) until shortly before you logged in and took this lab. Also note that while we have set a non-standard data collection interval of one minute in this lab pod (see frequency of data points in the top graph), the historical preview uses the standard 5-minute interval for calculations.

If you are interested, you can select VM, host, datacenter and datastore objects in this environment and confirm that the super metrics we created and enabled for each of those object types is also being calculated.

## Conclusion

In this module we discovered how to use the super metrics editor. We also walked through creating several super metrics in order to show many concepts that are important to understand when working with super metrics. Finally, we saw how to import and export super metrics and then verified that the metrics we created were being calculated as expected.

You've finished module 5



Congratulations on completing the lab module.

If you are looking for additional general information on vRealize Operations 8.4, try one of these:

- VMware Product Public Page - vRealize Operations: <https://www.vmware.com/products/vrealize-operations.html>
- vRealize Operations 8.4 - Release Notes: <https://docs.vmware.com/en/vRealize-Operations-Manager/8.4/rn/vRealize-Operations-Manager-84.html>
- vRealize Operations 8.4 - Documentation: <https://docs.vmware.com/en/vRealize-Operations-Manager/8.4/com.vmware.vcom.core.doc/GUID-7E6B5805-3D2F-41C4-ADFF-B7248386E7AC.html>
- VMware Cloud Management Blog - What's New in vRealize Operations 8.4: <https://blogs.vmware.com/management/2021/04/whats-new-in-vrealize-operations-8-4-and-cloud.html>

From here you can:

1. Click to advanced to the next page and continue with the next lab module
2. Open the **TABLE OF CONTENTS** to jump to any module or lesson in this lab manual
3. Click on the **END** button if you are done with the lab for now and want to exit

## Appendix

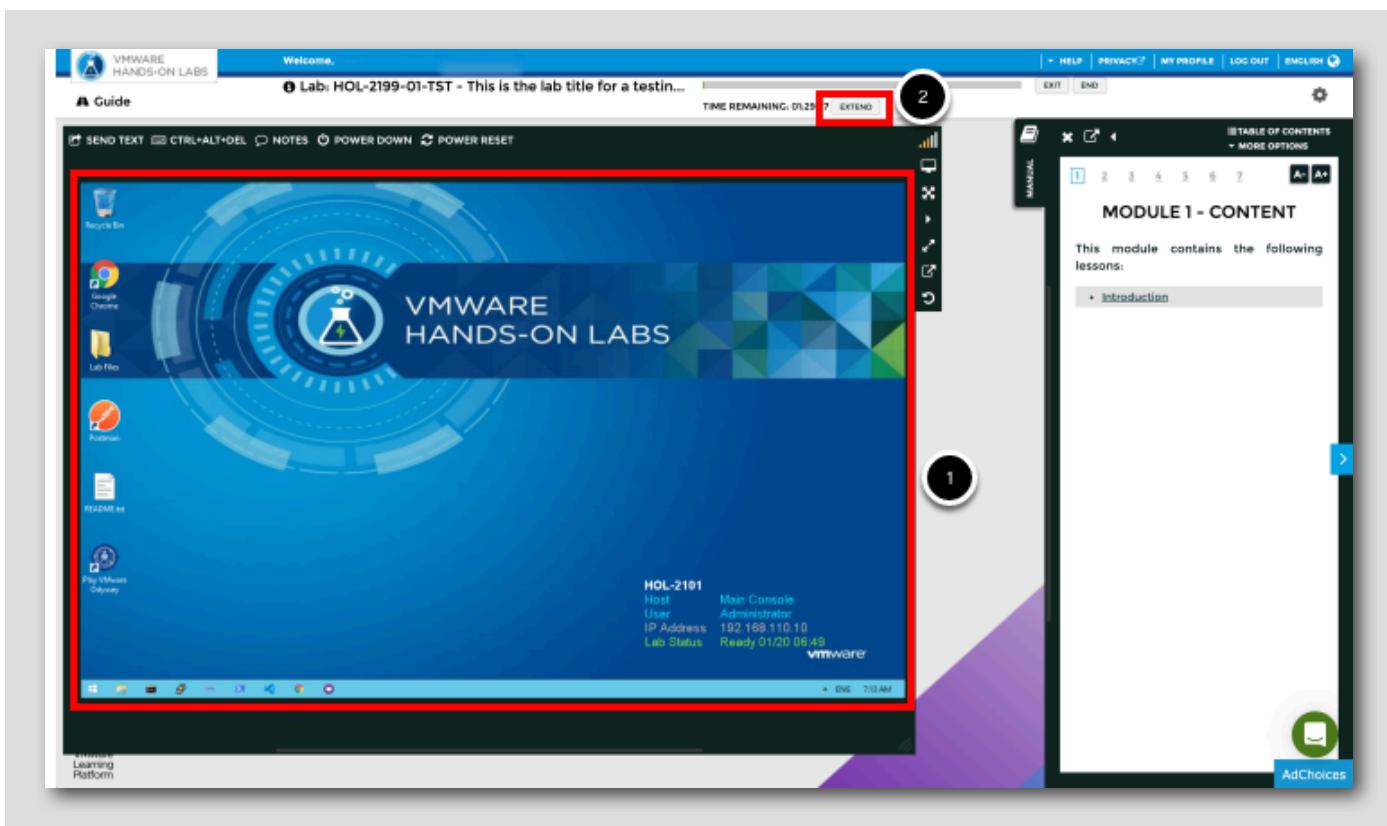
### Hands-on Labs Interface

[505]

Welcome to Hands-on Labs! This overview of the interface and features will help you to get started quickly. Click next in the manual to explore the Main Console or use the Table of Contents to return to the Lab Overview page or another module.

### Location of the Main Console

[506]

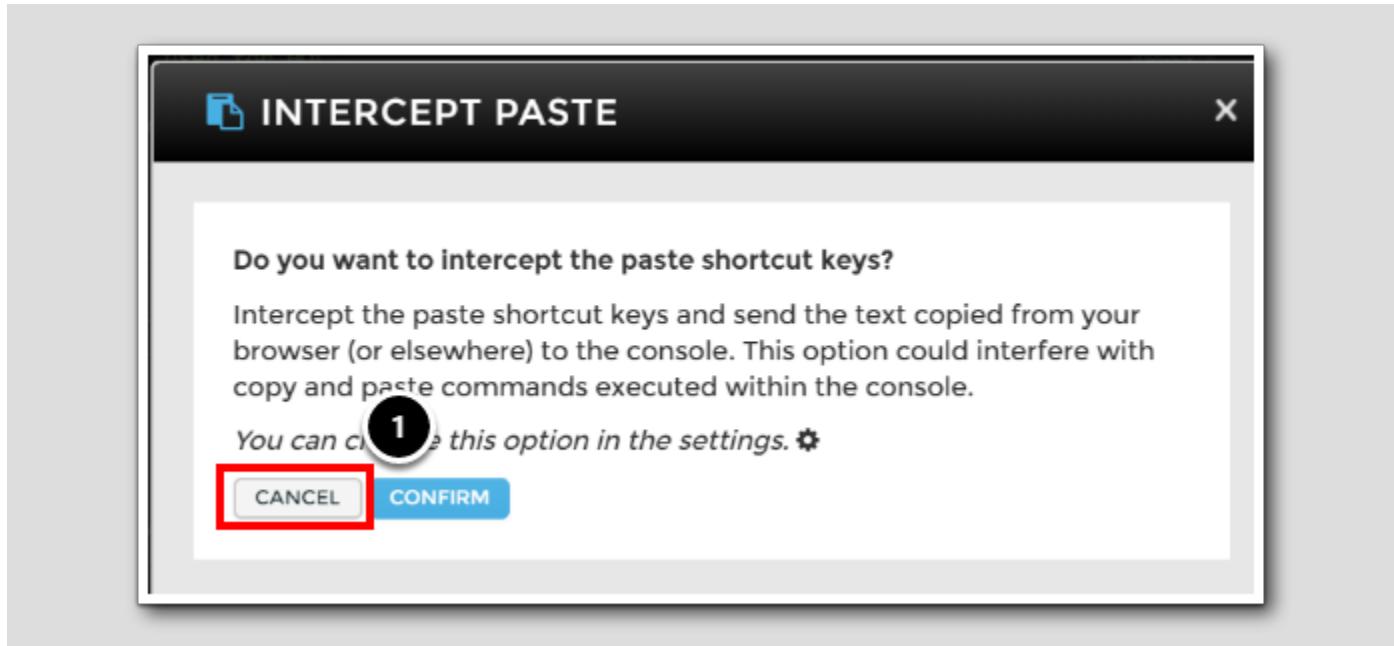


1. The area in the large RED box contains the Main Console. The Lab Manual is on the tab to the right of the Main Console.
2. Your lab starts with 90 minutes on the timer. The lab cannot be saved. Your lab will end when the timer expires. Click the EXTEND button to increase the time allowed. If you are at a VMware event, you can extend your lab time twice up to 30 minutes. Each click gives you an additional 15 minutes. Outside of VMware events, you can extend your lab time up to 9 hours and 30 minutes. Each click gives you an additional hour.

## Alternate Methods of Keyboard Data Entry

In this lab you will input text into the Main Console. Besides directly typing it in, there are two very helpful methods of entering data which make it easier to enter complex data.

### Do Not Enable The Intercept Paste Feature

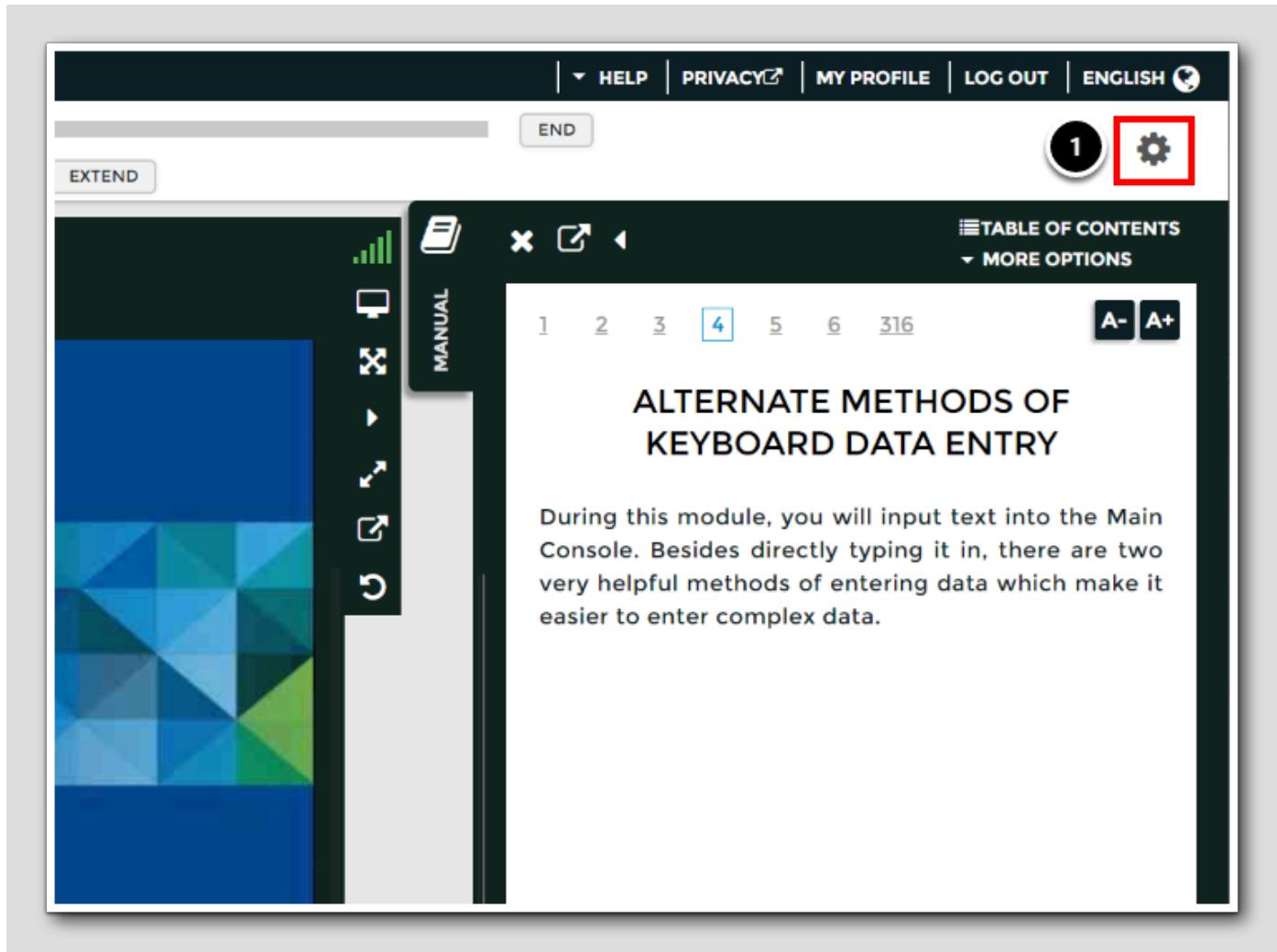


The lab interface environment has the option of intercepting your paste keyboard shortcut (ctrl-v on Windows, command-v on Mac) to paste from your desktop environment into the lab console. This is not recommended for the lab because you will be copying and pasting within the lab console and enabling this feature will make that impossible.

When you first attempt to use your paste keyboard shortcut within a lab session, you will be prompted to enable the intercept feature. If you are prompted, be sure to:

1. Click CANCEL

## To Disable Paste Intercept



If you do find when copying text in the lab console and attempting to paste it that you are either not getting any text pasted or the text is coming from the host computer where you are accessing the lab, you will need to turn off the Intercept Paste feature.

1. Click the gear icon at the top-right corner of the interface above the docked manual

2. Uncheck the Intercept Paste box

The screenshot shows the 'SETTINGS' window with the title bar 'SETTINGS' and a close button 'X'. Below the title bar is a dropdown menu for 'Keyboard Layout' set to 'Enalish (US)'. A note says: 'Select your keyboard layout to adjust any incorrect keys being sent to the console.' To the right is a keyboard icon. A red box highlights the checkbox for 'Intercept Paste'. Below it, another red box highlights the checkbox for 'Manual Shortcuts'. The 'Intercept Paste' section contains text about intercepting paste shortcut keys and an icon of two overlapping documents. The 'Manual Shortcuts' section contains text about changing page navigation and an icon of a notebook.

**Keyboard Layout** Enalish (US)

Select your keyboard layout to adjust any incorrect keys being sent to the console.

**Intercept Paste**

Intercept the paste shortcut keys and send the text copied from your browser (or elsewhere) to the console. This option could interfere with the console's own copy and paste commands.

**Manual Shortcuts**

If enabled, the following keyboard shortcuts will change the page in the manual even when the console has focus:

**Previous Page** `ctrl + ,`  
`ctrl + >`

**Next Page** `ctrl + .`  
`ctrl + <`

**Fix non-ANSI US keyboard layouts**

Remap the keys pressed on your keyboard to send US ANSI key code equivalents to the console. If you are using an non-US keyboard or have the keyboard set a non-US language in

## Click and Drag Lab Manual Content Into Console Active Window

<https://www.youtube.com/watch?v=xS07n6GzGuo>



You can also click and drag text and Command Line Interface (CLI) commands directly from the Lab Manual into the active window in the Main Console.

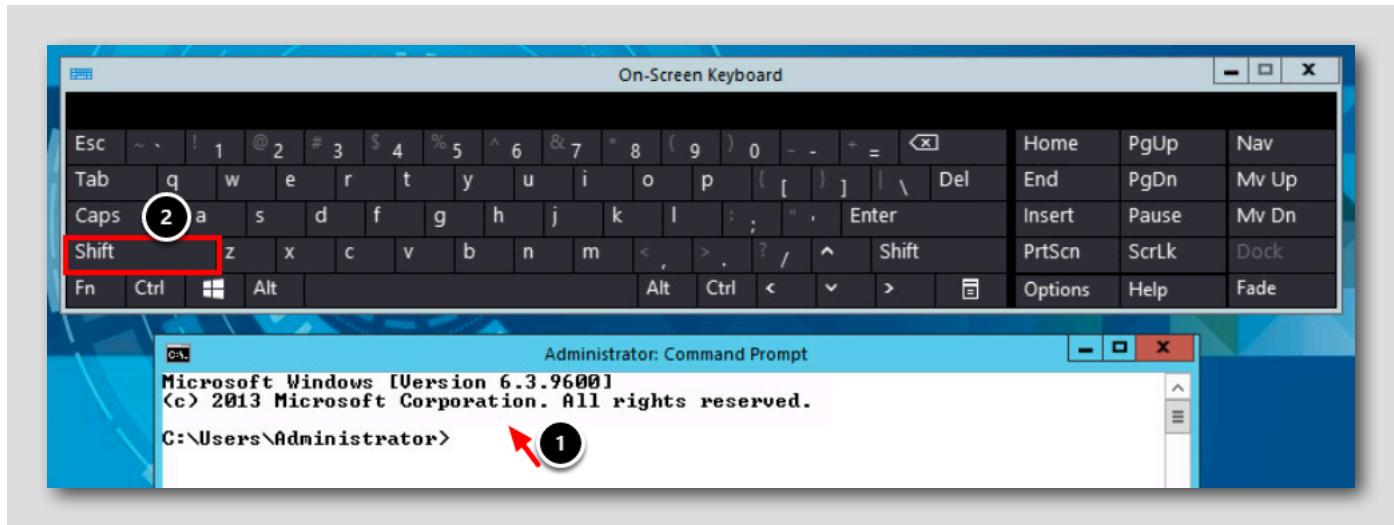
## Accessing the Online International Keyboard



You can also use the Online International Keyboard found in the Main Console.

1. Click on the keyboard icon found on the Windows Quick Launch Task Bar.

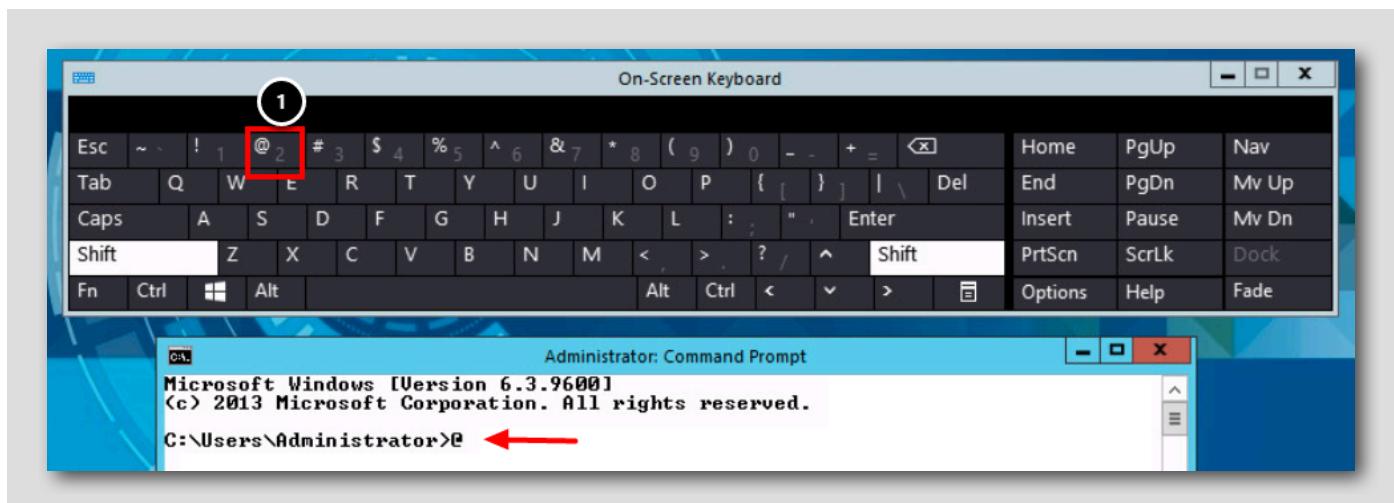
Click once in active console window



In this example, you will use the Online Keyboard to enter the "@" sign used in email addresses. The "@" sign is Shift-2 on US keyboard layouts.

1. Click once in the active console window.
2. Click on the Shift key.

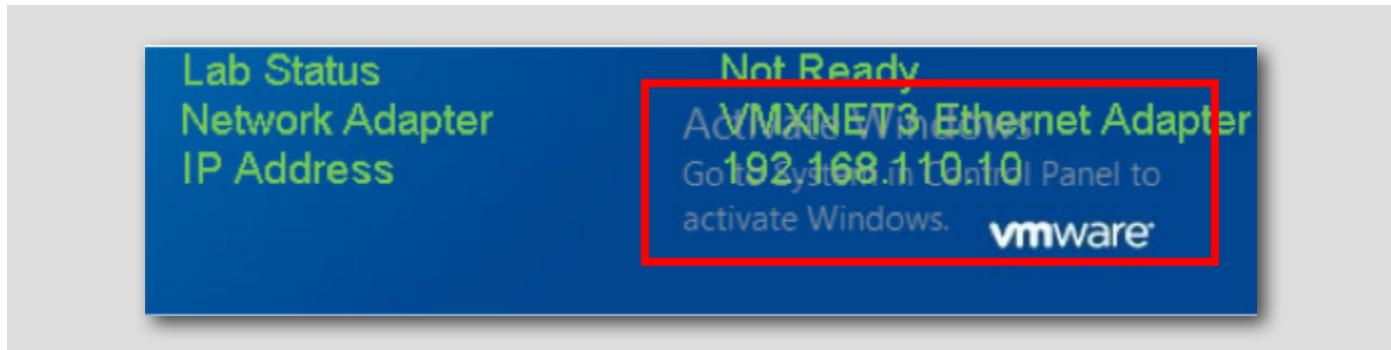
Click on the @ key



1. Click on the "@" key.

Notice the @ sign entered in the active console window.

## Activation Prompt or Watermark



When the lab starts you may notice a watermark on the desktop indicating that Windows is not activated.

A major benefit of virtualization allows virtual machines to be moved and run on any platform. Hands-on Labs utilizes this benefit and hosts labs from multiple datacenters. However, these datacenters may not have identical processors which triggers a Microsoft activation check through the Internet.

Rest assured VMware and Hands-on Labs are in full compliance with Microsoft licensing requirements. The lab that you are using is a self-contained pod and does not have full access to the Internet. Without this the Microsoft activation process fails, and you see this watermark.

This cosmetic issue has no effect on your lab.

## Return to Lab Guidance

Use the Table of Contents to return to the Lab Overview page or another module.



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