

The plugin stores workflows in the AZURE folder.

Embedded-VRO

Dashboard

Library

Workflows

Actions

Policies

Activity

Workflow Runs

Workflows

AZURE

AZURE CRUD Operations

Default

- Invoke 'CREATE SQL Managed Instance: PUT https:\_\_manage...' (Icon)
- Invoke 'Create VM: PUT https:\_\_management.azure.com\_sub...' (Icon)
- Invoke 'DELETE vm2 object' (Icon)
- Invoke 'DELETE vm: DELETE https:\_\_management.azure.com\_...' (Icon)
- Test DT actions (Icon)

The plugin stores 'get' actions in two modules.

Embedded-VRO

Dashboard

Library

Workflows

Actions

Policies

Activity

Workflow Runs

Scheduled

Waiting for Input (0)

Policy Runs

Actions 4 of 697

Add filter...

NEW ACTION

Name	Tags	Description
getAzureCustomHeaders	com.vmware.coe.dynamicTypes.plugin...	Get authorization header for Azures
getAzureSubscriptionIds	com.vmware.pve.azure	
getAzureNetworkInterfaceNames	com.vmware.pve.azure	
getAzureResourceGroupNames	com.vmware.pve.azure	

## Dynamic Type Plug-in generator

Reader will use Dynamic Type Plug-in generator v3.1 to create Dynamic Types for the plugin.  
The generator is consisted of a set of workflows and actions.

# A vRO Plugin for Azure

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Product Value Engineering, Broadcom  
Version 0.2, Feb 8, 2024

## Introduction

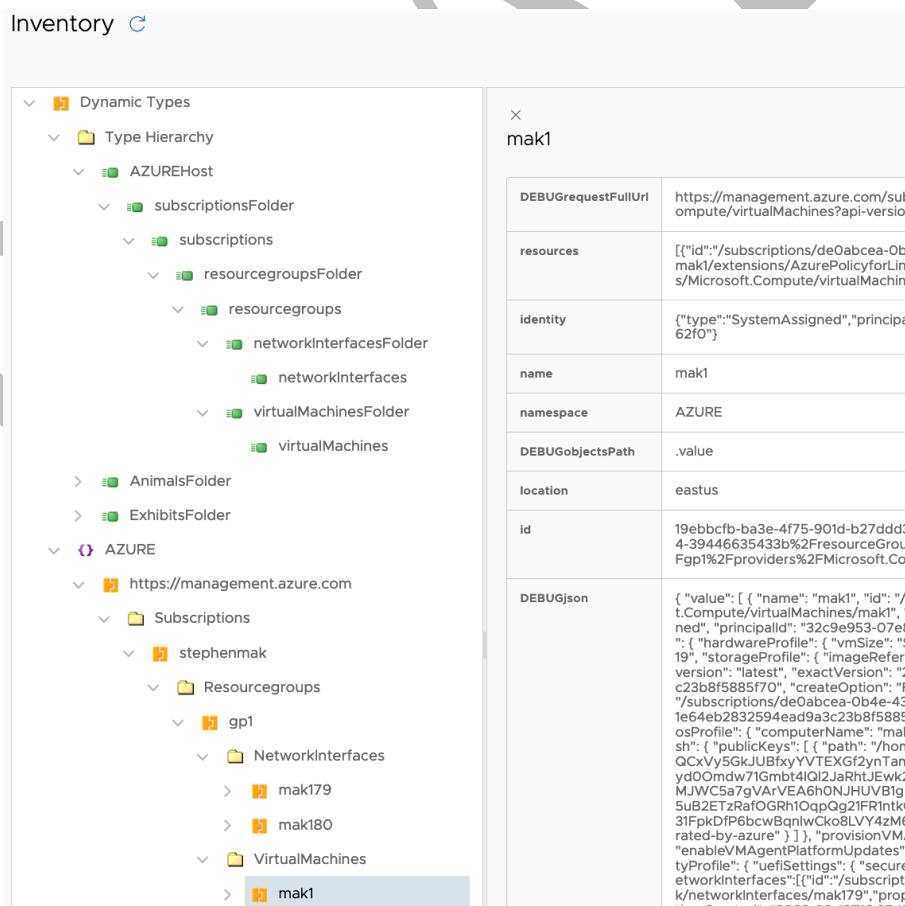
This document lists instructions to create a vRO plugin for Azure. We define vRO Dynamic Types to interface with Azure public cloud for the purpose of consuming native cloud services.

The plugin offers below capabilities.

- 1) A custom REST header action to authenticate with Azure
- 2) Collect subscriptions, resource groups, network interfaces and virtual machines via REST calls and store them in vRO as inventory objects
- 3) A workflow to create a virtual machine using input form actions to look up required resources
- 4) A workflow to delete a virtual machine with the VM object as input
- 5) A workflow to delete a virtual machine with a VM name, a subscription ID and a resource group name as inputs

The plugin has a Type Hierarchy below with a sample of inventory objects for reference.

Inventory 



The screenshot shows the vRO Inventory interface. On the left, there's a tree view of 'Dynamic Types' under 'Type Hierarchy'. It includes categories like 'AZUREHost' (with 'subscriptionsFolder', 'resourcegroupsFolder', 'networkInterfacesFolder', 'virtualMachinesFolder'), 'AZURE' (with 'https://management.azure.com' and its subfolders 'Subscriptions' and 'stephenmak' which contains 'Resourcegroups', 'Networkinterfaces', and 'VirtualMachines'). Other visible nodes include 'AnimalsFolder' and 'ExhibitsFolder'. On the right, there's a detailed view of a VM object named 'mak1'. The properties shown are:

DEBUGRequestFullPath	https://management.azure.com/subcompute/virtualMachines?api-version=2023-07-01
resources	[{"id": "subscriptions/de0abcea-0b4mak1/extensions/AzurePolicyForLinux/Microsoft.Compute/virtualMachines/mak1"}]
identity	{"type": "SystemAssigned", "principalId": "62f0"}
name	mak1
namespace	AZURE
DEBUGObjectsPath	.value
location	eastus
id	19ebbcfb-ba3e-4f75-901d-b27ddd4-39446635433b%2FresourceGroups%2Fproviders%2FMicrosoft.CognitiveServices%2Fmachines/mak1
DEBUGJson	{ "value": [ { "name": "mak1", "id": "/subscriptions/de0abcea-0b4mak1/resources/extensions/AzurePolicyForLinux/Microsoft.Compute/virtualMachines/mak1", "type": "Microsoft.Compute/virtualMachines", "principalId": "32c9e953-07e8-464eb2832594ead9a3c23bbf5885", "hardwareProfile": { "vmSize": "Standard_D2_v2", "storageProfile": { "imageReference": { "version": "latest", "exactVersion": "2_c23bbf5885f70" }, "createOptions": "FromImage" }, "osProfile": { "computerName": "mak1", "publicKeys": [ { "path": "/home/stephenmak/.ssh/id_rsa" } ], "provisionVMAgent": true, "enableVMAgentPlatformUpdates": true, "vhd": { "uri": "https://stephenmak1.vault.azure.net/storage/vhds/mak1.vhd", "accessType": "Upload" } } } ] }

Embedded-VRO

«

- Dashboard
- Library
- Workflows
- Actions
- Policies
- Activity
- Workflow Runs
- Scheduled
- Waiting for Input (0)
- Policy Runs
- Assets
- Packages
- Configurations
- Resources
- Environments
- Administration
- Groups
- Inventory
- Audit Logs
- Git Repositories
- Git History
- Deleted Items
- API Explorer

»

CSE

Dynamic Types Plug-in generator v3.1

- Create a plug-in no swagger
  - 3- Repeat for each object type
    - 3a- Add a REST operation
    - 3b- Invoke a REST operation with headers from action
    - 3c- Create a type from a REST operation
    - 4- Remove a REST operation (Optional)
  - 1- Create new plug-in
  - 2a- Create a REST host
  - 2b- Add REST Host as DT Host
- Create a plug-in with Swagger
- Helper
  - CRUD operations creation
    - Create a type - Helper
    - Create plug-in from swagger string and REST Host
    - Get swagger properties as JSON
    - Update a type findById
- Test
  - Create DT for vRA Services
  - Delete vRA DT services
  - Get workflow tokens duration
  - Test plug-ins types
  - Delete a type
  - Delete plug-in
  - Export a plug-in as a package
  - Set up first - Set vRO credentials

# Install

Below are the steps.

## Create REST host - <https://login.azure.com>

Run below workflow with no authentication to create the REST endpoint for Azure login.

Add a REST host

Adds a REST host to the plug-in's inventory.

Host Properties		Host Authentication	Proxy Settings	SSL
Properties to create a new host. The name is the host's unique identifier.				
Name *	<input type="text" value="https://login.microsoftonline.com"/>			
URL *	<input type="text" value="https://login.microsoftonline.com"/>			
Connection timeout (seconds)	<input type="text" value="30"/>			
Operation timeout (seconds)	<input type="text" value="60"/>			
If set to true, the certificate is accepted silently and the certificate is added to the trusted store.	<input checked="" type="checkbox"/>			
Support for parallel request executions	<input checked="" type="checkbox"/>			
Redirect strategy	<input type="text" value="defaultRedirect"/>			
<b>RUN</b>		<b>CANCEL</b>		

## Create vRA host endpoint

Run below workflow with authentication to create the vRA REST endpoint.

Add vRA Host

Adds the configuration of the VMware Aria Automation Host in the plugin's inventory

Host properties		User credentials
Connection Type *	<input type="text" value="vra-onprem"/>	
Host Name *	<input type="text" value="cava-n-82-056.eng.vmware.com"/>	
Host URL *	<input type="text" value="https://cava-n-82-056.eng.vmware.com"/>	
Automatically install SSL certificates	<input checked="" type="checkbox"/>	

Add vRA Host

Adds the configuration of the VMware Aria Automation Host in the plugin's inventory

Host properties		User credentials
Session Mode *	<input checked="" type="radio"/> Shared Session <input type="radio"/> Per User Session	
User Name *	<input type="text" value="fritz@coke.sqa-horizon.local"/>	
Password *	<input type="password" value="*****"/>	

Inventory 

- >  SNMP
- >  PowerShell
- ▽  VMware Aria Automation
- ▽  Default: https://cava-n-82-056.eng.vmware.com

## Set Configuration Elements

Update below values for your environment. Hostname is ‘default’ matching vRA object name in inventory.

Orchestrator credentials   

General  Variables Version History Audit

View, edit, and create local variables for your configuration.

 NEW	 DELETE	 COPY	 PASTE
Variable	Value	Type	Description
<input type="checkbox"/> password	*****	SecureString	
<input type="checkbox"/> username	fritz@coke.sqa-horizon.local	string	
<input type="checkbox"/> hostname	<b>Default</b>	string	host description

microsoftonline   

General  Variables Version History Audit

View, edit, and create local variables for your configuration.

 NEW	 DELETE	 COPY	 PASTE																														
Variable	Value																																
<input type="checkbox"/> url	*****																																
<input type="checkbox"/> azureAuthenticationContent	*****																																
<input type="checkbox"/> restHost	<p>[object REST:RESTHost]</p> <table border="1"> <tbody> <tr> <td>redirectStrategy</td> <td>defaultRedirect</td> </tr> <tr> <td>operationTimeout</td> <td>60</td> </tr> <tr> <td>displayName</td> <td>https://login.microsoftonline.com: https://logi...</td> </tr> <tr> <td>@type</td> <td>RESTHost</td> </tr> <tr> <td>proxyAuthentication</td> <td>NONE</td> </tr> <tr> <td>type</td> <td>RESTHost</td> </tr> <tr> <td>proxyHost</td> <td></td> </tr> <tr> <td>url</td> <td>https://login.microsoftonline.com</td> </tr> <tr> <td>proxyPort</td> <td>0</td> </tr> <tr> <td>dunesId</td> <td>becc9baa-dd3f-45c1-8a72- c8f15641d175</td> </tr> <tr> <td>hostVerification</td> <td>true</td> </tr> <tr> <td>name</td> <td>https://login.microsoftonline.com</td> </tr> <tr> <td>id</td> <td>becc9baa-dd3f-45c1-8a72- c8f15641d175</td> </tr> <tr> <td>@fullType</td> <td>REST:RESTHost</td> </tr> <tr> <td>connectionTimeout</td> <td>30</td> </tr> <tr> <td>authentication</td> <td>NONE</td> </tr> </tbody> </table>	redirectStrategy	defaultRedirect	operationTimeout	60	displayName	https://login.microsoftonline.com: https://logi...	@type	RESTHost	proxyAuthentication	NONE	type	RESTHost	proxyHost		url	https://login.microsoftonline.com	proxyPort	0	dunesId	becc9baa-dd3f-45c1-8a72- c8f15641d175	hostVerification	true	name	https://login.microsoftonline.com	id	becc9baa-dd3f-45c1-8a72- c8f15641d175	@fullType	REST:RESTHost	connectionTimeout	30	authentication	NONE
redirectStrategy	defaultRedirect																																
operationTimeout	60																																
displayName	https://login.microsoftonline.com: https://logi...																																
@type	RESTHost																																
proxyAuthentication	NONE																																
type	RESTHost																																
proxyHost																																	
url	https://login.microsoftonline.com																																
proxyPort	0																																
dunesId	becc9baa-dd3f-45c1-8a72- c8f15641d175																																
hostVerification	true																																
name	https://login.microsoftonline.com																																
id	becc9baa-dd3f-45c1-8a72- c8f15641d175																																
@fullType	REST:RESTHost																																
connectionTimeout	30																																
authentication	NONE																																

Where url is a string of below format:

/ [TENANT\_ID] /oauth2/token

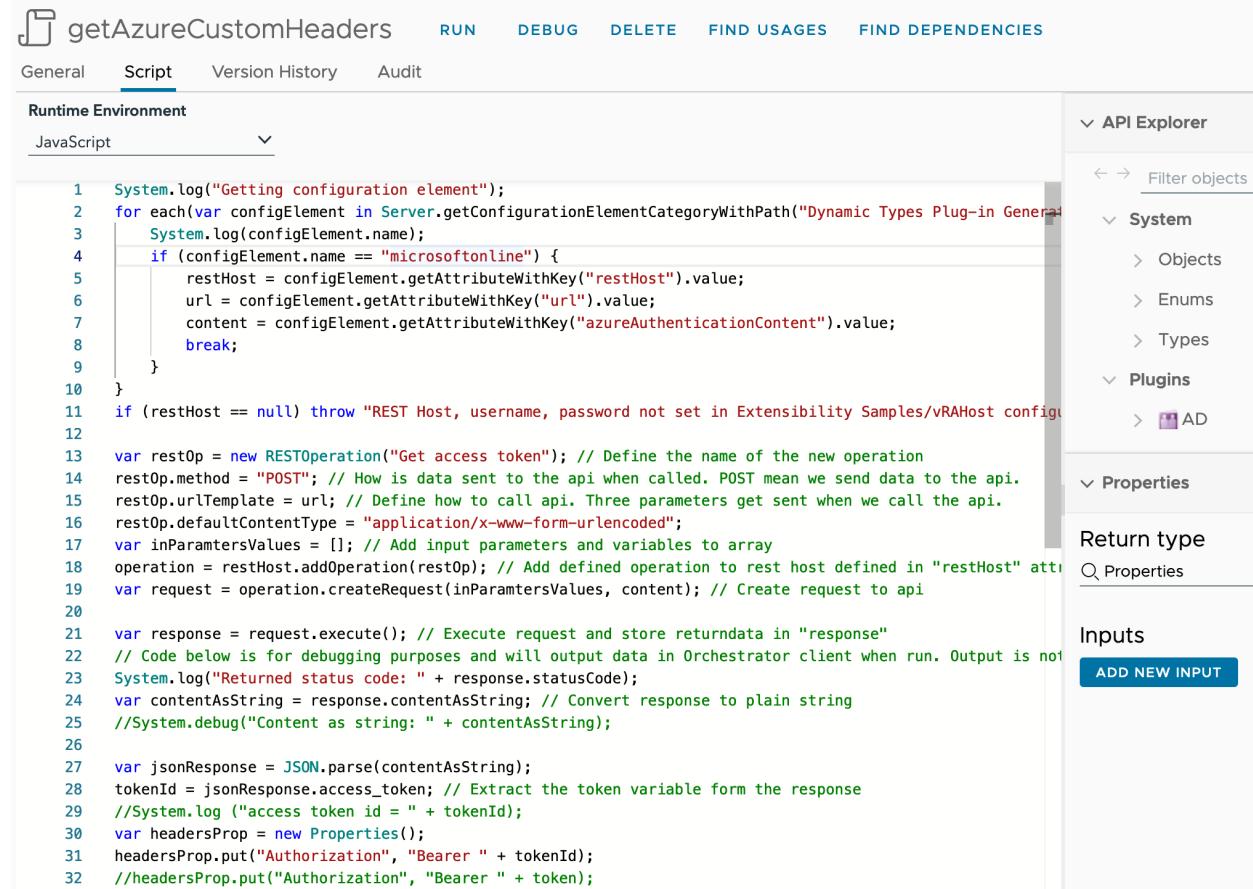
azureAuthenticationContent is a string of below format:

grant\_type=client\_credentials&client\_id=[CLIENT\_ID]&client\_secret=[SECRET]&resource=https://management.azure.com

See reference section Getting Azure API token for detail.

Run getAzureCustomHeaders action

Run this action to obtain a bearer token.



```
System.log("Getting configuration element");
for each(var configElement in Server.getConfigurationElementCategoryWithPath("Dynamic Types Plug-in General")) {
    System.log(configElement.name);
    if (configElement.name == "microsoftonline") {
        restHost = configElement.getAttributeWithKey("restHost").value;
        url = configElement.getAttributeWithKey("url").value;
        content = configElement.getAttributeWithKey("azureAuthenticationContent").value;
        break;
    }
}
if (restHost == null) throw "REST Host, username, password not set in Extensibility Samples/vRAHost configuration";
var restOp = new RESTOperation("Get access token"); // Define the name of the new operation
restOp.method = "POST"; // How is data sent to the api when called. POST mean we send data to the api.
restOp.urlTemplate = url; // Define how to call api. Three parameters get sent when we call the api.
restOp.defaultContentType = "application/x-www-form-urlencoded";
var inParamtersValues = []; // Add input parameters and variables to array
operation = restHost.addOperation(restOp); // Add defined operation to rest host defined in "restHost" attribute
var request = operation.createRequest(inParamtersValues, content); // Create request to api
var response = request.execute(); // Execute request and store return data in "response"
// Code below is for debugging purposes and will output data in Orchestrator client when run. Output is not part of the actual logic
System.log("Returned status code: " + response.statusCode);
var contentAsString = response.contentAsString; // Convert response to plain string
//System.debug("Content as string: " + contentAsString);

var jsonResponse = JSON.parse(contentAsString);
tokenId = jsonResponse.access_token; // Extract the token variable from the response
//System.log ("access token id = " + tokenId);
var headersProp = new Properties();
headersProp.put("Authorization", "Bearer " + tokenId);
//headersProp.put("Authorization", "Bearer " + token);
return headersProp;
```

Create namespace (plugin) – AZURE

Rename AZURE CRUD Operations to Original. Then run below workflow to create a namespace. Use the same input values.

-1- Create new plug-in

Plug-in Name *	AZURE
Host icon *	default-16x16.png
Action module to create	com.vmware.cse.dt.azure
Workflow category	AZURE
Action to get custom headers	getAzureCustomHeaders

**RUN** **CANCEL**

### Create REST host - <https://management.azure.com>

Run below workflow (2a) with no authentication to add the AZURE management host.

-2a- Create a REST host

Adds a REST host to the plug-in's inventory.

Host Properties	Host Authentication	Proxy Settings	SSL
Properties to create a new host. The name is the host's unique identifier.			
Name *	https://management.azure.com		
URL *	https://management.azure.com		
Connection timeout (seconds)	30		
Operation timeout (seconds)	60		
If set to true, the certificate is accepted silently and the certificate is added to the trusted store.	<input checked="" type="checkbox"/>		
Automatically URL Redirection	<input checked="" type="checkbox"/>		
Support for parallel request executions	<input checked="" type="checkbox"/>		

### Create DT Host from REST Host – AZUREHost

Run below workflow (2b) to create a Dynamic Type (DT) host in inventory.

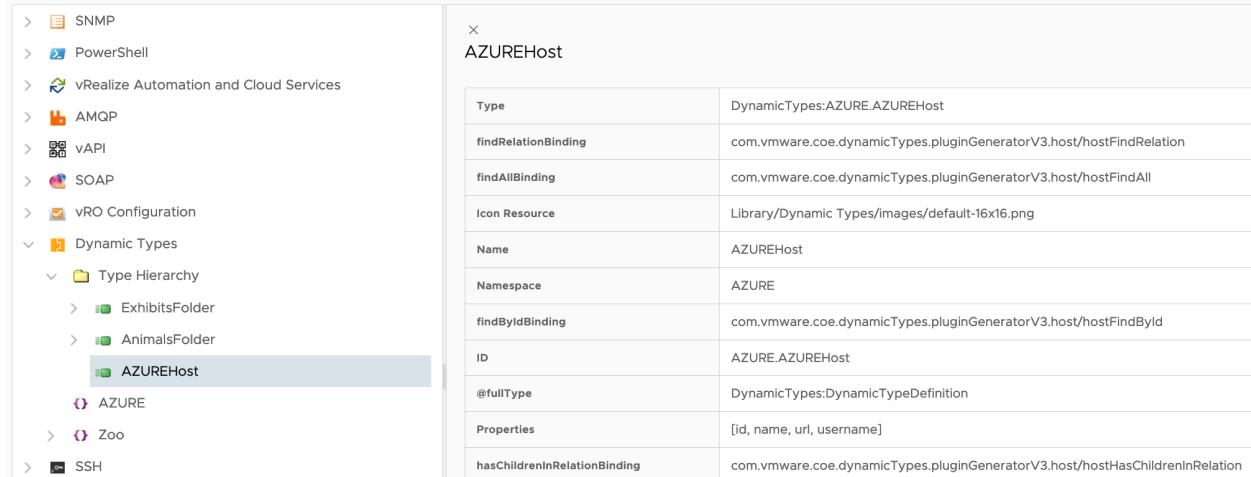
-2b- Add REST Host as DT Host

restHost *	https://management.azure.com/: https://manageme...
namespace *	AZURE
authenticationConfigurationElement	<input type="text"/>

**RUN** **CANCEL**

## Examine AZUREHost in Inventory

Inventory 



The screenshot shows the vRealize Automation inventory interface. On the left, there's a tree view of connection types: SNMP, PowerShell, vRealize Automation and Cloud Services, AMQP, vAPI, SOAP, vRO Configuration, Dynamic Types, Type Hierarchy, ExhibitsFolder, AnimalsFolder, and AZUREHost. The AZUREHost node is selected and highlighted with a gray background. To the right, a detailed view of the AZUREHost object is shown in a table:

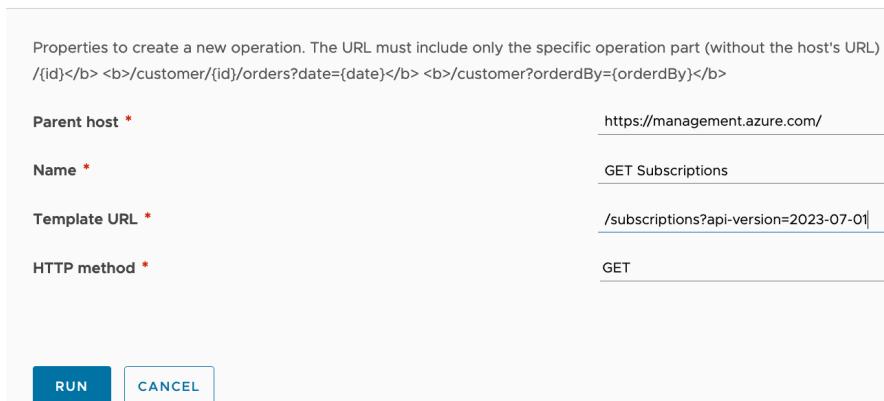
Type	DynamicTypes:AZURE.AZUREHost
findRelationBinding	com.vmware.coe.dynamicTypes.pluginGeneratorV3.host/hostFindRelation
findAllBinding	com.vmware.coe.dynamicTypes.pluginGeneratorV3.host/hostFindAll
Icon Resource	Library/Dynamic Types/images/default-16x16.png
Name	AZUREHost
Namespace	AZURE
findByIdBinding	com.vmware.coe.dynamicTypes.pluginGeneratorV3.host/hostFindById
ID	AZURE.AZUREHost
@fullType	DynamicTypes:DynamicTypeDefinition
Properties	[id, name, url, username]
hasChildrenInRelationBinding	com.vmware.coe.dynamicTypes.pluginGeneratorV3.host/hostHasChildrenInRelation

## GET Subscriptions

Run workflow (3a) to add the REST operation. Use the same input values.

-3a- Add a REST operation

Adds an operation to a REST host.



Properties to create a new operation. The URL must include only the specific operation part (without the host's URL) a /{id}</b> <b>/customer/{id}/orders?date={date}</b> <b>/customer?orderdBy=(orderdBy)</b>

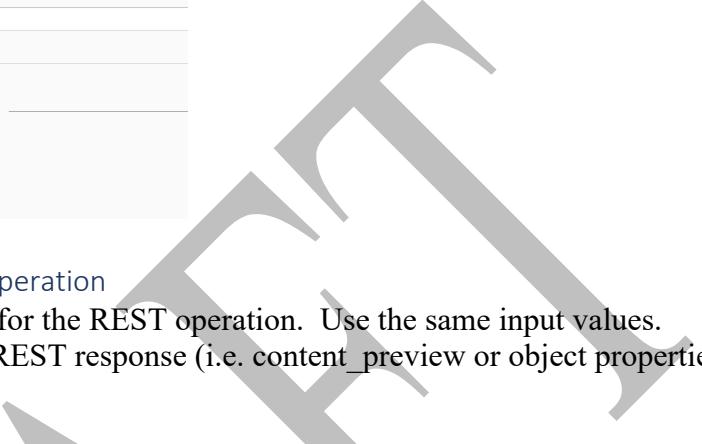
Parent host *	<input type="text" value="https://management.azure.com/"/>
Name *	<input type="text" value="GET Subscriptions"/>
Template URL *	<input type="text" value="/subscriptions?api-version=2023-07-01 "/>
HTTP method *	<input type="text" value="GET"/>

**RUN** **CANCEL**

## Test REST Operation

Run workflow (3b) to test the operation.

-3b- Invoke a REST operation with headers from action



REST Operation \*

getCustomHeadersAction

inParametersValues

+

content

GET Subscriptions

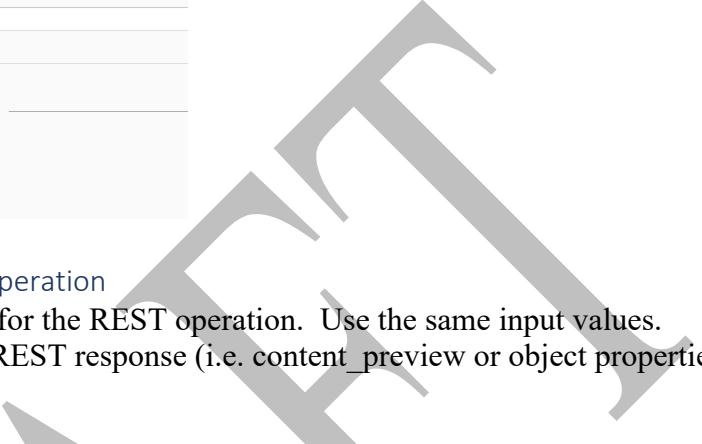
getAzureCustomHeaders

RUN CANCEL

Create subscriptions type from REST operation

Run workflow (3c) to a dynamic type for the REST operation. Use the same input values.  
Map ID property to subscriptionId in REST response (i.e. content\_preview or object properties).  
Map name property to displayName.

-3c- Create a type from a REST operation



List objects operation \*

Type name \*

Icon \*

Parent type \*

Parent name and ID

Folder label \*

hasCustomHeadersAction

Action to get custom headers

Content preview

Objects path

Element index

Object properties

+

Property	Value
<input type="checkbox"/> displayName	stephenmak

GET Subscriptions

subscriptions

default-16x16.png

AZUREHost

<https://management.azure.com/> : 19ebbcfb-ba3e-4f75-901d-b27ddd31fa5a

Subscriptions

getAzureCustomHeaders

{  
  "value": [  
    {  
      ".value":  
        0  
    }  
  ]  
}

<input type="checkbox"/>	authorizationSource	RoleBased
<input type="checkbox"/>	tags	{"Environment":"INDIVIDUAL","CostCenter":"US1071310","ShortCostCenter":"71310","Management","CostType":"OPEX","OwnerEmail":"smak@vmware.com","SecondaryCD-1336769"}
<a href="#">Show Or Hide Columns</a>		
ID property *	subscriptionId	
Name property *	displayName	

In case of an error, correct the error, delete the type and its actions then retry. Type delete instruction is provided in a section below.

## Examine Subscriptions in inventory

### Examine the DT object in inventory for error.

Inventory [C](#)

- > SNMP
- > PowerShell
- > vRealize Automation and Cloud Services
- > AMQP
- > vAPI
- > SOAP
- > vRO Configuration
- < **Dynamic Types**
  - < **Type Hierarchy**
    - > ExhibitsFolder
    - < AZUREHost
      - < subscriptionsFolder
        - < subscriptions
        - < AnimalsFolder
  - < AZURE
    - < https://management.azure.com
      - < Subscriptions
        - > Error - click me for more information

x  
Error - click me for more information

fixAction	Check <a href="#">subscriptionsFolderFindRelation</a> action
name	Error - click me for more information
namespace	AZURE
DEBUGRequestFullUrl	https://management.azure.com/subscriptions
DEBUGobjectsPath	.value
id	error
DEBUGjson	{"error":{"code":"MissingApiVersionParameter","message":"The api-version query parameter (?api-version=) is required for all requests."}}
@fullType	DynamicTypes:AZURE.subscriptions
error	{"error":{"code":"MissingApiVersionParameter","message":"The api-version query parameter (?api-version=) is required for all requests."}}

Update subscriptionsFolderFindRelation action

Error: MissingApiVersionParameter

Solution: update urlTemplate

```

1 // Cache;
2 var cacheTimeout = 60 * 1; // 5 minutes cache
3 var objectId = "com.vmware.cse.dt.azure.subscriptionsFolderFindRelation(" + parentType + "," + parentId + "," + relationName +
4 var objects = System.getModule("com.vmware.coe.dynamicTypes.pluginGeneratorV3.caching").getFromCache(objectId);
5 if (objects != null) return objects;
6 System.log("SubscriptionsFolderFindRelation()");
7 // REST Operation variables;
8 var operationName = "folder findRelation";
9 var method = "GET";
10 var urlTemplate = "/subscriptions?api-version=2023-07-01";
11 var content = "";
12 var defaultContentType = "";
13 var objectsPath = ".value"; // Edit this line if the objectsPath property is wrong
14 var cache = true;
15 var idProp = new Properties();
16 var contentAsStringLink;
17 var namespace = parentType.split(".")[0];
18 var childType = System.getModule("com.vmware.coe.dynamicTypes.pluginGeneratorV3").getChildType(parentType, parentId, relationName);

```

## GET Resource Groups

Run workflow 3a to add the REST operation. Use the same input values. Be aware of the {id} parameter.

### -3a- Add a REST operation

Adds an operation to a REST host.

Properties to create a new operation. The URL must include only the specific operation part (without the host's URL) and placeholders for parameters that are provided at request run time. Examples: <b>/customer/{id}</b> <b>/customer/{id}</b> <b>/customer?orderBy={orderBy}</b>

Parent host *	<input type="text" value="https://management.azure.com: https://managemen..."/>	<input type="button" value="X"/>
Name *	<input type="text" value="GET Resource Groups"/>	
Template URL *	<input type="text" value="/subscriptions/{id}/resourcegroups?api-version=2023-07-01"/>	
HTTP method *	<input type="text" value="GET"/>	

## Test REST Operation

### -3b- Invoke a REST operation with headers from action

REST Operation *	<input type="text" value="GET Resource Groups"/>
getCustomHeadersAction	<input type="text" value="getAzureCustomHeaders"/>
inParametersValues	<input type="button" value="+"/>
<input type="checkbox"/> <input type="checkbox"/> dev...	

Create resourcegroups type from REST operation  
Run workflow 3c to add the REST operation. Use the same input values.  
Map ID and Name to the corresponding property in REST response.

-3c- Create a type from a REST operation

List objects operation \*

Type name \*

Icon \*

Parent type \*

Parent name and ID

Folder label \*

hasCustomHeadersAction

Action to get custom headers

Content preview

Objects path

Element index

Object properties

**+**

<input type="checkbox"/>	Property	Value
<input type="checkbox"/>	<a href="#">name</a>	gp1
<input type="checkbox"/>	<a href="#">location</a>	eastus
<input type="checkbox"/>	<a href="#">id</a>	/subscriptions/de0abcea-0

GET Resource Groups: GET /subscriptions/{subscriptionId}/resourceGroups

resourcegroups

default-16x16.png

subscriptions

stephenmak : 19ebbcfb-ba3e-4f75-901

Resourcegroups

getAzureCustomHeaders

getAzureCustomHeaders

{  
  "value": [  
    {  
      ".value":  
        0  
    }  
  ]  
}

Examine Resourcegroups in inventory  
Examine the DT object in inventory for error.

## Inventory

The screenshot shows the vRealize Automation inventory interface. On the left, there's a tree view of resources under 'AZURE'. One item, 'gp1', is selected and highlighted with a blue box. To the right of this selection, an error message 'Error - click me for more information' is displayed. Below this message is a detailed error table:

fixAction	Check resourcegroupsFolderFindRelation action
name	Error - click me for more information
namespace	AZURE
DEBUGrequestFullUrl	<a href="https://management.azure.com/subscriptions/de0abcea-0b4e">https://management.azure.com/subscriptions/de0abcea-0b4e</a>
DEBUGobjectsPath	.value
id	error
DEBUGjson	{"error":{"code":"MissingApiVersionParameter","message":"The ts."}}
@fullType	DynamicTypes:AZURE.resourcegroups
error	{"error":{"code":"MissingApiVersionParameter","message":"The ts."}}

Update resourcegroupsFolderFindRelation action

Error: MissingApiVersionParameter

Solution: update urlTemplate

## Examine a specific resourcegroups object in inventory

The screenshot shows the vRealize Automation inventory interface. On the left, there's a tree view of resources under 'AZURE'. One item, 'gp1', is selected and highlighted with a blue box. To the right of this selection is a detailed table:

DEBUGrequestFullUrl	<a href="https://management.azure.com/resourcegroups?api-version=2018-05-01">https://management.azure.com/resourcegroups?api-version=2018-05-01</a>
tags	{}
name	gp1
namespace	AZURE
DEBUGobjectsPath	.value
location	eastus
id	19ebbcfb-ba3e-4f75-91subscriptions%2Fde0a
DEBUGjson	{"value": [{"id": "/subscriptions/de0a/resourcegroups/gp1", "name": "gp1", "type": "Microsoft.Resources/resourceGroups", "properties": {"provisioningState": "S"}]}]
@fullType	DynamicTypes:AZURE
properties	{"provisioningState": "S"}

## GET Network Interfaces

Run workflow 3a to add the REST operation. Use the same input values. Be aware of two parameters – id and rg.

### -3a- Add a REST operation

Adds an operation to a REST host.

Properties to create a new operation. The URL must include only the specific operation part (without the host's URL) and can contain placeholders for parameters that are provided at run time.  
`<b></b>/customer/{id}/orders?date={date}</b> <b>/customer?orderBy={orderBy}</b>`

Parent host *	<a href="https://management.azure.com/">https://management.azure.com/</a> : https://manageme...
Name *	GET Network Interfaces
Template URL *	/subscriptions/{id}/resourceGroups/{rg}/providers/Microsoft.Network/networkInterfaces?api-version=2023-09-01
HTTP method *	GET

**RUN** **CANCEL**

## Test REST Operation

Run workflow 3b to test the operation. Supply a value for each parameter in order.

### 3b- Invoke a REST operation with headers from action

REST Operation \*

getCustomHeadersAction	GET Network Interfaces
getAzureCustomHeaders	

inParametersValues

+  e0abced

gp1

content

**RUN** **CANCEL**

## Create interfaces type from REST operation

Run workflow 3c to add the REST operation. Use the same input values. Map ID and Name to the corresponding property in REST response.

-3c- Create a type from a REST operation

The screenshot shows the Azure portal interface for creating a custom type. The 'List objects operation' is set to 'GET Network Interfaces'. The 'Type name' is 'networkinterfaces', and the 'Icon' is 'default-16x16.png'. Under 'Content preview', there is a JSON snippet:

```
{
  "value": [
    {
      ...
    }
  ]
}
```

The 'Object properties' section displays a detailed JSON schema for a NetworkInterface resource, including properties like id, type, and properties (which contain provisioningState, resourceGUID, ipConfigurations, and more). The 'ID property' is 'id' and the 'Name property' is 'name'.

Examine NetworkInterfaces in inventory  
Examine the DT object in inventory for error.

Inventory

The inventory tree on the left shows various connection types and a 'Dynamic Types' node under 'AZURE'. The 'Dynamic Types' node has a tooltip 'Error - click me for more information' pointing to it. The tooltip content is as follows:

Error - click me for more information

fixAction	Check networkInterfacesFolderFindRelation action
name	Error - click me for more information
namespace	AZURE
DEBUGrequestFullUri	<a href="https://management.azure.com/subscriptions/de0abce6-0b4e-433b%2fresourceGroups%2fp1/providers/Microsoft.Network/networkInterfaces">https://management.azure.com/subscriptions/de0abce6-0b4e-433b%2fresourceGroups%2fp1/providers/Microsoft.Network/networkInterfaces</a>
DEBUGobjectsPath	.value
id	error
DEBUGjson	{"error":{"code":"MissingApiVersionParameter","message":"The api-version query parameter (?api-version=) is required for all requests."}}
@fullType	DynamicTypes:AZURE.networkInterfaces
error	{"error":{"code":"MissingApiVersionParameter","message":"The api-version query parameter (?api-version=) is required for all requests."}}

Update networkInterfacesFolderFindRelation action

*Error 1: MissingApiVersionParameter*

Solution: update urlTemplate

networkInterfacesFolderFindRelation

RUN DEBUG DELETE FIND USAGES FIND DEPENDENCIES

General Script Version History Audit

Runtime Environment JavaScript

Inputs:

parentType : string parentId : string relationName : string

```

1 // Cache;
2 var cacheTimeout = 60 * 1; // 5 minutes cache
3 var objectId = "com.vmware.cse.dt.azure.networkInterfacesFolderFindRelation(" + parentType + "," + parentId + "," + relationName + ")";
4 var objects = System.getModule("com.vmware.coe.dynamicTypes.pluginGeneratorV3.caching").getFromCache(objectId);
5 if (objects != null) return objects;
6
7 // REST Operation variables;
8 var operationName = "folder findRelation";
9 var method = "GET";
10 var urlTemplate = "/subscriptions/{id}/resourceGroups/{rg}/providers/Microsoft.Network/networkInterfaces";
11 // Parameters api-version=2023-09-01;
12 var content = "";
13 var defaultContentType = "";
14 var objectsPath = ".value"; // Edit this line if the objectsPath property is wrong
15 var cache = true;
16 var idProp = new Properties();
17 var contentAsStringLink;
18 var namespace = parentType.split(".")[0];
19 var childType = System.getModule("com.vmware.coe.dynamicTypes.pluginGeneratorV3").getChildType(parentType, parentId, relationName);
20 if (childType != null) {
21     try {
22         var shortType = childType.split(".")[1];
23         var fixAction = "Check " + shortType + "FolderFindRelation action";
24         var params = parentId.split("/");
25         var restHostId = params.shift(); // Removing the host ID
26         params = getParams(urlTemplate); // This is only needed when parent folder object URL has parameters in different order
    
```

API Explorer

System Objects Enums Types Plugins AD

Properties

Return type DynamicTypes:DynamicObject

Inputs

parentType  
parentId  
relationName

## Error 2: invalid subscription Id and resource group name



Error - click me for more information

fixAction	Check networkInterfacesFolderFindRelation action
name	Error - click me for more information
namespace	AZURE
DEBUGRequestFullUrl	https://management.azure.com/subscriptions/de0abcea-0bc5-4b48-adf4-f83dae459bd1/resourceGroups/%2Fsubscriptions%2Fde0abcea-0bc5-4b48-adf4-f83dae459bd1%2FresourceGroups%2Fgp1/providers/Microsoft.Network/networkInterfaces?api-version=2023-09-01
DEBUGobjectsPath	.value
id	error
DEBUGJson	{"error":{"code":"AuthorizationFailed","message":"The client '36d733c1-0bc5-4b48-adf4-f83dae459bd1' with object id '36d733c1-0bc5-4b48-adf4-f83dae459bd1' does not have authorization to perform action 'Microsoft.Resources/subscriptions/resourceGroups/de0abcea-0bc5-4b48-adf4-f83dae459bd1/gp1/Microsoft.Network/read' over scope '/subscriptions/de0abcea-0bc5-4b48-adf4-f83dae459bd1/resourceGroups/subscriptions/de0abcea-0bc5-4b48-adf4-f83dae459bd1/gp1/providers/Microsoft.Network/networkInterfaces' or the scope is invalid. If access was recently granted, please refresh your credentials."}}
@fullType	DynamicTypes:AZURE.networkInterfaces
error	{"error":{"code":"AuthorizationFailed","message":"The client '36d733c1-0bc5-4b48-adf4-f83dae459bd1' with object id '36d733c1-0bc5-4b48-adf4-f83dae459bd1' does not have authorization to perform action 'Microsoft.Resources/subscriptions/resourceGroups/de0abcea-0bc5-4b48-adf4-f83dae459bd1/gp1/Microsoft.Network/read' over scope '/subscriptions/de0abcea-0bc5-4b48-adf4-f83dae459bd1/resourceGroups/subscriptions/de0abcea-0bc5-4b48-adf4-f83dae459bd1/gp1/providers/Microsoft.Network/networkInterfaces' or the scope is invalid. If access was recently granted, please refresh your credentials."}}

Solution: Update subscription ID and resource group name value in action

File: networkInterfacesFolderFindRelation

General Script Version History Audit

Runtime Environment

JavaScript

Inputs:

```
parentType : string parentId : string relationName : string
```

```
1 // Cache;
2 var cacheTimeout = 60 * 1; // 5 minutes cache
3 var objectId = "com.vmware.cse.dt.azure.networkInterfacesFolderFindRelation(" + parentType + "," + parentId + "," + relationName + ")";
4 var objects = System.getModule("com.vmware.coe.dynamicTypes.pluginGeneratorV3.caching").getFromCache(objectId);
5 if (objects != null) return objects;
6
7 // REST Operation variables;
8 var operationName = "folder findRelation";
9 var method = "GET";
10 var subscriptionId = parentId.split("/")[1];
11 var rest = parentId.split("%2F");
12 var resourceGroupName = rest[rest.length - 1];
13 // update URL
14 var urlTemplate = "/subscriptions/" + subscriptionId + "/resourceGroups/" + resourceGroupName + "/providers/Microsoft.Network/networkInterfaces?api-version=2023-09-01";
15 System.debug(urlTemplate);
16 var content = "";
-- ...
```

// REST Operation variables;

```
var operationName = "folder findRelation";
var method = "GET";
var subscriptionId = parentId.split("/")[1];
var rest = parentId.split("%2F");
var resourceGroupName = rest[rest.length - 1];
// update URL
var urlTemplate =
"/subscriptions/" + subscriptionId + "/resourceGroups/" + resourceGroupName + "/providers/Microsoft.Network/networkInterfaces?api-version=2023-09-01";
System.debug(urlTemplate);
```

## GET Virtual Machines

Run workflow 3a to add the REST operation. Be aware of two parameters – subscriptionId and resouceGroupName.

### -3a- Add a REST operation

Adds an operation to a REST host.

Properties to create a new operation. The URL must include only the specific operation part (without the host's URL) and can contain placeholders for parameters that are provided at request run time. Examples: <b>/customer/{id}</b>

<b>/customer?orderBy=(orderBy)</b>	
<b>Parent host *</b>	<a href="https://management.azure.com">https://management.azure.com</a>
<b>Name *</b>	GET Virtual Machines
<b>Template URL *</b>	/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Compute/virtualMachines?api-version=2023-07-01
<b>HTTP method *</b>	GET

## Create virtualMachines type from REST Operation

Run workflow 3c to add the REST operation. Use the same input values. Map ID and Name to the corresponding property in REST response.

### -3c- Create a type from a REST operation

List objects operation *	GET Virtual Machines	<input type="button" value="X"/>						
Type name *	virtualMachines	<input type="button" value="X"/>						
Icon *	default-16x16.png	<input type="button" value="X"/>						
Parent type *	resourcegroups	<input type="button" value="X"/>						
Parent name and ID	gp1 : 19ebbcfb-ba3e-4f75-901d-b27ddd31fa5a/de0acea-0b4e-403b%2Fsubscriptions%2Fde0acea-0b4e-403b%2FresourceGroups%2Fgp1	<input type="button" value="X"/>						
Folder label *	VirtualMachines	<input type="button" value="X"/>						
hasCustomHeadersAction	<input checked="" type="checkbox"/>							
Action to get custom headers	getAzureCustomHeaders	<input type="button" value="X"/>						
Content preview	<pre>{   "value": [     {       ...     }   ] }</pre>							
Objects path	.value	<input type="button" value="X"/>						
Element index	0	<input type="button" value="X"/>						
Object properties	<input type="button" value="+"/> <table border="1"> <thead> <tr> <th>Property</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>identity</td> <td>{"type":"SystemAssigned","principalId":"32c9e953-07e8-4430-80659a8db","tenantId":"b39138ca-3cee-411a-92f0"} {"type": "SystemAssigned", "principalId": "32c9e953-07e8-4430-80659a8db", "tenantId": "b39138ca-3cee-411a-92f0"}</td> </tr> <tr> <td>name</td> <td>mak1</td> </tr> </tbody> </table>		Property	Value	identity	{"type":"SystemAssigned","principalId":"32c9e953-07e8-4430-80659a8db","tenantId":"b39138ca-3cee-411a-92f0"} {"type": "SystemAssigned", "principalId": "32c9e953-07e8-4430-80659a8db", "tenantId": "b39138ca-3cee-411a-92f0"}	name	mak1
Property	Value							
identity	{"type":"SystemAssigned","principalId":"32c9e953-07e8-4430-80659a8db","tenantId":"b39138ca-3cee-411a-92f0"} {"type": "SystemAssigned", "principalId": "32c9e953-07e8-4430-80659a8db", "tenantId": "b39138ca-3cee-411a-92f0"}							
name	mak1							

Examine VirtualMachines in inventory  
 Examine the DT object in inventory for error.

The screenshot shows the vRealize Automation interface. On the left, there is a navigation tree with various service types like SNMP, PowerShell, vRealize Automation and Cloud Services, AMQP, vAPI, SOAP, vRO Configuration, Dynamic Types, and AZURE. Under AZURE, there is a link to https://management.azure.com. Below this, there are Subscriptions, stephenmak, Resourcegroups, gp1, and VirtualMachines. The VirtualMachines folder is selected, and a tooltip says "Error - click me for more". On the right, there is a detailed view of the VirtualMachines object with the following properties:

name	VirtualMachines
namespace	AZURE
urlWithParameters	/subscriptions/({subscriptionId})/resourceGroups/({resourceGroupName})/providers/Microsoft.Compute/virtualMachines?api-version=2023-07-01
InParameters	subscriptionId,resourceGroupName
id	19ebbcfb-ba3e-4f75-901d-b27ddd31fa5a/de0acea-0b4e-403b%2Fsubscriptions%2Fde0acea-0b4e-403b%2FresourceGroups%2Fgp1
@fullType	DynamicTypes:AZURE.virtualMachinesFolder

Update virtualMachinesFolderFindRelation action  
 Error 2: invalid subscriptionId

X  
Error - click me for more information

fixAction	Check virtualMachinesFolderFindRelation action
name	Error - click me for more information
namespace	AZURE
DEBUGRequestFullUrl	https://management.azure.com/subscriptions/%2Fsubscriptions%2Fde0abc...%2FresourceGroups%2Fgp1/resourceGroups%2Fgp1/providers/Microsoft.Compute/virtualMachines?api-version=2023-07-01
DEBUGObjectsPath	.value
id	error
DEBUGJson	{"error":{"code":"InvalidSubscriptionId","message":"The provided subscription identifier 'subscriptions' is malformed or invalid."}}
@fullType	DynamicTypes:AZURE.virtualMachines
error	{"error":{"code":"InvalidSubscriptionId","message":"The provided subscription identifier 'subscriptions' is malformed or invalid."}}

## Solution:

Update urlTemplate in virtualMachineFolderFindRelation action; replacing two parameters.

```

virtualMachinesFolderFindRelation
RUN DEBUG DELETE FIND USAGES FIND DEPENDENCIES

General Script Version History Audit

Runtime Environment
JavaScript

Inputs:
parentType : string parentId : string relationName : string

1 // Cache;
2 var cacheTimeout = 60 * 1; // 5 minutes cache
3 var objectId = "com.vmware.cse.dt.azure.virtualMachinesFolderFindRelation(" + parentType + "," + parentId + "," + relationName + ")";
4 var objects = System.getModule("com.vmware.coe.dynamicTypes.pluginGeneratorV3.caching").getFromCache(objectId);
5 if (objects != null) return objects;
6
7 // REST Operation variables;
8 var operationName = "folder findRelation";
9 var method = "GET";
10 var subscriptionId = parentId.split("/")[1];
11 var rest = parentId.split("%2F");
12 var resourceGroupName = rest[rest.length - 1];
13 // update URL
14 var urlTemplate = "/subscriptions/" + subscriptionId + "/resourceGroups/" + resourceGroupName + "/providers/Microsoft.Compute/virtualMachines?api-version=2023-07-01";
15 System.debug(urlTemplate);
16
17 var content = "";
18 var defaultContentType = "";
19 var objectsPath = ".value";// Edit this line if the objectsPath property is wrong
20 var cache = true;
21 var idProp = new Properties();
22 var contentAsStringLink;
23 var namespace = parentType.split(".")[0];
24 var childType = System.getModule("com.vmware.coe.dynamicTypes.pluginGeneratorV3").getChildType(parentType, parentId, relationName);
25 if (childType != null) {
26 | try {
// REST Operation variables;
var operationName = "folder findRelation";
var method = "GET";
var subscriptionId = parentId.split("/")[1];
var rest = parentId.split("%2F");
var resourceGroupName = rest[rest.length - 1];
// update URL
var urlTemplate =
"/subscriptions/" + subscriptionId + "/resourceGroups/" + resourceGroupName + "/providers/Microsoft.Compute/virtualMachines?api-version=2023-07-01";
System.debug(urlTemplate);

```

## HTTPS Operations

Below are the HPPS Operations after install.

The screenshot shows the 'Policy Runs' interface. On the left, there's a sidebar with 'Assets', 'Packages', 'Configurations', 'Resources', 'Environments', 'Administration' (with 'Groups' expanded), 'Inventory', and 'Audit Logs'. The main area shows a tree view under 'HTTP-REST' with several actions listed:

- > CREATE SQL Managed Instance: PUT https://management.azure.com/...
- > Create VM: PUT https://management.azure.com/sub...
- > DELETE vm: DELETE https://management.azure.com/...
- > GET Network Interfaces: GET /subscriptions/(id)...
- > GET Resource Groups: GET /subscriptions/(id)/re...
- > GET Subscriptions: GET /subscriptions?api-versi...
- > GET Virtual Machines: GET /subscriptions/(subsc...
- > sm-vra8.sqa.local: https://sm-vra8.sqa.local
- > https://login.microsoftonline.com: https://logi...

## Input Form Actions

com.vmware.pve.azure module has below input form actions.

### getAzureResourceGroupNames action

The screenshot shows the configuration page for the 'getAzureResourceGroupNames' action. It includes tabs for General, Script, Version History, and Audit. The Script tab is selected, showing the following code:

```

subscriptionId : string
1 var type = "AZURE.resourcegroups";
2
3 var actionPerformed = System.getModule("com.vmware.cse.dt.azure").resourcegroupsFindAll(type);
4
5 var breakpoint = /%2F/;
6
7 var array = [];
8 //System.log(System.getObjectClassName(actionResult));
9 for (i in actionPerformed) {
10     System.log(actionResult[i].id);
11     string = actionPerformed[i].id;
12     System.log(string);
13     y = string.split("/");
14     if (y[1] == subscriptionId) {
15         z = string.split(breakpoint);
16         array.push(z[z.length-1]);
17     }
18 }
19 return array;
```

The right side of the screen shows the API Explorer with the following details:

- Inputs:** subscriptionId (string, checked for Array)
- Return type:** string (checked for Array)
- Properties:** None

### getAzureNetworkInterfaceNames action

The screenshot shows the configuration page for the 'getAzureNetworkInterfaceNames' action. It includes tabs for General, Script, Version History, and Audit. The Script tab is selected, showing the following code:

```

subscriptionId : string resourceGroupName : string
1 var type = "AZURE.networkInterfaces";
2
3 var actionPerformed = System.getModule("com.vmware.cse.dt.azure").networkInterfacesFindAll(type);
4
5 var breakpoint = /%2F/;
6
7 var array = [];
8 //System.log(System.getObjectClassName(actionResult));
9 for (i in actionPerformed) {
10     System.log(actionResult[i].id);
11     string = actionPerformed[i].id;
12     y = string.split("/");
13     z = string.split("%2F");
14     if (y[1] == subscriptionId && z[8] == resourceGroupName ) {
15         z = string.split(breakpoint);
16         array.push(z[z.length-1]);
17     }
18 }
19 return array;
```

The right side of the screen shows the API Explorer with the following details:

- Inputs:** subscriptionId (string, checked for Array), resourceGroupName (string, checked for Array)
- Return type:** string (checked for Array)
- Properties:** None

## getAzureSubscriptionIds action

```
1 var type = "AZURE.subscriptions";
2
3 var actionResult = System.getModule("com.vmware.cse.dt.azure").subscriptionsFindAll(type);
4
5 array = [];
6 for (i in actionResult) {
7     System.log(actionResult[i]);
8     array.push(actionResult[i].id.split("/") [1]);
9 }
10
11 return array;
```

## Provisioning Workflows

Folder AZURE/Default contains pre-defined workflows. Reader needs create a REST operation and map to restOperations parameter before use. In addition, reader needs attach input form actions and field inputs to workflow.

Invoke 'Create VM: PUT https://management.azure.com/\_subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Compute/virtualMachines/{vmName}'?api-version=2023-09-01

Use below url to create a REST operation:

<https://management.azure.com/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Compute/virtualMachines/{vmName}?api-version=2023-09-01>

The screenshot shows a software interface for managing workflows and their schema.

**Left Panel (Workflows):**

- Workflows
  - ACoE
  - ASB
    - Machine
  - AZURE
    - AZURE CRUD Operations
      - Copy of test DT actions
      - Invoke 'CREATE SQL Managed Instance: PU'
      - Invoke 'Create VM: PUT https://management.azure.com/resources/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Compute/virtualMachines/{vmName}?api-version=2023-09-01'**
      - Invoke 'DELETE vm2 object'
      - Invoke 'DELETE vm: DELETE https://management.azure.com/resources/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Compute/virtualMachines/{vmName}'
  - Content Management Tests
  - CSE
    - Dynamic Types Plug-in generator v3
      - Create a plug-in no swagger
      - 3- Repeat for each object type
        - 3a- Add a REST operation
        - 3b- Invoke a REST operation with headers
        - 3c- Create a type from a REST operation
        - 4- Remove a REST operation (Optic)
      - 1- Create new plug-in
      - 2a- Create a REST host
      - 2b- Add REST Host as DT Host
    - Create a plug-in with Swagger
    - Helper

**Top Right Panel (Variables):**

Name	Type
errorCode	string
restOperation	REST:RESTOperation
method	PUT
dunesId	19ebbcfb- ba3e-4f75-901d- b27ddd31fa5: 14ef768c-2043-4b14-8f2 d-c06a67131c07
displayName	Create VM: PUT https://management.azure.com/resources/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Compute/virtualMachines/{vmName}?api-version=2023-09-01
@type	RESTOperation
inParametersCount	3
urlTemplate	https://management.azure.com/resources/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Compute/virtualMachines/{vmName}?api-version=2023-09-01
name	Create VM
id	19ebbcfb-

**Bottom Panel (Workflow Details):**

**Workflow Diagram:**

```

graph TD
    Start(( )) --> DefinePayload[Define Payload]
    DefinePayload --> InvokeAction[InvokeRestOperationWithHeadersFromAction]
    InvokeAction --> Decision{Custom Condition}
    Decision -- True --> End(( ))
    Decision -- False --> Error(( ))
  
```

**Workflow Schema (Details View):**

**Item 1: invokeRestOperationWithHeadersFromAction**

**General:**

- Name: invokeRestOperationWithHeadersFromAction
- Next element: item2: Custom Condition
- Business status:
- Description: Add a note to the workflow schema.

**Action:**

- Action: invokeRestOperationWithHeadersFromAction

**Inputs:**

- restOperation: REST:RESTOperation
- inParametersValues: Array/string
- content: string
- getCustomHeadersAction: Action

**Outputs:**

- actionResult: Properties

**Exception handling:**

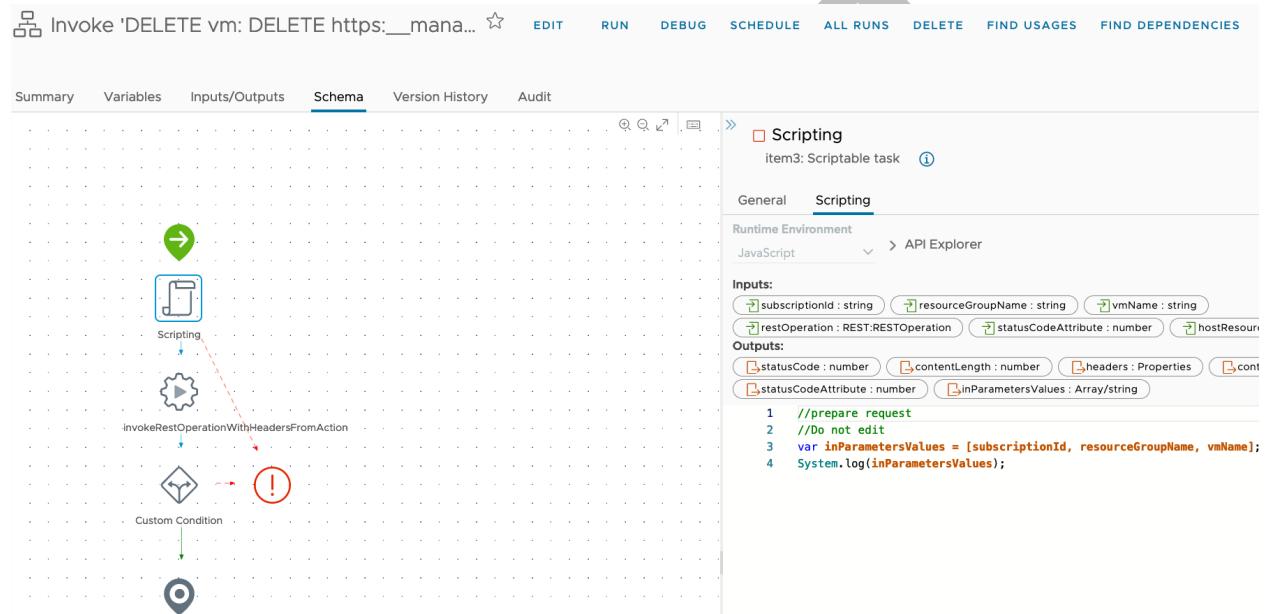
Use a below GET response as template in “Define Payload” task and update key values accordingly.

<https://management.azure.com/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Compute/virtualMachines/{vmName}?api-version=2023-09-01>

Invoke 'DELETE vm: DELETE https:\_\_manag...

Use below url to create a REST operation:

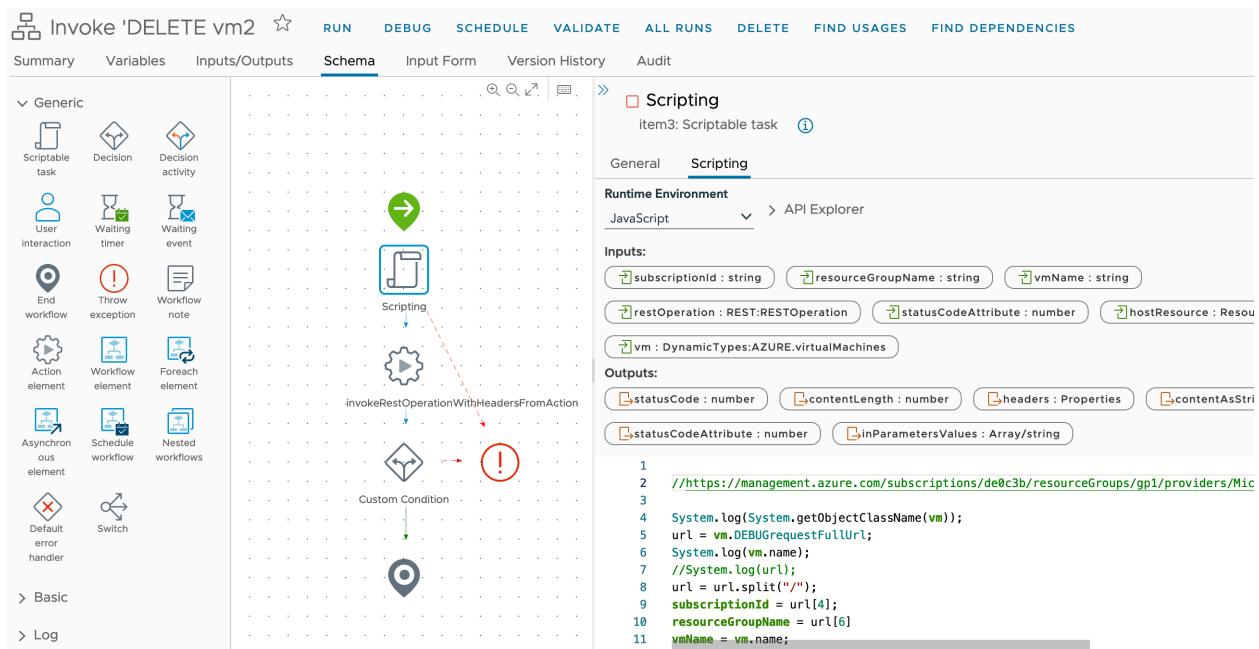
<https://management.azure.com/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Compute/virtualMachines/{vmName}?api-version=2023-09-01>



Invoke 'DELETE vm2

Use below url to create a REST operation:

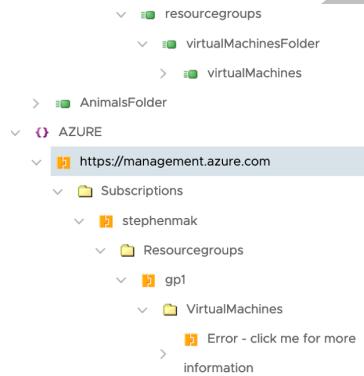
<https://management.azure.com/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Compute/virtualMachines/{vmName}?api-version=2023-09-01>



## Inventory Objects and Properties

Below are inventory objects after install.

### DT Host



https://management.azure.com	
name	https://management.azure.com
namespace	AZURE
id	19ebbcfb-ba3e-4f75-901d-b27d
@fullType	DynamicTypes:AZURE.AZUREH
url	https://management.azure.com

## Subscriptions

virtualMachinesFolder

virtualMachines

AnimalsFolder

AZURE

- <https://management.azure.com>
- Subscriptions
- stephenmak**
- Resourcegroups
- gp1
- VirtualMachines
- Error - click me for more information

Zoo

SSH

OvaTransfer

Active Directory

vRO Multi-Node

Auto Deploy

vSphere vCenter Plug-in

HTTP-REST

stephenmak

DEBUGRequestFullUrl	https://management.azure.com/subscriptions/19ebbcfb-ba3e-4f75-901d-b27/resourceGroups/gp1
subscriptionPolicies	{"locationPlacer": "AZURE"}
tags	{"Environment": "Test", "Owner": "Stephen Mak", "Manager": "Stephen Mak", "Email": "smak@azuresolutions.com"}
name	stephenmak
tenantId	b39138ca-3cee-4a2a-8a2a-0a2a2a2a2a2a
namespace	AZURE
DEBUGObjectsPath	.value
state	Enabled
id	19ebbcfb-ba3e-4f75-901d-b27
managedByTenants	None
DEBUGJson	{"value": [{"id": "/subscriptions/19ebbcfb-ba3e-4f75-901d-b27/resourceGroups/gp1", "tags": {"Environment": "Test", "Owner": "Stephen Mak", "Manager": "Stephen Mak", "Email": "smak@azuresolutions.com"}, "name": "gp1", "type": "Microsoft.Resources/resourceGroups", "location": "eastus", "resourceType": "ResourceGroup", "resourceName": "gp1", "resourceId": "/subscriptions/19ebbcfb-ba3e-4f75-901d-b27/resourceGroups/gp1"}]}
@fullType	DynamicTypes:AZURE.subscription
subscriptionId	de0abcea-0b4e-4a2a-8a2a-0a2a2a2a2a2a
authorizationSource	RoleBased

## Resource groups

Dynamic Types

Type Hierarchy

ExhibitsFolder

AZUREHost

subscriptionsFolder

subscriptions

resourcegroupsFolder

resourcegroups

virtualMachinesFolder

virtualMachines

AnimalsFolder

AZURE

Subscriptions

stephenmak

Resourcegroups

gp1

VirtualMachines

gp1

DEBUGRequestFullUrl	https://management.azure.com/subscriptions/19ebbcfb-ba3e-4f75-901d-b27/resourceGroups/gp1
tags	{}
name	gp1
namespace	AZURE
DEBUGObjectsPath	.value
location	eastus
id	19ebbcfb-ba3e-4f75-901d-b27
DEBUGJson	{"value": [{"id": "/subscriptions/19ebbcfb-ba3e-4f75-901d-b27/resourceGroups/gp1", "tags": {}, "name": "gp1", "type": "Microsoft.Resources/resourceGroups", "location": "eastus", "resourceType": "ResourceGroup", "resourceName": "gp1", "resourceId": "/subscriptions/19ebbcfb-ba3e-4f75-901d-b27/resourceGroups/gp1"}]}
@fullType	DynamicTypes:AZURE.resourceGroup
properties	{"provisioningState": "Succeeded"}

## VirtualMachines

The screenshot shows the 'VirtualMachines' module structure. It includes sections for SNMP, PowerShell, vRealize Automation and Cloud Services, AMQP, vAPI, SOAP, vRO Configuration, Dynamic Types (Type Hierarchy, AZURE), and Azure resources (Subscriptions, stephenmak, Resourcegroups, gp1, VirtualMachines). The 'VirtualMachines' folder under gp1 is highlighted.

## VirtualMachines

<b>name</b>	VirtualMachines
<b>namespace</b>	AZURE
<b>urlWithParameters</b>	/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Compute/virtualMachines/{vmName}
<b>inParameters</b>	subscriptionId,resourceGroupName,vmName
<b>id</b>	19ebbcfb-ba3e-4f75-901d-3b%2FresourceGroups%2Fstephenmak%2Fgp1%2FVirtualMachines
<b>@fullType</b>	DynamicTypes:AZURE.virtualMachine

## Virtual Machines

The screenshot shows the 'Virtual Machines' module structure. It includes sections for SNMP, PowerShell, vRealize Automation and Cloud Services, AMQP, vAPI, SOAP, vRO Configuration, Dynamic Types (Type Hierarchy, AZURE), and Azure resources (Subscriptions, stephenmak, Resourcegroups, gp1, VirtualMachines). The 'mak1' folder under gp1 is highlighted.

## mak1

<b>DEBUGRequestFullUrl</b>	https://management.azure.com/providers/Microsoft.Compute/virtualMachines/mak1?api-version=2018-06-01
<b>resources</b>	[{"id": "/subscriptions/3cb-9834-39446634/resourceGroups/OmsAgentForWindows/providers/Microsoft.Compute/virtualMachines/mak1"}]
<b>identity</b>	{"type": "SystemAssigned", "id": "3cee-4b4a-a4d6-cc35-000000000000"}
<b>name</b>	mak1
<b>namespace</b>	AZURE
<b>DEBUGObjectsPath</b>	.value
<b>location</b>	eastus
<b>id</b>	19ebbcfb-ba3e-4f75-901d-3b%2FresourceGroups%2Fstephenmak%2Fgp1%2FVirtualMachines%2Fmak1
<b>DEBUGJson</b>	{ "value": [ { "name": "ups/gp1/providers/stephenmak", "location": "eastus", "id": "b510659a8db", "type": "Microsoft.Compute/virtualMachines", "vmSize": "StandardD2", "storageProfile": { "osDisk": { "sku": "20_0", "osType": "Linux", "name": "e", "caching": "ReadWrite", "osDiskSizeGB": 1024, "diskControllerType": "LinuxConfigured", "linuxConfiguration": { "username": "UBfxvYVTEXGfzynNG8tvKW5d5bVyd+3LPDbNzzBEAnbc" } } } } ] }

## com.vmware.cse.dt.azure module

Below are some plugin actions created by the tool.

**NEW ACTION**

Name	Tags
virtualMachinesFindAll	com.vmware.cse.dt.azure
virtualMachinesFolderFindAll	com.vmware.cse.dt.azure
virtualMachinesFolderFindById	com.vmware.cse.dt.azure
virtualMachinesFolderHasChildrenInRelation	com.vmware.cse.dt.azure
resourcegroupsFolderFindRelation	com.vmware.cse.dt.azure
resourcegroupsFindById	com.vmware.cse.dt.azure
resourcegroupsFindRelation	com.vmware.cse.dt.azure
resourcegroupsFindAll	com.vmware.cse.dt.azure
resourcegroupsFolderFindAll	com.vmware.cse.dt.azure
resourcegroupsFolderHasChildrenInRelation	com.vmware.cse.dt.azure
subscriptionsFolderFindRelation	com.vmware.cse.dt.azure
subscriptionsFindById	com.vmware.cse.dt.azure
subscriptionsFindRelation	com.vmware.cse.dt.azure

## Add additional REST Operations

Reader can map a REST call to a vRO workflow. Our tool creates a vRO workflow with inputs and Azure authentication. Below is the instruction.

### a) Run below workflow to add a REST Operation

Add a REST operation

Adds an operation to a REST host.

Properties to create a new operation. The URL must include only the specific operation part (without the host's URL) and can contain placeholders for parameters that are provided at request run time. Examples: /customer/{id} ; /customer/{id}/orders?date={date} ; /customer?orderBy={orderd

Parent host *	https://management.azure.com/
Name *	CREATE SQL Managed Instance
Template URL *	management.azure.com/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Sql/managedInstances/{managedInstanceName}?api-version=2023-07-01
HTTP method *	PUT
Content type	application/json

**RUN** **CANCEL**

### b) Run below workflow to generate a workflow from REST operation

## Generate a new workflow from a REST operation

Generates a new workflow from a REST operation.

**Operation** [Workflow properties](#)

Specify an operation to generate a workflow from. If the operation takes input and XSD schemas are added to its host, you can optionally specify the request input type.

<b>Operation *</b>	CREATE SQL Managed Instance	<a href="#">X</a>
<b>Content type</b>	application/json	

**RUN** **CANCEL**

## Generate a new workflow from a REST operation

Generates a new workflow from a REST operation.

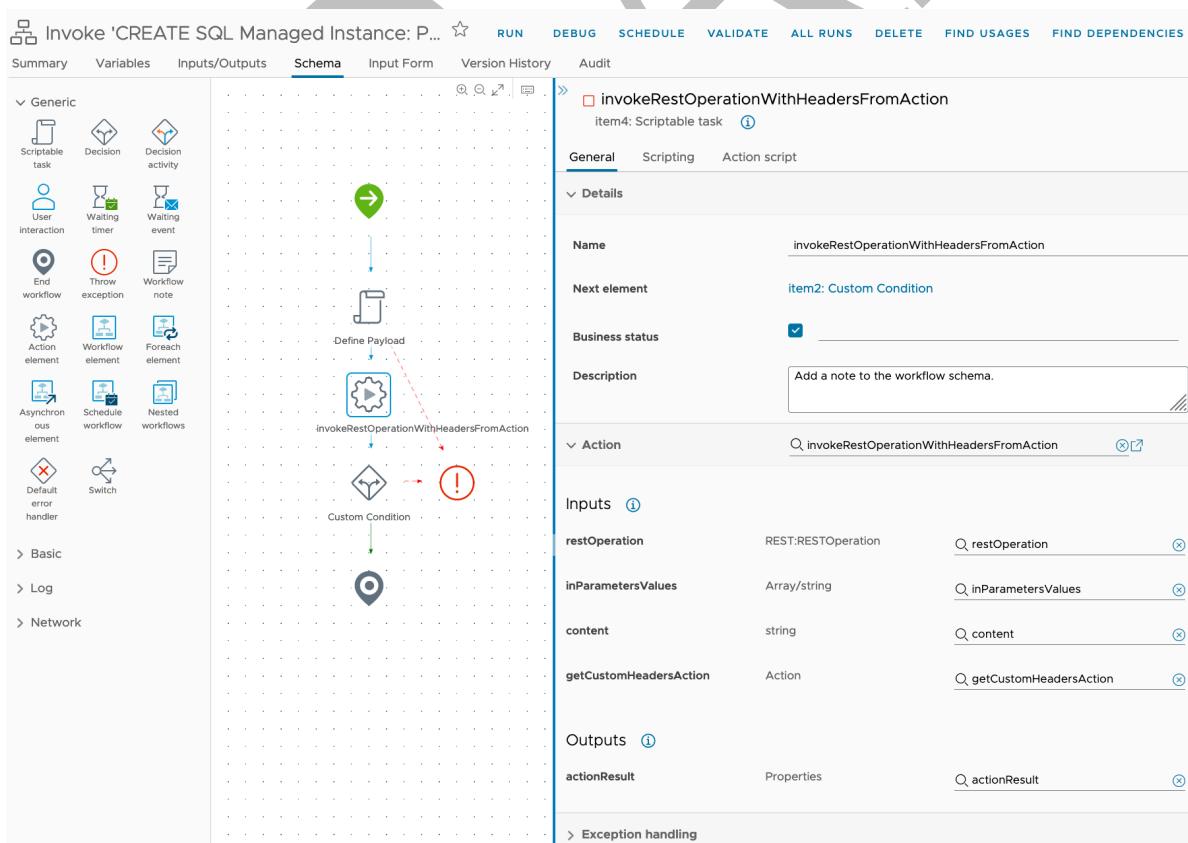
**Operation** [Workflow properties](#)

Specify workflow name and category to save to.

<b>Name *</b>	Invoke 'CREATE SQL Managed Instance: PUT https:__manage...'	
<b>Folder *</b>	AZURE/AZURE CRUD Operations	<a href="#">X</a>

**RUN** **CANCEL**

- c) Add Define Payload and invokeRestOperationWithHeadersFromAction tasks to workflow



## Supply variable values:

The screenshot shows a workflow editor interface with the 'Variables' tab selected. The 'restOperation' variable is expanded, revealing its detailed properties. The table below lists the variables and their details:

	Name	Type	Description
<input type="checkbox"/>	errorCode	string	
<input type="checkbox"/> >	restOperation	[object REST:RESTOperation]	REST:RESTOperation
<input type="checkbox"/>	statusCodeAttribute		number
<input type="checkbox"/> >	hostResource	[object ResourceElement]	ResourceElement
<input type="checkbox"/>	inParametersValues	Not set	Array/string
<input type="checkbox"/> >	getCustomHeadersAction	[object Action]	Action
	createdAt	1704993072145	
	editable	true	
	canEdit	true	
	name	getAzureCustomHeaders	
	description	Get authorization header for Azures Stephen Mak, Product Value Engineering, Broadcom	
	@returnType	Properties	
	id	d3fafe39-59fb-4b6d-8340-74198b 2e9525	
	type	ScriptModule	
	globalTags	com.vmware.coe.dynamicTypes.pi uginGeneratorV3.getCustomHead er...:__SYSTEM_TAG__	
	categoryName	com.vmware.coe.dynamicTypes.pi uginGeneratorV3.getCustomHead ersActions	
	version	0.0.0	
	updatedAt	1706833070915	
<input type="checkbox"/>	content	string	content
<input type="checkbox"/>	contentAsString	string	Response content as string
<input type="checkbox"/>	headers	Properties	Response headers
<input type="checkbox"/>	contentLength	number	Response content length

At the bottom, there are buttons for 'SAVE', 'VERSION', and 'CLOSE'.

d) Apply input form actions

Invoke 'CREATE SQL Managed Instance: P...' ⚡

RUN DEBUG SCHEDULE VALIDATE ALL RUNS DELETE FIND USAGES FIND DEPENDENCIES

Summary Variables Inputs/Outputs Schema Input Form Version History Audit

Request Validations

**Workflow Inputs**

- subscriptionId Added
- resourceGroupName Added
- managedInstanceName Added

**Url parameters**

SubscriptionId	ResourceGroupName	ManagedInstanceName
subscriptionId	resourceGroupName	managedInstanceName

**Properties**

**subscriptionId**

Field ID: subscriptionId

**Appearance** **Values** **Constraints**

**Label** subscriptionId  
**Placeholder** Enter placeholder  
**Data type** String  
**Display type** DropDown

**Visibility** Yes  
**Read-only** No  
**Custom help**

Invoke 'CREATE SQL Managed Instance: P...' ⚡

RUN DEBUG SCHEDULE VALIDATE ALL RUNS DELETE FIND USAGES FIND DEPENDENCIES

Summary Variables Inputs/Outputs Schema Input Form Version History Audit

Request Validations

**Workflow Inputs**

- subscriptionId Added
- resourceGroupName Added
- managedInstanceName Added

**Url parameters**

SubscriptionId	ResourceGroupName	ManagedInstanceName
subscriptionId	resourceGroupName	managedInstanceName

**Properties**

**subscriptionId**

Field ID: subscriptionId

**Appearance** **Values** **Constraints**

**Default value** Constant

Value source Constant  
Value Enter value

**Value options** External source

Value source External source  
Select action com.vmware.cse.dt.azure/getAzur ...

e) Test workflow

Invoke 'CREATE SQL Managed Instance: PUT https://\_\_manage\_\_'

Autogenerated workflow.

subscriptionId *	d...
resourceGroupName *	gp1
managedInstanceName *	SQL_Test_1

**RUN** **CANCEL**

## References

Authentication Failure

When

```
{"error": {"code": "AuthenticationFailed", "message": "Authentication failed. The 'Authorization' header is missing."}}
```

Troubleshooting:

- 1) Test getAzureCustomHeaders action  
 solution: run update rest operation workflow

## DELETE VM Cert Error

The screenshot shows two main parts of the vRealize Orchestrator interface.

**Workflow View:**

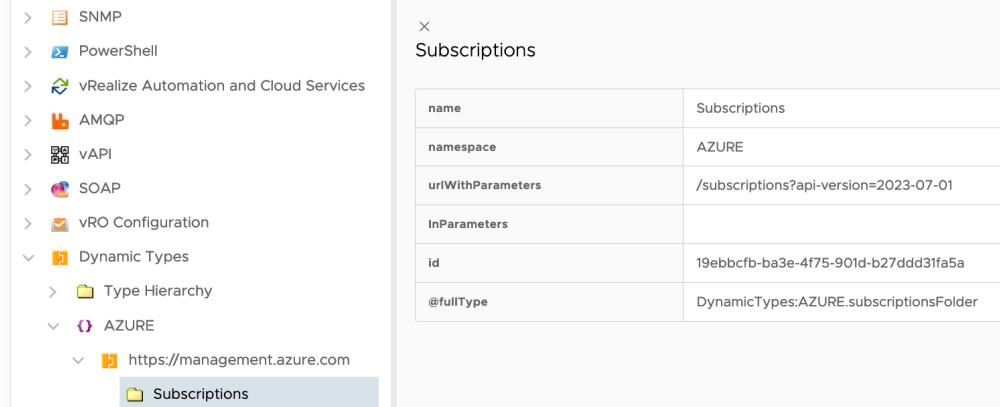
- Top bar: embedded-VRO, https://sm-vra8.sqa.local:443, vm: DELETE https://management.azure.com, Failed, ALL RUNS, DELETE RUN, RUN AGAIN, DEBUG, EXPORT.
- Workflow canvas: A sequence of actions. It starts with a "Scripting" action (3 ms), followed by an "invokeRestOperationWithHeadersFromAction" action (220 ms). This second action has a red error icon and a tooltip: "Cannot execute the request: Certificate is not in CA store. Certificate is not in CA store. (Dynamic Script Module name : executeRequest#44)". After this, there's a "Custom Condition" action with a red exclamation mark icon.
- Details panel for the "invokeRestOperationWithHeadersFromAction" step:
  - Name: invokeRestOperationWithHeadersFromAction
  - Next element: item2: Custom Condition
  - Business status: checked
  - Description: Add a note to the workflow schema.
  - Action: invokeRestOperationWithHeadersFromAction

**Certificates Management View:**

- Header: VMware vRealize Orchestrator
- Section: Certificates
  - Manage the certificates used by the Orchestrator server.
  - TRUSTED CERTIFICATES (selected), PACKAGE SIGNING CERTIFICATE, PUBLISHER TRUSTED CERTIFICATES
  - Manage the Orchestrator trust store. Mark self-signed certificates as trusted by importing them to the internal trust store.
  - IMPORT FROM URL:
    - URL: https://management.azure.com
    - Proxy URL: (empty)
    - Port: (empty)
    - Use Proxy: (checkbox)
    - CANCEL, IMPORT buttons

## Inventory Issue

### Inventory



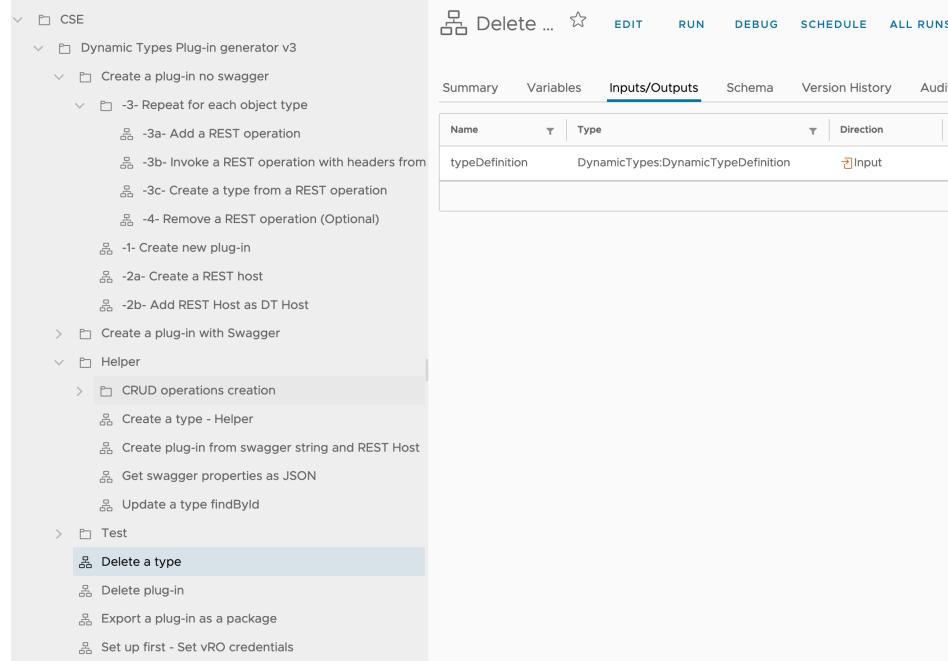
The screenshot shows the 'Inventory' section of the vRealize Automation and Cloud Services interface. On the left, there's a tree view of various providers. Under 'AZURE', there's a folder named 'Subscriptions'. A grey arrow points from the text 'Manually reimport the management.azure.com certificate.' towards this 'Subscriptions' folder.

name	Subscriptions
namespace	AZURE
urlWithParameters	/subscriptions?api-version=2023-07-01
InParameters	
id	19ebbcfb-ba3e-4f75-901d-b27ddd31fa5a
@fullType	DynamicTypes:AZURE.subscriptionsFolder

Solution: examine inventory objects. If not displayed, cert has an issue (may be expired). Manually reimport the management.azure.com certificate.

### Delete a DT type

- 1) Run 'Delete a type' workflow two times. First, select child type as input (e.g., virtualMachines). Then, select parent (e.g., virtualMachineFolder).



The screenshot shows the 'Dynamic Types Plug-in generator v3' interface. On the left, there's a tree view of actions. Under 'Delete a type', it's highlighted. The right panel shows the details for this action, including its inputs and outputs. A grey arrow points from the text 'Delete all actions of this type from module com.vvware.cse.dt.azure (e.g., subscriptions)' towards the 'Delete a type' workflow in the sidebar.

Name	Type	Direction
typeDefinition	DynamicTypes:DynamicTypeDefinition	Input

- 2) Delete all actions of this type from module com.vvware.cse.dt.azure (e.g., subscriptions). See the list below.

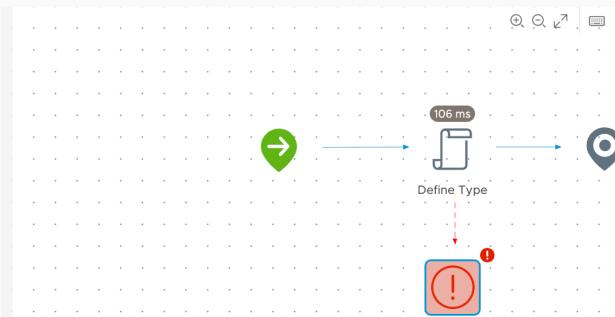
com.vmware.cse.dt.azure 0 7 EDIT DELETE

Filter...

+ NEW ACTION MOVE DELETE

<input type="checkbox"/>	Name	Type
<input type="checkbox"/>	<a href="#">subscriptionsFindAll</a>	Action
<input type="checkbox"/>	<a href="#">subscriptionsFindById</a>	Action
<input type="checkbox"/>	<a href="#">subscriptionsFindRelation</a>	Action
<input type="checkbox"/>	<a href="#">subscriptionsFolderFindAll</a>	Action
<input type="checkbox"/>	<a href="#">subscriptionsFolderFindById</a>	Action
<input type="checkbox"/>	<a href="#">subscriptionsFolderFindRelation</a>	Action
<input type="checkbox"/>	<a href="#">subscriptionsFolderHasChildrenInRelation</a>	Action

### Create a Type from REST Operation issue

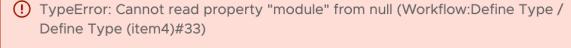


-3c- Create a type from a REST operation Failed ALL RUNS DELETE RUN RUN AGAIN DEBUG EXPORT

-3c- Create a type from a REST operation > Create a type - Helper > Define Type

Total transitions 20 | Display total duration

Workflow Element  
item1: Exception 



Details

End mode Error, throw an exception

Business status 

Could not delete item 'resourcegroupsFindAll': Action 'com.vmware.cse.dt.azure/resourcegroupsFindAll' is in use. Specify 'force=true' parameter to delete it. Force delete 

< 1 / 3 >

com.vmware.cse.dt.azure 0 3 EDIT DELETE

Filter...

+ NEW ACTION MOVE DELETE  

<input checked="" type="checkbox"/>	Name	Type
<input checked="" type="checkbox"/>	<a href="#">resourcegroupsFindAll</a>	Action
<input checked="" type="checkbox"/>	<a href="#">resourcegroupsFindById</a>	Action
<input checked="" type="checkbox"/>	<a href="#">subscriptionsFindAll</a>	Action

3 Actions per page 20 1 - 3 of 3 actions

Solution: delete the type and its actions. Retry.

## Azure Managed instances

<https://learn.microsoft.com/en-us/rest/api/sql/managed-instances?view=rest-sql-2021-11-01>

<https://learn.microsoft.com/en-us/rest/api/sql/managed-instances/update?view=rest-sql-2021-11-01&tabs=HTTP>

<https://learn.microsoft.com/en-us/azure/azure-sql/managed-instance/quickstart-content-reference-guide?view=azuresql>

<https://learn.microsoft.com/en-us/rest/api/sql/managed-instances/create-or-update?view=rest-sql-2021-11-01&tabs=HTTP>

**PUT**

<https://management.azure.com/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Sql/managedInstances/{managedInstanceName}?api-version=2023-07-01>

## Azure REST

<https://learn.microsoft.com/en-us/rest/api/azure/>

## Azure search service

Validation Success

Basics

Subscription	stephenmak
Resource Group	gp1
Location	West US
Service name	(new) maks
Pricing tier	free (50 MB, max 1 replicas, max 1 partitions, max 1 search units)
Estimated cost per month	\$0.00

Scale

Replicas	1
Partitions	1

Create    Previous    Next    Download a template for automation

## Getting Azure API Token

See <https://learn.microsoft.com/en-us/rest/api/servicebus/get-azure-active-directory-token#use-postman-to-get-the-azure-ad-token> for instructions. Use below curl test your values.

```

curl -X POST -d
'grant_type=client_credentials&client_id=[APP_ID]&client_secret=[PASSWORD]&re
source=https%3A%2F%2Fmanagement.azure.com%2F'
https://login.microsoftonline.com/[TENANT_ID]/oauth2/token

```

The screenshot shows the Microsoft Azure portal interface. At the top, there's a navigation bar with various icons and links. Below it, the main header says "Microsoft Azure" and "VMware, Inc. | Microsoft Entra ID". On the left, there's a sidebar with "Overview", "Preview features", "Diagnose and solve problems", "Manage", and "Users". The main content area is titled "Services" and lists several items under "All". To the right, there's a search bar and some user information.

**Services**

- Microsoft Entra ID
- Security
- Activity log
- Azure Cosmos DB
- Azure Database for MySQL servers
- Azure Large Instances
- Initiatives
- Azure Arc

**App registrations**

Display name	Application (client) ID	Created on	Certificates
AZ	ff4f1725-cdca-4d57-b9f5-a0d1f934d0d7	9/19/2023	Current
smak-app1	4e6e61a4-6cab-46c6-892b-37d90d1c55b6	6/9/2023	Expired

The screenshot shows the Microsoft Azure portal's 'Certificates & secrets' page for an application registration. The left sidebar lists management options like Overview, Quickstart, Integration assistant, and Certificates & secrets (which is selected). The main content area displays two client secrets: 'rbac' (Expires 10/17/2024) and 'rbac2' (Expires 1/10/2026). A large 'X' watermark is overlaid on the page.

## Dynamic Type Generator Acknowledgement

Dynamic Type Generator v3 was created by Chris Decanini. Version 3.1 has below updates over version 3 and has been regression tested with vRA8.14.1 and vRA8.11.1.

The screenshot shows the Dynamic Type Generator configuration interface. It lists various actions and their properties, such as 'Invoke 'DELETE vm: DELETE https://management.azure.com...'', 'networkInterfacesFindAll', and 'Invoke 'CREATE SQL Managed Instance: PUT https://management.azure.com...''. Each entry includes a 'Version' column (e.g., 'Higher Version') and a 'Workflow' column. At the bottom, there are import configuration settings for attribute values and secure strings, along with a 'Tag import mode' dropdown.

Action	Version	Workflow	Version
Invoke 'DELETE vm: DELETE https://management.azure.com...'	Higher Version	Workflow	0.0.1
networkInterfacesFindAll	Higher Version	Action	0.0.1
Invoke 'CREATE SQL Managed Instance: PUT https://management.azure.com...'	Higher Version	Workflow	0.0.1
getAzureResourceGroupNames	Higher Version	Action	0.0.0
getAzureNetworkInterfaceNames	Higher Version	Action	0.0.0
getAzureSubscriptionIds	Higher Version	Action	0.0.1
subscriptionsFindAll	Higher Version	Action	0.0.1
Invoke 'Create VM: PUT https://management.azure.com/_sub...'	Higher Version	Workflow	0.0.1
resourcegroupsFindAll	Higher Version	Action	0.0.1
Test DT actions	Higher Version	Workflow	0.0.1
executeOrchestratorRequestWithConfigurationElement	Higher Version	Action	0.0.0
getAzureCustomHeaders	Higher Version	Action	0.0.0
executeOrchestratorRequest	Higher Version	Action	0.0.1
resourcegroupsFindById	Higher Version	Action	0.0.1
Invoke 'DELETE vm2 object'	Higher Version	Workflow	0.0.1
microsoftonline	Higher Version	Configuration Element	0.0.0