

A vRO Plugin for Azure

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Introduction

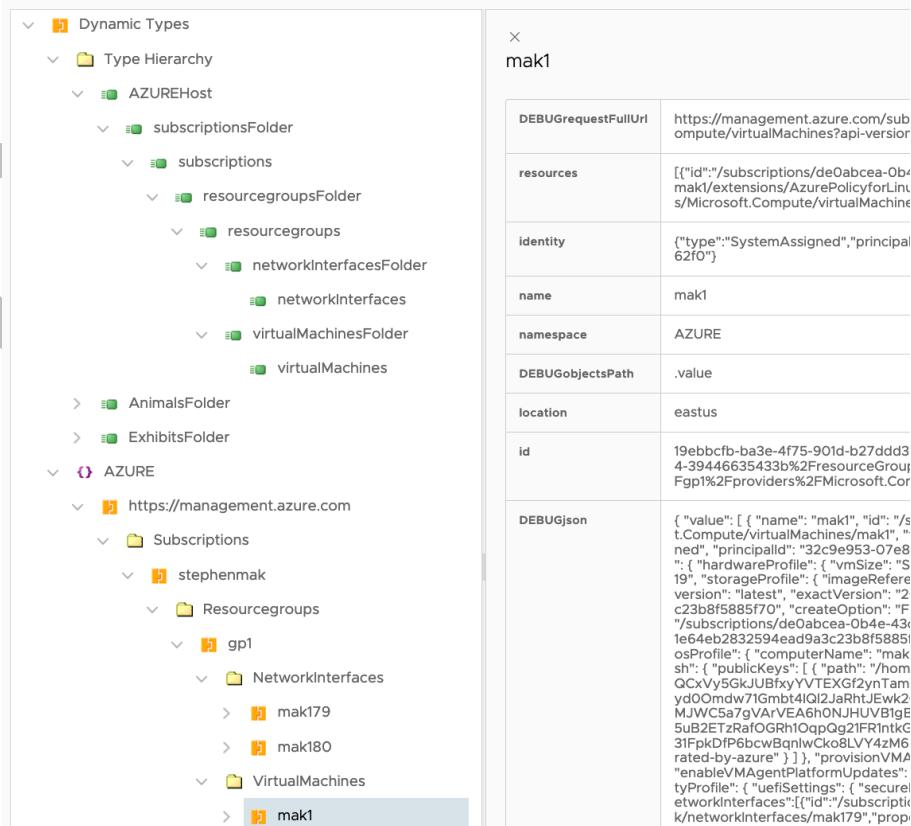
This document lists instructions to create a vRO plugin for Azure. We define vRO Dynamic Types to interface with Azure public cloud for the purpose of consuming native cloud services.

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
- 6) Instruction to convert a REST call to a vRO workflow. Our tool creates a vRO workflow with inputs and Azure authentication.

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

Inventory 



The screenshot shows the vRO Inventory interface. On the left, there is a tree view of 'Dynamic Types' under 'Type Hierarchy'. The tree includes 'AZUREHost' (with 'subscriptionsFolder', 'resourcegroupsFolder', 'networkInterfacesFolder', and 'virtualMachinesFolder' children), 'AnimalsFolder', 'ExhibitsFolder', and 'AZURE' (with 'https://management.azure.com' and 'stephenmak' children). 'stephenmak' has 'Resourcegroups' and 'VirtualMachines' children, with 'gp1' and 'mak1' respectively. On the right, there is a detailed view of the 'mak1' object. The object has the following properties:

Property	Value
DEBUGRequestFullPath	https://management.azure.com/subscriptions/de0acea-0b4e-43c3-b23bf5885f70/resources/AzurePolicyForLinux/providers/Microsoft.Compute/virtualMachines/mak1?api-version=2024-01-01
resources	[{"id": "subscriptions/de0acea-0b4e-43c3-b23bf5885f70/extensions/AzurePolicyForLinux/providers/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%2Fgp1%2Fproviders%2FMicrosoft.Compute%2FvirtualMachines%2Fmak1
DEBUGJson	{ "value": [{ "name": "mak1", "id": "/subscriptions/de0acea-0b4e-43c3-b23bf5885f70/resources/AzurePolicyForLinux/providers/Microsoft.Compute/virtualMachines/mak1", "type": "Microsoft.Compute/virtualMachines", "principalId": "32c9e953-07e8-43c3-b23bf5885f70", "hardwareProfile": { "vmSize": "Standard_D2_v2", "storageProfile": { "imageReference": { "version": "latest", "exactVersion": "2024-01-01", "createOptions": "FromImage" }, "osDisk": { "computerName": "mak1", "publicKeys": [{ "path": "/home/stephenmak/.ssh/id_rsa" }] } }, "provisionVMAgent": true, "enableVMPlatformUpdates": true, "vhd": { "uri": "https://management.azure.com/subscriptions/de0acea-0b4e-43c3-b23bf5885f70/resourceGroups/gp1/providers/Microsoft.Compute/virtualMachines/mak1/vhds/mak1.vhd?api-version=2024-01-01" } } }] }

The plugin stores pre-defined workflows in the AZURE/Default folder.

The screenshot shows the Embedded-VRO interface. On the left, there is a navigation sidebar with the following items: Dashboard, Library (selected), Workflows, Actions, Policies, Activity (selected), Workflow Runs, and Scheduled. Under the Library section, there is a sub-section for Workflows. The main content area shows a tree view of workflows under the AZURE/Default folder. The visible items are:

- Workflows
- AZURE
- AZURE CRUD Operations
- Default
 - Invoke 'CREATE SQL Managed Instance: PUT https:__manage...' (with a warning icon)
 - Invoke 'Create VM: PUT https:__management.azure.com_sub...' (with a warning icon)
 - Invoke 'DELETE vm2 object' (with a warning icon)
 - Invoke 'DELETE vm: DELETE https:__management.azure.com_...' (with a warning icon)
 - Test DT actions

The plugin stores pre-defined ‘get’ actions in two modules.

The screenshot shows the Embedded-VRO interface. On the left, there is a navigation sidebar with the following items: Dashboard, Library (selected), Workflows, Actions, Policies, Activity (selected), Workflow Runs, Scheduled, Waiting for Input (0), and Policy Runs. Under the Library section, there is a sub-section for Actions. The main content area shows a table titled "Actions" with 4 of 697 results. The table has columns for Name, Tags, and Description. The data is as follows:

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.

Embedded-VRO

The screenshot shows the 'Library' section of the Embedded-VRO interface. The left sidebar has a tree structure with the following items:

- Dashboard
- Library
- Workflows
- Actions
- Policies
- Activity
- Assets
- Administration
- Deleted Items
- API Explorer

The 'Activity' item is currently selected, indicated by a blue border. The main content area shows a tree structure under 'CSE' with the following items:

- 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 *	https://login.microsoftonline.com			
URL *	https://login.microsoftonline.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"/>			
Support for parallel request executions	<input checked="" type="checkbox"/>			
Redirect strategy	defaultRedirect			
RUN		CANCEL		

Create vRA host endpoint

Run below workflow with authentication to create a 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 *	vra-onprem	
Host Name *	cava-n-82-056.eng.vmware.com	
Host URL *	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 *	fritz@coke.sqa-horizon.local	
Password *	*****	

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.

	Variable	Value	Type	Description
	password	*****	SecureString	
	username	fritz@coke.sqa-horizon.local	string	
	hostname	Default	string	host description

microsoftonline

General Variables Version History Audit

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

	Variable	Value
	url	*****
	azureAuthenticationContent	*****
	restHost	[object REST:RESTHost]
	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

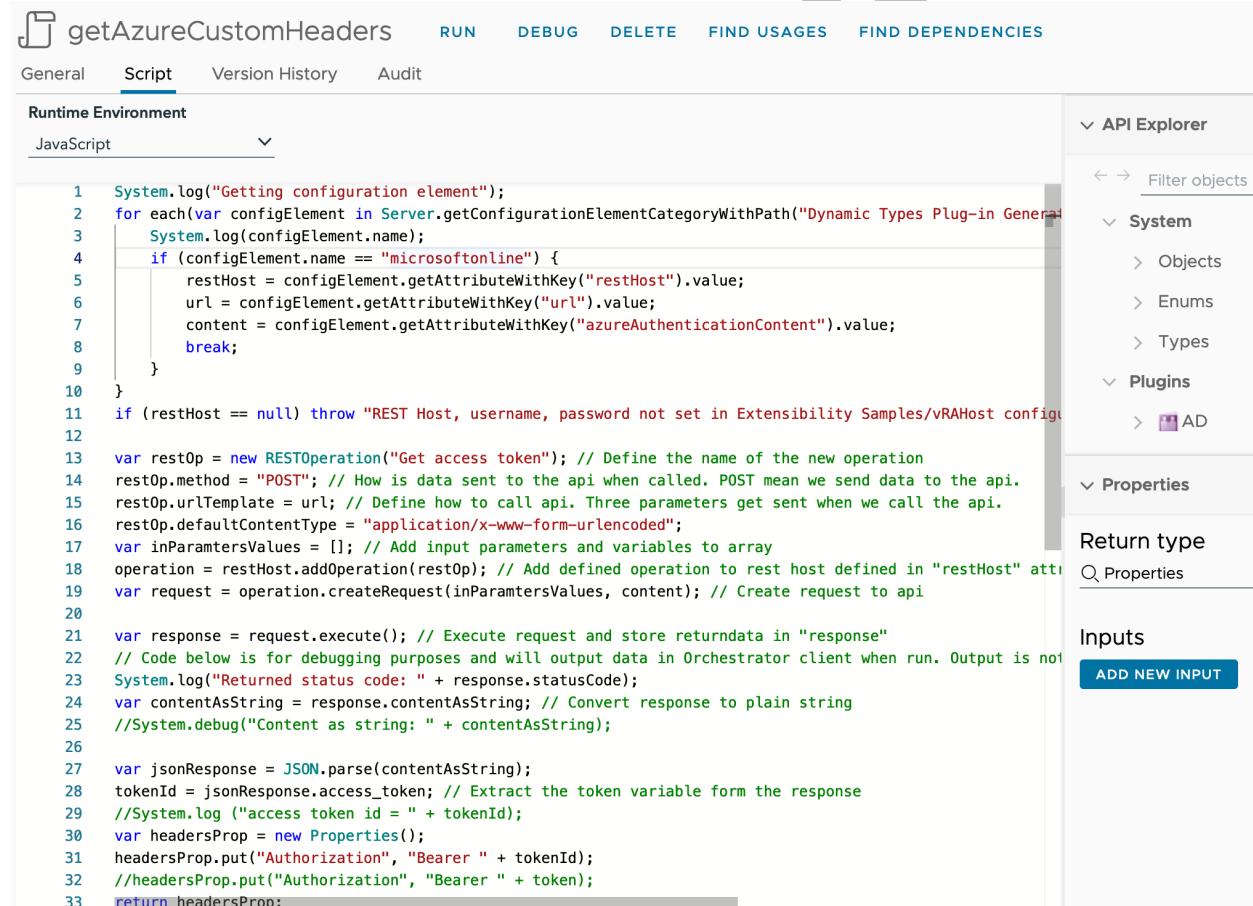
azureAuthenticationContent is a string of below format:

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.

Test getAzureCustomHeaders action

Run this action to obtain a bearer token.



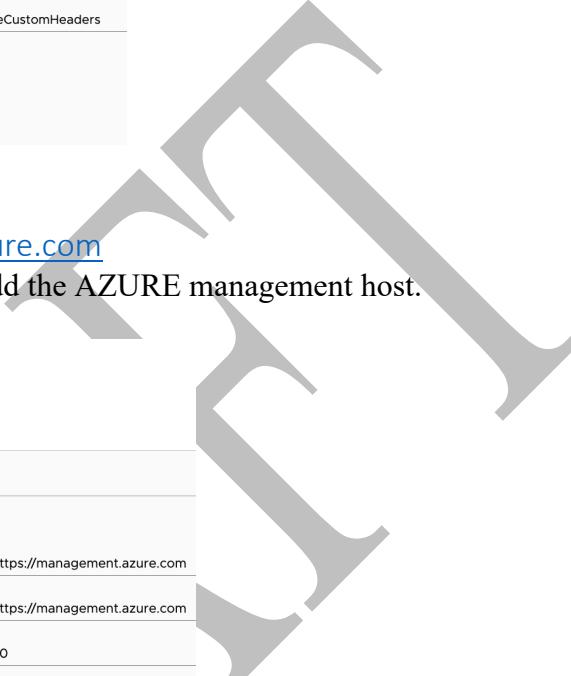
The screenshot shows the ServiceNow API Explorer interface. On the left, there is a code editor window titled "getAzureCustomHeaders" containing a JavaScript script. The script logs configuration elements, finds a specific element for "microsoftonline", and extracts restHost, url, and azureAuthenticationContent. It then creates a REST operation to "Get access token" using POST method, URL template, and default content type. Input parameters are added, and a request is created. The response is executed, and the access token is extracted from the JSON response. Finally, an Authorization header is added to a properties object. On the right side of the interface, there is a sidebar titled "API Explorer" which includes sections for System (Objects, Enums, Types), Plugins (AD), and Properties. There is also a "Return type" dropdown set to "Properties" and an "Inputs" section with a "ADD NEW INPUT" button.

```
1 System.log("Getting configuration element");
2 for each(var configElement in Server.getConfigurationElementCategoryWithPath("Dynamic Types Plug-in General")) {
3     System.log(configElement.name);
4     if (configElement.name == "microsoftonline") {
5         restHost = configElement.getAttributeWithKey("restHost").value;
6         url = configElement.getAttributeWithKey("url").value;
7         content = configElement.getAttributeWithKey("azureAuthenticationContent").value;
8         break;
9     }
10 }
11 if (restHost == null) throw "REST Host, username, password not set in Extensibility Samples/vRAHost configuration";
12
13 var restOp = new RESTOperation("Get access token"); // Define the name of the new operation
14 restOp.method = "POST"; // How is data sent to the api when called. POST mean we send data to the api.
15 restOp.urlTemplate = url; // Define how to call api. Three parameters get sent when we call the api.
16 restOp.defaultContentType = "application/x-www-form-urlencoded";
17 var inParamtersValues = []; // Add input parameters and variables to array
18 operation = restHost.addOperation(restOp); // Add defined operation to rest host defined in "restHost" attribute
19 var request = operation.createRequest(inParamtersValues, content); // Create request to api
20
21 var response = request.execute(); // Execute request and store return data in "response"
22 // Code below is for debugging purposes and will output data in Orchestrator client when run. Output is not part of the actual API response
23 System.log("Returned status code: " + response.statusCode);
24 var contentAsString = response.contentAsString; // Convert response to plain string
25 //System.debug("Content as string: " + contentAsString);
26
27 var jsonResponse = JSON.parse(contentAsString);
28 tokenId = jsonResponse.access_token; // Extract the token variable from the response
29 //System.log ("access token id = " + tokenId);
30 var headersProp = new Properties();
31 headersProp.put("Authorization", "Bearer " + tokenId);
32 //headersProp.put("Authorization", "Bearer " + token);
33 return headersProp;
```

Create namespace (plugin) – AZURE

Run workflow (1) 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

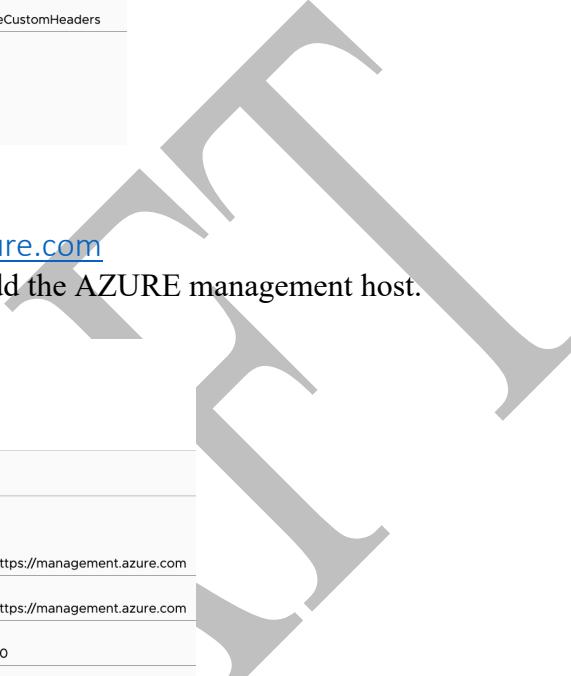
RUN **CANCEL**

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

Run 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.

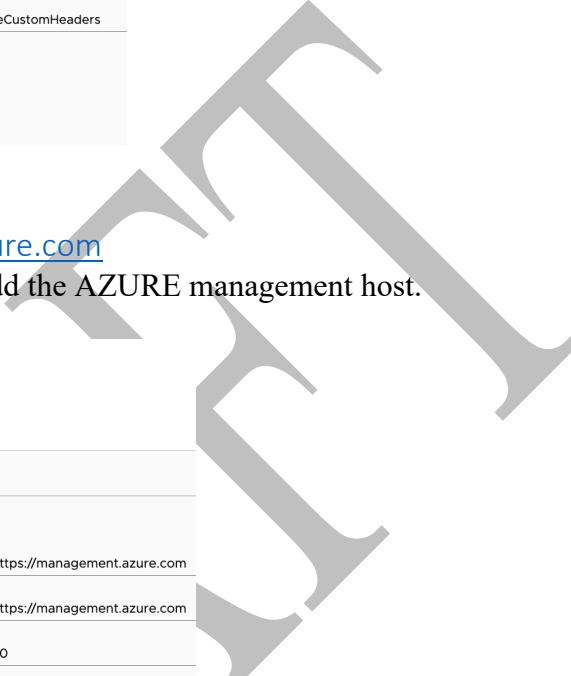


Host Properties	Host Authentication	Proxy Settings	SSL
Properties to create a new host. The name is the host's unique identifier.			
Name *	https://management.azure.com		
URL *	https://management.azure.com		
Connection timeout (seconds)	30		
Operation timeout (seconds)	60		
If set to true, the certificate 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 workflow (2b) to create a Dynamic Type (DT) host in inventory.

-2b- Add REST Host as DT Host

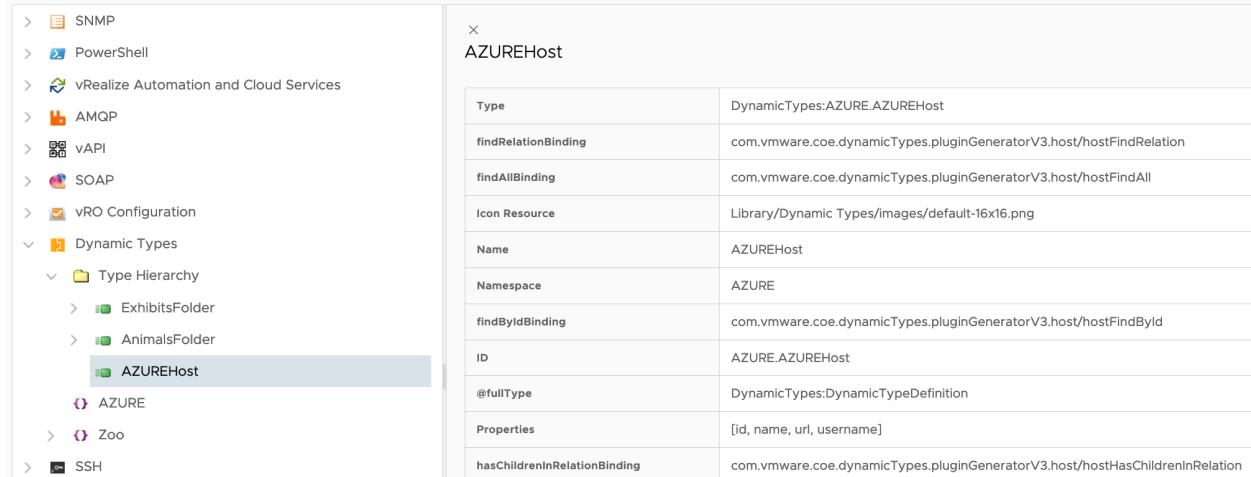


restHost *	https://management.azure.com/: https://manageme...
namespace *	AZURE
authenticationConfigurationElement	<input type="text"/>

RUN **CANCEL**

Examine AZUREHost in Inventory

Inventory 



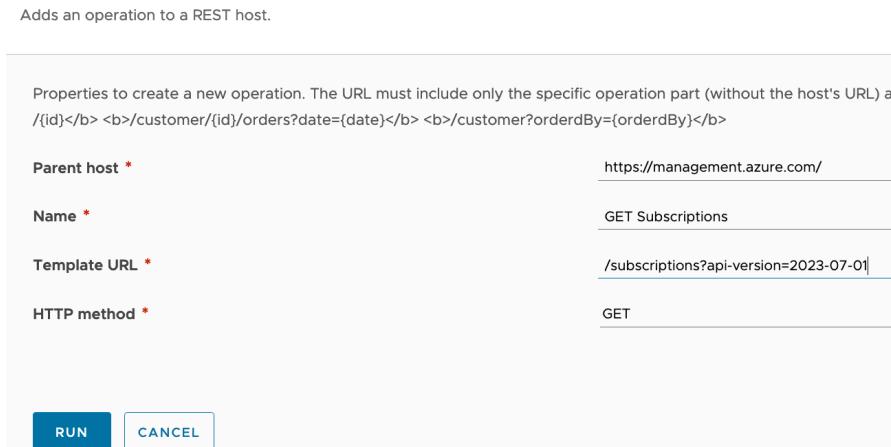
The screenshot shows the vRealize Automation and Cloud Services inventory interface. On the left, there is a tree view of available connection types: SNMP, PowerShell, vRealize Automation and Cloud Services, AMQP, vAPI, SOAP, vRO Configuration, Dynamic Types, Type Hierarchy, ExhibitsFolder, AnimalsFolder, and AZUREHost. The AZUREHost node is selected and highlighted with a gray background. On 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} /customer/{id}/orders?date={date} /customer?orderdBy=(orderdBy)

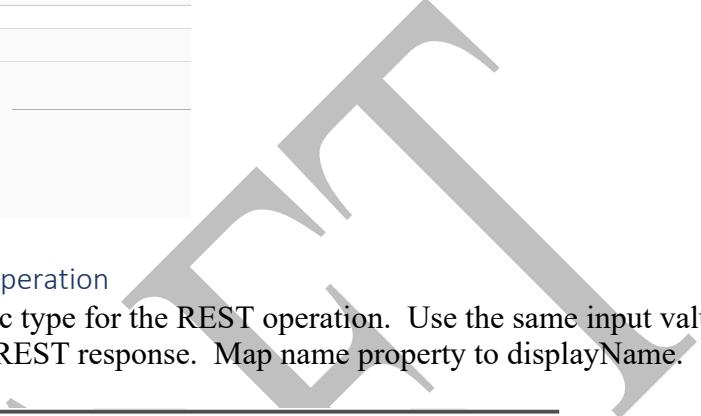
Parent host *	<input type="text" value="https://management.azure.com/"/>
Name *	<input type="text" value="GET Subscriptions"/>
Template URL *	<input type="text" value="/subscriptions?api-version=2023-07-01 "/>
HTTP method *	<input type="text" value="GET"/>

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

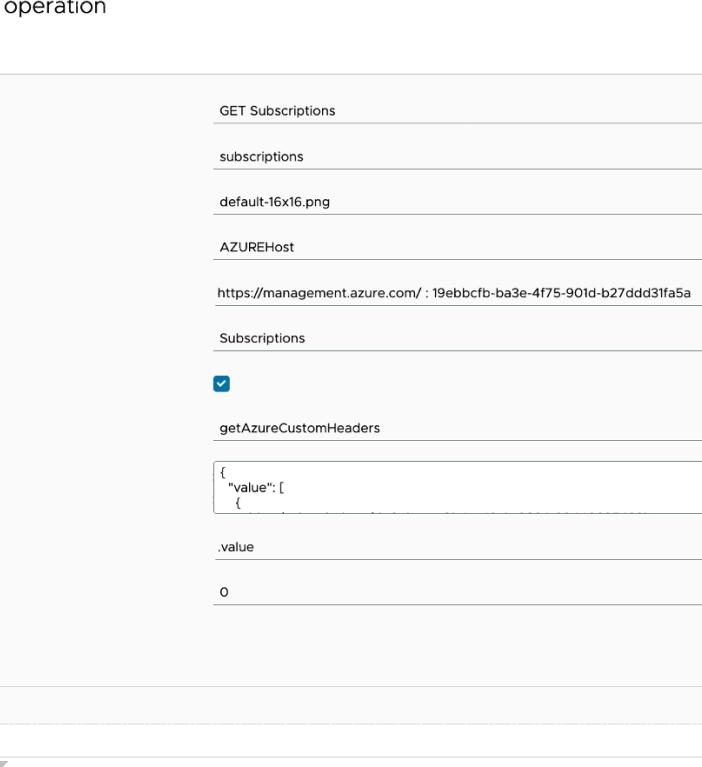
getAzureCustomHeaders

RUN CANCEL

Create subscriptions type from REST operation

Run workflow (3c) to create a dynamic type for the REST operation. Use the same input values. Map ID property to subscriptionId in REST response. 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

{
 "value": [
 {
 ".value": [

Objects path

Element index

Object properties

+

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

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

Error - click me for more information

fixAction	Check subscriptionsFolderFindRelation 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 as below

```

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: /customer/{id} /customer/{id} /customer?orderBy={orderBy}

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="button" value="GET"/>	

Test REST Operation

Run workflow (3b) to test the operation. Supply a subscription id as input.

-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"/> decided	

Create resourcegroups type from REST operation

Run workflow (3c) to create a dynamic type for the REST operation. Use the same input values. Map ID and Name to the corresponding property in REST response.

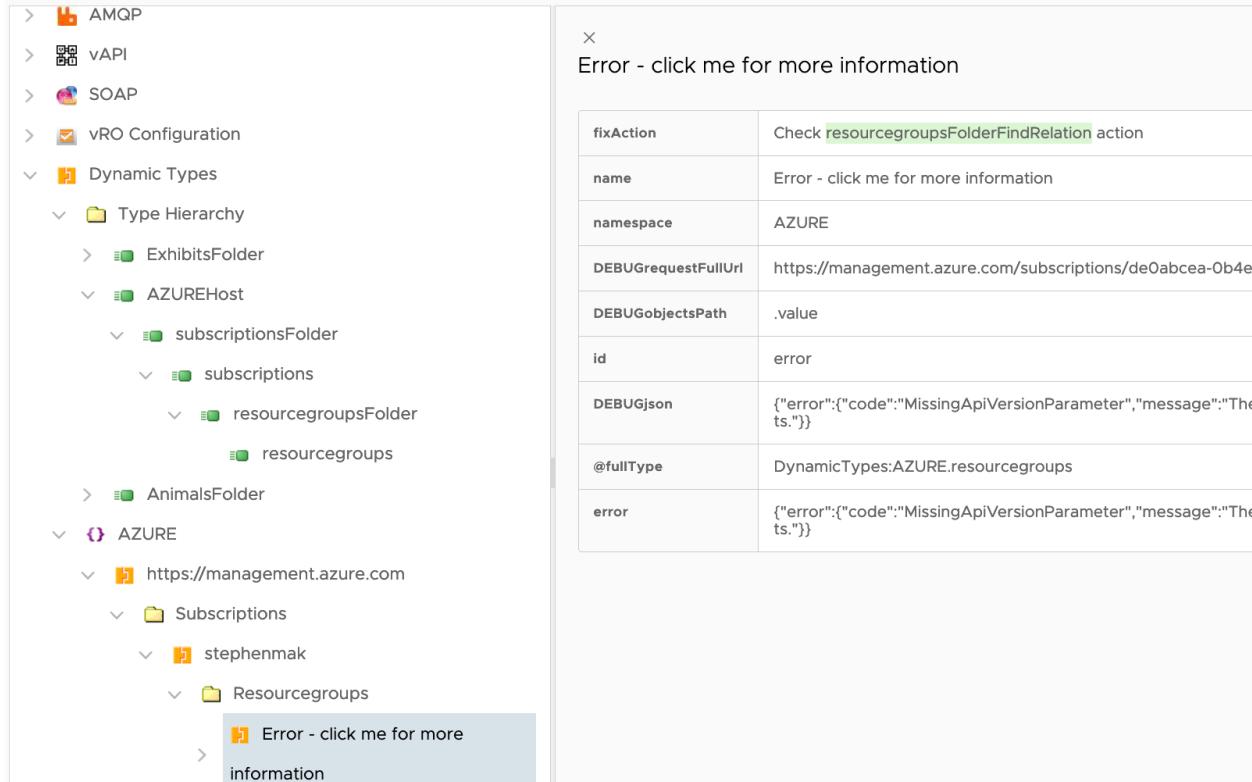
-3c- Create a type from a REST operation

List objects operation *	GET Resource Groups: GET /subscriptions/{subscriptionId}/resourceGroups								
Type name *	resourcegroups								
Icon *	default-16x16.png								
Parent type *	subscriptions								
Parent name and ID	stephenmak : 19ebbcfb-ba3e-4f75-901								
Folder label *	Resourcegroups								
hasCustomHeadersAction	<input checked="" type="checkbox"/>								
Action to get custom headers	getAzureCustomHeaders								
Content preview	<pre>{ "value": [{ "id": "/subscriptions/19ebbcfb-ba3e-4f75-901/resourceGroups/resourcegroups", "name": "resourcegroups", "location": "eastus", "type": "Microsoft.Resources/resourceGroups", "kind": null }] }</pre>								
Objects path	.value								
Element index	0								
Object properties	<table border="1"><thead><tr><th>Property</th><th>Value</th></tr></thead><tbody><tr><td>name</td><td>gp1</td></tr><tr><td>location</td><td>eastus</td></tr><tr><td>id</td><td>/subscriptions/19ebbcfb-ba3e-4f75-901/resourceGroups/resourcegroups</td></tr></tbody></table>	Property	Value	name	gp1	location	eastus	id	/subscriptions/19ebbcfb-ba3e-4f75-901/resourceGroups/resourcegroups
Property	Value								
name	gp1								
location	eastus								
id	/subscriptions/19ebbcfb-ba3e-4f75-901/resourceGroups/resourcegroups								

Examine Resourcegroups in inventory

Examine the DT object in inventory for error.

Inventory



AMQP
vAPI
SOAP
vRO Configuration
Dynamic Types
Type Hierarchy
ExhibitsFolder
AZUREHost
subscriptionsFolder
subscriptions
resourcegroupsFolder
resourcegroups
AnimalsFolder
AZURE
https://management.azure.com
Subscriptions
stephenmak
Resourcegroups
Error - click me for more information

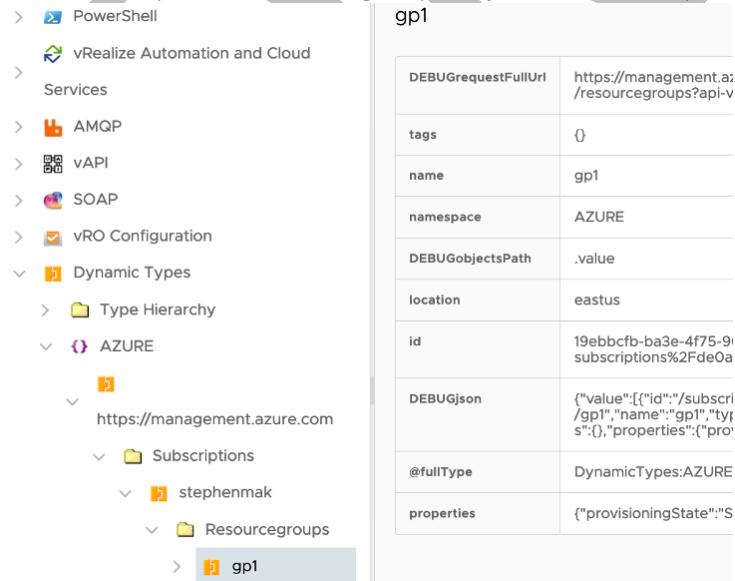
fixAction	Check resourcegroupsFolderFindRelation action
name	Error - click me for more information
namespace	AZURE
DEBUGrequestFullUrl	https://management.azure.com/subscriptions/de0abcea-0b4e
DEBUGobjectsPath	.value
id	error
DEBUGjson	{"error":{"code":"MissingApiVersionParameter","message":"The ts."}}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



PowerShell
vRealize Automation and Cloud Services
AMQP
vAPI
SOAP
vRO Configuration
Dynamic Types
Type Hierarchy
AZURE
https://management.azure.com
Subscriptions
stephenmak
Resourcegroups
gp1

DEBUGrequestFullUrl	https://management.azure.com/resourcegroups?api-version=2017-05-01
tags	{}
name	gp1
namespace	AZURE
DEBUGobjectsPath	.value
location	eastus
id	19ebbcfb-ba3e-4f75-91subscr...%2Fde0a
DEBUGjson	{"value": [{"id": "/subscriptions/19ebbcfb-ba3e-4f75-91subscr.../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.
`/customer/{id}/orders?date={date} /customer?orderBy={orderBy}`

Parent host *	https://management.azure.com/ : 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 to each parameter in the order as listed in URL.

3b- Invoke a REST operation with headers from action

REST Operation * [GET Network Interfaces](#)

getCustomHeadersAction [getAzureCustomHeaders](#)

inParametersValues

+
e0abce...
gp1

content

RUN **CANCEL**

Create interfaces type from REST operation

Run workflow (3c) to create a dynamic type for 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

Property	Type	Value
kind	Regular	
name	mak179	
etag	W/"1c016d00-19b5-4aa6-93f3-b9c6b77aad0f"	
location	eastus	
id	/subscriptions/de0abc.../resourceGroups/gp1/providers/Microsoft.Network/networkInterfaces/mak179	
type	Microsoft.Network/networkInterfaces	
properties	(large JSON object)	(large JSON object)

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

Inventory

fixAction	Check networkInterfacesFolderFindRelation action
name	Error - click me for more information
namespace	AZURE
DEBUGrequestFullUri	https://management.azure.com/subscriptions/de0abc.../resourceGroups/%2Fsubscriptions%2Fde0.../resourceGroups/gp1/providers/Microsoft.Network/networkInterfaces
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 as below

```

networkInterfacesFolderFindRelation
RUN DEBUG DELETE FIND USAGES FIND DEPENDENCIES

General Script Version History Audit
Runtime Environment
JavaScript

Inputs:
  
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 = "";
17

```

```

// 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 resourceGroupName.

-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: /customer/<id>

Parent host *	<input type="text" value="https://management.azure.com"/>
Name *	<input type="text" value="GET Virtual Machines"/>
Template URL *	<input type="text" value="/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Compute/virtualMachines?api-version=2023-07-01"/>
HTTP method *	<input type="text" value="GET"/>

Create virtualMachines type from REST Operation

Run workflow (3c) to create a dynamic type for 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%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="▼"/>									
Element index	0	<input type="button" value="▼"/>									
Object properties	<input type="button" value="+"/> <table border="1"> <thead> <tr> <th></th> <th>Property</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/></td> <td>identity</td> <td>{"type":"SystemAssigned","principalId":"32c9e953-07e8-4430-80659a8db","tenantId":"b39138ca-3cee-4100-92f0"} {"type": "SystemAssigned", "principalId": "32c9e953-07e8-4430-80659a8db", "tenantId": "b39138ca-3cee-4100-92f0"}</td> </tr> <tr> <td><input type="checkbox"/></td> <td>name</td> <td>mak1</td> </tr> </tbody> </table>			Property	Value	<input type="checkbox"/>	identity	{"type":"SystemAssigned","principalId":"32c9e953-07e8-4430-80659a8db","tenantId":"b39138ca-3cee-4100-92f0"} {"type": "SystemAssigned", "principalId": "32c9e953-07e8-4430-80659a8db", "tenantId": "b39138ca-3cee-4100-92f0"}	<input type="checkbox"/>	name	mak1
	Property	Value									
<input type="checkbox"/>	identity	{"type":"SystemAssigned","principalId":"32c9e953-07e8-4430-80659a8db","tenantId":"b39138ca-3cee-4100-92f0"} {"type": "SystemAssigned", "principalId": "32c9e953-07e8-4430-80659a8db", "tenantId": "b39138ca-3cee-4100-92f0"}									
<input type="checkbox"/>	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 sections for Subscriptions and Resourcegroups. A specific resource group 'gp1' is selected, and within it, a folder named 'VirtualMachines' is highlighted. To the right of the navigation tree, there is a detailed view of the 'VirtualMachines' object. The object has 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%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%2FresourceGroups%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 virtualMachinesFolderFindRelation action as below; 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);

```

API Explorer

Filter objects

System

- Objects
- Enums
- Types

Plugins

- AD

Properties

Return type

DynamicTypes:DynamicObject

Inputs

parentType	string
parentId	string
relationName	string

HTTPS Operations

Below are the HTTPS Operations after install.

The screenshot shows the 'Policy Runs' interface in a software application. On the left, there is a navigation sidebar with the following items:

- Assets
- Packages
- Configurations
- Resources
- Environments
- Administration
- Groups
- Inventory
- Audit Logs

The 'Audit Logs' item is currently selected and highlighted in grey. To the right of the sidebar, under the heading 'HTTP-REST', is a list of HTTPS operations:

- https://management.azure.com/: https://manageme...
- CREATE SQL Managed Instance: PUT https://manage...
- 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 pre-defined input form actions. Reader can use them with no changes.

The screenshot shows the configuration screen for the 'getAzureResourceGroupNames' action. At the top, there is a toolbar with buttons for RUN, DEBUG, DELETE, FIND USAGES, and FIND DEPENDENCIES. Below the toolbar, there are tabs for General, Script, Version History, and Audit. The Script tab is currently selected and highlighted in blue.

In the main area, there is a code editor window titled 'getAzureResourceGroupNames'. The code is written in JavaScript and defines a function that retrieves Azure resource group names based on a provided subscription ID. The code includes comments and uses the 'System' module to interact with the com.vmware.cse.dt.azure plugin.

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

To the right of the code editor, there is an 'API Explorer' panel. The 'System' section is expanded, showing options for Objects, Enums, Types, and AD. The 'Properties' section is also visible. Below the API Explorer, there is a 'Return type' field set to 'string' and an 'Inputs' section where a new input named 'subscriptionId' is being added. The 'subscriptionId' input is defined as a string type.

getAzureNetworkInterfaceNames action

```

getAzureNetworkInterfaceNames
RUN DEBUG DELETE FIND USAGES FIND DEPENDENCIES
General Script Version History Audit
Runtime Environment
JavaScript
Inputs:
subscriptionId : string
resourceGroupName : string
1 var type = "AZURE.networkInterfaces";
2 var actionBar = System.getModule("com.vmware.cse.dt.azure").networkInterfacesFindAll(type);
3
4 var breakpoint = /%2F/ ;
5
6 var array = [];
7 //System.log(System.getObjectClassName(actionBar));
8 for (i in actionBar) {
9     if (i in actionBar) {
10         //System.log(actionBar[i]);
11         string = actionBar[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;

```

API Explorer

- System
 - Objects
 - Enums
 - Types
- Plugins
 - AD

Properties

Return type: string

Inputs:

subscriptionId	string	<input checked="" type="checkbox"/> Array	Description
resourceGroupName	string	<input checked="" type="checkbox"/> Array	Description

getAzureSubscriptionIds action

```

getAzureSubscriptionIds
RUN DEBUG DELETE FIND USAGES FIND DEPENDENCIES
General Script Version History Audit
Runtime Environment
JavaScript
Inputs:
1 var type = "AZURE.subscriptions";
2
3 var actionBar = System.getModule("com.vmware.cse.dt.azure").subscriptionsFindAll(type);
4
5 array = [];
6 for (i in actionBar) {
7     System.log(actionBar[i]);
8     array.push(actionBar[i].id.split(/\//)[1]);
9 }
10
11 return array;

```

API Explorer

- System
 - Objects
 - Enums
 - Types
- Plugins

Properties

Return type: string

Inputs:

subscriptionId	string	<input checked="" type="checkbox"/> Array	Description
-----------------------	--------	---	-------------

Provisioning Workflows

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

Invoke 'Create VM: PUT https:__management.azure.com_sub.

Use below url to create a REST operation:

PUT

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 Schema):

The workflow diagram shows a sequence of steps:

```

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

The "invokeRestOperationWithHeadersFromAction" step is highlighted with a green arrow. A red circle with a question mark is placed over the "Custom Condition" decision step.

Right Panel (Details):

Item4: Scriptable task

General

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

Action

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

Outputs

- actionResult: Properties

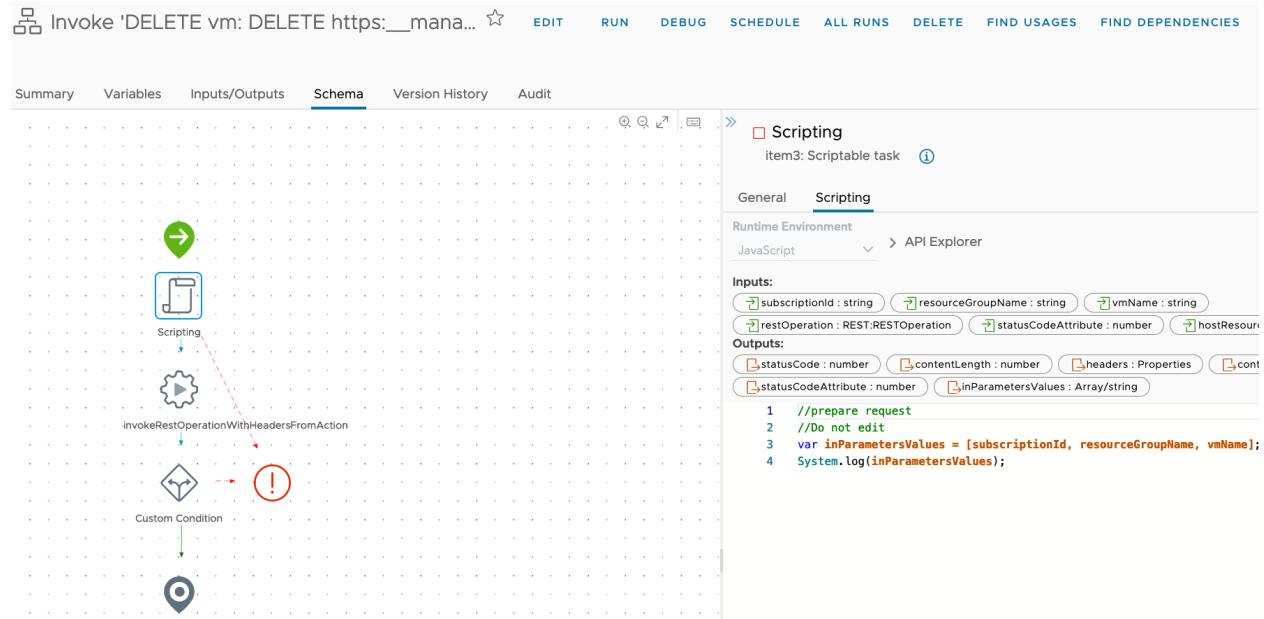
Exception handling

Invoke 'DELETE vm: DELETE 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:

DELETE

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

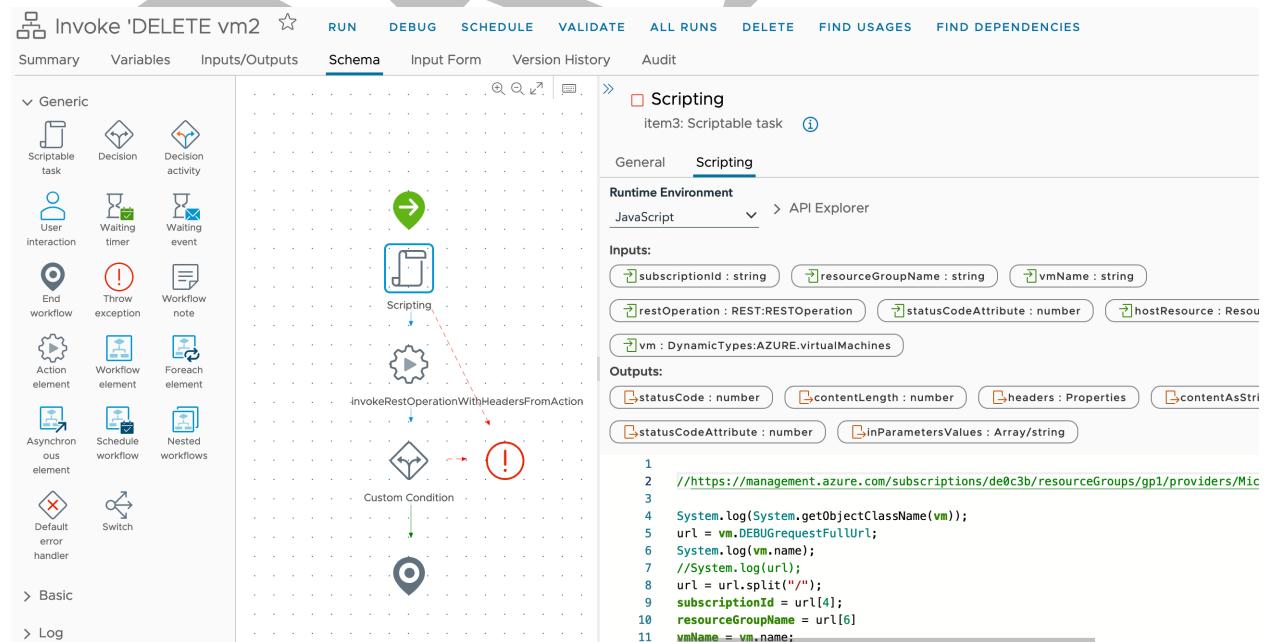


Invoke 'DELETE vm2

Use below url to create a REST operation:

DELETE

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



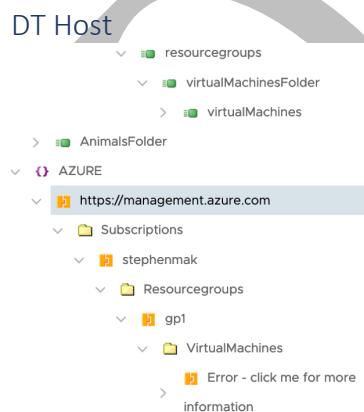
com.vmware.cse.dt.azure module

The tool auto-generates a list of plugin actions. Table below highlights all actions of the resourcegroups Dynamic Type.

NEW ACTION		Tags
Name		
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

Inventory Objects and Properties

Below are inventory objects after install.



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-4a2a2a2a2a2a
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", "tenantId": "b39138ca-3cee-4a2a-8a2a-4a2a2a2a2a2a", "namespace": "AZURE", "state": "Enabled", "id": "19ebbcfb-ba3e-4f75-901d-b27"}]}
@fullType	DynamicTypes:AZURE.subscription
subscriptionId	de0abcea-0b4e-4a2a-8a2a-4a2a2a2a2a2a
authorizationSource	RoleBased

Resource groups

Dynamic Types

Type Hierarchy

ExhibitsFolder

AZUREHost

subscriptionsFolder

subscriptions

resourcegroupsFolder

resourcegroups

virtualMachinesFolder

virtualMachines

AnimalsFolder

AZURE

https://management.azure.com

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", "name": "gp1", "location": "eastus", "id": "19ebbcfb-ba3e-4f75-901d-b27"}]}
@fullType	DynamicTypes:AZURE.resourceGroup
properties	{"provisioningState": "Succeeded"}

VirtualMachines

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 are the instructions.

- a) Run below workflow to add a REST Operation. Be aware of three parameters in URL.
 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=(order

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

RUN **CANCEL**

- b) Run below workflow to generate a workflow from the 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.

Operation *	<input type="text" value="CREATE SQL Managed Instance"/>	
Content type	<input type="text" value="application/json"/>	

RUN **CANCEL**

Generate a new workflow from a REST operation

Generates a new workflow from a REST operation.

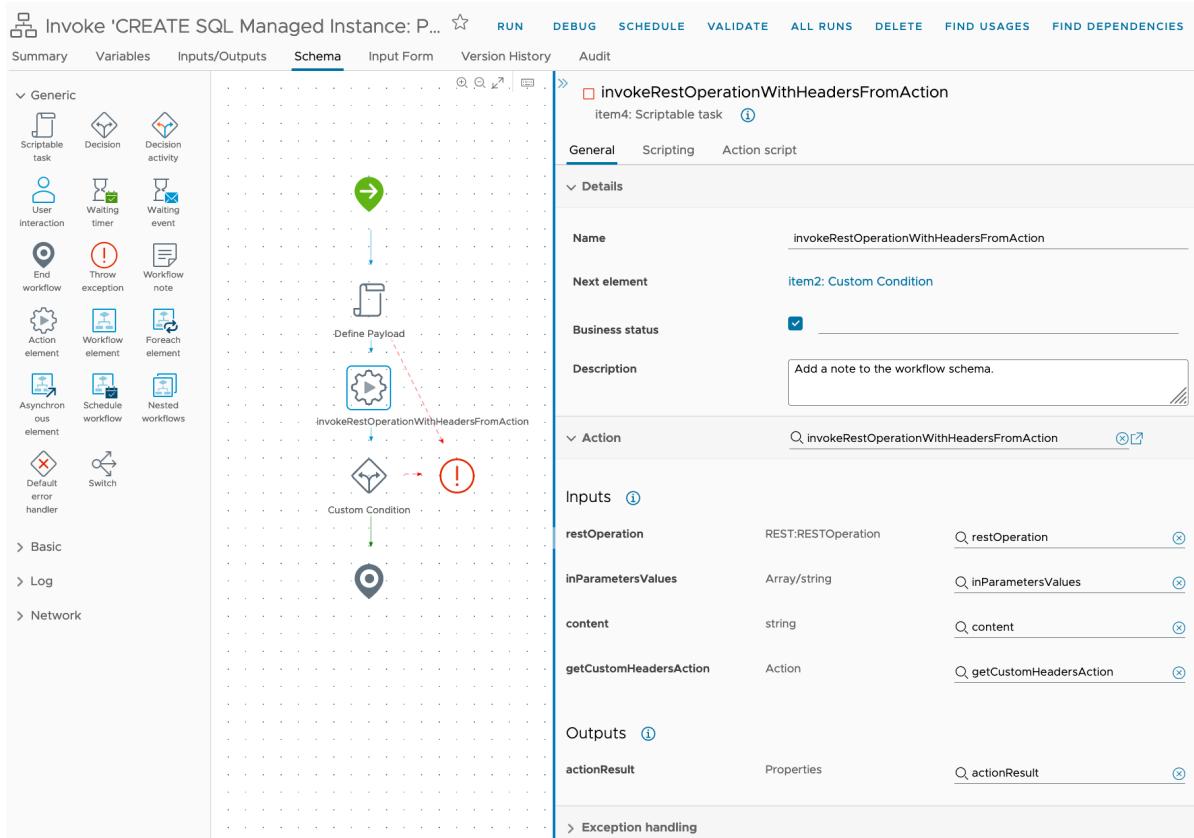
Operation **Workflow properties**

Specify workflow name and category to save to.

Name *	<input style="width: 200px;" type="text" value="Invoke 'CREATE SQL Managed Instance: PUT https:_manage...'"/>	
Folder *	<input type="text" value="AZURE/AZURE CRUD Operations"/>	

RUN **CANCEL**

- c) Add two tasks, Define Payload and invokeRestOperationWithHeadersFromAction, to workflow



- d) Edit “Define Payload” task. Paste in task the GET response of a resource instance (e.g., virtual machine) in JSON format. Update its key values accordingly. See an example in pre-defined workflow, ‘Create VM: PUT https: __management.azure.com __sub.’

GET

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

- e) Assign `getAzureCustomHeaders` action to variable `getCustomHeadersAction`. Latter is an input of `invokeRestOperationWithHeadersFromAction`.

Invoke 'CREATE SQL Managed Instance: PUT https://__manage...' ☆

Variables RUN DEBUG SCHEDULE VALIDATE ALL RUNS DELETE

Summary Variables Inputs/Outputs Schema Input Form Version History Audit

View, edit, and create local variables for your workflow. (i)

NEW	DELETE	COPY	PASTE	MOVE TO ↴																																																																																																																			
<table border="1"> <thead> <tr> <th><input type="checkbox"/></th> <th>Name</th> <th>Value</th> <th>Type</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/></td> <td>errorCode</td> <td></td> <td>string</td> <td></td> </tr> <tr> <td><input checked="" data-kind="parent" data-rs="2" type="checkbox"/></td> <td>restOperation</td> <td>[object REST:RESTOperation]</td> <td>REST:RESTOperation</td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>statusCodeAttribute</td> <td></td> <td>number</td> <td></td> </tr> <tr> <td><input checked="" data-kind="parent" data-rs="2" type="checkbox"/></td> <td>hostResource</td> <td>[object ResourceElement]</td> <td>ResourceElement</td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>inParametersValues</td> <td>Not set</td> <td>Array/string</td> <td></td> </tr> <tr> <td><input checked="" data-kind="parent" data-rs="12" type="checkbox"/></td> <td>getCustomHeadersAction</td> <td>[object Action]</td> <td>Action</td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>createdAt</td> <td>1704993072145</td> <td></td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>editable</td> <td>true</td> <td></td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>canEdit</td> <td>true</td> <td></td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>name</td> <td>getAzureCustomHeaders</td> <td></td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>description</td> <td>Get authorization header for Azures Stephen Mak, Product Value Engineering, Broadcom</td> <td></td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>@returnType</td> <td>Properties</td> <td></td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>id</td> <td>d3fafe39-59fb-4b6d-8340-74198b 2e9525</td> <td></td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>type</td> <td>ScriptModule</td> <td></td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>globalTags</td> <td>com.vmware.coe.dynamicTypes.pl uginGeneratorV3.getCustomHead er...:__SYSTEM_TAG__</td> <td></td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>categoryName</td> <td>com.vmware.coe.dynamicTypes.pl uginGeneratorV3.getCustomHead ersActions</td> <td></td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>version</td> <td>0.0.0</td> <td></td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>updatedAt</td> <td>1706833070915</td> <td></td> <td></td> </tr> <tr> <td><input type="checkbox"/></td> <td>content</td> <td></td> <td>string</td> <td>content</td> </tr> <tr> <td><input type="checkbox"/></td> <td>contentAsString</td> <td></td> <td>string</td> <td>Response content as string</td> </tr> <tr> <td><input type="checkbox"/></td> <td>headers</td> <td>Not set</td> <td>Properties</td> <td>Response headers</td> </tr> <tr> <td><input type="checkbox"/></td> <td>contentLength</td> <td></td> <td>number</td> <td>Response content length</td> </tr> </tbody> </table>					<input type="checkbox"/>	Name	Value	Type	Description	<input type="checkbox"/>	errorCode		string		<input checked="" data-kind="parent" data-rs="2" type="checkbox"/>	restOperation	[object REST:RESTOperation]	REST:RESTOperation		<input type="checkbox"/>	statusCodeAttribute		number		<input checked="" data-kind="parent" data-rs="2" type="checkbox"/>	hostResource	[object ResourceElement]	ResourceElement		<input type="checkbox"/>	inParametersValues	Not set	Array/string		<input checked="" data-kind="parent" data-rs="12" type="checkbox"/>	getCustomHeadersAction	[object Action]	Action		<input type="checkbox"/>	createdAt	1704993072145			<input type="checkbox"/>	editable	true			<input type="checkbox"/>	canEdit	true			<input type="checkbox"/>	name	getAzureCustomHeaders			<input type="checkbox"/>	description	Get authorization header for Azures Stephen Mak, Product Value Engineering, Broadcom			<input type="checkbox"/>	@returnType	Properties			<input type="checkbox"/>	id	d3fafe39-59fb-4b6d-8340-74198b 2e9525			<input type="checkbox"/>	type	ScriptModule			<input type="checkbox"/>	globalTags	com.vmware.coe.dynamicTypes.pl uginGeneratorV3.getCustomHead er...:__SYSTEM_TAG__			<input type="checkbox"/>	categoryName	com.vmware.coe.dynamicTypes.pl uginGeneratorV3.getCustomHead ersActions			<input type="checkbox"/>	version	0.0.0			<input type="checkbox"/>	updatedAt	1706833070915			<input type="checkbox"/>	content		string	content	<input type="checkbox"/>	contentAsString		string	Response content as string	<input type="checkbox"/>	headers	Not set	Properties	Response headers	<input type="checkbox"/>	contentLength		number	Response content length
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<input type="checkbox"/>	contentLength		number	Response content length																																																																																																																			
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f) Apply input form actions (e.g., getAzureSubscriptionIds)

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

Properties

subscriptionId

Field ID: subscriptionId

Appearance **Values** **Constraints**

Label subscriptionId

Placeholder Enter placeholder

Data type String

Display type DropDownList

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

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 ...

g) 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

vm: DELETE https:__mana... Failed ALL RUNS DELETE RUN RUN AGAIN DEBUG EXPORT Total transitions 2 | Display total duration ▾

invokeRestOperationWithHeadersFromAction item4: Scriptable task ⓘ

① Cannot execute the request: Certificate is not in CA store.Certificate is not in CA store. (Dynamic Script Module name : executeRequest#44)

General Scripting Action script

Details

Name invokeRestOperationWithHeadersFromAction

Next element item2: Custom Condition

Business status

Description Add a note to the workflow schema.

Action invokeRestOperationWithHeadersFromAction

Certificates Manage the certificates used by the Orchestrator server.

TRUSTED CERTIFICATES 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

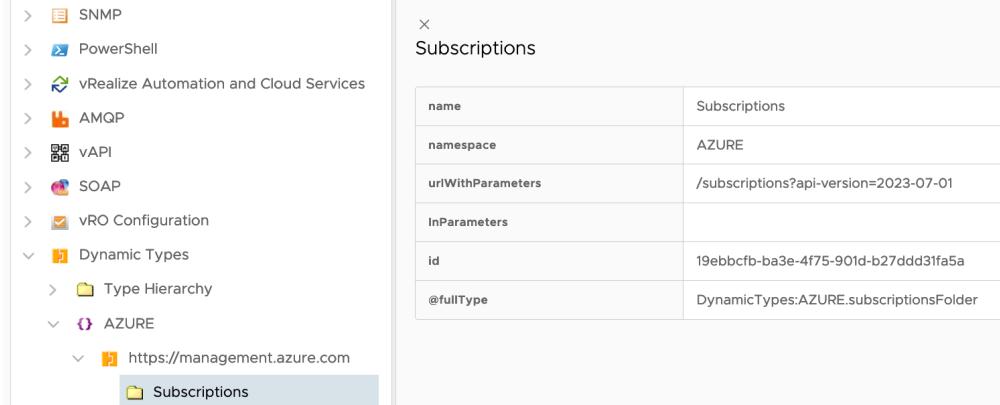
URL https://management.azure.com

Proxy URL : Port Use Proxy

CANCEL IMPORT

Inventory Issue

Inventory

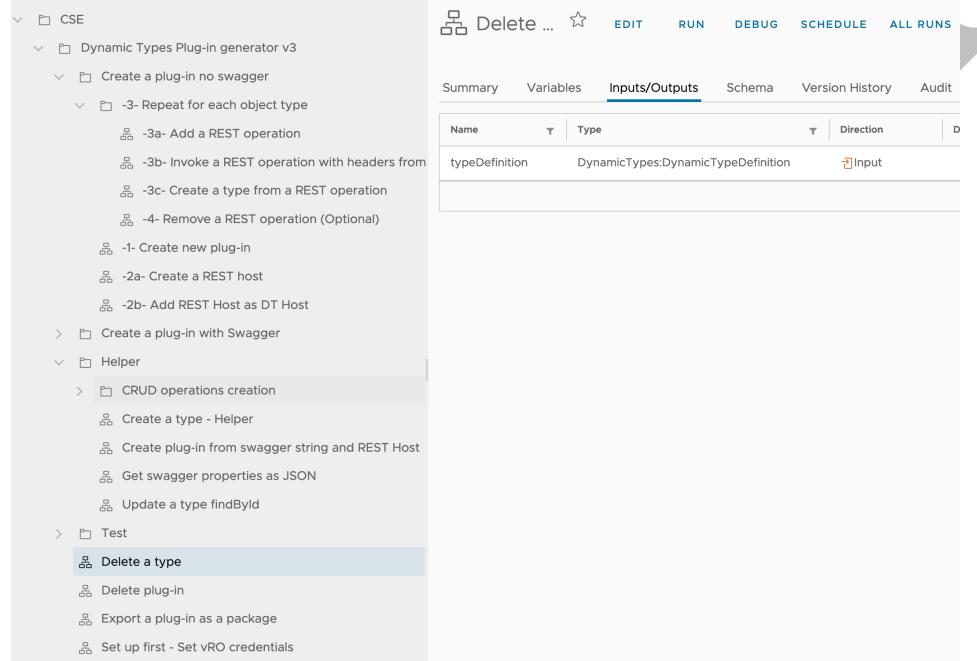


name	Subscriptions
namespace	AZURE
urlWithParameters	/subscriptions?api-version=2023-07-01
InParameters	
id	19ebbcfb-ba3e-4f75-901d-b27ddd31fa5a
@fullType	DynamicTypes:AZURE.subscriptionsFolder

Solution: examine inventory objects. If nothing displayed, cert has an issue. 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 its parent (e.g., virtualMachineFolder).



Name	Type	Direction
typeDefinition	DynamicTypes:DynamicTypeDefinition	Input

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

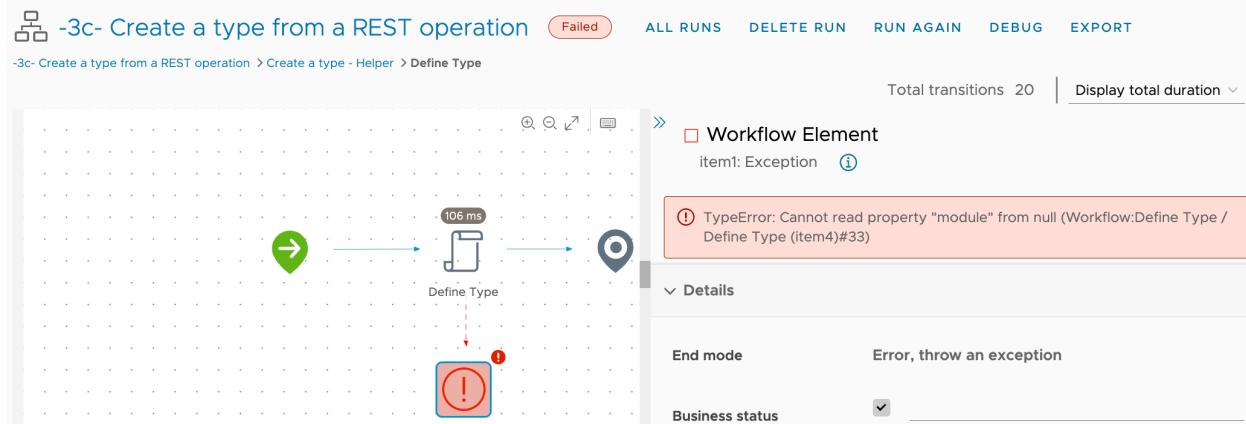
com.vmware.cse.dt.azure 0 7 EDIT DELETE

Filter...

+ NEW ACTION MOVE DELETE

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

Create a Type from REST Operation issue
Below is an example.



Solution: delete the type and its actions. Then recreate the type.

Azure Managed instances

Below are links about Azure Managed Instances. Each can be created via a REST call.

<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=2021-11-01>

ame}/providers/Microsoft.Sql/managedInstances/{managedInstanceName}?api-version=2023-07-01

Azure REST Reference Page

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

Azure search service Screenshot

Validation Success

Basics Scale Tags Review + create

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>. Use curl to 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
```

Below are screenshots to create a secret.

Microsoft Azure

Home > VMware, Inc. | Microsoft Entra ID

Overview

Preview features

Diagnose and solve problems

Manage

Users

All Services

Search resources, services, and docs (G+)

See all

Microsoft Entra ID

Keywords: Azure Active Directory

Security

Keywords: azure active directory

Activity log

Azure Cosmos DB

Azure Database for MySQL servers

AzureLargeInstances

Initiatives

Azure Arc

All services > VMware, Inc.

VMware, Inc. | App registrations

Overview

Preview features

Diagnose and solve problems

Manage

Users

Groups

External identities

Roles and administrators

Administrative units

Delegated admin partners

Enterprise applications

+ New registration

Endpoints

Troubleshooting

Refresh

Download

Preview features

Got feedback?

Starting June 30th, 2020 we will no longer add any new features to Azure Active Directory Authentication Library (ADAL) and Azure Active Directory Graph. We will continue to provide technical support and security updates but we will no longer provide feature updates. Applications will need to be upgraded to Microsoft Authentication Library (MSAL) and Microsoft Graph. [Learn more](#)

All applications Owned applications Deleted applications

Start typing a display name or application (client) ID to filter these r...

Add filters

2 applications found

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

Home > VMware, Inc. | App registrations > azure-cli-2023-09-19-18-01-49

azure-cli-2023-09-19-18-01-49 | Certificates & secrets

Search

Got feedback?

Got a second to give us some feedback? →

Credentials enable confidential applications to identify themselves to the authentication service when receiving tokens at a web addressable location (using an HTTPS scheme). For a higher level of assurance, we recommend using a certificate (instead of a client secret) as a credential.

Application registration certificates, secrets and federated credentials can be found in the tabs below.

Certificates (0) Client secrets (2) Federated credentials (0)

A secret string that the application uses to prove its identity when requesting a token. Also can be referred to as application password.

+ New client secret

Description	Expires	Value	Secret ID
rbac	10/17/2024	_fZ*****	67 [REDACTED] 35
rbac2	1/10/2026	XQW8*****wrVi ...	b734 [REDACTED] 3ef

Dynamic Type Generator Acknowledgement

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

<input checked="" type="checkbox"/> Invoke 'DELETE vm: DELETE https://management.azure.com/_...'		Higher Version	Workflow	0.0.1
<input checked="" type="checkbox"/> networkInterfacesFindAll		Higher Version	Action	0.0.1
<input checked="" type="checkbox"/> Invoke 'CREATE SQL Managed Instance: PUT https://management.azure.com/_...'		Higher Version	Workflow	0.0.1
<input checked="" type="checkbox"/> getAzureResourceGroupNames		Higher Version	Action	0.0.0
<input checked="" type="checkbox"/> getAzureNetworkInterfaceNames		Higher Version	Action	0.0.0
<input checked="" type="checkbox"/> getAzureSubscriptionIds		Higher Version	Action	0.0.1
<input checked="" type="checkbox"/> subscriptionsFindAll		Higher Version	Action	0.0.1
<input checked="" type="checkbox"/> Invoke 'Create VM: PUT https://management.azure.com/_sub...'		Higher Version	Workflow	0.0.1
<input checked="" type="checkbox"/> resourcegroupsFindAll		Higher Version	Action	0.0.1
<input checked="" type="checkbox"/> Test DT actions		Higher Version	Workflow	0.0.1
<input checked="" type="checkbox"/> executeOrchestratorRequestWithConfigurationElement		Higher Version	Action	0.0.0
<input checked="" type="checkbox"/> getAzureCustomLeaders		Higher Version	Action	0.0.0
<input checked="" type="checkbox"/> executeOrchestratorRequest		Higher Version	Action	0.0.1
<input checked="" type="checkbox"/> resourcegroupsFindByid		Higher Version	Action	0.0.1
<input checked="" type="checkbox"/> Invoke 'DELETE vm2 object'		Higher Version	Workflow	0.0.1
<input checked="" type="checkbox"/> microsoftonline		Higher Version	Configuration Element	0.0.0
<input checked="" type="checkbox"/> 16				
Import configuration attribute values				
Import configuration SecureString attribute values				
Tag import mode		Import tags but preserve existing values.		

