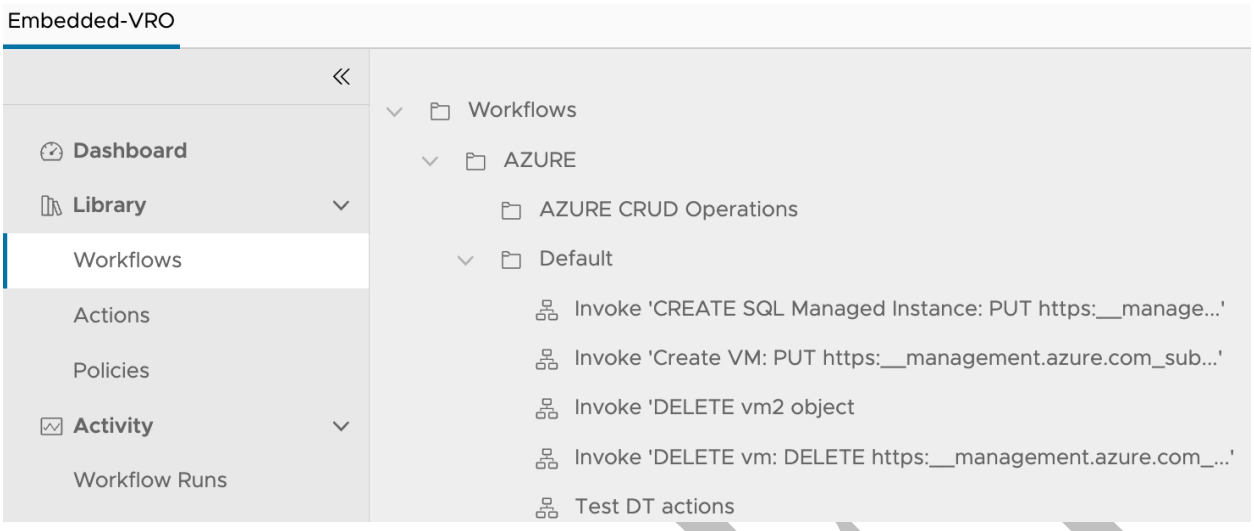
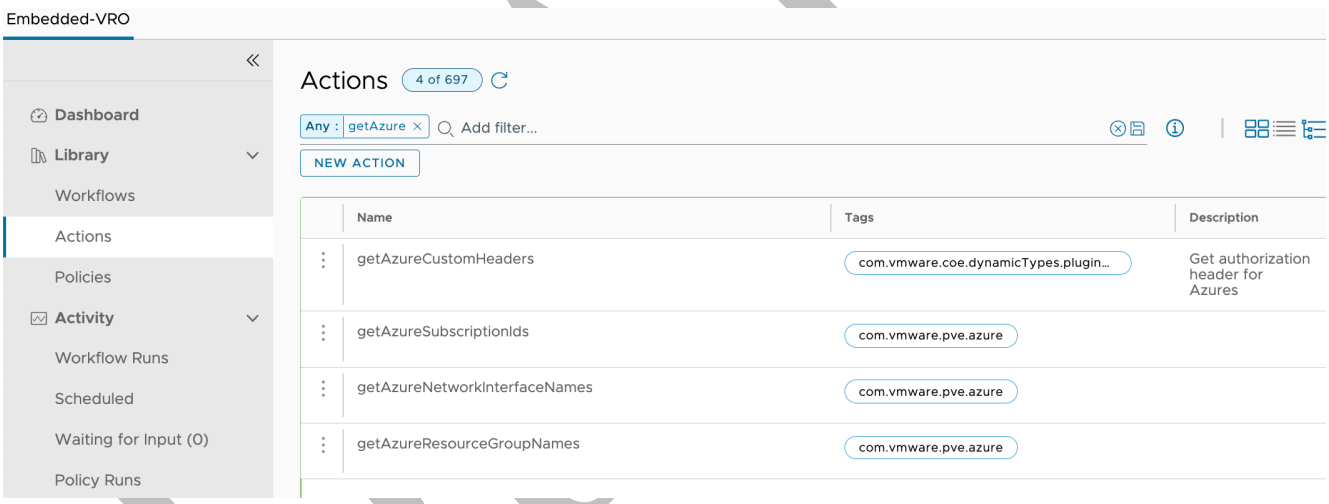
The plugin stores workflows in the AZURE folder.



The plugin stores 'get' actions in two modules.



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

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

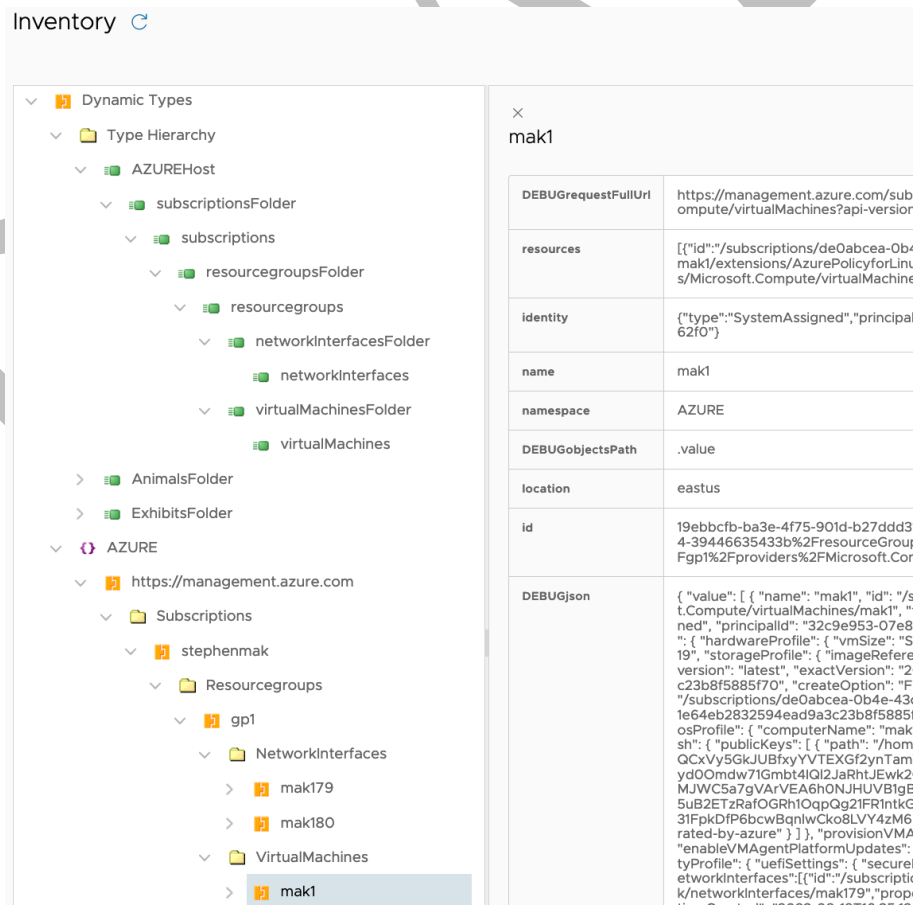
Introduction

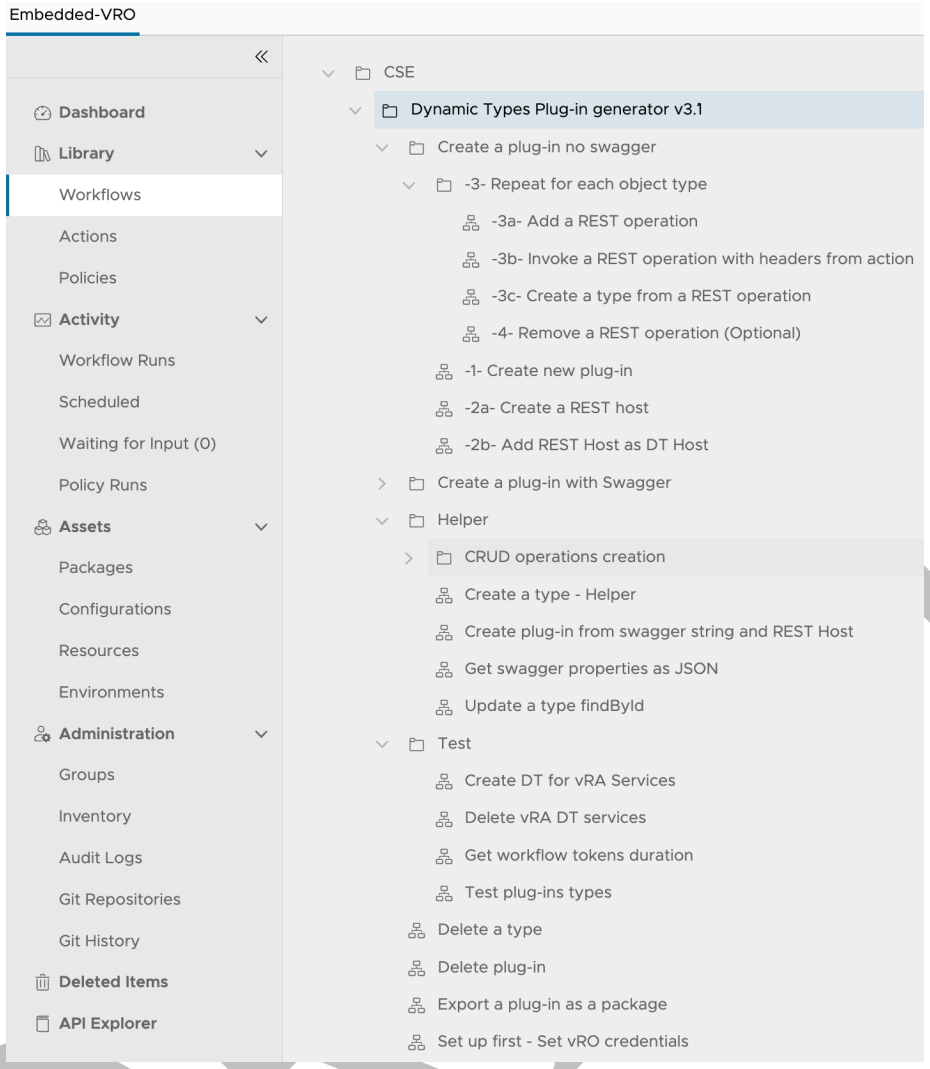
This document lists instructions to create a vRO plugin for Azure. We define vRO Dynamic Types to interface with Azure public cloud for the purpose of consuming native cloud services.

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.



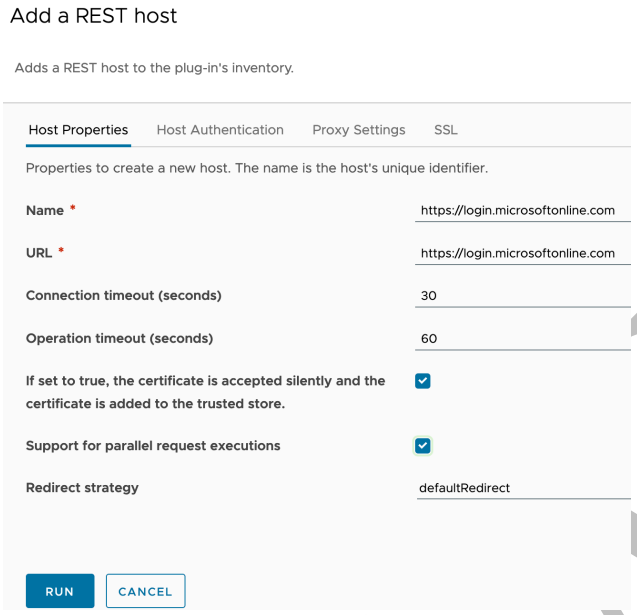

Embedded-VRO
Dashboard
Library
Workflows
Actions
Policies
Activity
Workflow Runs
Scheduled
Waiting for Input (0)
Policy Runs
Assets
Packages
Configurations
Resources
Environments
Administration
Groups
Inventory
Audit Logs
Git Repositories
Git History
Deleted Items
API Explorer
CSE
Dynamic Types Plug-in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

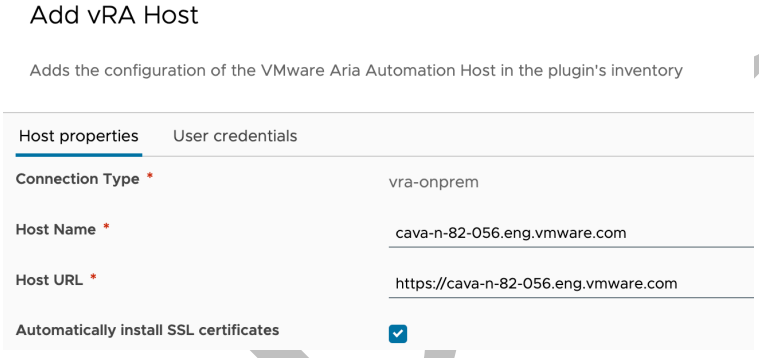
Create REST host - https://login.azure.com

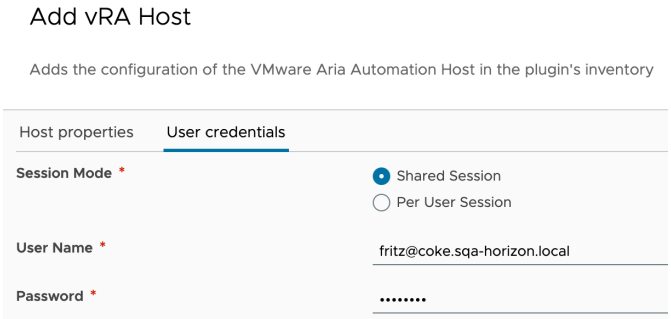
Run below workflow with no authentication to create the REST endpoint for Azure login.

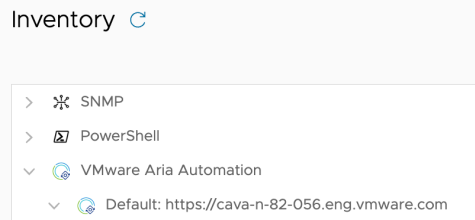


Create vRA host endpoint

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

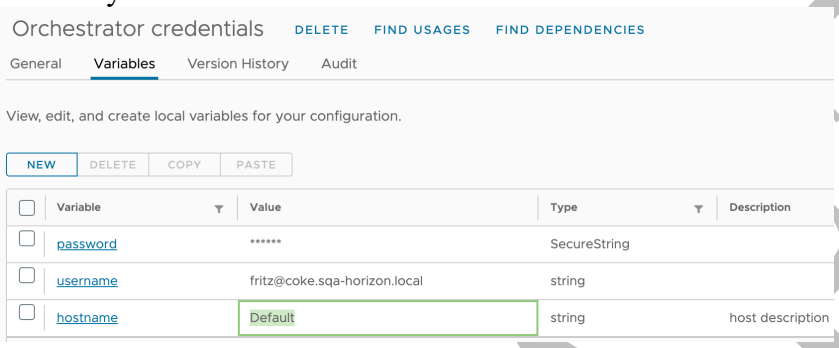


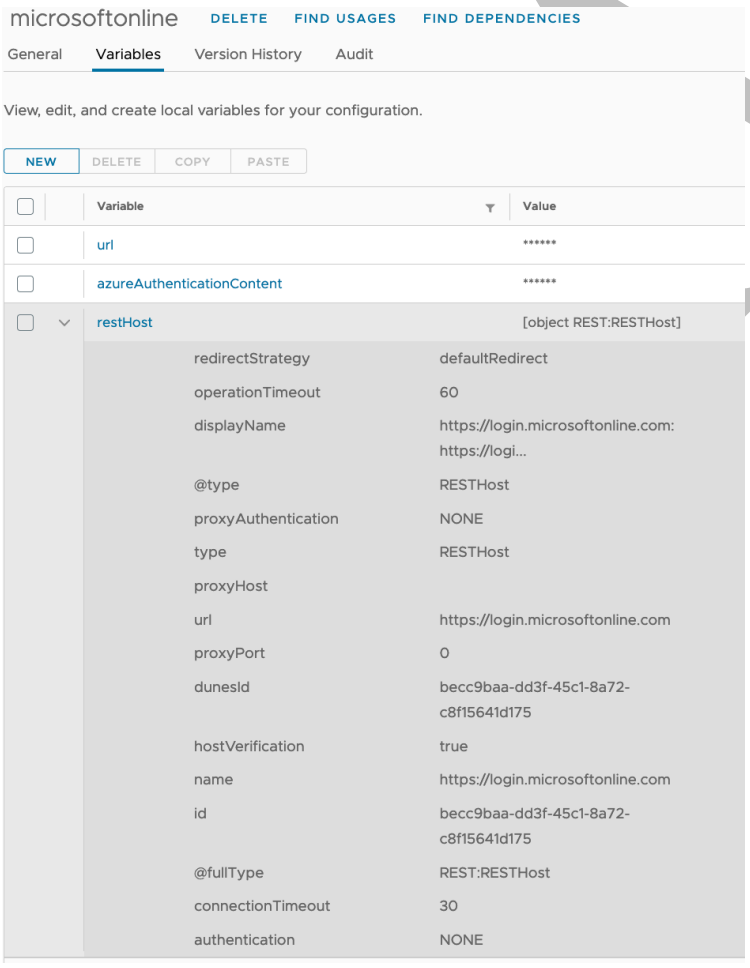




Set Configuration Elements

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





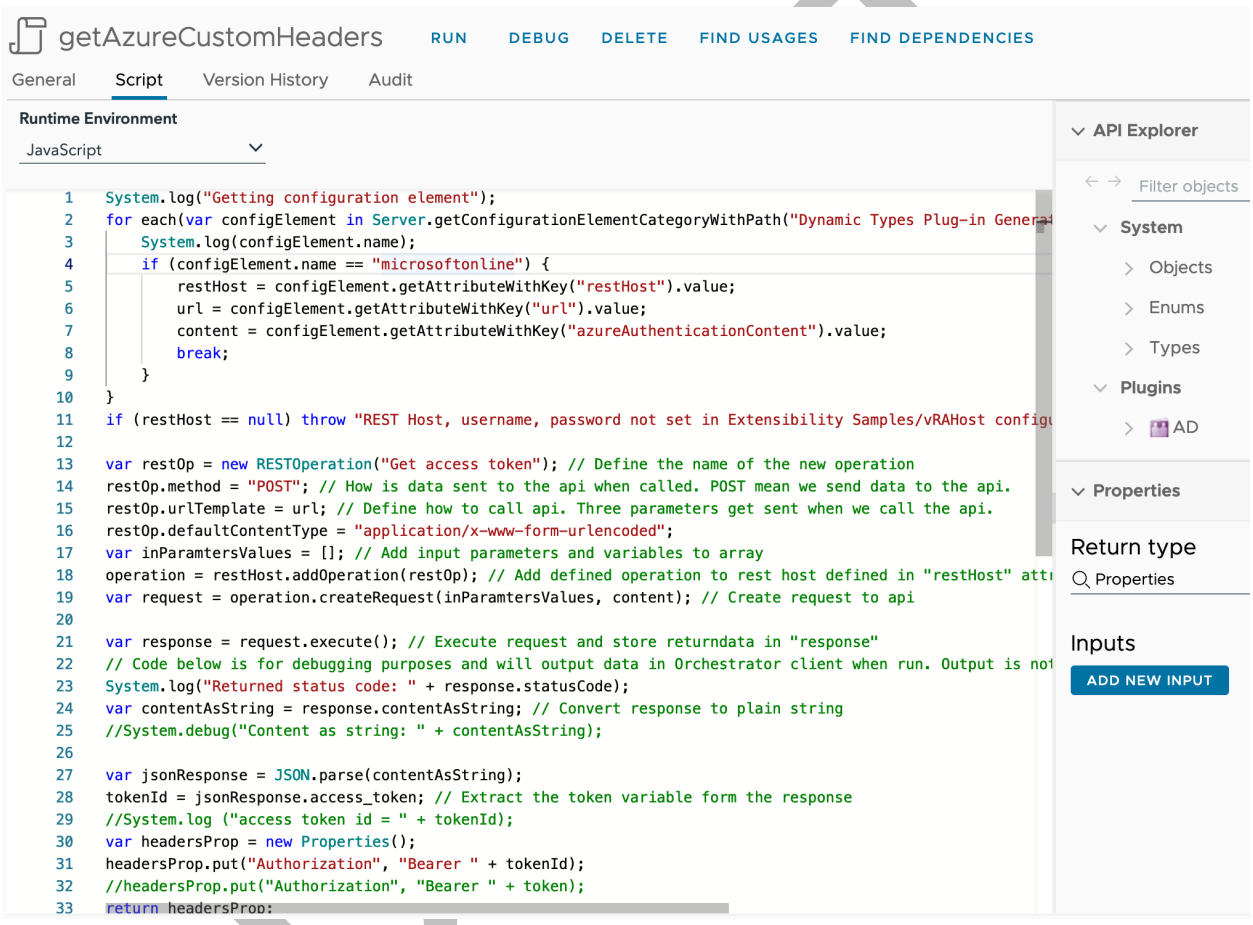
Where url is a string of below format:
`/[TENANT_ID]/oauth2/token`

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

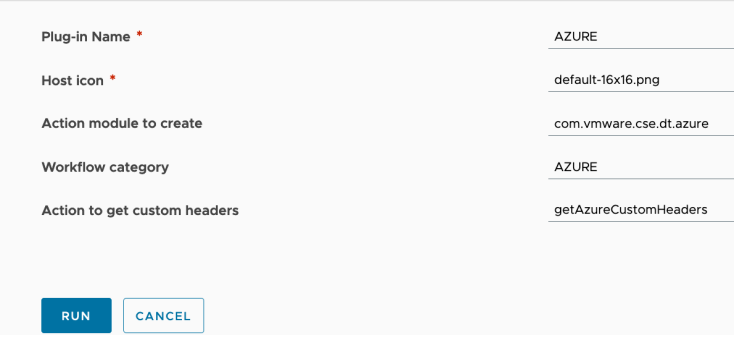
Run this action to obtain a bearer token.



Create namespace (plugin) – AZURE

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

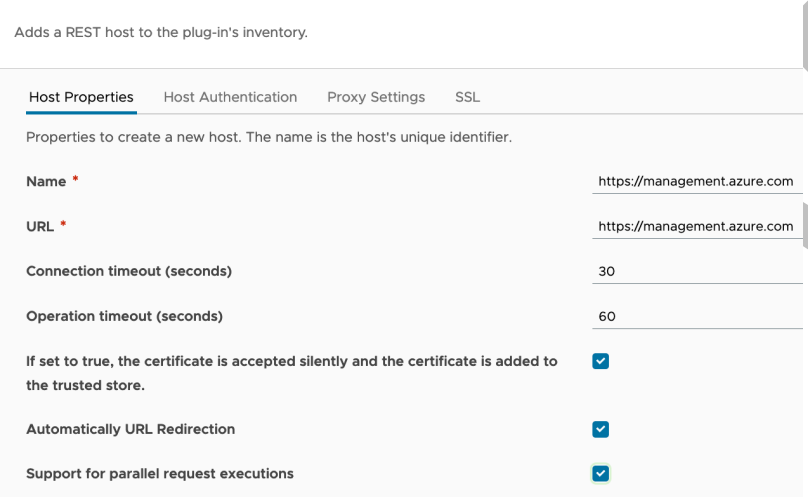
-1- Create new plug-in



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

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

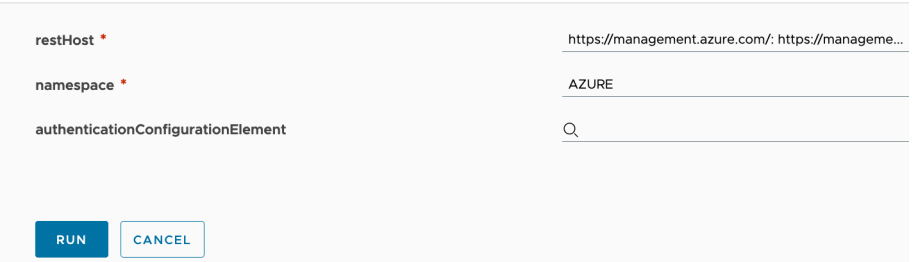
-2a- Create a REST host



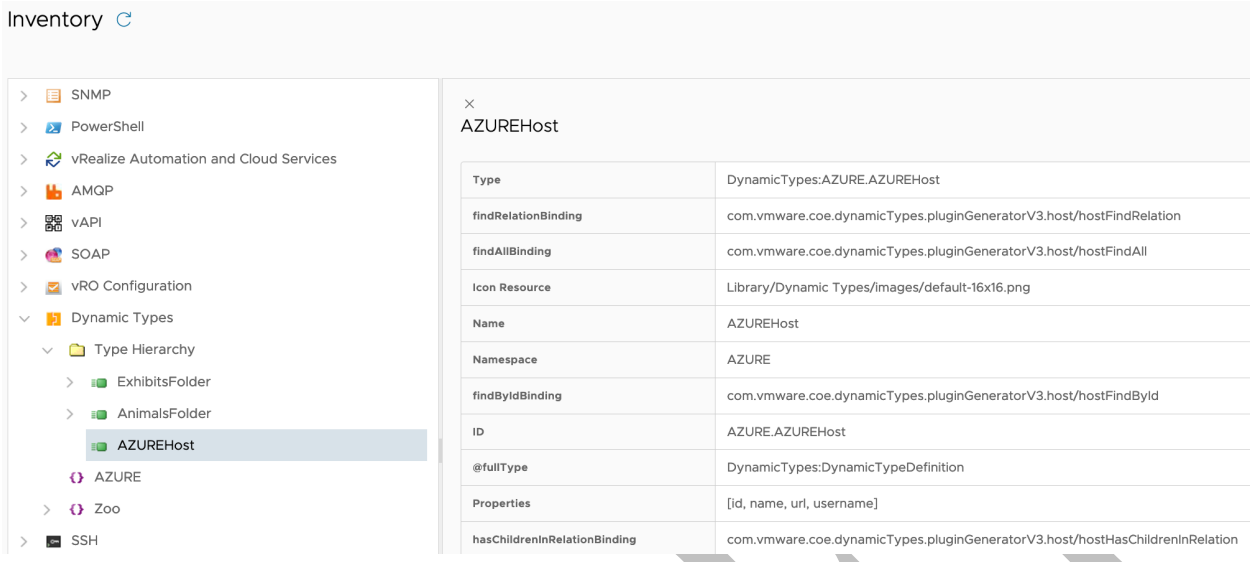
Create DT Host from REST Host – AZUREHost

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

-2b- Add REST Host as DT Host

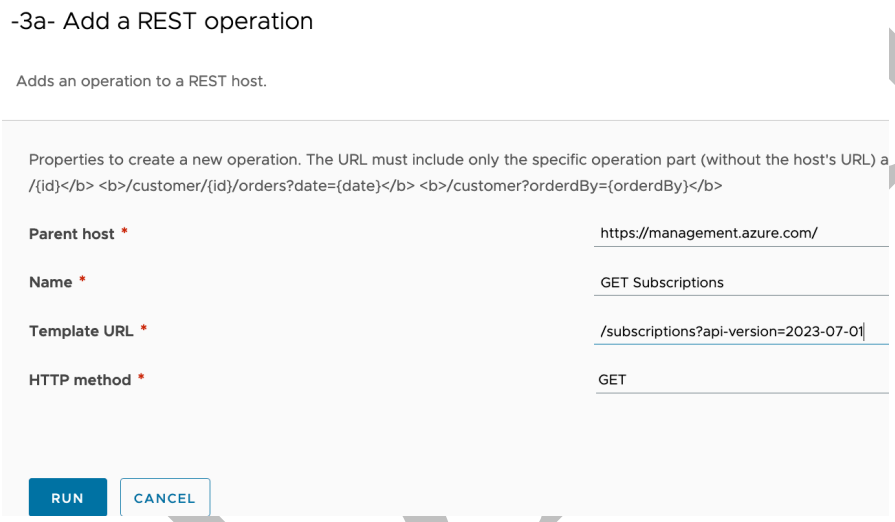


Examine AZUREHost in Inventory



GET Subscriptions

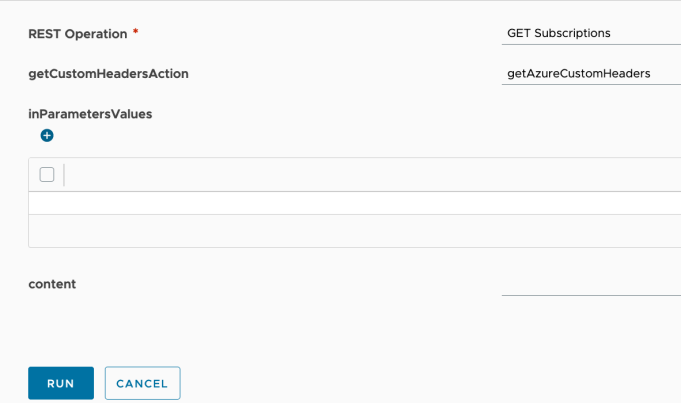
Run workflow (3a) to add the REST operation. Use the same input values.



Test REST Operation

Run workflow (3b) to test the operation.

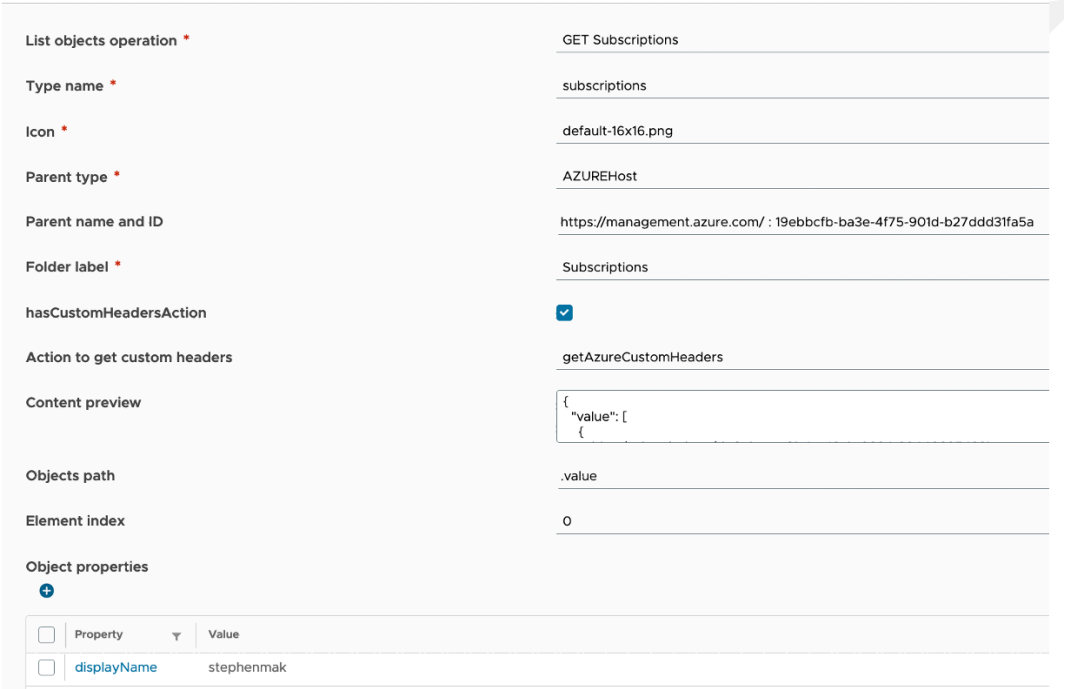
-3b- Invoke a REST operation with headers from action

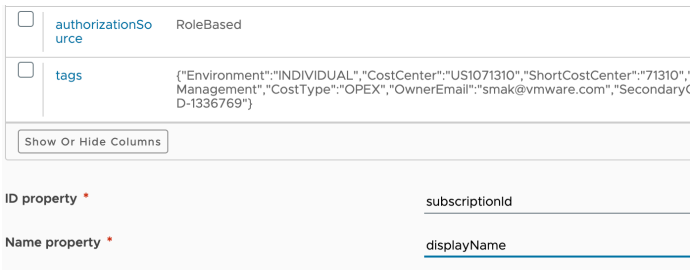


Create subscriptions type from REST operation

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

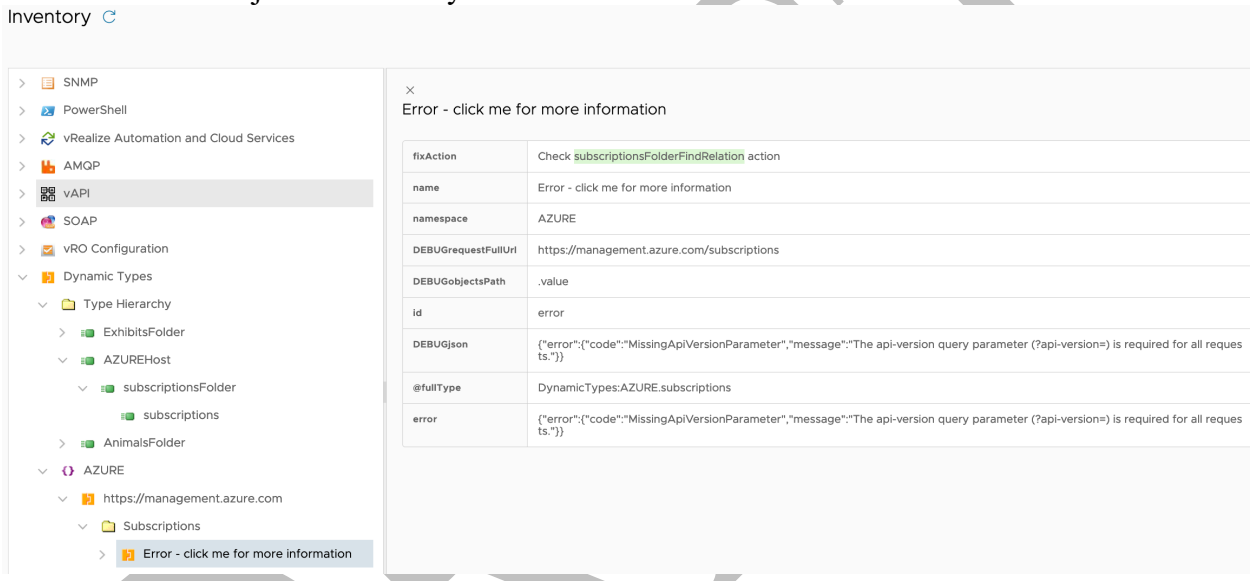




In case of an error, correct the error, delete the type and its actions then retry. Type delete instruction is provided in a section below.

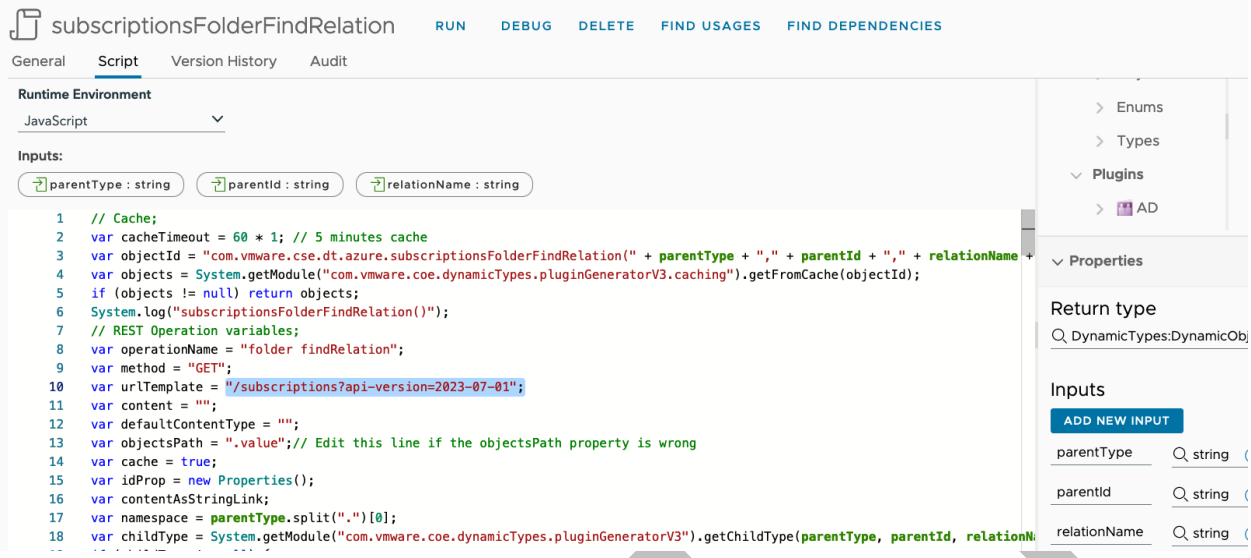
Examine Subscriptions in inventory

Examine the DT object in inventory for error.



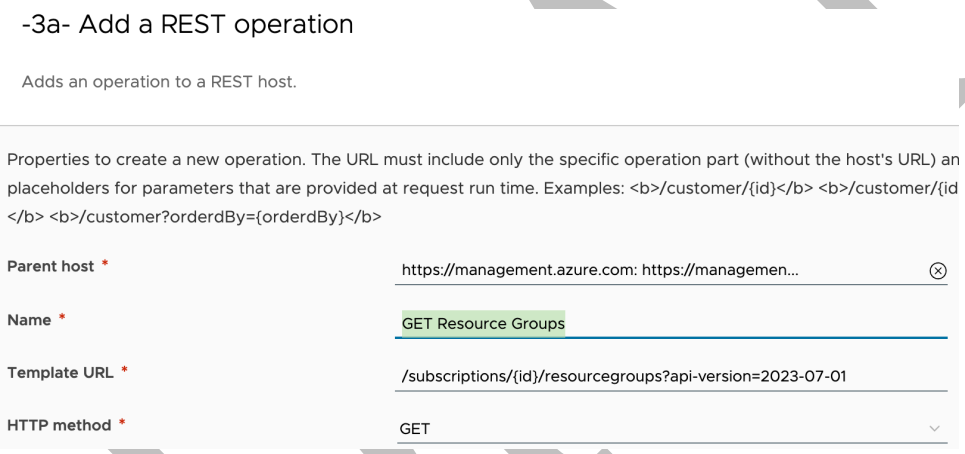
Update subscriptionsFolderFindRelation action

Error: MissingApiVersionParameter
Solution: update urlTemplate

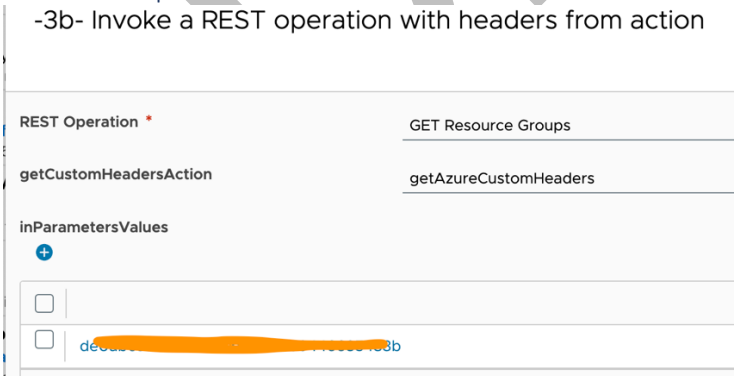


GET Resource Groups

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



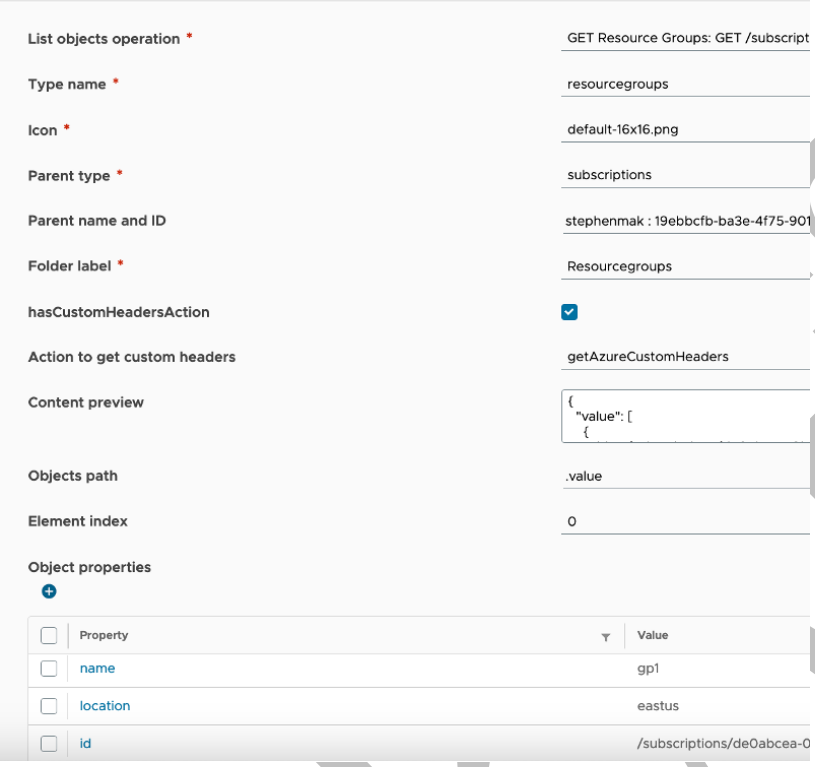
Test REST Operation



Create resourcegroups type from REST operation

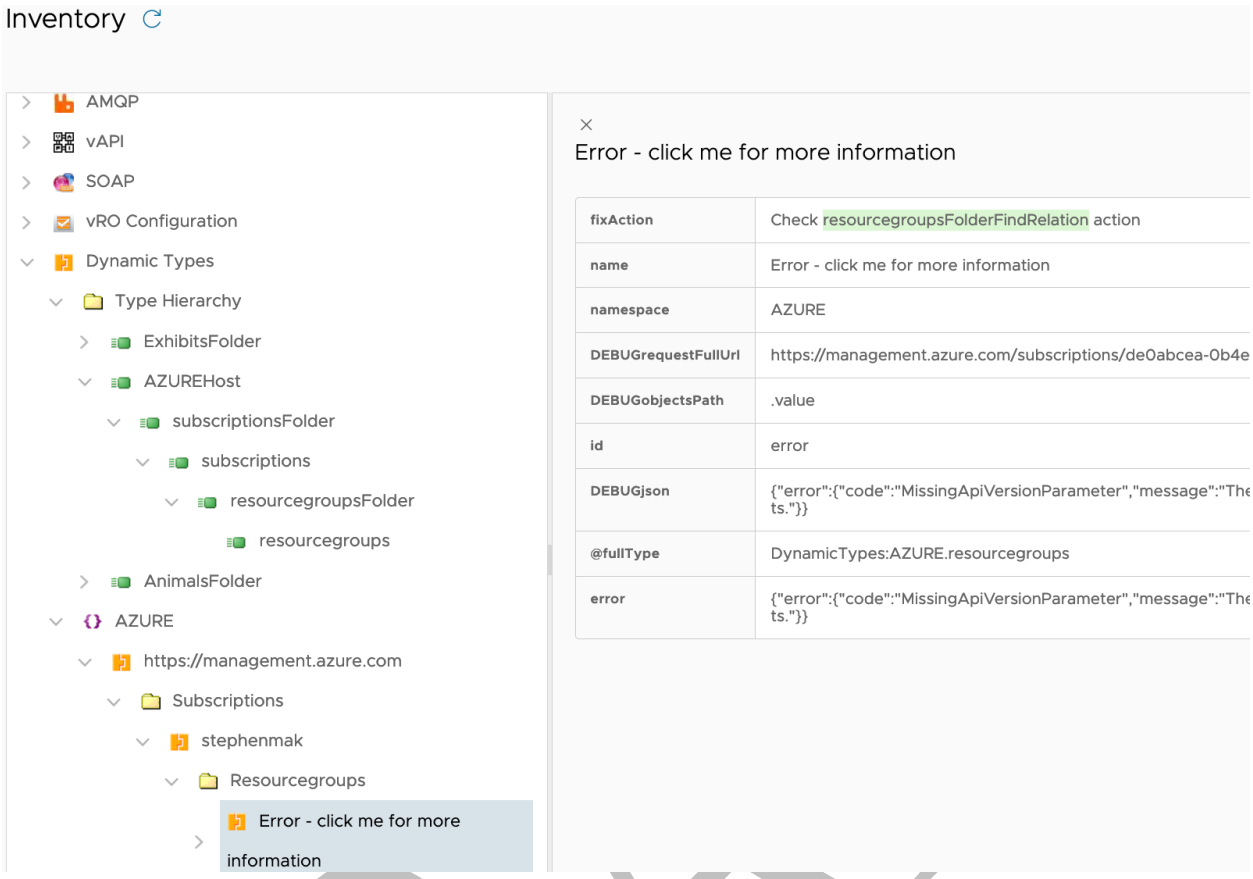
Run workflow 3c to add the REST operation. Use the same input values.
Map ID and Name to the corresponding property in REST response.

-3c- Create a type from a REST operation



Examine Resourcegroups in inventory

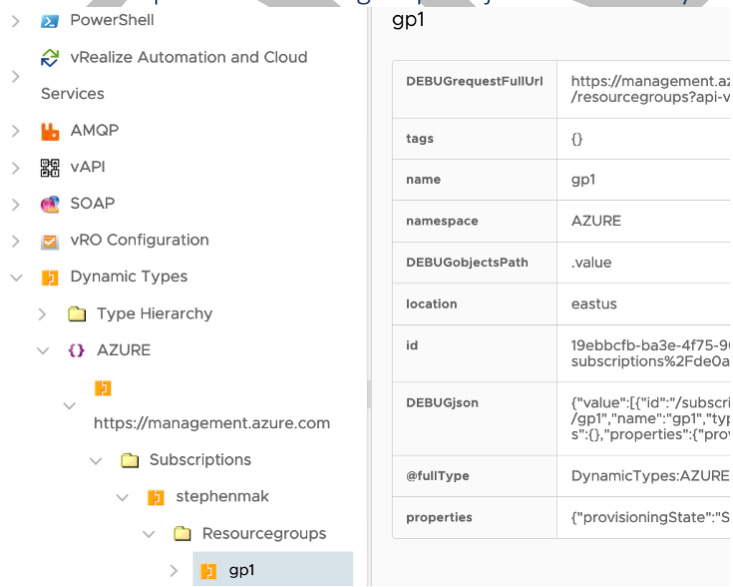
Examine the DT object in inventory for error.



Update resourcegroupsFolderFindRelation action

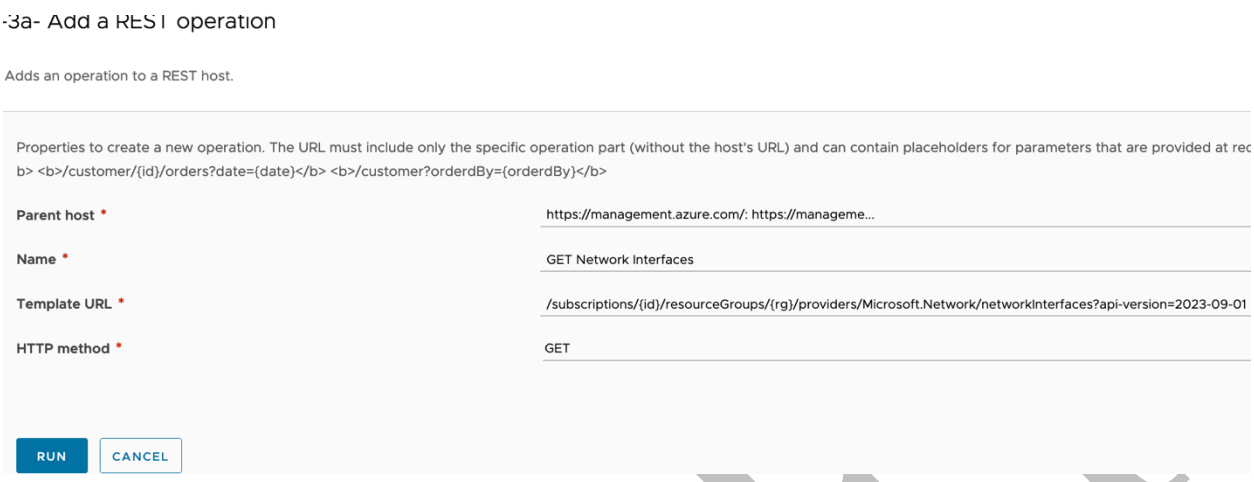
Error: MissingApiVersionParameter
Solution: update urlTemplate

Examine a specific resourcegroups object in inventory



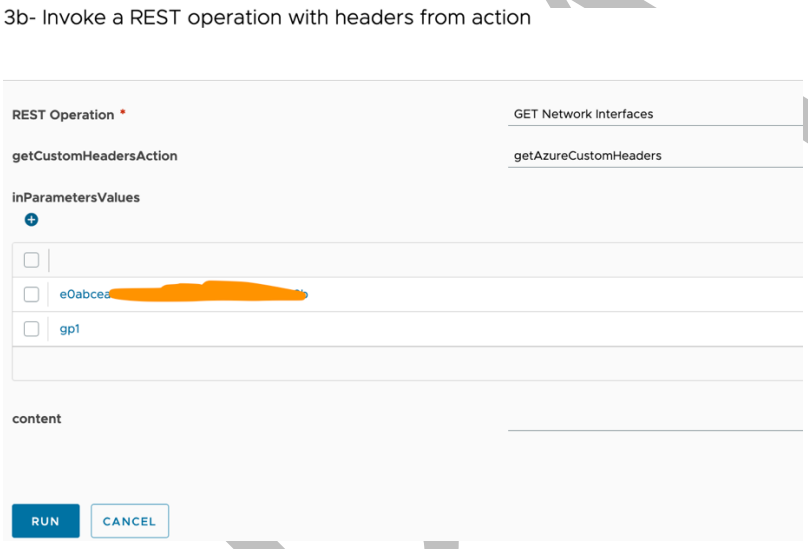
GET Network Interfaces

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



Test REST Operation

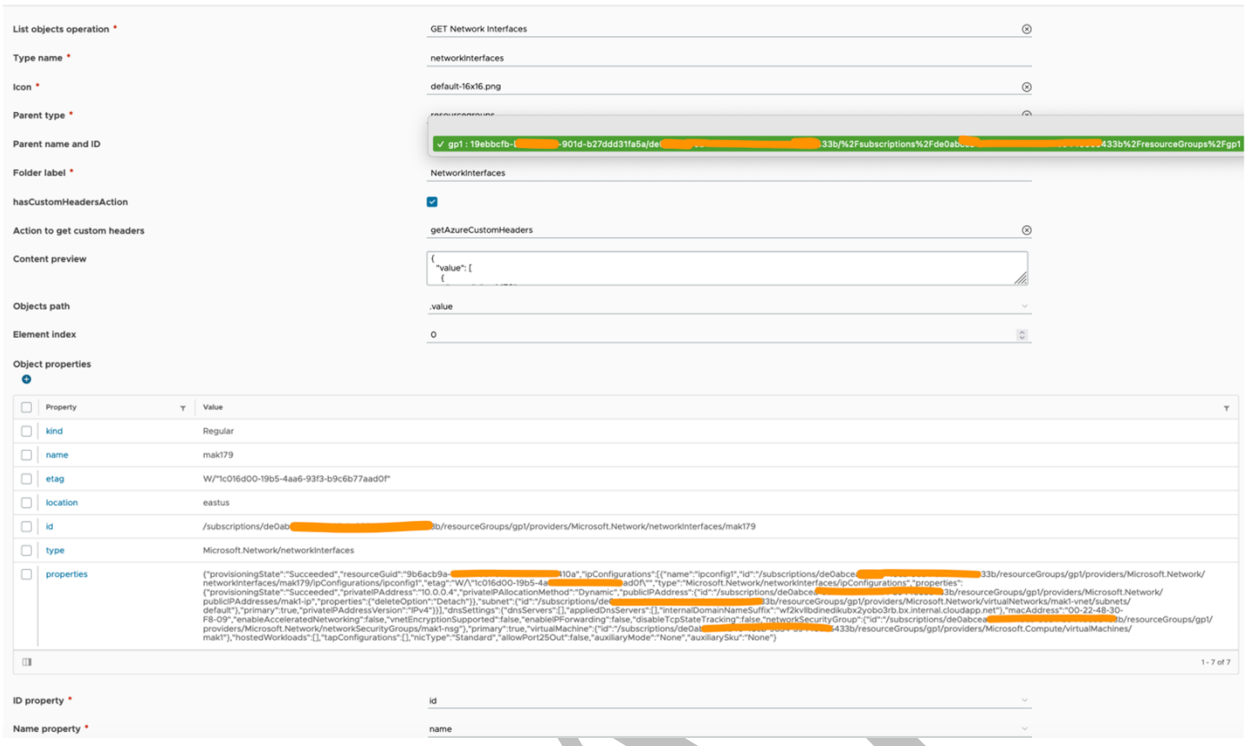
Run workflow 3b to test the operation. Supply a value for each parameter in order.



Create interfaces type from REST operation

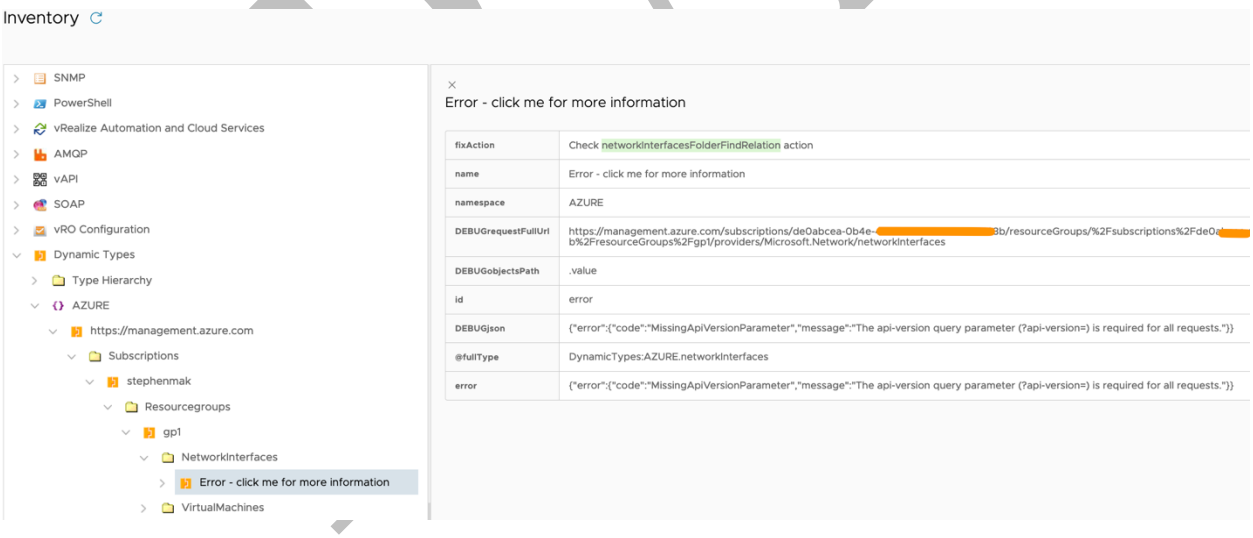
Run workflow 3c to add the REST operation. Use the same input values.
Map ID and Name to the corresponding property in REST response.

-3c- Create a type from a REST operation



Examine NetworkInterfaces in inventory

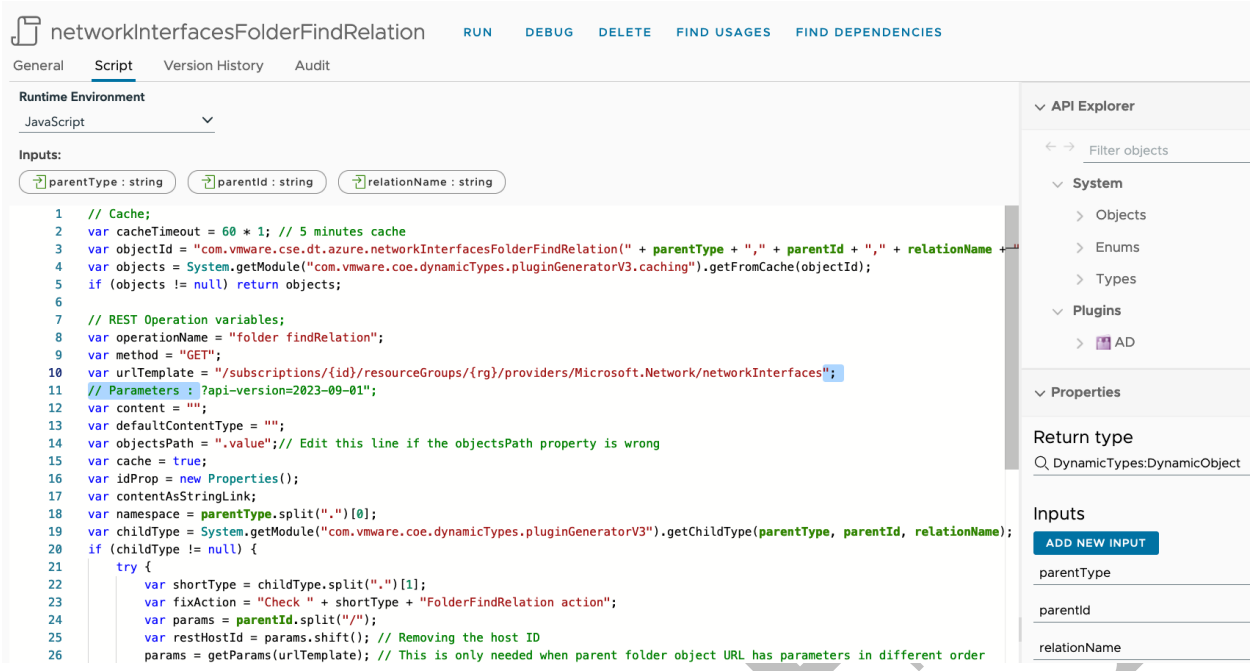
Examine the DT object in inventory for error.



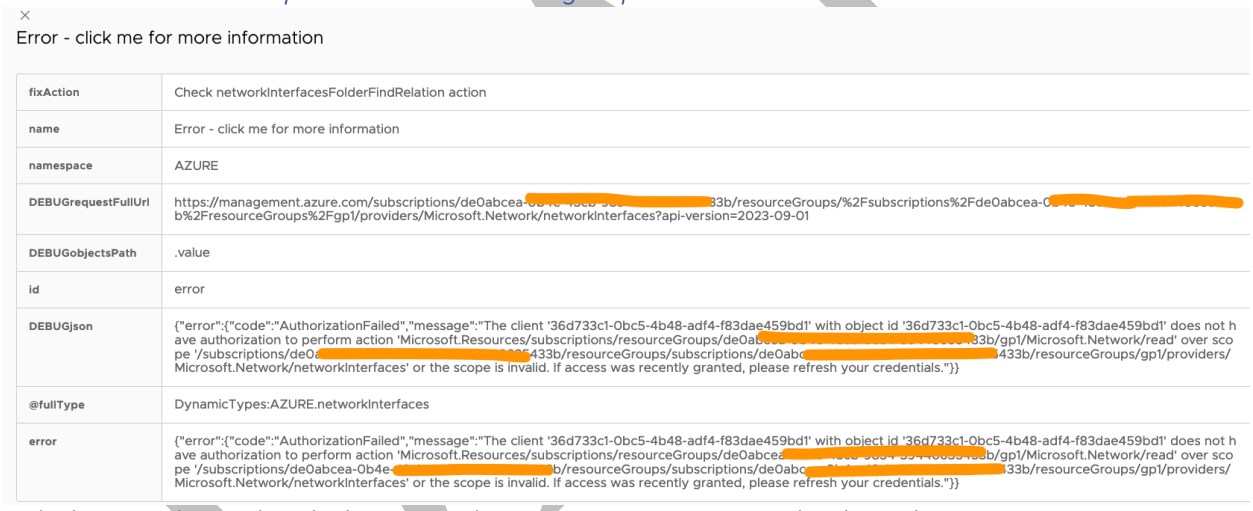
Update networkInterfacesFolderFindRelation action

Error 1: MissingApiVersionParameter

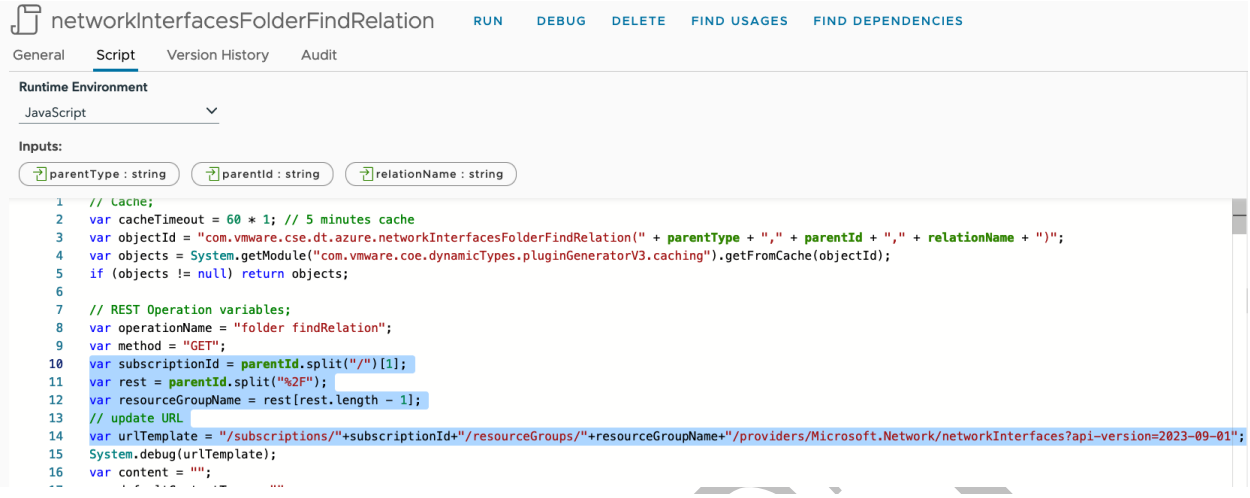
Solution: update urlTemplate



Error 2: invalid subscription Id and resource group name



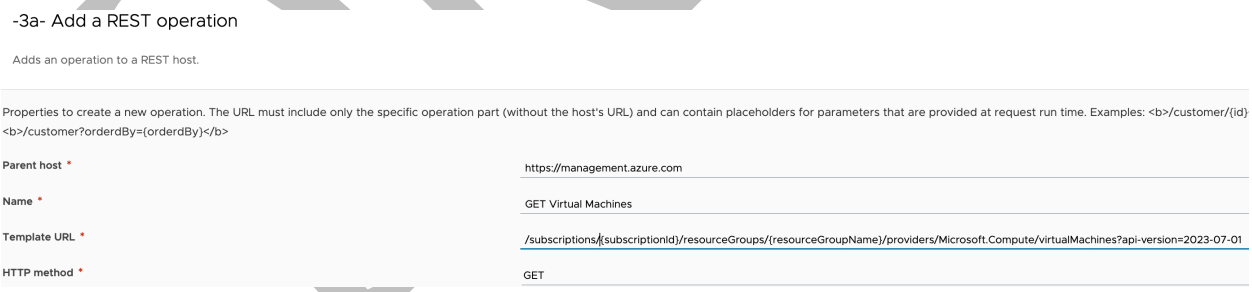
Solution: Update subscription ID and resource group name value in action




```
// 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/Micr
osoft.Network/networkInterfaces?api-version=2023-09-01";
System.debug(urlTemplate);
```

GET Virtual Machines

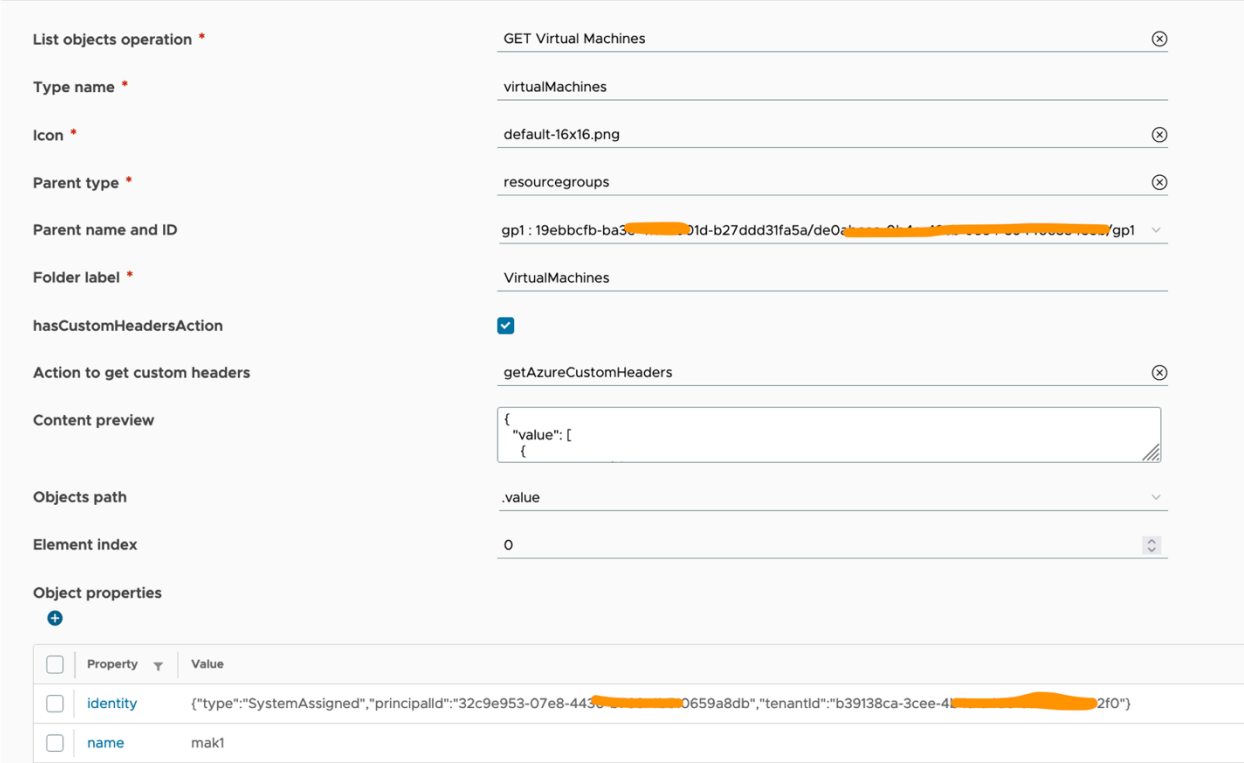
Run workflow 3a to add the REST operation. Be aware of two parameters – subscriptionId and resoureGroupName.



Create virtualMachines type from REST Operation

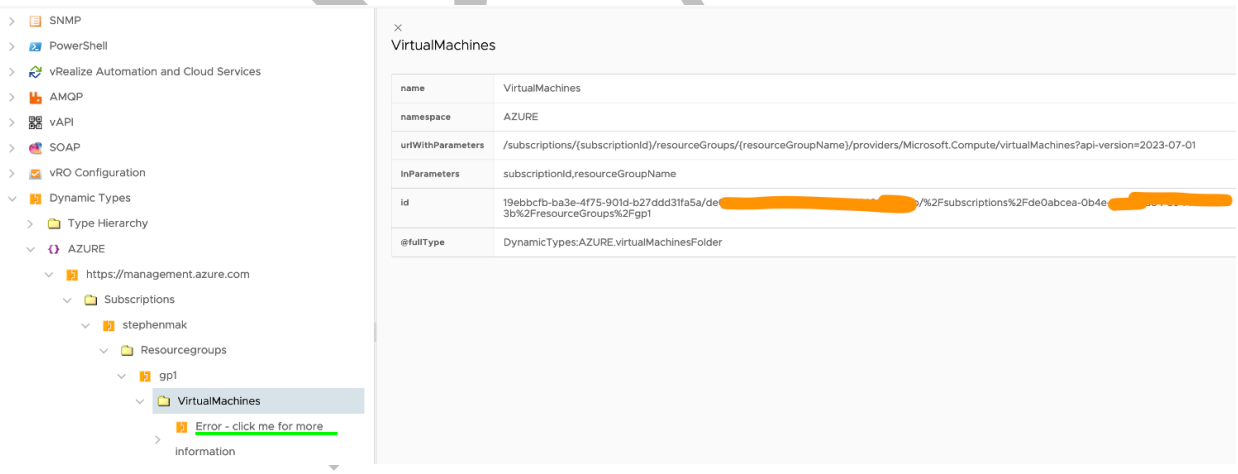
Run workflow 3c to add the REST operation. Use the same input values.
Map ID and Name to the corresponding property in REST response.

-3c- Create a type from a REST operation



Examine VirtualMachines in inventory

Examine the DT object in inventory for error.



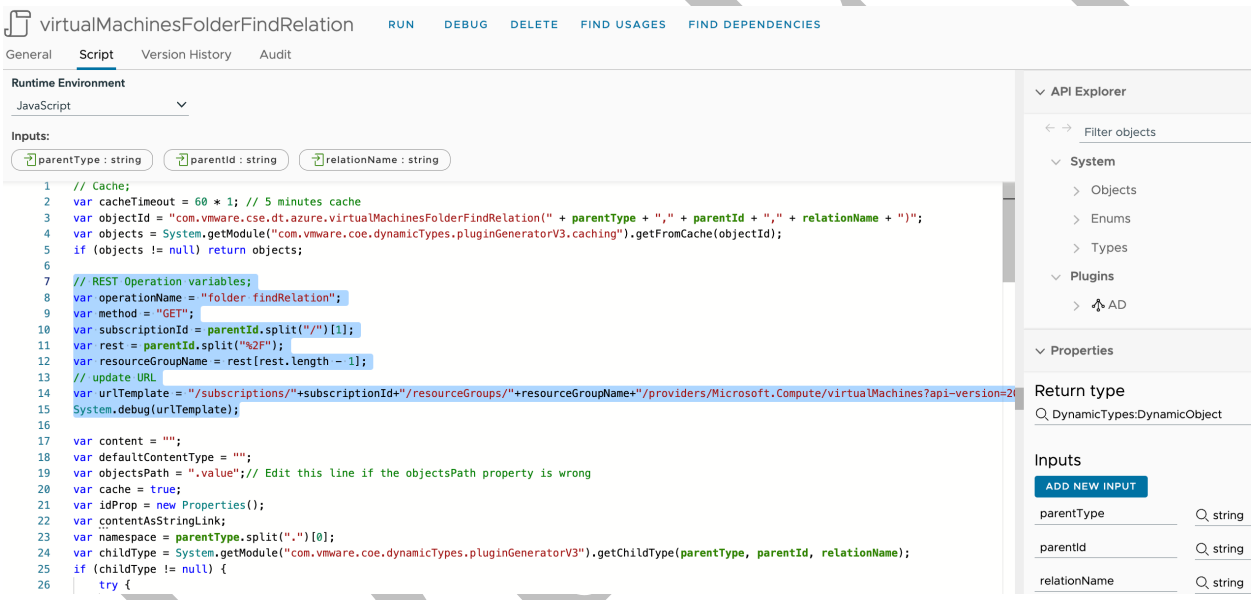
Update vritualMachinesFolderFindRelation action

Error 2: invalid subscriptionId

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[redacted]8b%2FresourceGroups%2Fgp1/resourceGroups/%2Fsubscriptions%2Fde0a[redacted]b%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."}}

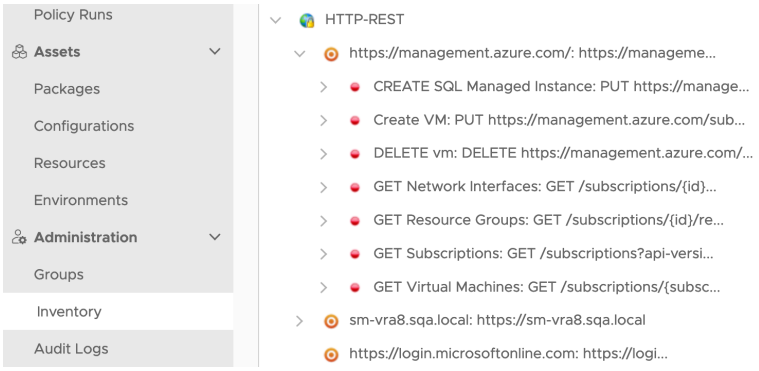
Solution:
Update urlTemplate in virtualMachineFolderFindRelation action; replacing two parameters.




```
// 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/Micr
osoft.Compute/virtualMachines?api-version=2023-07-01";
System.debug(urlTemplate);
```

HTTPS Operations

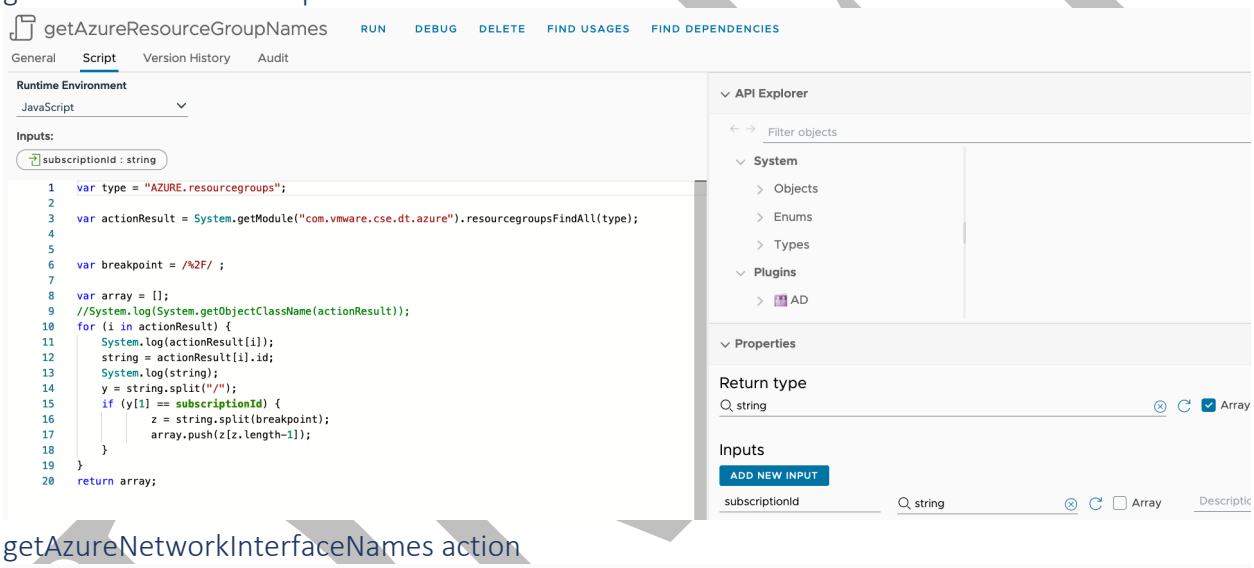
Below are the HPPS Operations after install.



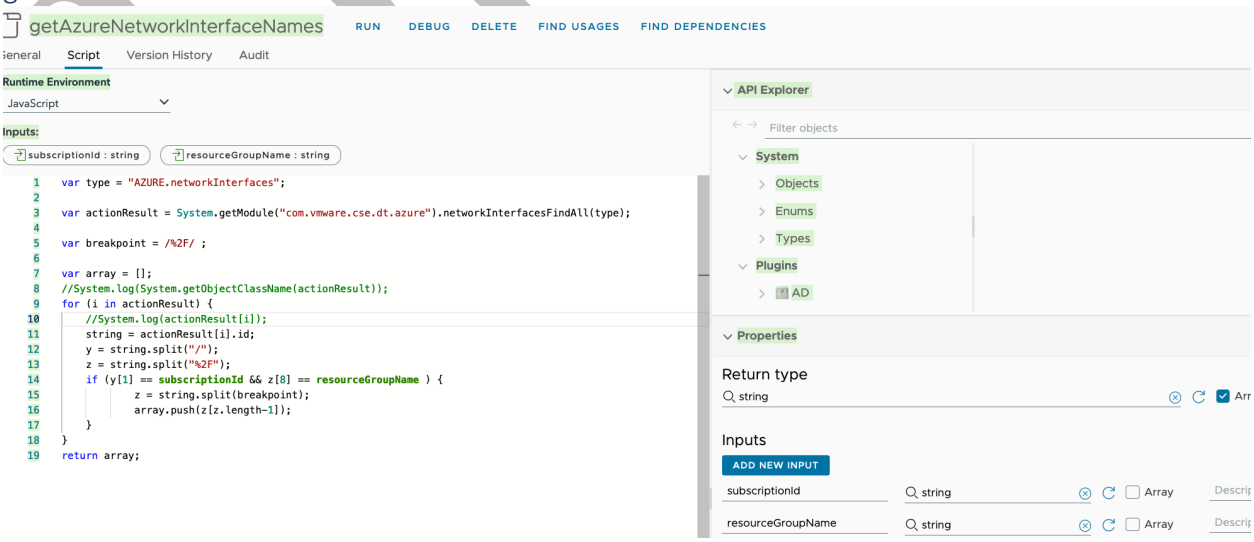
Input Form Actions

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

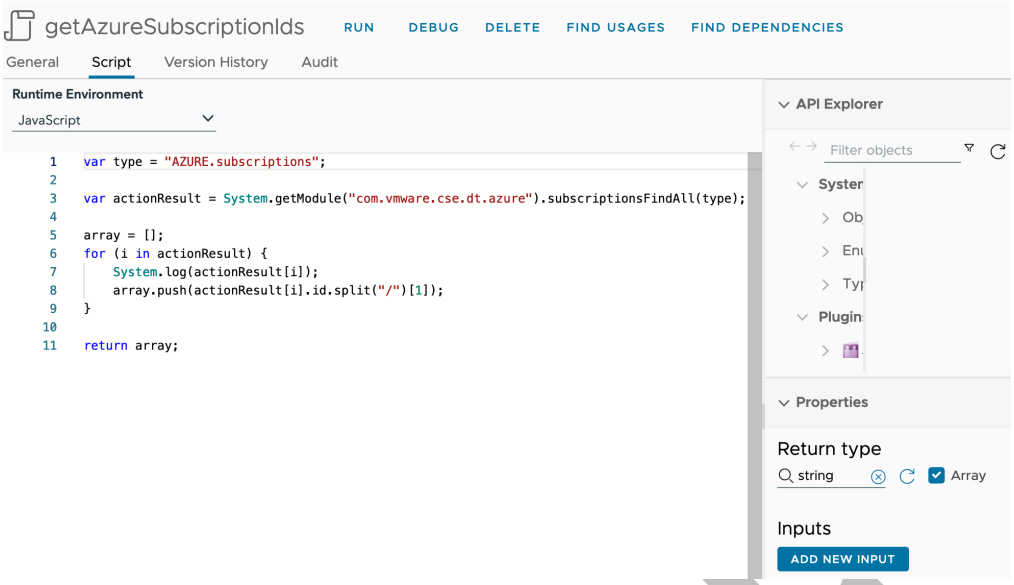
getAzureResourceGroupNames action



getAzureNetworkInterfaceNames action



getAzureSubscriptionIds action



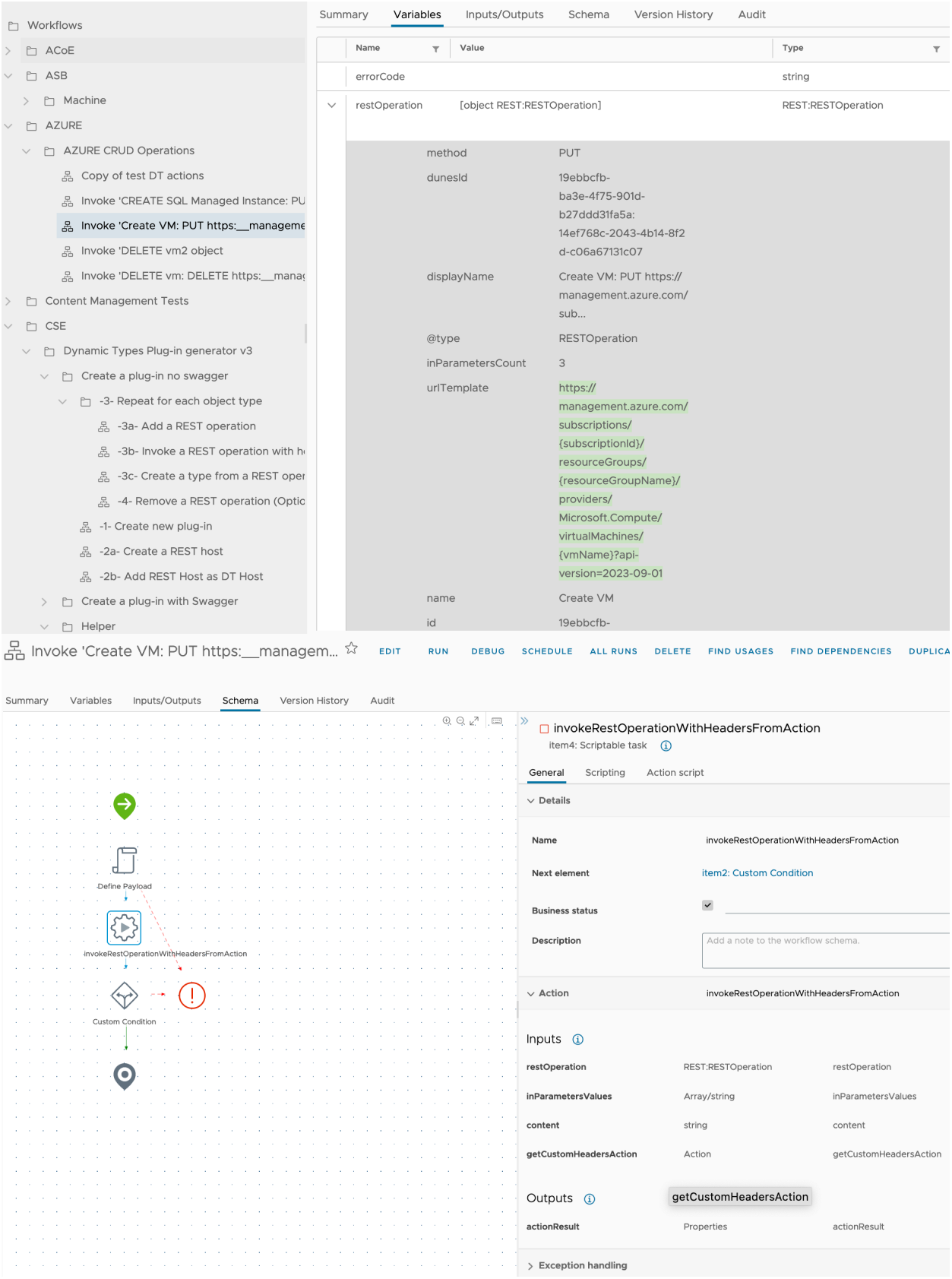
Provisioning Workflows

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_sub.

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


Workflows
ACoE
ASB
Machine
AZURE
AZURE CRUD Operations
Copy of test DT actions
Invoke 'CREATE SQL Managed Instance: PU
Invoke 'Create VM: PUT https:__manageme
Invoke 'DELETE vm2 object
Invoke 'DELETE vm: DELETE https:__manag
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 h
-3c- Create a type from a REST oper
-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
Summary
Variables
Inputs/Outputs
Schema
Version History
Audit
Name
Value
Type
errorCode
string
restOperation
[object REST:RESTOperation]
REST:RESTOperation
method
PUT
dunesId
19ebbcfb-ba3e-4f75-901d-b27ddd31fa5a:14ef768c-2043-4b14-8f2d-c06a67131c07
displayName
Create VM: PUT https://management.azure.com/sub...
@type
RESTOperation
inParametersCount
3
urlTemplate
https://management.azure.com/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Compute/virtualMachines/{vmName}?api-version=2023-09-01
name
Create VM
id
19ebbcfb-
Invoke 'Create VM: PUT https:__managem...
EDIT
RUN
DEBUG
SCHEDULE
ALL RUNS
DELETE
FIND USAGES
FIND DEPENDENCIES
DUPLICA
Summary
Variables
Inputs/Outputs
Schema
Version History
Audit
Define Payload
invokeRestOperationWithHeadersFromAction
Custom Condition
invokeRestOperationWithHeadersFromAction
item4: Scriptable task
General
Scripting
Action script
Details
Name
invokeRestOperationWithHeadersFromAction
Next element
item2: Custom Condition
Business status
Description
Add a note to the workflow schema.
Action
invokeRestOperationWithHeadersFromAction
Inputs
restOperation
REST:RESTOperation
restOperation
inParametersValues
Array/string
inParametersValues
content
string
content
getCustomHeadersAction
Action
getCustomHeadersAction
Outputs
getCustomHeadersAction
actionResult
Properties
actionResult
Exception handling

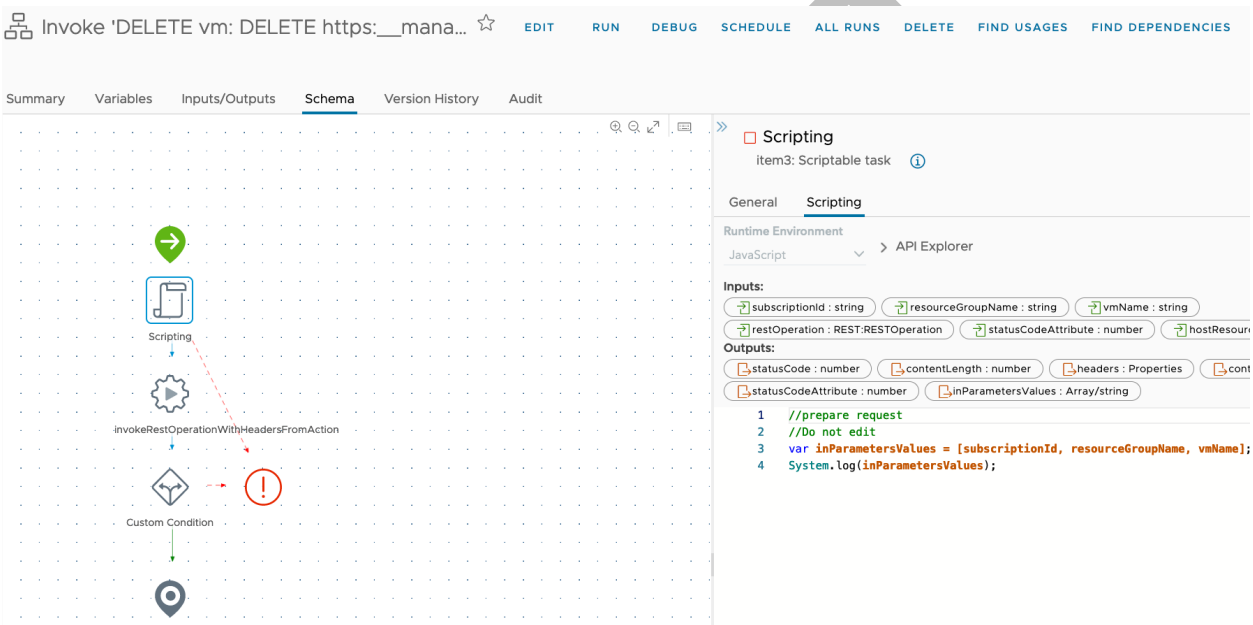
Use a below GET response as template in “Define Payload” task and update key values accordingly.

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

Invoke 'DELETE vm: DELETE https:__managem

Use below url to create a REST operation:

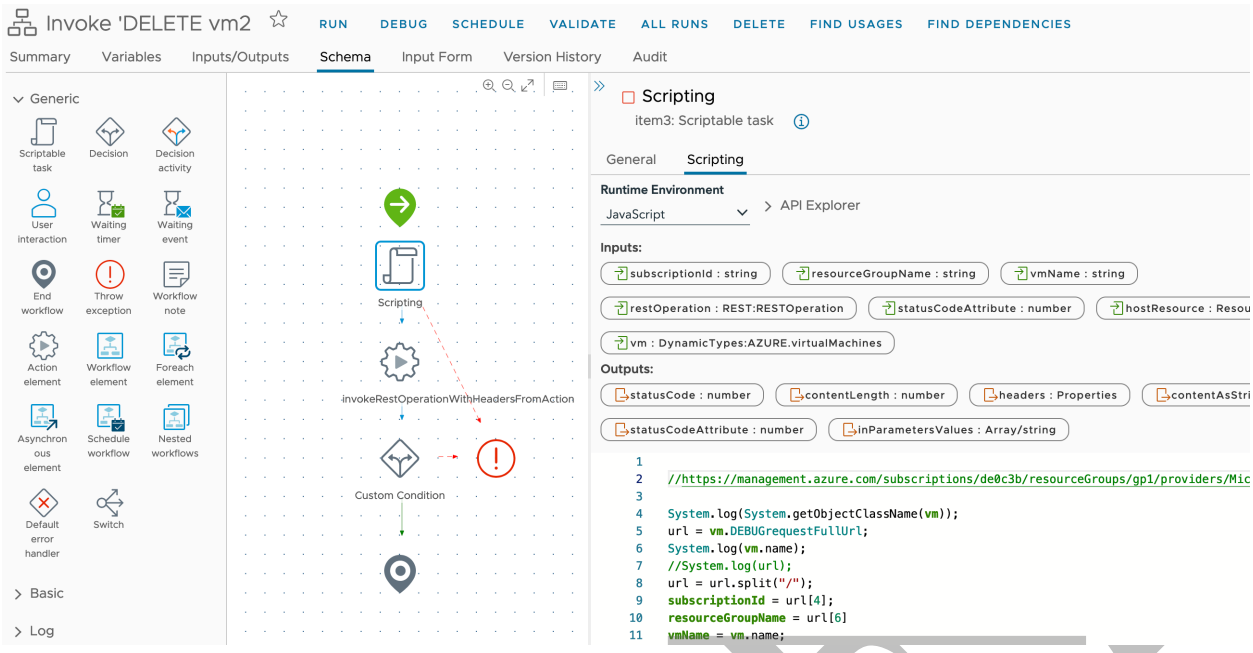
```
https://management.azure.com/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Compute/virtualMachines/{vmName}?api-version=2023-09-01
```



Invoke 'DELETE vm2

Use below url to create a REST operation:

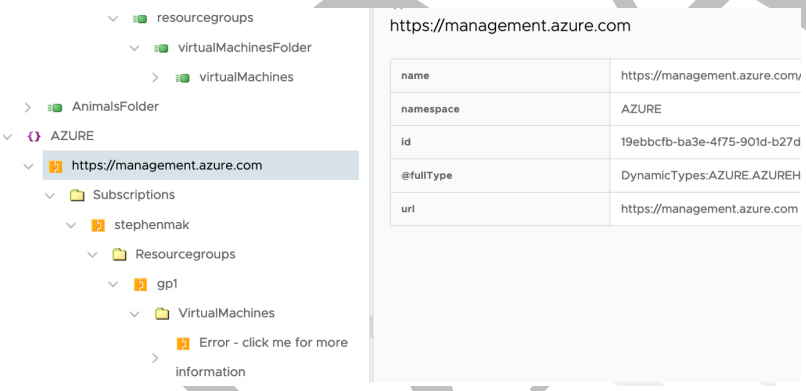
```
https://management.azure.com/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Compute/virtualMachines/{vmName}?api-version=2023-09-01
```



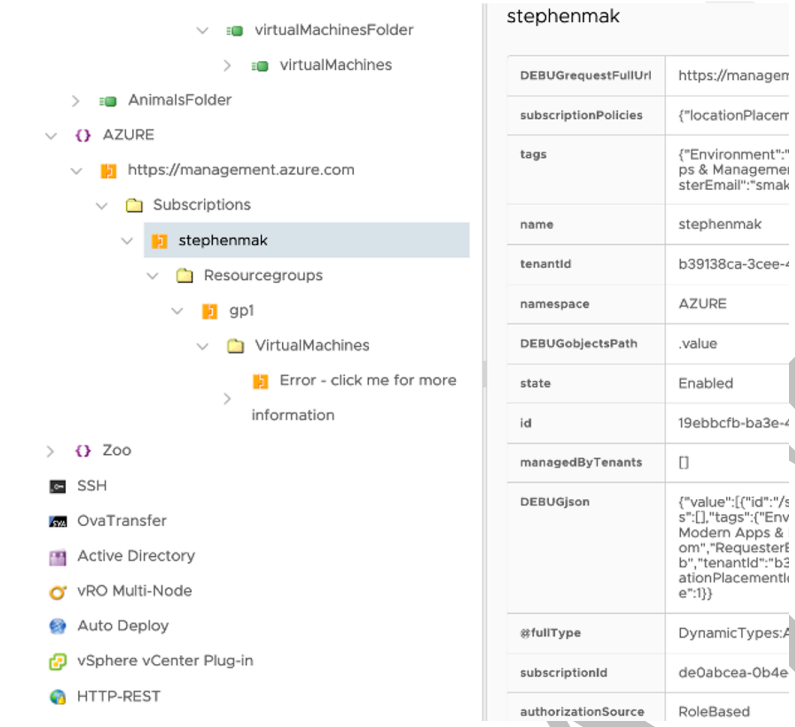
Inventory Objects and Properties

Below are inventory objects after install.

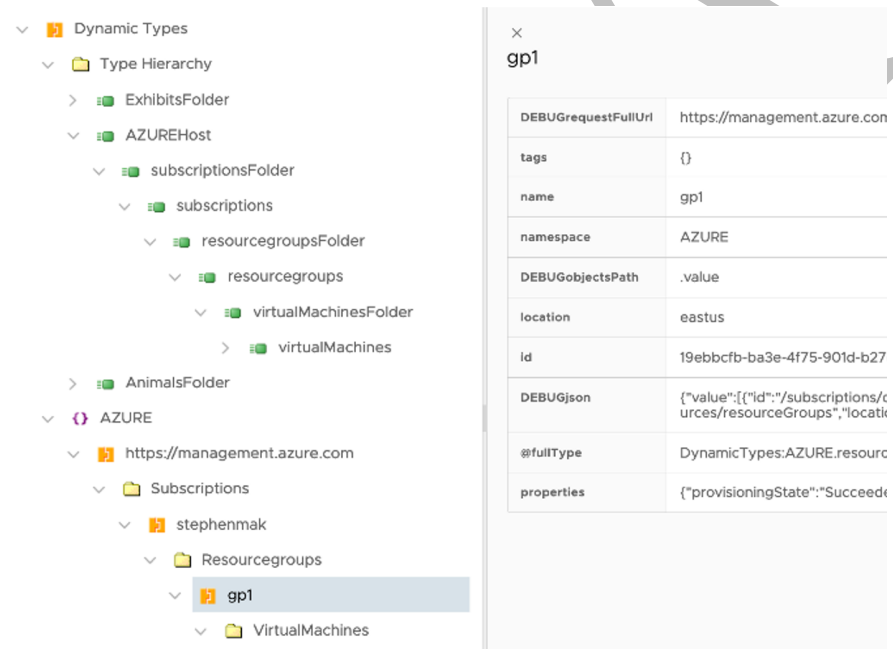
DT Host



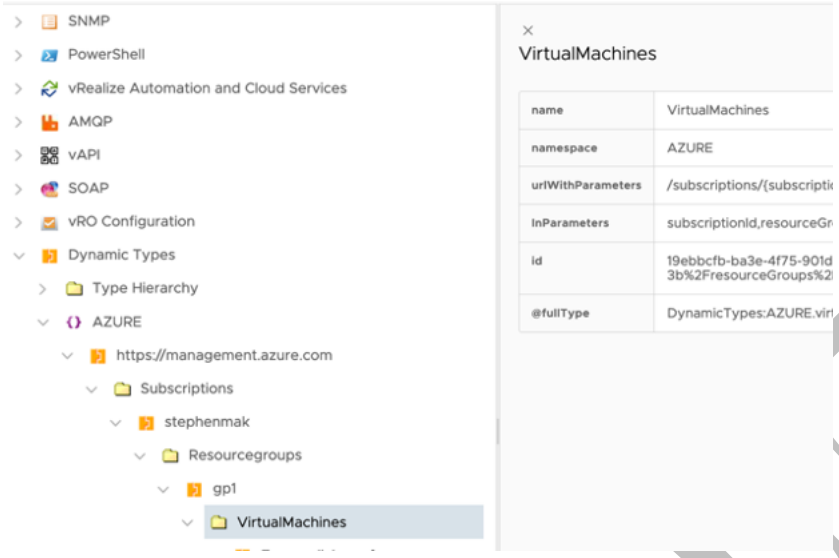
Subscriptions



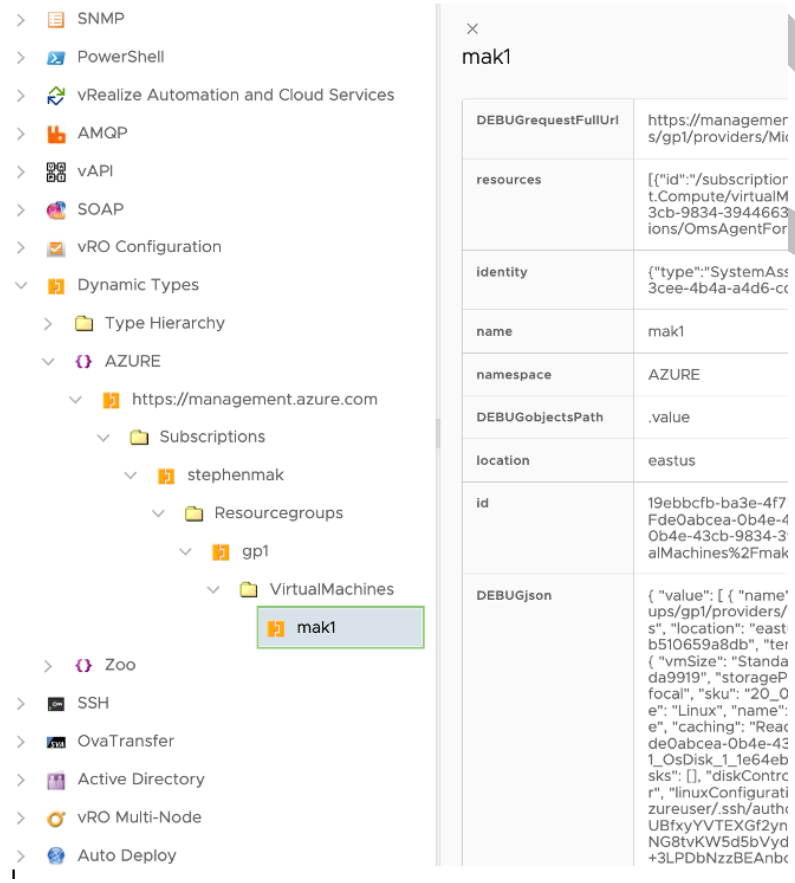
Resource groups



VirtualMachines

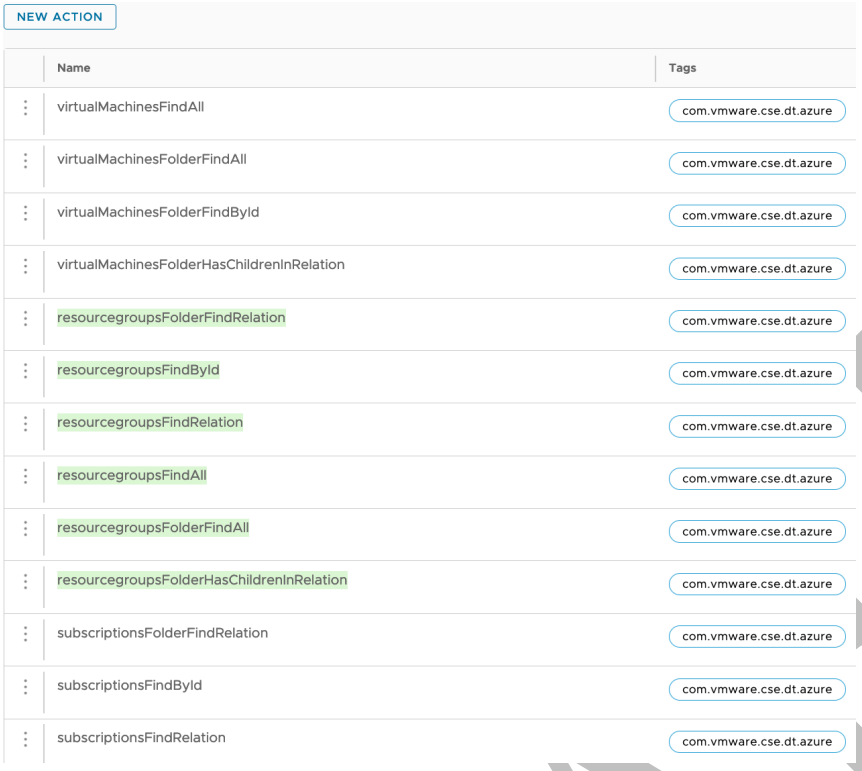


Virtual Machines



com.vmware.cse.dt.azure module

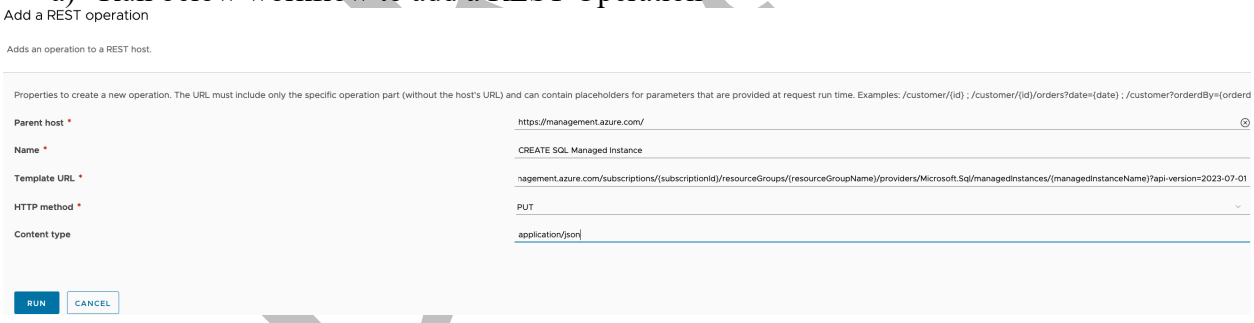
Below are some plugin actions created by the tool.



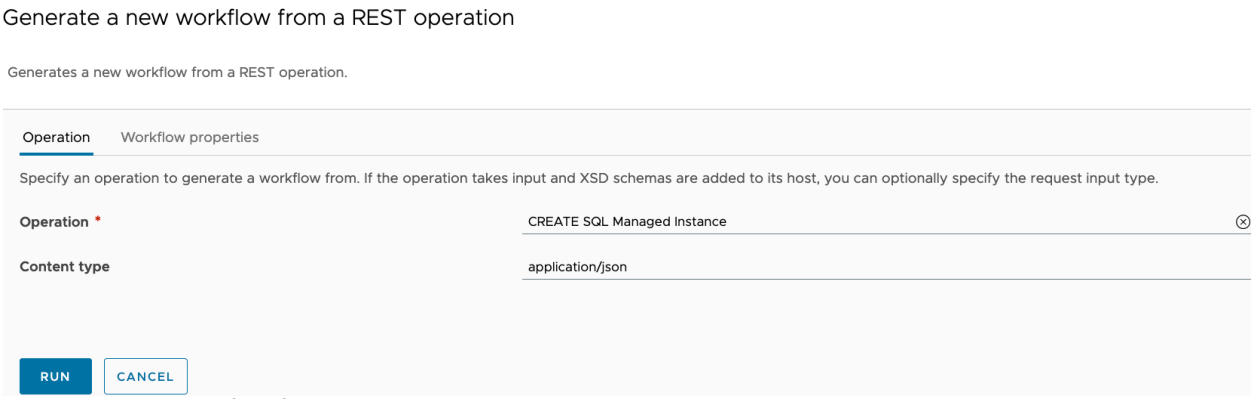
Add additional REST Operations

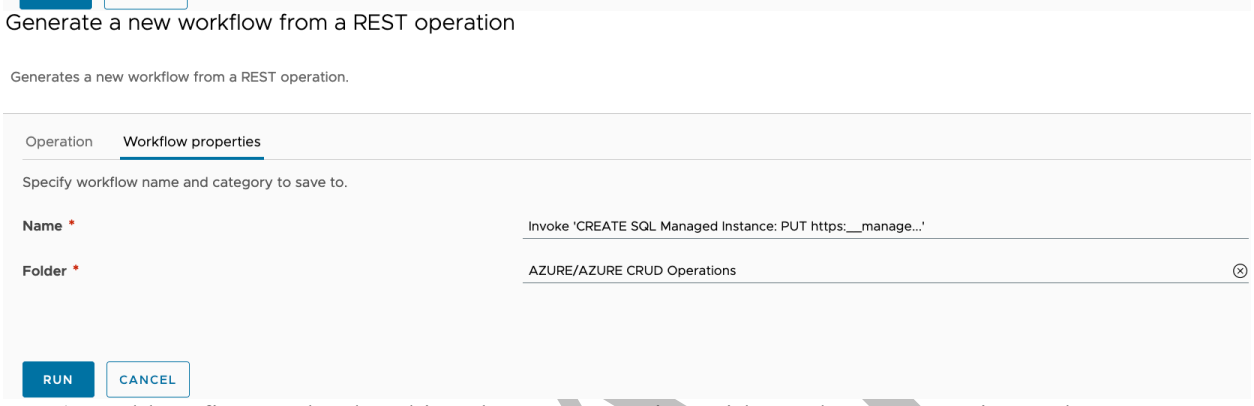
Reader can map a REST call to a vRO workflow. Our tool creates a vRO workflow with inputs and Azure authentication. Below is the instruction.

a) Run below workflow to add a REST Operation

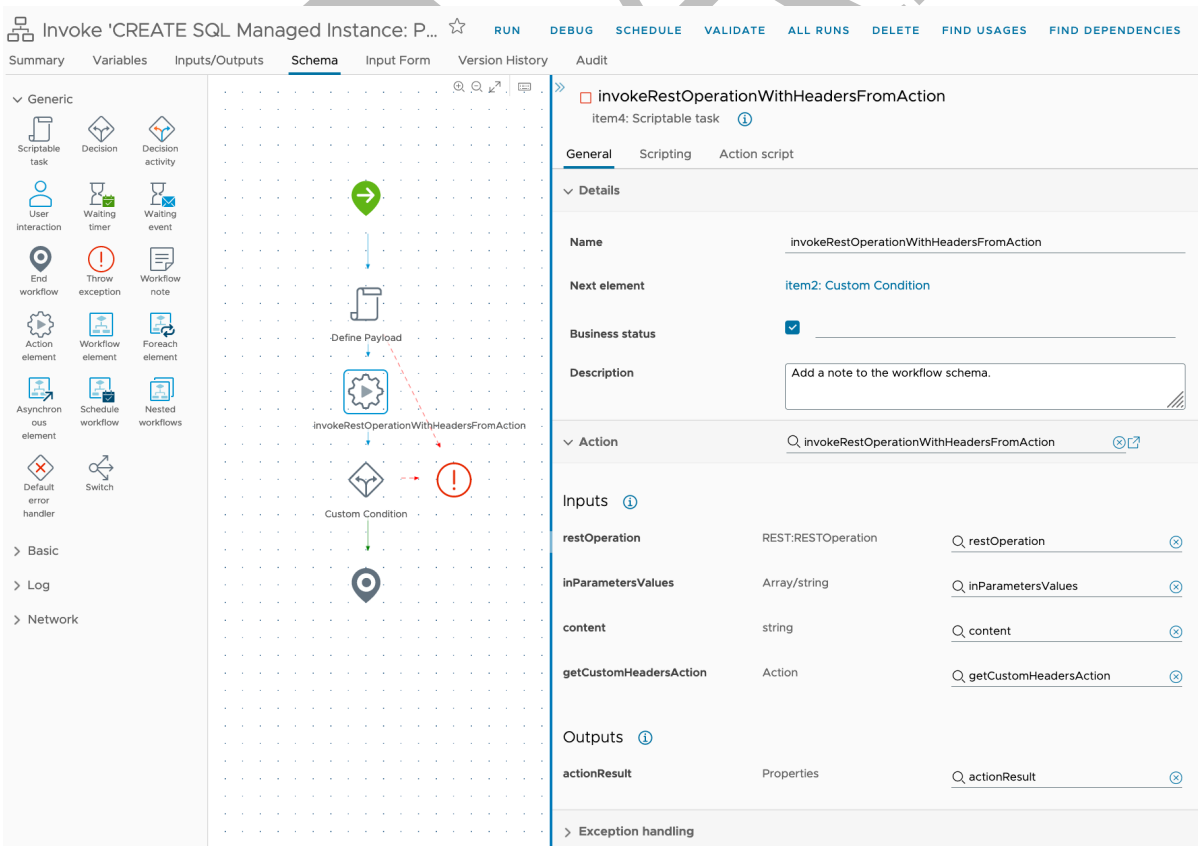


b) Run below workflow to generate a workflow from REST operation

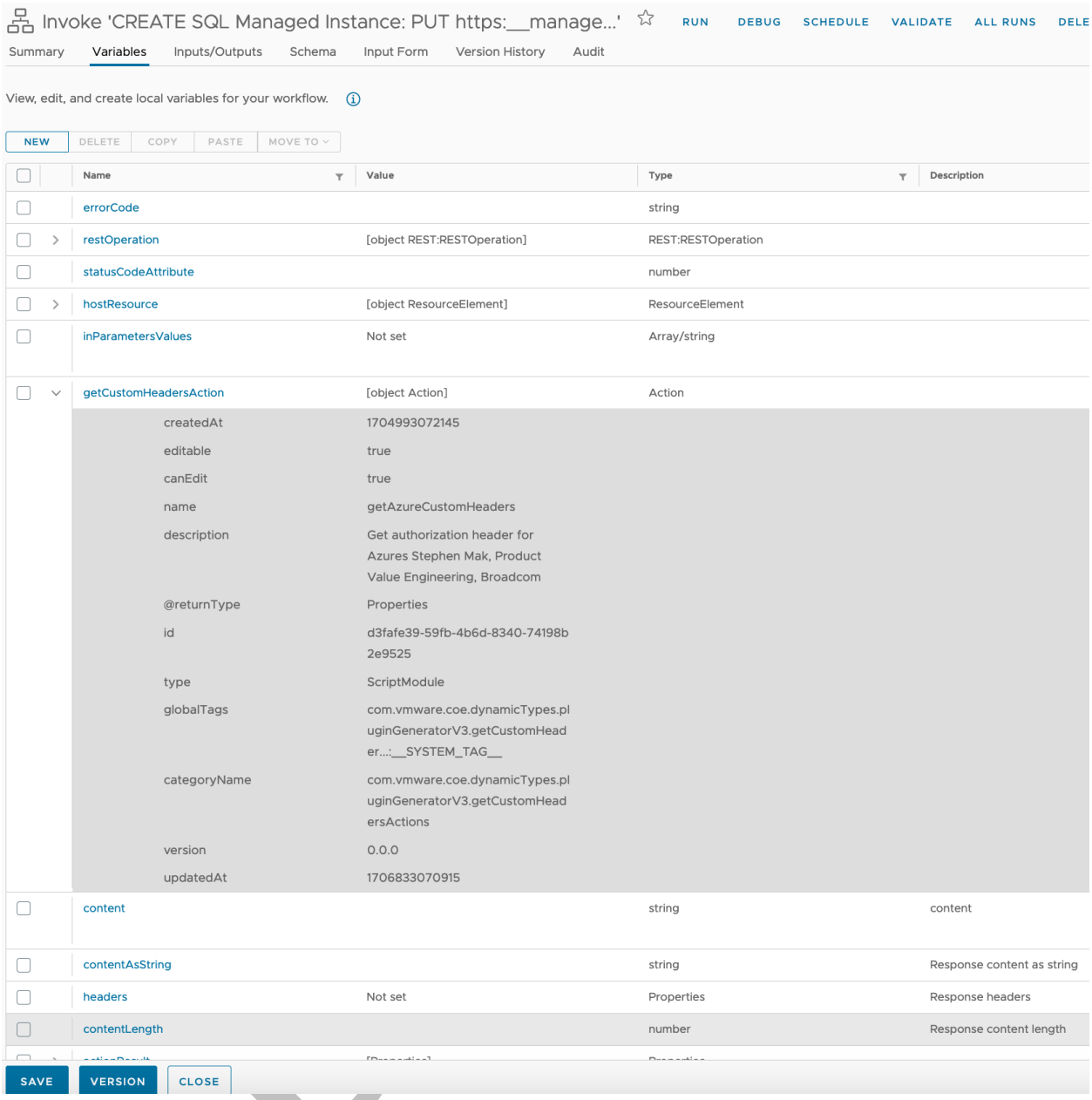




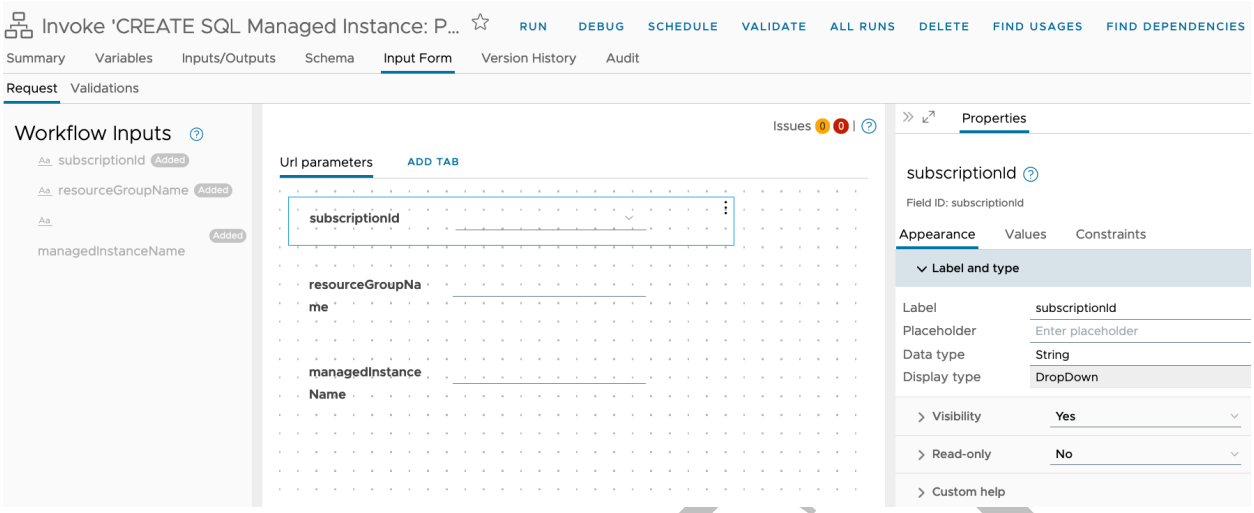
c) Add Define Payload and invokeRestOperationWithHeadersFromAction tasks to workflow

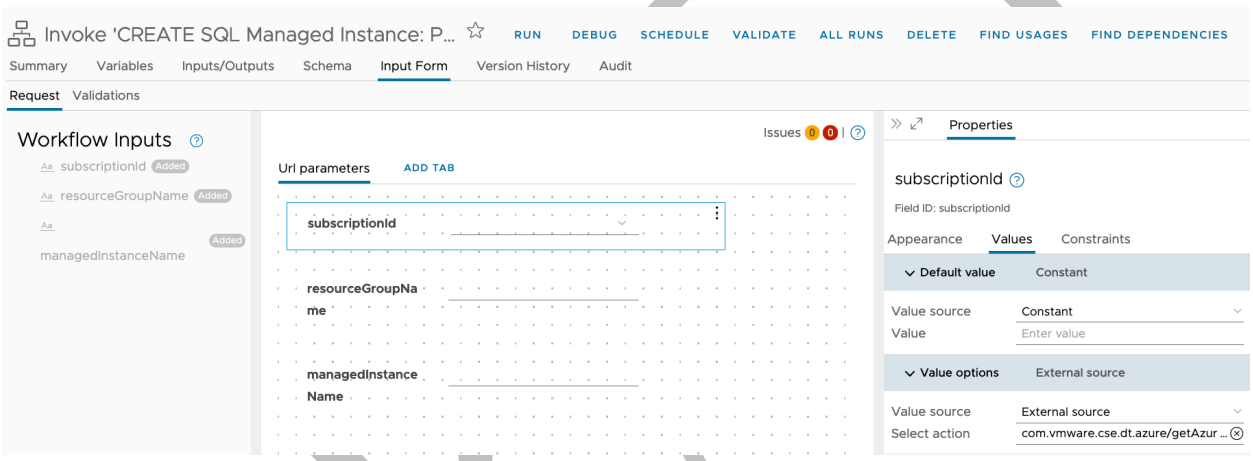


Supply variable values:

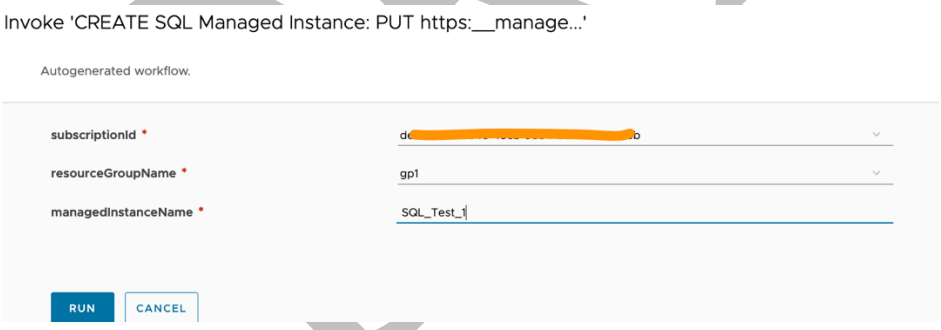


d) Apply input form actions





e) Test workflow



References

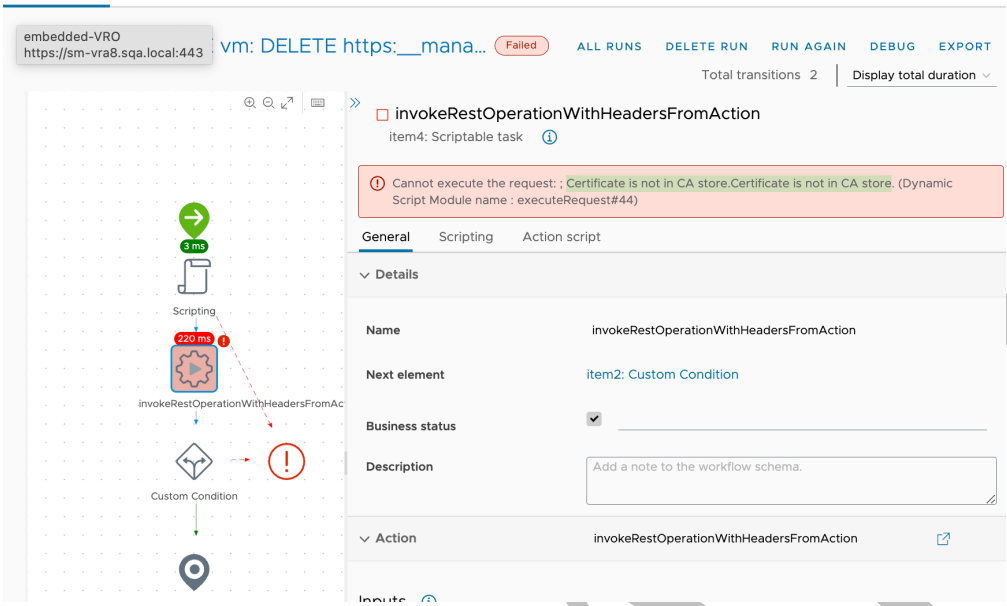
Authentication Failure

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

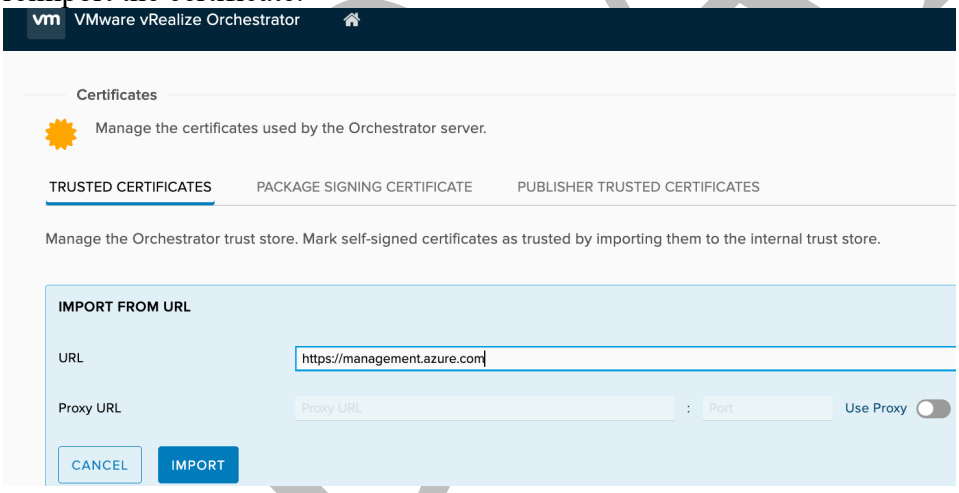
Troubleshooting:

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

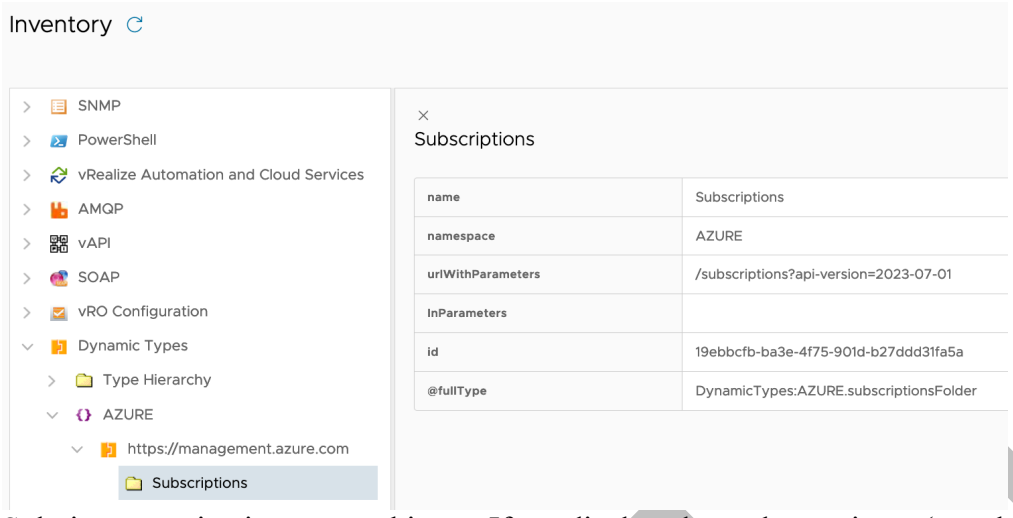
DELETE VM Cert Error



Solution: examine inventory objects. If not displayed, below cert has an issue. Manually reimport the certificate.



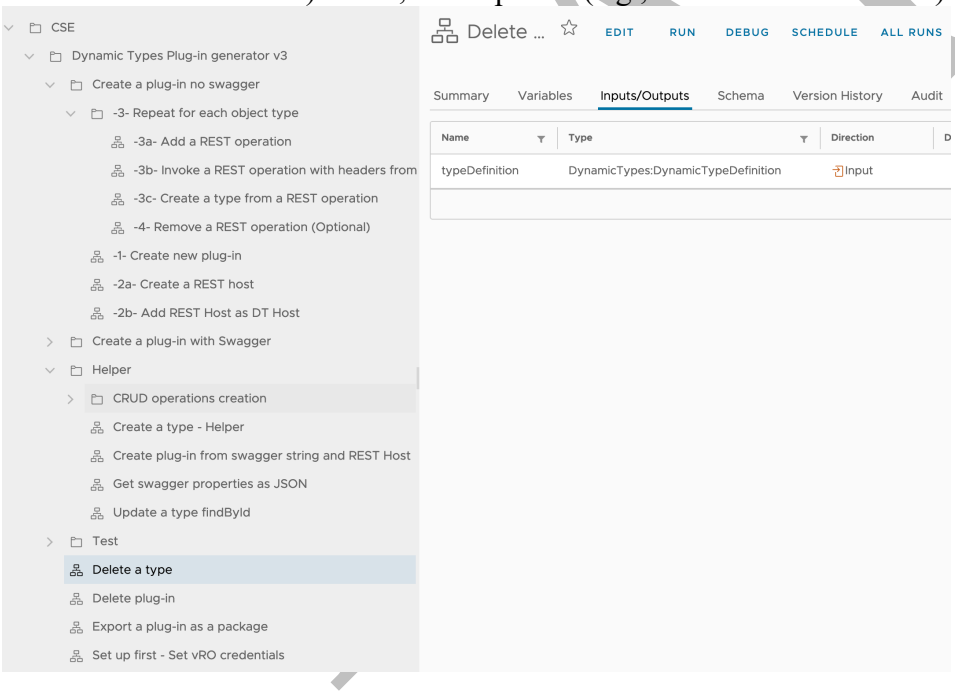
Inventory Issue



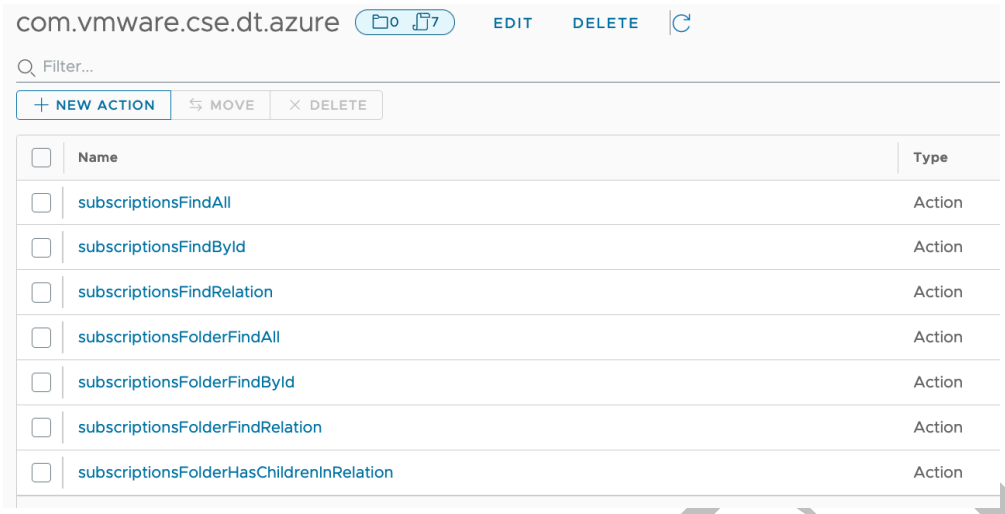
Solution: examine inventory objects. If not displayed, cert has an issue (may be expired). Manually reimport the management.azure.com certificate.

Delete a DT type

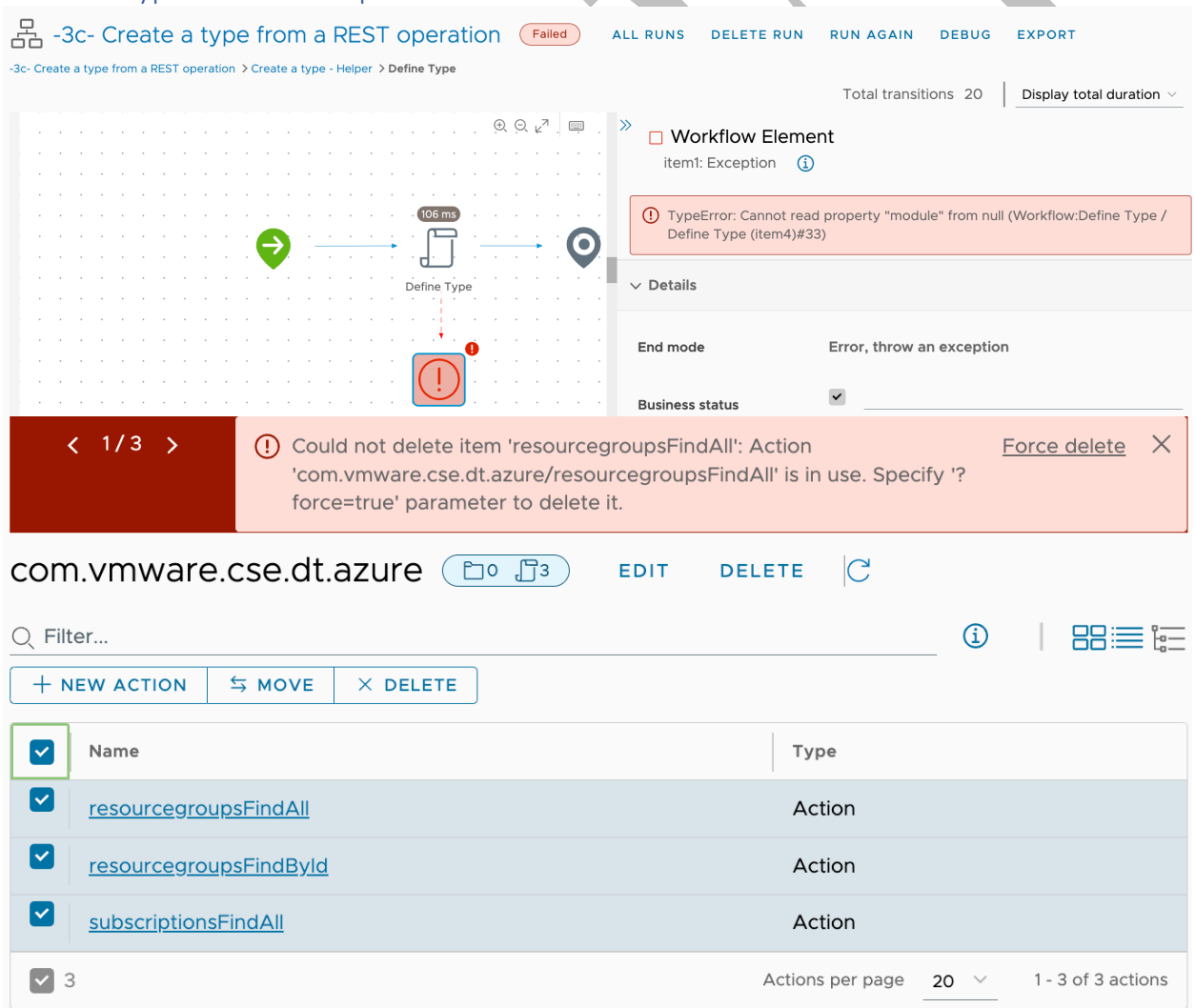
1) Run 'Delete a type' workflow two times. First, select child type as input (e.g., virtualMachines). Then, select parent (e.g., virtualMachineFolder).



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



Create a Type from REST Operation issue



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

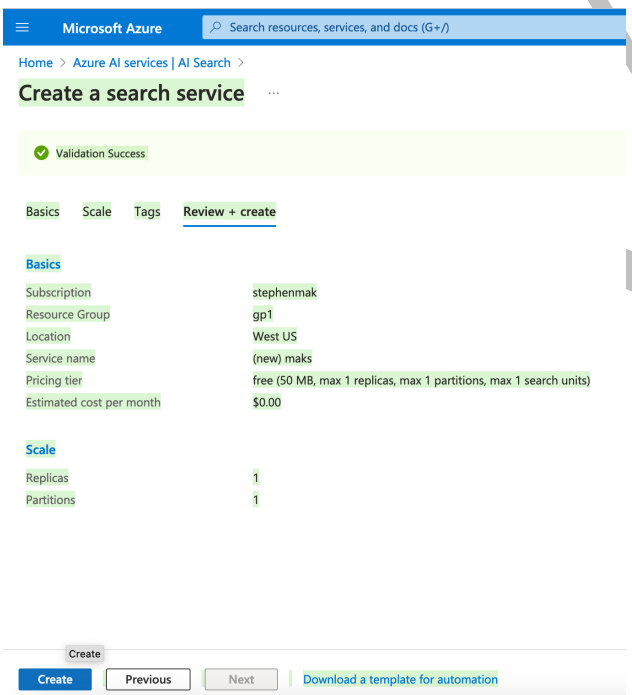
https://learn.microsoft.com/en-us/rest/api/sql/managed-instances/create-or-update?view=rest-sql-2021-11-01&tabs=HTTP

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/

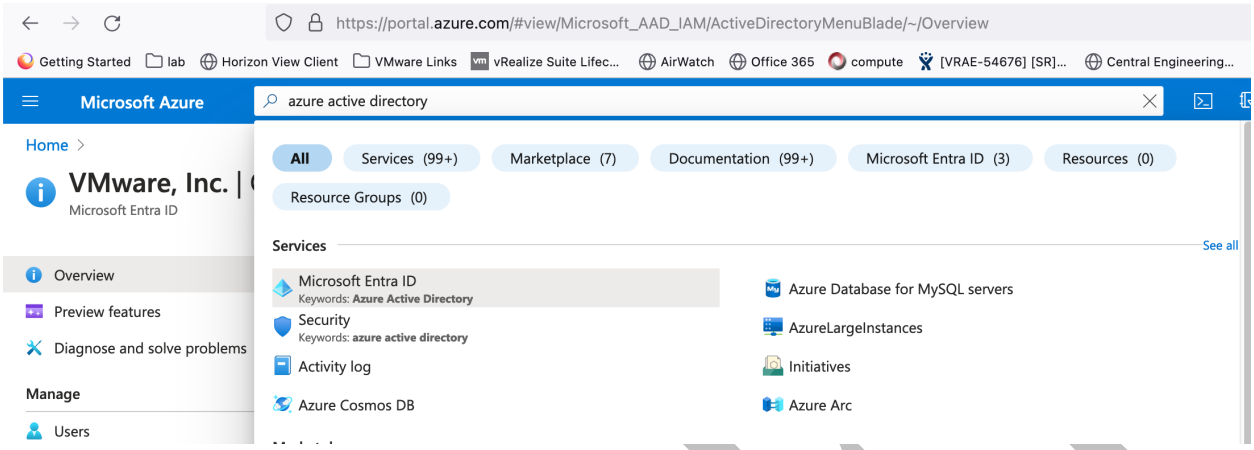
Azure search service

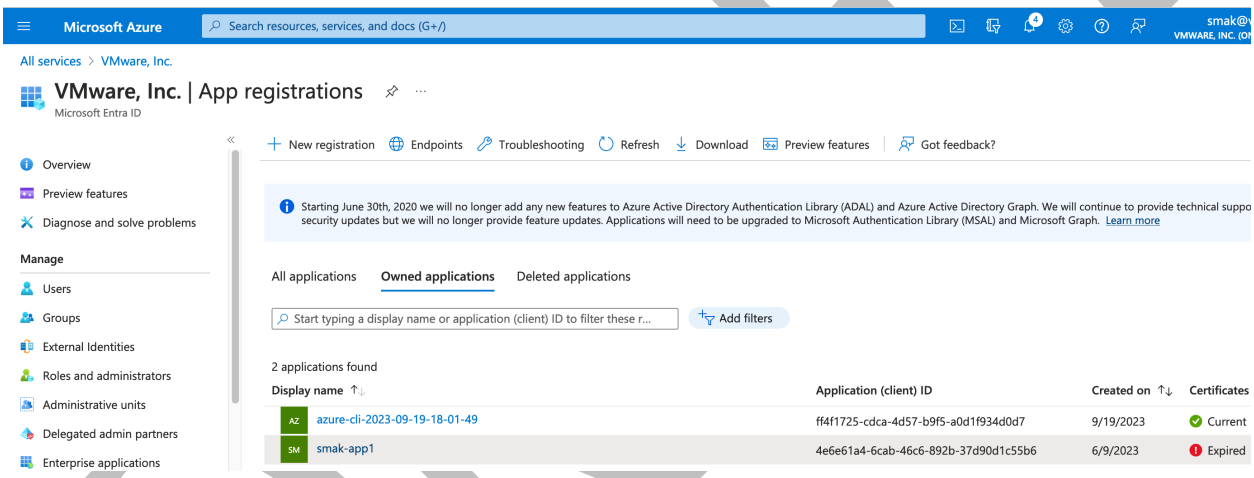


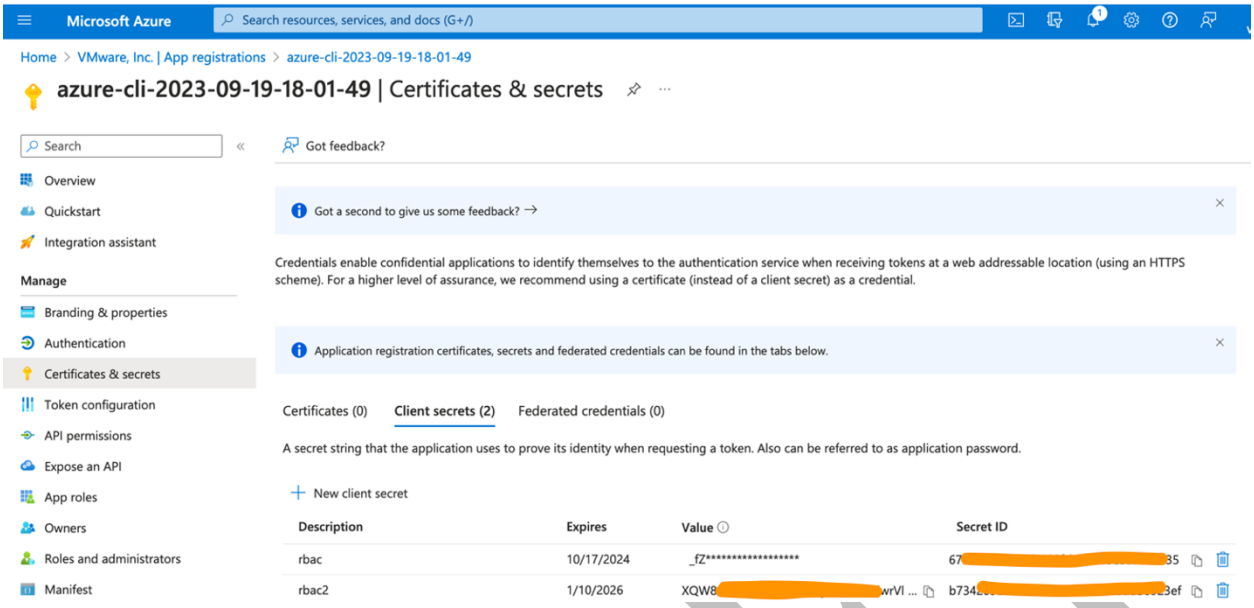
Getting Azure API Token

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
```







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.