Control Loops for O-RU Fronthaul Recovery usecase F Release

This page describes how to create and run the control loops for the "Hello World" O-RU Fronthaul Recovery usecase. This can be done either in docker environment using docker-compose files (available in the nonrtric repo of OSC), or in kubernetes environment using the complete ONAP installation done via OOM. Moreover, the control loop for apex policy version of the usecase can be created using Policy participant, whereas the control loop for script version of the usecase can be created using Kubernetes participant (both participants available in policy/clamp repo of ONAP).

The use case implementations are located in the "nonrtric/rapp/orufhrecovery" repo. Some test scripts and docker compose files are located in the "nonrtric" repo.

Control loops in kubernetes

This section is related to running the control loops in a kubernetes environment. Specifically, it describes how to deploy the control loops in a full-fledge installation of ONAP assuming that the installation was done in a cluster using 'istanbul' branch of OOM.

Firstly, the common steps for creating control loops for both apex policy and script versions of the usecase are described. This is followed by the steps that are unique for setting up and testing each version individually.

Create topic in DmaaP MR

In order to create the fault notification topic in DMaaP Message Router, the first step is to find out its NodePort and NodeIP. The NodeIP is the IP address of any k8s node in the cluster where ONAP has been installed, and it can be found using the command "kubectl get nodes -o wide". The NodePort can be found using the command "kubectl -n onap get svc | grep message-router-external". Next, the topic defined for this usecase can be created using:

```
curl -k -X POST -H "Content-Type: application/json" -d "{"topicName": "unauthenticated.SEC_FAULT_OUTPUT"}"
https://<NodeIP>:<NodePort-message-router>/events/unauthenticated.SEC_FAULT_OUTPUT
```

Run Policy GUI

The easiest way to create the control loops is via Policy GUI component of the clamp. The below steps describe how to start this GUI.

NOTE: At the time of writing this page (15 Dec 2021), there is a bug in the helm chart of policy/clamp in 'istanbul' branch of OOM. The bug should be fixed by the policy/clamp team. Until then, the following steps should be done to fix this problem. Run the command:

```
kubectl -n onap edit cm def-policy-clamp-be-configmap
```

(whereas "def" refers to the name of deployment and should be replaced with the name used when installing ONAP. The same should be done for all instructions given on this page that use "def" as deployment name)

and change http to https in clamp.config.controlloop.runtime.url under application.properties. Then, run this command:

```
kubectl rollout restart deployment def-policy-clamp-be
```

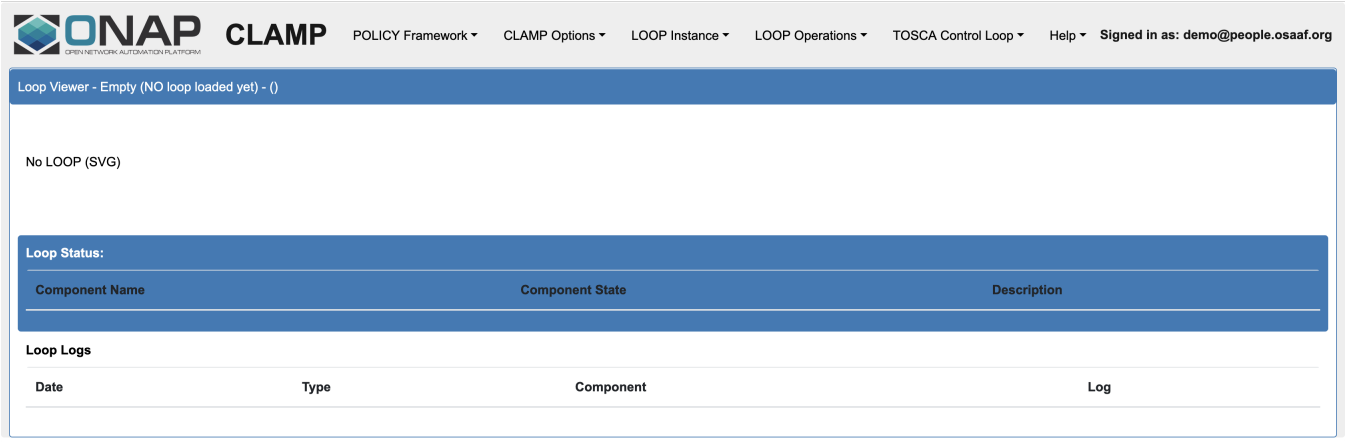
Next step is to find out the NodePort of policy-gui. This can be done by using the command "kubectl -n onap get svc | grep policy-gui".

Then, open a web browser and navigate to the url:

https://<NodeIP>:<NodePort-policy-gui>/clamp/

Use below credentials for the GUI:

username: demo@people.osaaf.org. password: demo123456!

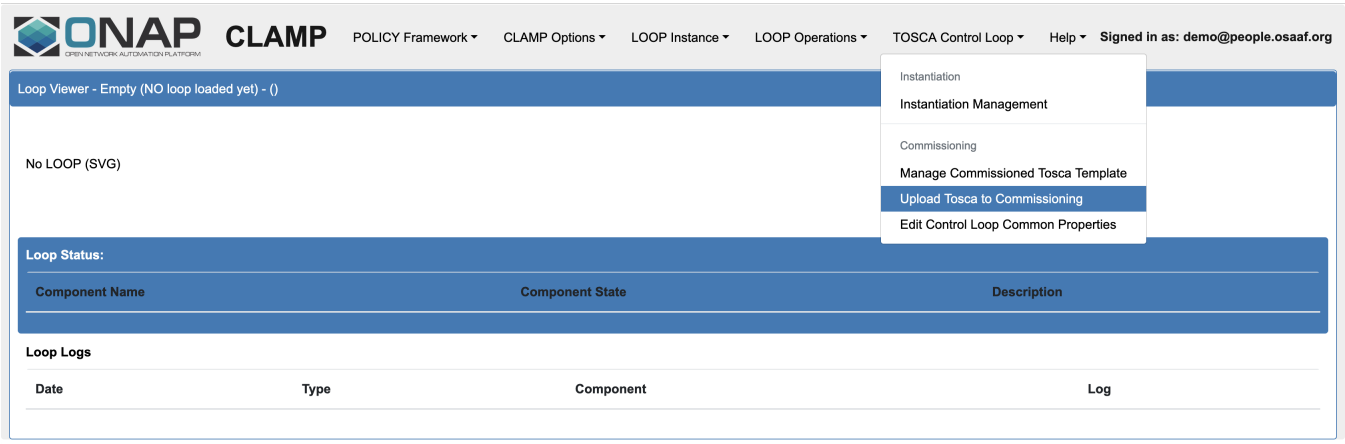


Start-up screen of the Policy GUI

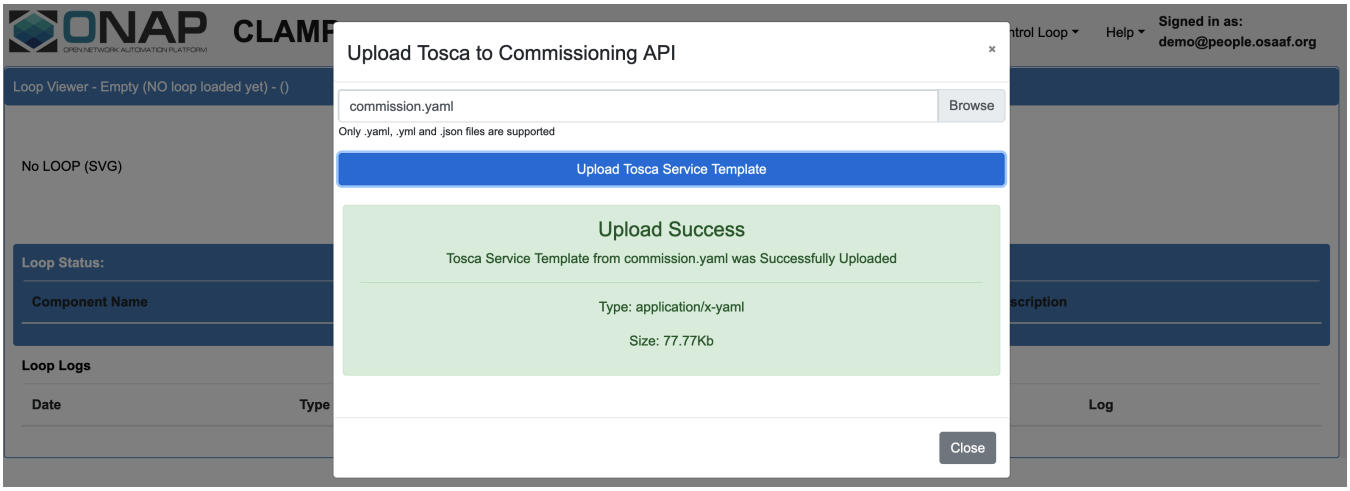
Commission/Instantiate control loop via GUI

This sub-section shows how to commission and instantiate the control loops via policy-gui. The individual tosca templates for each of the apex policy and script versions are provided later in the relevant sub-sections. The screenshots shown in this sub-section are general steps that are applicable for both versions.

Go to **Tosca Control Loop** pane, and select **Upload Tosca to Commissioning** in order to upload the tosca template (provided later in the relevant sub-section).

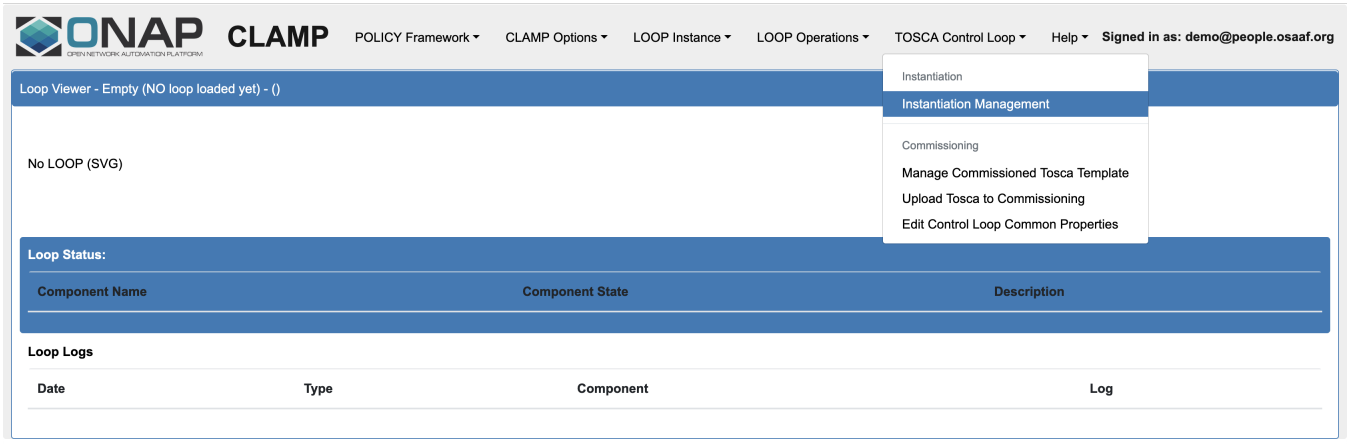


Upload tosca template for commissioning

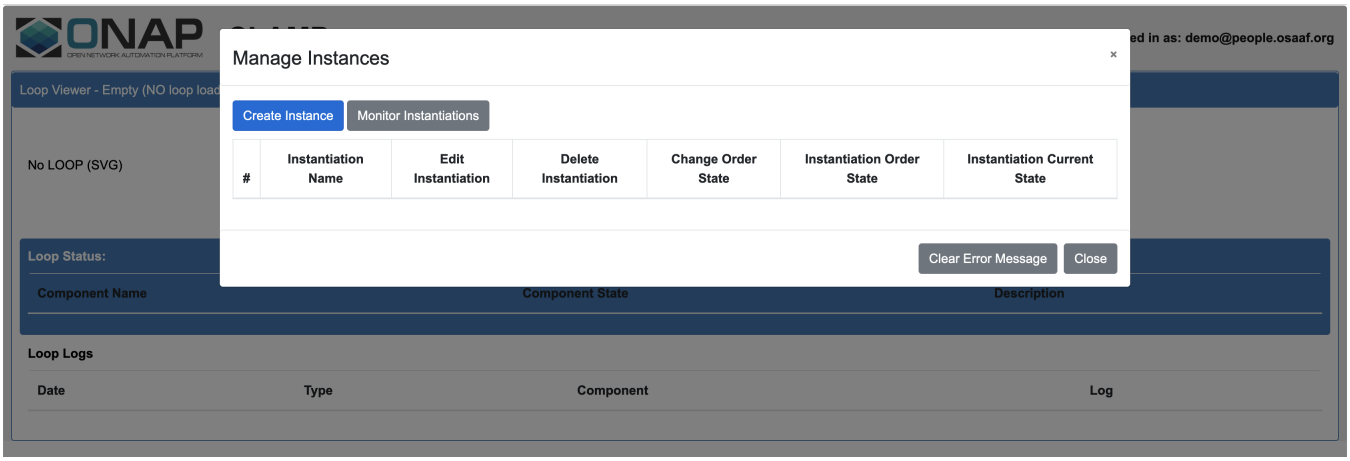


Tosca template uploaded successfully

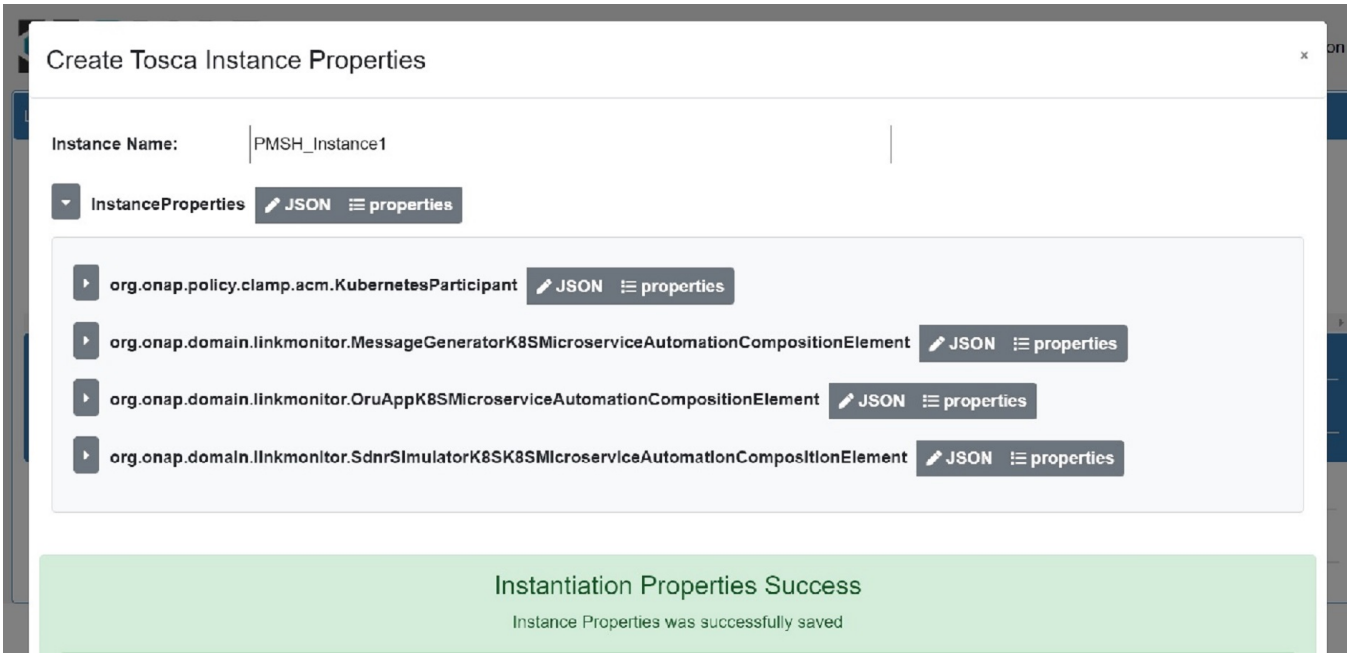
After commissioning the tosca template, the next step is to instantiate the control loop. Go to **Tosca Control Loop** pane, and select **Instantiation Management** and then press the **Create Instance** button. If no changes need to be made in the instance properties, press the **Save** button and it should show a message depicting that the instantiation operation was successful.



Instantiate the control loop

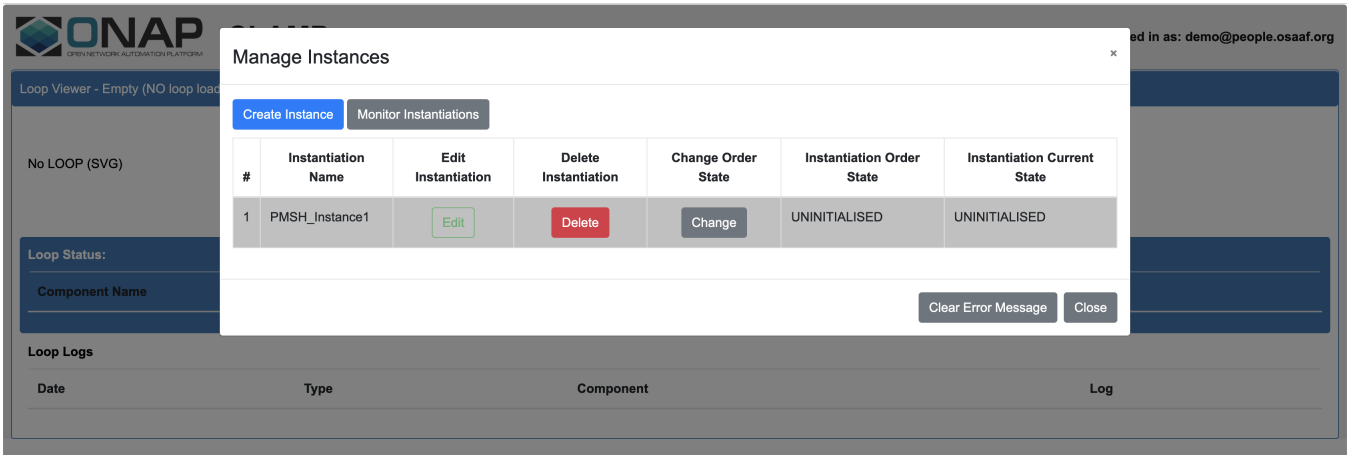


Create Instance dialog



Instantiation properties saved successfully

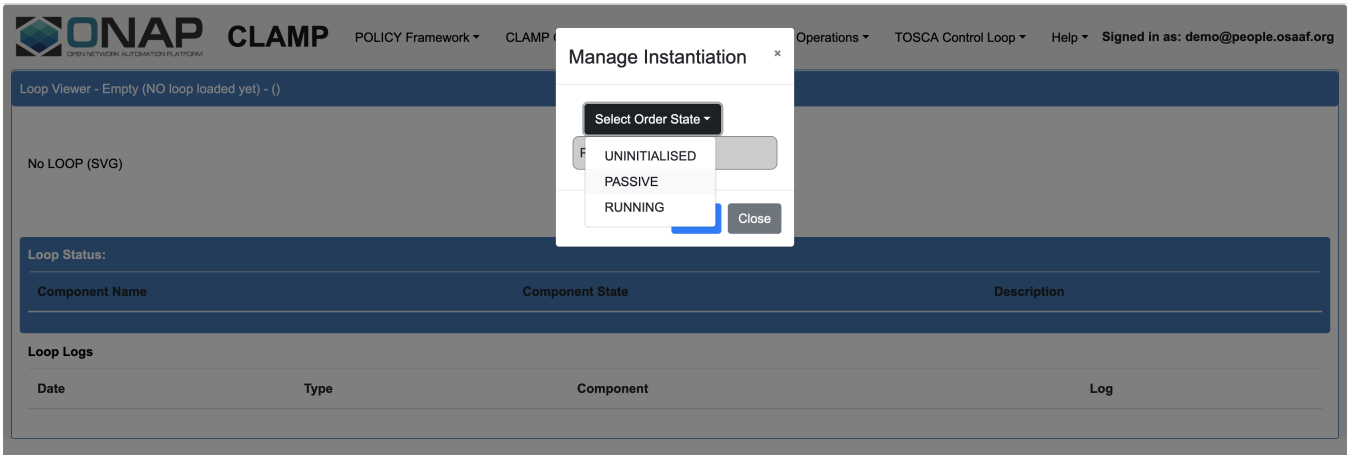
Go back again to **Instantiation Management** under **Tosca Control Loop** pane, and the newly created control loop instance in UNINITIALISED state will pop up. If nothing shows up, refresh the web browser and try again.



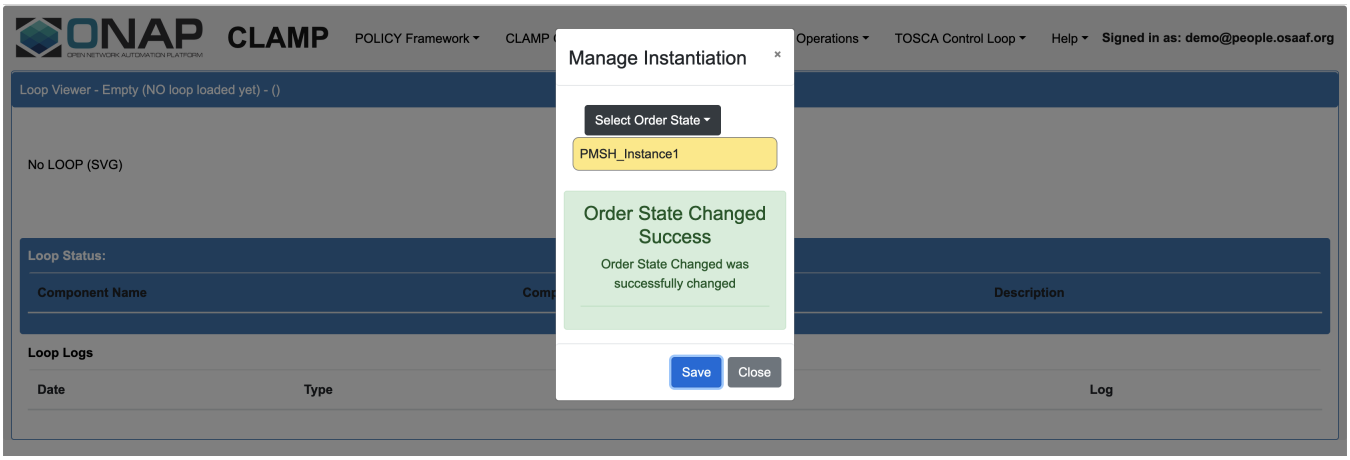
Newly created control loop instance in UNINITIALISED state

NOTE: There is a bug in the istanbul version of policy/clamp that each control loop instance is named as **PMSH_Instance1**. This should be fixed by the clamp team, however it can be ignored if the instance name is not important for the user.

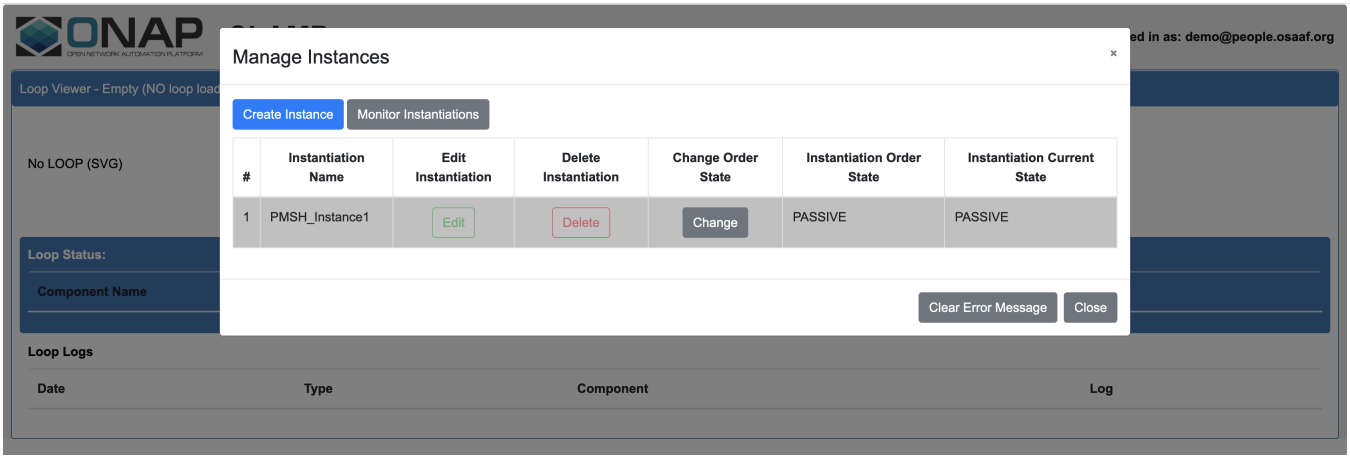
Press the **Change** button under **Change Order State**. Then, press the **Select Order State** drop-down menu, and select PASSIVE. Finally, press the **Save** button to change the control loop to PASSIVE state.



Changing the control loop to PASSIVE state



State changed successfully

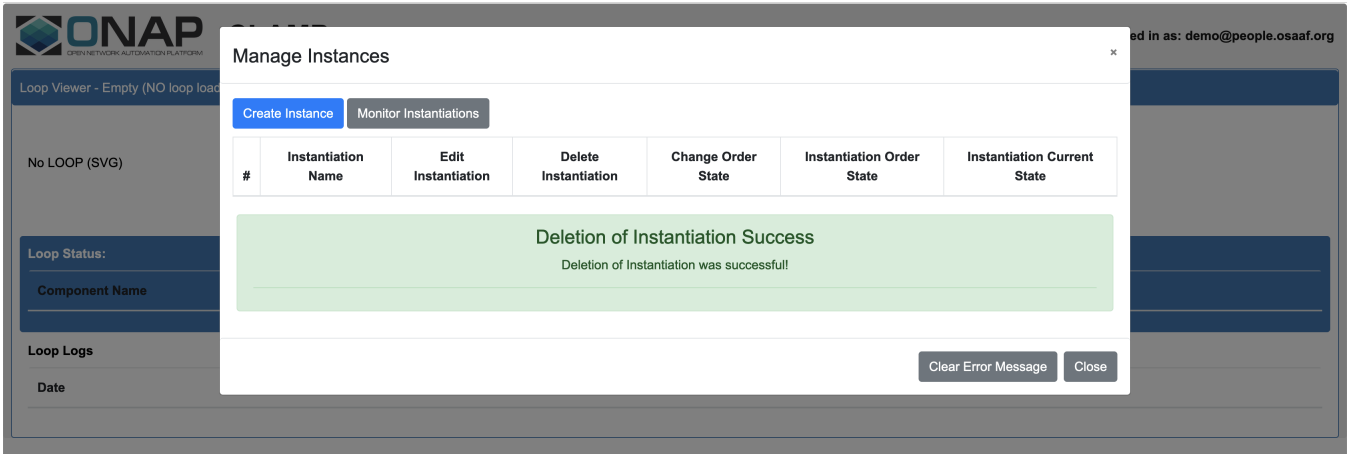


Control loop changed to PASSIVE state

Once the control loop gets into the PASSIVE state, the corresponding version of the usecase should be up and running.

NOTE: There is a limitation in the Jakarta version of policy/clamp that only one tosca template can be commissioned at a time. So, always delete the currently commissioned template before trying a new one.

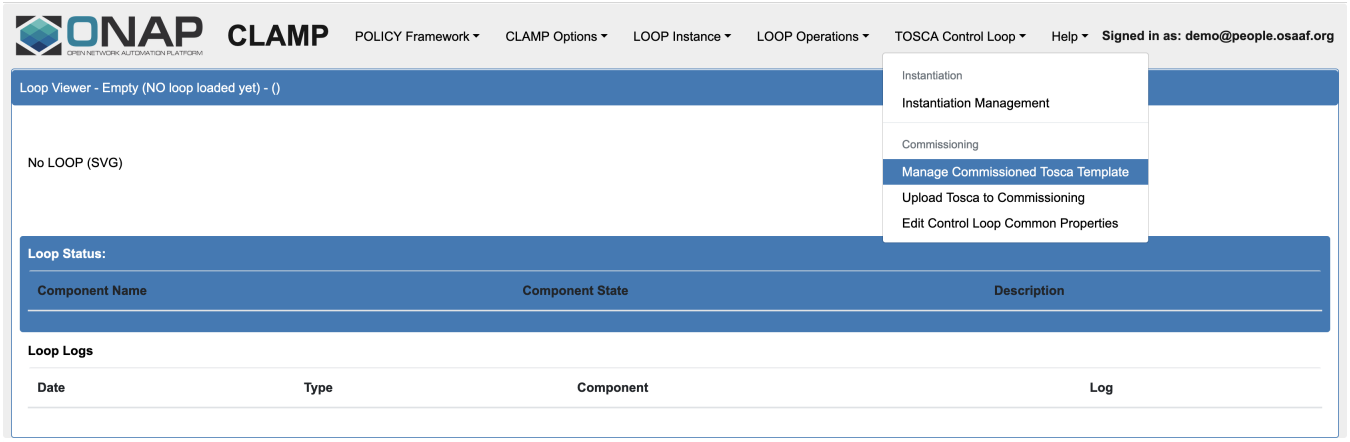
In order to delete the control loop instance, it should be first changed back to PASSIVE state and then to UNINITIALISED state. Once the instance shows UNINITIALISED under **Instantiation Current State**, press the **Delete** button under **Delete Instantiation**.



Control loop instance deleted

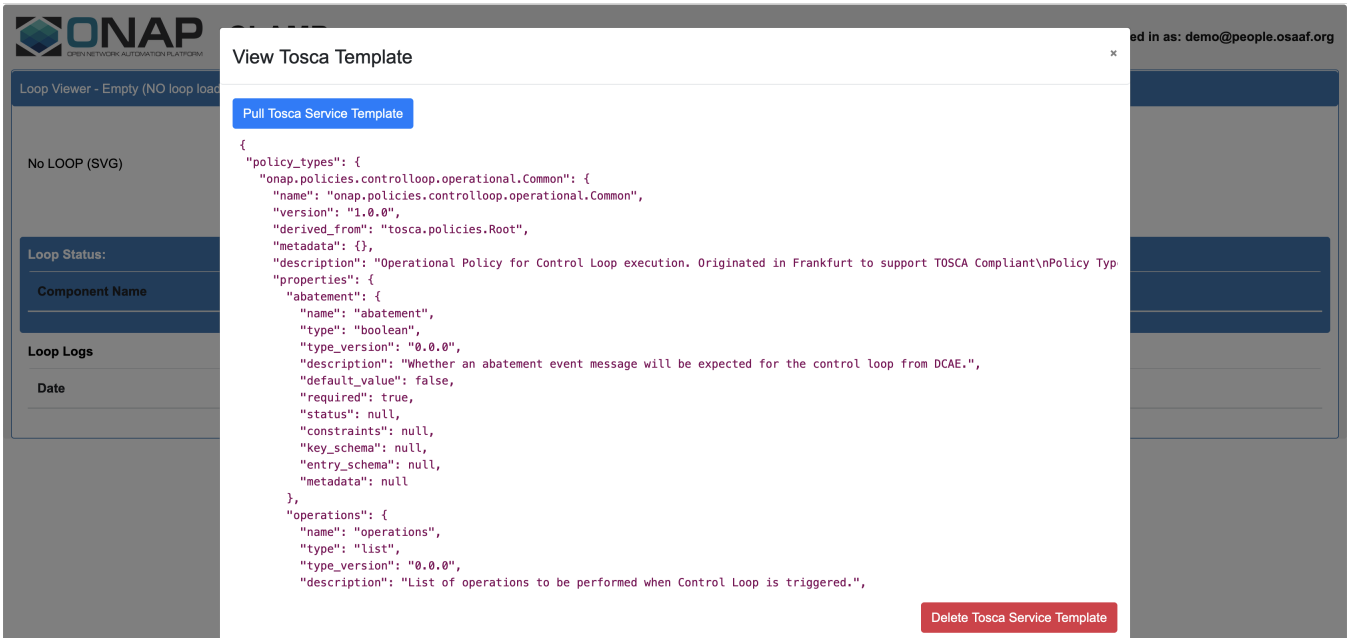
After deleting the control loop instance, the tosca template can be decommissioned as follows.

Go to **Tosca Control Loop** pane, and select **Manage Commissioned Tosca Template**.



Manage commissioned tosca template

Press the button **Pull Tosca Service Template** and it should show the commissioned tosca template. Once the template shows up, press the **Delete Tosca Service Template** button. This will be followed by a "Delete Successful" message.



Deleting the commissioned tosca template

Tosca template deleted successfully

a) Control loop for apex policy version

This sub-section describes the steps required for bringing up the control loop with apex policy version of the usecase. The tosca template to be used for commissioning this control loop is given below. The steps for commissioning are depicted in the previous sub-section.

commission.yaml

```
 tosca_definitions_version: tosca_simple_yaml_1_3
data_types:
  onap.datatypes.ToscaConceptIdentifier:
    derived_from: tosca.datatypes.Root
```

```
  properties:
    name:
      type: string
      required: true
    version:
      type: string
      required: true
onap.datatype.controlloop.Target:
  derived_from: tosca.datatypes.Root
  description: Definition for a entity in A&AI to perform a control loop operation
    on
  properties:
    targetType:
      type: string
      description: Category for the target type
      required: true
      constraints:
      - valid_values:
        - VNF
        - VM
        - VFMODULE
        - PNF
    entityIds:
      type: map
      description: |
        Map of values that identify the resource. If none are provided, it is assumed that the
        entity that generated the ONSET event will be the target.
      required: false
      metadata:
        clamp_possible_values: ClampExecution:CSAR_RESOURCES
      entry_schema:
        type: string
onap.datatype.controlloop.Actor:
  derived_from: tosca.datatypes.Root
  description: An actor/operation/target definition
  properties:
    actor:
      type: string
      description: The actor performing the operation.
      required: true
      metadata:
        clamp_possible_values: Dictionary:DefaultActors,ClampExecution:CDS/actor
    operation:
      type: string
      description: The operation the actor is performing.
      metadata:
        clamp_possible_values: Dictionary:DefaultOperations,ClampExecution:CDS/operation
      required: true
    target:
      type: onap.datatype.controlloop.Target
      description: The resource the operation should be performed on.
      required: true
    payload:
      type: map
      description: Name/value pairs of payload information passed by Policy to the
        actor
      required: false
      metadata:
        clamp_possible_values: ClampExecution:CDS/payload
      entry_schema:
        type: string
onap.datatype.controlloop.Operation:
  derived_from: tosca.datatypes.Root
  description: An operation supported by an actor
  properties:
    id:
      type: string
      description: Unique identifier for the operation
      required: true
    description:
      type: string
```

```
        description: A user-friendly description of the intent for the operation
        required: false
      operation:
        type: onap.datatype.controlloop.Actor
        description: The definition of the operation to be performed.
        required: true
      timeout:
        type: integer
        description: The amount of time for the actor to perform the operation.
        required: true
      retries:
        type: integer
        description: The number of retries the actor should attempt to perform the
          operation.
        required: true
        default: 0
      success:
        type: string
        description: Points to the operation to invoke on success. A value of "final_success"
          indicates and end to the operation.
        required: false
        default: final_success
      failure:
        type: string
        description: Points to the operation to invoke on Actor operation failure.
        required: false
        default: final_failure
      failure_timeout:
        type: string
        description: Points to the operation to invoke when the time out for the operation
          occurs.
        required: false
        default: final_failure_timeout
      failure_retries:
        type: string
        description: Points to the operation to invoke when the current operation
          has exceeded its max retries.
        required: false
        default: final_failure_retries
      failure_exception:
        type: string
        description: Points to the operation to invoke when the current operation
          causes an exception.
        required: false
        default: final_failure_exception
      failure_guard:
        type: string
        description: Points to the operation to invoke when the current operation
          is blocked due to guard policy enforcement.
        required: false
        default: final_failure_guard
policy_types:
  onap.policies.controlloop.operational.Common:
    derived_from: tosca.policies.Root
    version: 1.0.0
    name: onap.policies.controlloop.operational.Common
    description: |
      Operational Policy for Control Loop execution. Originated in Frankfurt to support TOSCA Compliant
      Policy Types. This does NOT support the legacy Policy YAML policy type.
    properties:
      id:
        type: string
        description: The unique control loop id.
        required: true
      timeout:
        type: integer
        description: |
          Overall timeout for executing all the operations. This timeout should equal or exceed the total
          timeout for each operation listed.
        required: true
      abatement:
```

```
        type: boolean
        description: Whether an abatement event message will be expected for the control
          loop from DCAE.
        required: true
        default: false
      trigger:
        type: string
        description: Initial operation to execute upon receiving an Onset event message
          for the Control Loop.
        required: true
      operations:
        type: list
        description: List of operations to be performed when Control Loop is triggered.
        required: true
        entry_schema:
          type: onap.datatype.controlloop.Operation
  onap.policies.controlloop.operational.common.Apex:
    derived_from: onap.policies.controlloop.operational.Common
    type_version: 1.0.0
    version: 1.0.0
    name: onap.policies.controlloop.operational.common.Apex
    description: Operational policies for Apex PDP
    properties:
      engineServiceParameters:
        type: string
        description: The engine parameters like name, instanceCount, policy implementation,
          parameters etc.
        required: true
      eventInputParameters:
        type: string
        description: The event input parameters.
        required: true
      eventOutputParameters:
        type: string
        description: The event output parameters.
        required: true
      javaProperties:
        type: string
        description: Name/value pairs of properties to be set for APEX if needed.
        required: false

node_types:
  org.onap.policy.clamp.acm.Participant:
    version: 1.0.1
    derived_from: tosca.nodetypes.Root
    properties:
      provider:
        type: string
        requred: false
  org.onap.policy.clamp.acm.AutomationCompositionElement:
    version: 1.0.1
    derived_from: tosca.nodetypes.Root
    properties:
      provider:
        type: string
        required: false
        metadata:
          common: true
        description: Specifies the organization that provides the automation composition element
      participant_id:
        type: onap.datatypes.ToscaConceptIdentifier
        requred: true
        metadata:
          common: true
      participantType:
        type: onap.datatypes.ToscaConceptIdentifier
        required: true
        metadata:
          common: true
        description: The identity of the participant type that hosts this type of Automation Composition Element
      startPhase:
```

```
        type: integer
        required: false
        constraints:
          - greater_or_equal: 0
        metadata:
          common: true
        description: A value indicating the start phase in which this automation composition element will be
started, the
          first start phase is zero. Automation Composition Elements are started in their start_phase order and
stopped
          in reverse start phase order. Automation Composition Elements with the same start phase are started
and
          stopped simultaneously
      uninitializedToPassiveTimeout:
        type: integer
        required: false
        constraints:
          - greater_or_equal: 0
        default: 60
        metadata:
          common: true
        description: The maximum time in seconds to wait for a state chage from uninitialized to passive
      passiveToRunningTimeout:
        type: integer
        required: false
        constraints:
          - greater_or_equal: 0
        default: 60
        metadata:
          common: true
        description: The maximum time in seconds to wait for a state chage from passive to running
      runningToPassiveTimeout:
        type: integer
        required: false
        constraints:
          - greater_or_equal: 0
        default: 60
        metadata:
          common: true
        description: The maximum time in seconds to wait for a state chage from running to passive
      passiveToUninitializedTimeout:
        type: integer
        required: false
        constraints:
          - greater_or_equal: 0
        default: 60
        metadata:
          common: true
        description: The maximum time in seconds to wait for a state chage from passive to uninitialized
  org.onap.policy.clamp.acm.AutomationComposition:
    version: 1.0.1
    derived_from: tosca.nodetypes.Root
    properties:
      provider:
        type: string
        required: false
        metadata:
          common: true
        description: Specifies the organization that provides the automation composition element
      elements:
        type: list
        required: true
        metadata:
          common: true
        entry_schema:
          type: onap.datatypes.ToscaConceptIdentifier
        description: Specifies a list of automation composition element definitions that make up this
automation composition definition
  org.onap.policy.clamp.acm.PolicyAutomationCompositionElement:
    version: 1.0.1
    derived_from: org.onap.policy.clamp.acm.AutomationCompositionElement
```

```
    properties:
      policy_type_id:
        type: onap.datatypes.ToscaConceptIdentifier
        requred: true
      policy_id:
        type: onap.datatypes.ToscaConceptIdentifier
        requred: false
topology_template:
  inputs:
    pmsh_operational_policy:
      type: onap.datatypes.ToscaConceptIdentifier
      description: The ID of the PMSH operational policy to use
      default:
        name: operational.apex.linkmonitor
        version: 1.0.0
  node_templates:
    org.onap.policy.clamp.acm.PolicyParticipant:
      version: 2.3.1
      type: org.onap.policy.clamp.acm.Participant
      type_version: 1.0.1
      description: Participant for DCAE microservices
      properties:
        provider: ONAP
    org.onap.domain.pmsh.PMSH_OperationalPolicyAutomationCompositionElement:
      version: 1.2.3
      type: org.onap.policy.clamp.acm.PolicyAutomationCompositionElement
      type_version: 1.0.1
      description: Automation composition element for the operational policy for Performance Management
Subscription Handling
      properties:
        provider: Ericsson
        participant_id:
          name: org.onap.PM_Policy
          version: 1.0.0
        participantType:
          name: org.onap.policy.clamp.acm.PolicyParticipant
          version: 2.3.1
        policy_type_id:
          name: onap.policies.operational.pm-subscription-handler
          version: 1.0.0
        policy_id:
          get_input: pmsh_operational_policy
    org.onap.domain.sample.GenericK8s_AutomationCompositionDefinition:
      version: 1.2.3
      type: org.onap.policy.clamp.acm.AutomationComposition
      type_version: 1.0.1
      description: Automation composition for Hello World
      properties:
        provider: Ericsson
        elements:
          - name: org.onap.domain.pmsh.PMSH_OperationalPolicyAutomationCompositionElement
            version: 1.2.3
  policies:
    - operational.apex.linkmonitor:
        type: onap.policies.controlloop.operational.common.Apex
        type_version: 1.0.0
        version: 1.0.0
        properties:
          engineServiceParameters:
            name: LinkMonitorApexEngine
            version: 0.0.1
            id: 101
            instanceCount: 1
            deploymentPort: 12345
            engineParameters:
              executorParameters:
                JAVASCRIPT:
                  parameterClassName: org.onap.policy.apex.plugins.executor.javascript.
JavascriptExecutorParameters
              contextParameters:
                parameterClassName: org.onap.policy.apex.context.parameters.ContextParameters
```

```
                schemaParameters:
                  Avro:
                    parameterClassName: org.onap.policy.apex.plugins.context.schema.avro.
AvroSchemaHelperParameters
              taskParameters:
              - key: ORU-ODU-Map
                value: |-
                  {
                     "ERICSSON-O-RU-11220": "O-DU-1122",
                     "ERICSSON-O-RU-11221": "O-DU-1122",
                     "ERICSSON-O-RU-11222": "O-DU-1122",
                     "ERICSSON-O-RU-11223": "O-DU-1122",
                     "ERICSSON-O-RU-11224": "O-DU-1123",
                     "ERICSSON-O-RU-11225": "O-DU-1123",
                     "ERICSSON-O-RU-11226": "O-DU-1123",
                     "ERICSSON-O-RU-11227": "O-DU-1124",
                     "ERICSSON-O-RU-11228": "O-DU-1125",
                     "ERICSSON-O-RU-11229": "O-DU-1125"
                  }
            policy_type_impl:
              apexPolicyModel:
                key:
                  name: LinkMonitorModel
                  version: 0.0.1
                keyInformation:
                  key:
                    name: LinkMonitorModel_KeyInfo
                    version: 0.0.1
                  keyInfoMap:
                    entry:
                    - key:
                        name: ApexMessageOutputEvent
                        version: 0.0.1
                      value:
                        key:
                          name: ApexMessageOutputEvent
                          version: 0.0.1
                        UUID: cca47d74-7754-4a61-b163-ca31f66b157b
                        description: Generated description for concept referred to by
                          key "ApexMessageOutputEvent:0.0.1"
                    - key:
                        name: CreateLinkClearedOutfieldsEvent
                        version: 0.0.1
                      value:
                        key:
                          name: CreateLinkClearedOutfieldsEvent
                          version: 0.0.1
                        UUID: a295d6a3-1b73-387e-abba-b41e9b608802
                        description: Generated description for concept referred to by
                          key "CreateLinkClearedOutfieldsEvent:0.0.1"
                    - key:
                        name: CreateLinkClearedOutfieldsTask
                        version: 0.0.1
                      value:
                        key:
                          name: CreateLinkClearedOutfieldsTask
                          version: 0.0.1
                        UUID: fd594e88-411d-4a94-b2be-697b3a0d7adf
                        description: This task creates the output fields when link failure
                          is cleared.
                    - key:
                        name: CreateLinkFailureOutfieldsEvent
                        version: 0.0.1
                      value:
                        key:
                          name: CreateLinkFailureOutfieldsEvent
                          version: 0.0.1
                        UUID: 02be2b5d-45b7-3c54-ae54-97f2b5c30125
                        description: Generated description for concept referred to by
                          key "CreateLinkFailureOutfieldsEvent:0.0.1"
                    - key:
```

```
    name: CreateLinkFailureOutfieldsTask
    version: 0.0.1
  value:
    key:
      name: CreateLinkFailureOutfieldsTask
      version: 0.0.1
    UUID: ac3d9842-80af-4a98-951c-bd79a431c613
    description: This task the output fields when link failure is
      detected.
- key:
    name: LinkClearedTask
    version: 0.0.1
  value:
    key:
      name: LinkClearedTask
      version: 0.0.1
    UUID: eecfde90-896c-4343-8f9c-2603ced94e2d
    description: This task sends a message to the output when link
      failure is cleared.
- key:
    name: LinkFailureInputEvent
    version: 0.0.1
  value:
    key:
      name: LinkFailureInputEvent
      version: 0.0.1
    UUID: c4500941-3f98-4080-a9cc-5b9753ed050b
    description: Generated description for concept referred to by
      key "LinkFailureInputEvent:0.0.1"
- key:
    name: LinkFailureInputSchema
    version: 0.0.1
  value:
    key:
      name: LinkFailureInputSchema
      version: 0.0.1
    UUID: 3b3974fc-3012-3b02-9f33-c9d8eefe4dc1
    description: Generated description for concept referred to by
      key "LinkFailureInputSchema:0.0.1"
- key:
    name: LinkFailureOutputEvent
    version: 0.0.1
  value:
    key:
      name: LinkFailureOutputEvent
      version: 0.0.1
    UUID: 4f04aa98-e917-4f4a-882a-c75ba5a99374
    description: Generated description for concept referred to by
      key "LinkFailureOutputEvent:0.0.1"
- key:
    name: LinkFailureOutputSchema
    version: 0.0.1
  value:
    key:
      name: LinkFailureOutputSchema
      version: 0.0.1
    UUID: 2d1a7f6e-eb9a-3984-be1f-283d98111b84
    description: Generated description for concept referred to by
      key "LinkFailureOutputSchema:0.0.1"
- key:
    name: LinkFailureTask
    version: 0.0.1
  value:
    key:
      name: LinkFailureTask
      version: 0.0.1
    UUID: 3351b0f4-cf06-4fa2-8823-edf67bd30223
    description: This task updates the config for O-RU when link
      failure is detected.
- key:
    name: LinkMonitorModel
```

```
    version: 0.0.1
  value:
    key:
      name: LinkMonitorModel
      version: 0.0.1
    UUID: 540226fb-55ee-4f0e-a444-983a0494818e
    description: This is the Apex Policy Model for link monitoring.
- key:
    name: LinkMonitorModel_Events
    version: 0.0.1
  value:
    key:
      name: LinkMonitorModel_Events
      version: 0.0.1
    UUID: 27ad3e7e-fe3b-3bd6-9081-718705c2bcea
    description: Generated description for concept referred to by
      key "LinkMonitorModel_Events:0.0.1"
- key:
    name: LinkMonitorModel_KeyInfo
    version: 0.0.1
  value:
    key:
      name: LinkMonitorModel_KeyInfo
      version: 0.0.1
    UUID: ea0b5f58-eefd-358a-9660-840c640bf981
    description: Generated description for concept referred to by
      key "LinkMonitorModel_KeyInfo:0.0.1"
- key:
    name: LinkMonitorModel_Policies
    version: 0.0.1
  value:
    key:
      name: LinkMonitorModel_Policies
      version: 0.0.1
    UUID: ee9e0b0f-2b7d-3ab7-9a98-c5ec05ed823d
    description: Generated description for concept referred to by
      key "LinkMonitorModel_Policies:0.0.1"
- key:
    name: LinkMonitorModel_Schemas
    version: 0.0.1
  value:
    key:
      name: LinkMonitorModel_Schemas
      version: 0.0.1
    UUID: fa5f9b8f-796c-3c70-84e9-5140c958c4bb
    description: Generated description for concept referred to by
      key "LinkMonitorModel_Schemas:0.0.1"
- key:
    name: LinkMonitorModel_Tasks
    version: 0.0.1
  value:
    key:
      name: LinkMonitorModel_Tasks
      version: 0.0.1
    UUID: eec592f7-69d5-39a9-981a-e552f787ed01
    description: Generated description for concept referred to by
      key "LinkMonitorModel_Tasks:0.0.1"
- key:
    name: LinkMonitorPolicy
    version: 0.0.1
  value:
    key:
      name: LinkMonitorPolicy
      version: 0.0.1
    UUID: 6c5e410f-489a-46ff-964e-982ce6e8b6d0
    description: Generated description for concept referred to by
      key "LinkMonitorPolicy:0.0.1"
- key:
    name: MessageSchema
    version: 0.0.1
  value:
```

```
        key:
          name: MessageSchema
          version: 0.0.1
        UUID: ac4b34ac-39d6-3393-a267-8d5b84854018
        description: A schema for messages from apex
    - key:
        name: NoPolicyDefinedTask
        version: 0.0.1
      value:
        key:
          name: NoPolicyDefinedTask
          version: 0.0.1
        UUID: d48b619e-d00d-4008-b884-02d76ea4350b
        description: This task sends a message to the output when an
          event is received for which no policy has been defined.
    - key:
        name: OduIdSchema
        version: 0.0.1
      value:
        key:
          name: OduIdSchema
          version: 0.0.1
        UUID: 50662174-a88b-3cbd-91bd-8e91b40b2660
        description: A schema for O-DU-ID
    - key:
        name: OruIdSchema
        version: 0.0.1
      value:
        key:
          name: OruIdSchema
          version: 0.0.1
        UUID: 54daf32b-015f-39cd-8530-a1175c5553e9
        description: A schema for O-RU-ID
policies:
  key:
    name: LinkMonitorModel_Policies
    version: 0.0.1
  policyMap:
    entry:
      - key:
          name: LinkMonitorPolicy
          version: 0.0.1
        value:
          policyKey:
            name: LinkMonitorPolicy
            version: 0.0.1
          template: Freestyle
          state:
            entry:
            - key: LinkClearedState
              value:
                stateKey:
                  parentKeyName: LinkMonitorPolicy
                  parentKeyVersion: 0.0.1
                  parentLocalName: 'NULL'
                  localName: LinkClearedState
                trigger:
                  name: CreateLinkClearedOutfieldsEvent
                  version: 0.0.1
                stateOutputs:
                  entry:
                  - key: LinkClearedLogic_Output_Direct
                    value:
                      key:
                        parentKeyName: LinkMonitorPolicy
                        parentKeyVersion: 0.0.1
                        parentLocalName: LinkClearedState
                        localName: LinkClearedLogic_Output_Direct
                      outgoingEvent:
                        name: ApexMessageOutputEvent
                        version: 0.0.1
```

```
          nextState:
            parentKeyName: 'NULL'
            parentKeyVersion: 0.0.0
            parentLocalName: 'NULL'
            localName: 'NULL'
      contextAlbumReference: []
      taskSelectionLogic:
        key: 'NULL'
        logicFlavour: UNDEFINED
        logic: ''
      stateFinalizerLogicMap:
        entry: []
      defaultTask:
        name: LinkClearedTask
        version: 0.0.1
      taskReferences:
        entry:
        - key:
            name: LinkClearedTask
            version: 0.0.1
          value:
            key:
              parentKeyName: LinkMonitorPolicy
              parentKeyVersion: 0.0.1
              parentLocalName: LinkClearedState
              localName: LinkClearedTask
            outputType: DIRECT
            output:
              parentKeyName: LinkMonitorPolicy
              parentKeyVersion: 0.0.1
              parentLocalName: LinkClearedState
              localName: LinkClearedLogic_Output_Direct
  - key: LinkFailureOrClearedState
    value:
      stateKey:
        parentKeyName: LinkMonitorPolicy
        parentKeyVersion: 0.0.1
        parentLocalName: 'NULL'
        localName: LinkFailureOrClearedState
      trigger:
        name: LinkFailureInputEvent
        version: 0.0.1
      stateOutputs:
        entry:
        - key: CreateLinkClearedOutfieldsLogic_Output_Direct
          value:
            key:
              parentKeyName: LinkMonitorPolicy
              parentKeyVersion: 0.0.1
              parentLocalName: LinkFailureOrClearedState
              localName: CreateLinkClearedOutfieldsLogic_Output_Direct
            outgoingEvent:
              name: CreateLinkClearedOutfieldsEvent
              version: 0.0.1
            nextState:
              parentKeyName: LinkMonitorPolicy
              parentKeyVersion: 0.0.1
              parentLocalName: 'NULL'
              localName: LinkClearedState
        - key: CreateLinkFailureOutfieldsLogic_Output_Direct
          value:
            key:
              parentKeyName: LinkMonitorPolicy
              parentKeyVersion: 0.0.1
              parentLocalName: LinkFailureOrClearedState
              localName: CreateLinkFailureOutfieldsLogic_Output_Direct
            outgoingEvent:
              name: CreateLinkFailureOutfieldsEvent
              version: 0.0.1
            nextState:
              parentKeyName: LinkMonitorPolicy
```

```
                                    parentKeyVersion: 0.0.1
                                    parentLocalName: 'NULL'
                                    localName: LinkFailureState
                                - key: NoPolicyDefinedLogic_Output_Direct
                                  value:
                                    key:
                                      parentKeyName: LinkMonitorPolicy
                                      parentKeyVersion: 0.0.1
                                      parentLocalName: LinkFailureOrClearedState
                                      localName: NoPolicyDefinedLogic_Output_Direct
                                    outgoingEvent:
                                      name: ApexMessageOutputEvent
                                      version: 0.0.1
                                    nextState:
                                      parentKeyName: 'NULL'
                                      parentKeyVersion: 0.0.0
                                      parentLocalName: 'NULL'
                                      localName: 'NULL'
                              contextAlbumReference: []
                              taskSelectionLogic:
                                key: TaskSelectionLogic
                                logicFlavour: JAVASCRIPT
                                logic: |-
                                  /*
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                                   */

                                  executor.logger.info("Task Selection Execution: '"+executor.subject.id+
                                      "'. InputFields: '"+executor.inFields+"'");

                                  var linkFailureInput = executor.inFields.get("LinkFailureInput");
                                  var commonEventHeader = linkFailureInput.get("event").get
("commonEventHeader");
                                  var domain = commonEventHeader.get("domain");

                                  taskFailure = executor.subject.getTaskKey("CreateLinkFailureOutfieldsTask");
                                  taskCleared = executor.subject.getTaskKey("CreateLinkClearedOutfieldsTask");
                                  taskDefault = executor.subject.getDefaultTaskKey();

                                  if (domain == "fault") {
                                      var faultFields = linkFailureInput.get("event").get("faultFields");
                                      var alarmCondition = faultFields.get("alarmCondition");
                                      var eventSeverity = faultFields.get("eventSeverity");
                                      if (alarmCondition == "28" && eventSeverity != "NORMAL") {
                                          taskFailure.copyTo(executor.selectedTask);
                                      } else if (alarmCondition == "28" && eventSeverity == "NORMAL") {
                                          taskCleared.copyTo(executor.selectedTask);
                                      } else {
                                          taskDefault.copyTo(executor.selectedTask);
                                      }
                                  } else {
                                      taskDefault.copyTo(executor.selectedTask);
```

```
        }

        true;
    stateFinalizerLogicMap:
      entry: []
    defaultTask:
      name: NoPolicyDefinedTask
      version: 0.0.1
    taskReferences:
      entry:
      - key:
          name: CreateLinkClearedOutfieldsTask
          version: 0.0.1
        value:
          key:
            parentKeyName: LinkMonitorPolicy
            parentKeyVersion: 0.0.1
            parentLocalName: LinkFailureOrClearedState
            localName: CreateLinkClearedOutfieldsTask
          outputType: DIRECT
          output:
            parentKeyName: LinkMonitorPolicy
            parentKeyVersion: 0.0.1
            parentLocalName: LinkFailureOrClearedState
            localName: CreateLinkClearedOutfieldsLogic_Output_Direct
      - key:
          name: CreateLinkFailureOutfieldsTask
          version: 0.0.1
        value:
          key:
            parentKeyName: LinkMonitorPolicy
            parentKeyVersion: 0.0.1
            parentLocalName: LinkFailureOrClearedState
            localName: CreateLinkFailureOutfieldsTask
          outputType: DIRECT
          output:
            parentKeyName: LinkMonitorPolicy
            parentKeyVersion: 0.0.1
            parentLocalName: LinkFailureOrClearedState
            localName: CreateLinkFailureOutfieldsLogic_Output_Direct
      - key:
          name: NoPolicyDefinedTask
          version: 0.0.1
        value:
          key:
            parentKeyName: LinkMonitorPolicy
            parentKeyVersion: 0.0.1
            parentLocalName: LinkFailureOrClearedState
            localName: NoPolicyDefinedTask
          outputType: DIRECT
          output:
            parentKeyName: LinkMonitorPolicy
            parentKeyVersion: 0.0.1
            parentLocalName: LinkFailureOrClearedState
            localName: NoPolicyDefinedLogic_Output_Direct
- key: LinkFailureState
  value:
    stateKey:
      parentKeyName: LinkMonitorPolicy
      parentKeyVersion: 0.0.1
      parentLocalName: 'NULL'
      localName: LinkFailureState
    trigger:
      name: CreateLinkFailureOutfieldsEvent
      version: 0.0.1
    stateOutputs:
      entry:
      - key: LinkFailureLogic_Output_Direct
        value:
          key:
            parentKeyName: LinkMonitorPolicy
```

```
                        parentKeyVersion: 0.0.1
                        parentLocalName: LinkFailureState
                        localName: LinkFailureLogic_Output_Direct
                      outgoingEvent:
                        name: LinkFailureOutputEvent
                        version: 0.0.1
                      nextState:
                        parentKeyName: 'NULL'
                        parentKeyVersion: 0.0.0
                        parentLocalName: 'NULL'
                        localName: 'NULL'
                  contextAlbumReference: []
                  taskSelectionLogic:
                    key: 'NULL'
                    logicFlavour: UNDEFINED
                    logic: ''
                  stateFinalizerLogicMap:
                    entry: []
                  defaultTask:
                    name: LinkFailureTask
                    version: 0.0.1
                  taskReferences:
                    entry:
                    - key:
                        name: LinkFailureTask
                        version: 0.0.1
                      value:
                        key:
                          parentKeyName: LinkMonitorPolicy
                          parentKeyVersion: 0.0.1
                          parentLocalName: LinkFailureState
                          localName: LinkFailureTask
                        outputType: DIRECT
                        output:
                          parentKeyName: LinkMonitorPolicy
                          parentKeyVersion: 0.0.1
                          parentLocalName: LinkFailureState
                          localName: LinkFailureLogic_Output_Direct
            firstState: LinkFailureOrClearedState
tasks:
  key:
    name: LinkMonitorModel_Tasks
    version: 0.0.1
  taskMap:
    entry:
    - key:
        name: CreateLinkClearedOutfieldsTask
        version: 0.0.1
      value:
        key:
          name: CreateLinkClearedOutfieldsTask
          version: 0.0.1
        inputFields:
          entry:
          - key: LinkFailureInput
            value:
              key: LinkFailureInput
              fieldSchemaKey:
                name: LinkFailureInputSchema
                version: 0.0.1
              optional: false
        outputFields:
          entry:
          - key: OruId
            value:
              key: OruId
              fieldSchemaKey:
                name: OruIdSchema
                version: 0.0.1
              optional: false
        taskParameters:
```

```
                        entry: []
                      contextAlbumReference: []
                      taskLogic:
                        key: TaskLogic
                        logicFlavour: JAVASCRIPT
                        logic: |-
                          /*
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                           */

                          executor.logger.info("Task Execution: '"+executor.subject.id+"'. Input Fields:
'"+executor.inFields+"'");

                          var linkFailureInput = executor.inFields.get("LinkFailureInput");
                          var oruId = linkFailureInput.get("event").get("commonEventHeader").get
("sourceName");

                          executor.outFields.put("OruId", oruId);

                          executor.logger.info(executor.outFields);

                          true;
                  - key:
                      name: CreateLinkFailureOutfieldsTask
                      version: 0.0.1
                    value:
                      key:
                        name: CreateLinkFailureOutfieldsTask
                        version: 0.0.1
                      inputFields:
                        entry:
                        - key: LinkFailureInput
                          value:
                            key: LinkFailureInput
                            fieldSchemaKey:
                              name: LinkFailureInputSchema
                              version: 0.0.1
                            optional: false
                      outputFields:
                        entry:
                        - key: OduId
                          value:
                            key: OduId
                            fieldSchemaKey:
                              name: OduIdSchema
                              version: 0.0.1
                            optional: false
                        - key: OruId
                          value:
                            key: OruId
                            fieldSchemaKey:
                              name: OruIdSchema
                              version: 0.0.1
                            optional: false
                      taskParameters:
```

```
                    entry: []
                  contextAlbumReference: []
                  taskLogic:
                    key: TaskLogic
                    logicFlavour: JAVASCRIPT
                    logic: |-
                      /*
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                       */

                      executor.logger.info("Task Execution: '"+executor.subject.id+"'. Input Fields:
'"+executor.inFields+"'");

                      var returnValue = true;
                      var linkFailureInput = executor.inFields.get("LinkFailureInput");
                      var oruId = linkFailureInput.get("event").get("commonEventHeader").get
("sourceName");
                      var oruOduMap = JSON.parse(executor.parameters.get("ORU-ODU-Map"));

                      if (oruId in oruOduMap) {
                          var oduId = oruOduMap[oruId];
                          executor.outFields.put("OruId", oruId);
                          executor.outFields.put("OduId", oduId);
                          executor.logger.info(executor.outFields);
                      } else {
                          executor.message = "No O-RU found in the config with this ID: " + oruId;
                          returnValue = false;
                      }

                      returnValue;
                - key:
                    name: LinkClearedTask
                    version: 0.0.1
                  value:
                    key:
                      name: LinkClearedTask
                      version: 0.0.1
                    inputFields:
                      entry:
                      - key: OruId
                        value:
                          key: OruId
                          fieldSchemaKey:
                            name: OruIdSchema
                            version: 0.0.1
                          optional: false
                    outputFields:
                      entry:
                      - key: message
                        value:
                          key: message
                          fieldSchemaKey:
                            name: MessageSchema
                            version: 0.0.1
                          optional: false
```

```
                    taskParameters:
                      entry: []
                    contextAlbumReference: []
                    taskLogic:
                      key: TaskLogic
                      logicFlavour: JAVASCRIPT
                      logic: |-
                        /*
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                         */

                        executor.logger.info("Task Execution: '"+executor.subject.id+"'. Input Fields:
'"+executor.inFields+"'");

                        var oruId = executor.inFields.get("OruId");

                        executor.outFields.put("message", "CLEARED link failure for O-RU: " + oruId);

                        executor.logger.info(executor.outFields);

                        true;
                - key:
                    name: LinkFailureTask
                    version: 0.0.1
                  value:
                    key:
                      name: LinkFailureTask
                      version: 0.0.1
                    inputFields:
                      entry:
                      - key: OduId
                        value:
                          key: OduId
                          fieldSchemaKey:
                            name: OduIdSchema
                            version: 0.0.1
                          optional: false
                      - key: OruId
                        value:
                          key: OruId
                          fieldSchemaKey:
                            name: OruIdSchema
                            version: 0.0.1
                          optional: false
                    outputFields:
                      entry:
                      - key: LinkFailureOutput
                        value:
                          key: LinkFailureOutput
                          fieldSchemaKey:
                            name: LinkFailureOutputSchema
                            version: 0.0.1
                          optional: false
                    taskParameters:
                      entry: []
```

```
                        contextAlbumReference: []
                        taskLogic:
                          key: TaskLogic
                          logicFlavour: JAVASCRIPT
                          logic: |-
                            /*
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                             */

                            executor.logger.info("Task Execution: '"+executor.subject.id+"'. Input Fields:
'"+executor.inFields+"'");

                            var linkFailureOutput = executor.subject.getOutFieldSchemaHelper
("LinkFailureOutput").createNewInstance();

                            var oruId = executor.inFields.get("OruId");
                            var oduId = executor.inFields.get("OduId");

                            var unlockMessageArray = new java.util.ArrayList();
                            for (var i = 0; i < 1; i++) {
                                unlockMessageArray.add({
                                  "id":"rrm-pol-1",
                                  "radio_DasH_resource_DasH_management_DasH_policy_DasH_max_DasH_ratio":25,
                                  "radio_DasH_resource_DasH_management_DasH_policy_DasH_members":
                                      [
                                          {
                                              "mobile_DasH_country_DasH_code":"310",
                                              "mobile_DasH_network_DasH_code":"150",
                                              "slice_DasH_differentiator":1,
                                              "slice_DasH_service_DasH_type":1
                                          }
                                      ],
                                  "radio_DasH_resource_DasH_management_DasH_policy_DasH_min_DasH_ratio":15,
                                  "user_DasH_label":"rrm-pol-1",
                                  "resource_DasH_type":"prb",
                                  "radio_DasH_resource_DasH_management_DasH_policy_DasH_dedicated_DasH_ratio":
20,
                                  "administrative_DasH_state":"unlocked"
                                });
                            }

                            linkFailureOutput.put
("o_DasH_ran_DasH_sc_DasH_du_DasH_hello_DasH_world_ColoN_radio_DasH_resource_DasH_management_DasH_policy_DasH_ra
tio", unlockMessageArray);
                            executor.outFields.put("LinkFailureOutput", linkFailureOutput.toString());

                            executor.getExecutionProperties().setProperty("OduId", oduId);
                            executor.getExecutionProperties().setProperty("OruId", oruId);

                            executor.logger.info(executor.outFields);

                            true;
                    - key:
                        name: NoPolicyDefinedTask
                        version: 0.0.1
```

```
                    value:
                      key:
                        name: NoPolicyDefinedTask
                        version: 0.0.1
                      inputFields:
                        entry:
                        - key: LinkFailureInput
                          value:
                            key: LinkFailureInput
                            fieldSchemaKey:
                              name: LinkFailureInputSchema
                              version: 0.0.1
                            optional: false
                      outputFields:
                        entry:
                        - key: message
                          value:
                            key: message
                            fieldSchemaKey:
                              name: MessageSchema
                              version: 0.0.1
                            optional: false
                      taskParameters:
                        entry: []
                      contextAlbumReference: []
                      taskLogic:
                        key: TaskLogic
                        logicFlavour: JAVASCRIPT
                        logic: |-
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                           */

                          executor.logger.info("Task Execution: '"+executor.subject.id+"'. Input Fields:
'"+executor.inFields+"'");

                          executor.outFields.put("message", "No policy defined for this event");

                          executor.logger.info(executor.outFields);

                          true;
                events:
                  key:
                    name: LinkMonitorModel_Events
                    version: 0.0.1
                  eventMap:
                    entry:
                    - key:
                        name: ApexMessageOutputEvent
                        version: 0.0.1
                      value:
                        key:
                          name: ApexMessageOutputEvent
                          version: 0.0.1
                        nameSpace: org.onap.policy.apex.auth.clieditor
```

```
    source: APEX
    target: APEX
    parameter:
      entry:
      - key: message
        value:
          key: message
          fieldSchemaKey:
            name: MessageSchema
            version: 0.0.1
          optional: false
- key:
    name: CreateLinkClearedOutfieldsEvent
    version: 0.0.1
  value:
    key:
      name: CreateLinkClearedOutfieldsEvent
      version: 0.0.1
    nameSpace: org.onap.policy.apex.auth.clieditor
    source: APEX
    target: APEX
    parameter:
      entry:
      - key: OruId
        value:
          key: OruId
          fieldSchemaKey:
            name: OruIdSchema
            version: 0.0.1
          optional: false
- key:
    name: CreateLinkFailureOutfieldsEvent
    version: 0.0.1
  value:
    key:
      name: CreateLinkFailureOutfieldsEvent
      version: 0.0.1
    nameSpace: org.onap.policy.apex.auth.clieditor
    source: APEX
    target: APEX
    parameter:
      entry:
      - key: OduId
        value:
          key: OduId
          fieldSchemaKey:
            name: OduIdSchema
            version: 0.0.1
          optional: false
      - key: OruId
        value:
          key: OruId
          fieldSchemaKey:
            name: OruIdSchema
            version: 0.0.1
          optional: false
- key:
    name: LinkFailureInputEvent
    version: 0.0.1
  value:
    key:
      name: LinkFailureInputEvent
      version: 0.0.1
    nameSpace: org.onap.policy.apex.auth.clieditor
    source: DMAAP
    target: APEX
    parameter:
      entry:
      - key: LinkFailureInput
        value:
          key: LinkFailureInput
```

```
                fieldSchemaKey:
                  name: LinkFailureInputSchema
                  version: 0.0.1
                optional: false
    - key:
        name: LinkFailureOutputEvent
        version: 0.0.1
      value:
        key:
          name: LinkFailureOutputEvent
          version: 0.0.1
        nameSpace: org.onap.policy.apex.auth.clieditor
        source: APEX
        target: OAM
        parameter:
          entry:
          - key: LinkFailureOutput
            value:
              key: LinkFailureOutput
              fieldSchemaKey:
                name: LinkFailureOutputSchema
                version: 0.0.1
              optional: false
schemas:
  key:
    name: LinkMonitorModel_Schemas
    version: 0.0.1
  schemas:
    entry:
    - key:
        name: LinkFailureInputSchema
        version: 0.0.1
      value:
        key:
          name: LinkFailureInputSchema
          version: 0.0.1
        schemaFlavour: Avro
        schemaDefinition: |-
          {
              "type": "record",
              "name": "Link_Failure_Input",
              "fields": [
                  {
                      "name": "event",
                      "type": {
                          "type": "record",
                          "name": "Event_Type",
                          "fields": [
                              {
                                  "name": "commonEventHeader",
                                  "type": {
                                      "type": "record",
                                      "name": "Common_Event_Header_Type",
                                      "fields": [
                                          {
                                              "name": "domain",
                                              "type": "string"
                                          },
                                          {
                                              "name": "eventId",
                                              "type": "string"
                                          },
                                          {
                                              "name": "eventName",
                                              "type": "string"
                                          },
                                          {
                                              "name": "eventType",
                                              "type": "string"
                                          },
                                          {
```

```
                    "name": "sequence",
                    "type": "int"
                },
                {
                    "name": "priority",
                    "type": "string"
                },
                {
                    "name": "reportingEntityId",
                    "type": "string"
                },
                {
                    "name": "reportingEntityName",
                    "type": "string"
                },
                {
                    "name": "sourceId",
                    "type": "string"
                },
                {
                    "name": "sourceName",
                    "type": "string"
                },
                {
                    "name": "startEpochMicrosec",
                    "type": "string"
                },
                {
                    "name": "lastEpochMicrosec",
                    "type": "string"
                },
                {
                    "name": "nfNamingCode",
                    "type": "string"
                },
                {
                    "name": "nfVendorName",
                    "type": "string"
                },
                {
                    "name": "timeZoneOffset",
                    "type": "string"
                },
                {
                    "name": "version",
                    "type": "string"
                },
                {
                    "name": "vesEventListenerVersion",
                    "type": "string"
                }
            ]
        }
    },
    {
        "name": "faultFields",
        "type": {
            "type": "record",
            "name": "Fault_Fields_Type",
            "fields": [
                {
                    "name": "faultFieldsVersion",
                    "type": "string"
                },
                {
                    "name": "alarmCondition",
                    "type": "string"
                },
                {
                    "name": "alarmInterfaceA",
                    "type": "string"
```

```
                                                },
                                                {
                                                    "name": "eventSourceType",
                                                    "type": "string"
                                                },
                                                {
                                                    "name": "specificProblem",
                                                    "type": "string"
                                                },
                                                {
                                                    "name": "eventSeverity",
                                                    "type": "string"
                                                },
                                                {
                                                    "name": "vfStatus",
                                                    "type": "string"
                                                },
                                                {
                                                    "name": "alarmAdditionalInformation",
                                                    "type": {
                                                        "type": "record",
                                                        "name": "Alarm_Additional_Information_Type",
                                                        "fields": [
                                                            {
                                                                "name": "eventTime",
                                                                "type": "string"
                                                            },
                                                            {
                                                                "name": "equipType",
                                                                "type": "string"
                                                            },
                                                            {
                                                                "name": "vendor",
                                                                "type": "string"
                                                            },
                                                            {
                                                                "name": "model",
                                                                "type": "string"
                                                            }
                                                        ]
                                                    }
                                                }
                                            ]
                                        }
                                    }
                                }
                            ]
                        }
                    - key:
                        name: LinkFailureOutputSchema
                        version: 0.0.1
                      value:
                        key:
                          name: LinkFailureOutputSchema
                          version: 0.0.1
                        schemaFlavour: Avro
                        schemaDefinition: "{\n  \"name\": \"Link_Failure_Output\",\n  \"type\": \"record\",\n
\"fields\": [\n    {\n      \"name\": \"
o_DasH_ran_DasH_sc_DasH_du_DasH_hello_DasH_world_ColoN_radio_DasH_resource_DasH_management_DasH_policy_DasH_rati
o\",\n      \"type\": {\n        \"type\": \"array\",\n        \"items\": {\n          \"name\": \"
o_DasH_ran_DasH_sc_DasH_du_DasH_hello_DasH_world_ColoN_radio_DasH_resource_DasH_management_DasH_policy_DasH_rati
o_record\",\n          \"type\": \"record\",\n          \"fields\": [\n            {\n              \"name\": \"
id\",\n              \"type\": \"string\"\n            },\n            {\n              \"name\": \"
radio_DasH_resource_DasH_management_DasH_policy_DasH_max_DasH_ratio\",\n              \"type\": \"int\"
\n            },\n            {\n              \"name\": \"
radio_DasH_resource_DasH_management_DasH_policy_DasH_members\",\n              \"type\": {\n                \"
type\": \"array\",\n                \"items\": {\n                  \"name\": \"
radio_DasH_resource_DasH_management_DasH_policy_DasH_members_record\",\n                  \"type\": \"record\",
\n                  \"fields\": [\n                    {\n                      \"name\": \"
```

```
mobile_DasH_country_DasH_code\",\n                    \"type\": \"string\"\n                    },
\n                  {\n                      \"name\": \"mobile_DasH_network_DasH_code\",
\n                    \"type\": \"string\"\n                    },\n
{\n                     \"name\": \"slice_DasH_differentiator\",\n                      \"type\": \"int\"
\n                  },\n                    {\n                      \"name\": \"
slice_DasH_service_DasH_type\",\n                      \"type\": \"int\"\n                    }
\n                ]\n              }\n             }\n            },\n           {\n             \"
name\": \"radio_DasH_resource_DasH_management_DasH_policy_DasH_min_DasH_ratio\",\n              \"type\": \"
int\"\n           },\n           {\n              \"name\": \"user_DasH_label\",\n              \"type\": \"
string\"\n           },\n           {\n              \"name\": \"resource_DasH_type\",\n              \"
type\": \"string\"\n           },\n           {\n              \"name\": \"
radio_DasH_resource_DasH_management_DasH_policy_DasH_dedicated_DasH_ratio\",\n              \"type\": \"int\"
\n          },\n           {\n              \"name\": \"administrative_DasH_state\",\n              \"
type\": \"string\"\n            }\n          ]\n        }\n      }\n    }\n  ]\n}"
                  - key:
                      name: MessageSchema
                      version: 0.0.1
                    value:
                      key:
                        name: MessageSchema
                        version: 0.0.1
                      schemaFlavour: Java
                      schemaDefinition: java.lang.String
                  - key:
                      name: OduIdSchema
                      version: 0.0.1
                    value:
                      key:
                        name: OduIdSchema
                        version: 0.0.1
                      schemaFlavour: Java
                      schemaDefinition: java.lang.String
                  - key:
                      name: OruIdSchema
                      version: 0.0.1
                    value:
                      key:
                        name: OruIdSchema
                        version: 0.0.1
                      schemaFlavour: Java
                      schemaDefinition: java.lang.String
        eventOutputParameters:
          RestProducer:
            carrierTechnologyParameters:
              carrierTechnology: RESTCLIENT
              parameterClassName: org.onap.policy.apex.plugins.event.carrier.restclient.
RestClientCarrierTechnologyParameters
              parameters:
                url: http://sdnr-simulator.nonrtric:9990/rests/data/network-topology:network-topology
/topology=topology-netconf/node={OduId}/yang-ext:mount/o-ran-sc-du-hello-world:network-function/distributed-
unit-functions={OruId}/radio-resource-management-policy-ratio=rrm-pol-1
                httpMethod: PUT
                httpHeaders:
                - - Authorization
                  - Basic YWRtaW46S3A4Yko0U1hzek0wV1hsaGFrM2VIbGNzZTJnQXc4NHZhb0dHbUp2VXkyVQ==
            eventProtocolParameters:
              eventProtocol: JSON
              parameters:
                pojoField: LinkFailureOutput
            eventNameFilter: LinkFailureOutputEvent
          StdOutProducer:
            carrierTechnologyParameters:
              carrierTechnology: FILE
              parameters:
                standardIo: true
            eventProtocolParameters:
              eventProtocol: JSON
              parameters:
                pojoField: message
            eventNameFilter: ApexMessageOutputEvent
        eventInputParameters:
```

```
            DMaaPConsumer:
              carrierTechnologyParameters:
                carrierTechnology: RESTCLIENT
                parameterClassName: org.onap.policy.apex.plugins.event.carrier.restclient.
RestClientCarrierTechnologyParameters
                parameters:
                  url: http://message-router:3904/events/unauthenticated.SEC_FAULT_OUTPUT/users/link-monitor-
nonrtric?timeout=15000&limit=100
              eventProtocolParameters:
                eventProtocol: JSON
                parameters:
                  versionAlias: version
                  pojoField: LinkFailureInput
              eventName: LinkFailureInputEvent
```

NOTE: The default hostname/port for sdnr-simulator and message-router are specified in lines 1547 and 1573 respectively of the above file. They should be replaced with actual values if using different hostname/port.

After commissioning the above tosca template, control loop can be instantiated using the steps described in previous sub-section. Once the control loop is in RUNNING state, the below steps can be done to test the correct working of the apex policy.

- First of all, deploy the sdnr-simulator in the cluster (if not using the real SDNR in ONAP). The sdnr simulator can be found in the nonrtric/rapp /orufhrecovery repo of OSC.

```
git clone "https://gerrit.o-ran-sc.org/r/nonrtric/rapp/orufhrecovery"
git checkout f-release --track origin/f-release

cd orucfronthaulrecovery/scriptversion/helm/sdnr-simulator/
helm package .

helm install sdnr-simulator sdnr-simulator-0.1.0.tgz --set image.repository=registry.nordix.org/onap/sdnr-
simulator --set image.tag=1.1.0 --set messagerouter.host="http://message-router.onap" --set messagerouter.port="
3904" --namespace nonrtric --create-namespace --wait
```

- In order to make sure that the apex policy has been deployed successfully, the REST APIs for policy-pap and policy-api components can be used. However, these components do not expose the NodePorts. Hence, a NodePort needs to be opened for accessing each of these APIs.

```
kubectl expose deployment def-policy-pap --type=NodePort --name=policy-pap-public

kubectl expose deployment def-policy-api --type=NodePort --name=policy-api-public
```

- Find the NodePort numbers allocated in the cluster for these two components.

```
kubectl -n onap get svc | grep policy-pap-public

kubectl -n onap get svc | grep policy-api-public
```

- Making this REST call to the policy-api component should return the deployed policy.

```
curl -k -u 'healthcheck:zb!XztG34' -X GET "https://<NodeIP>:<NodePort-policy-api>/policy/api/v1/policytypes
/onap.policies.controlloop.operational.common.Apex/versions/1.0.0/policies/operational.apex.linkmonitor/versions
/1.0.0"
```

- The status of deployed policy can be checked by making a REST call to policy-pap component.

```
curl -k -u 'healthcheck:zb!XztG34' -X GET "https://<NodeIP>:<NodePort-policy-pap>/policy/pap/v1/policies/status"
```

The above command should show a state of "SUCCESS" for the LinkMonitor policy.

- Finally, to test that the apex policy is actually working, an example LinkFailureEvent can be sent to the DmaaP MR.

```
cd orufhrecovery/apexpolicyversion/LinkMonitor

curl -k -X POST -H accept:application/json -H Content-Type:application/json "https://<NodeIP>:<NodePort-message-router>/events/unauthenticated.SEC_FAULT_OUTPUT/" -d @./events/LinkFailureEvent.json
```

The logs of the sdnr-simulator should show that a PUT request has been successfully received.

"PUT /rests/data/network-topology:network-topology/topology=topology-netconf/node=O-DU-1123/yang-ext:mount/o-ran-sc-du-hello-world:network-function/distributed-unit-functions=ERICSSON-O-RU-11225/radio-resource-management-policy-ratio=rrm-pol-1 HTTP/1.1" 200

b) Control loop for script version

This sub-section describes the steps required for bringing up the control loop with script version of the usecase. The tosca template to be used for commissioning this control loop is given below. The steps for commissioning are depicted in the sub-section Commission/Instantiate control loop via GUI.

commission.yaml

```
tosca_definitions_version: tosca_simple_yaml_1_3
data_types:
  onap.datatypes.ToscaConceptIdentifier:
    derived_from: tosca.datatypes.Root
    properties:
      name:
        type: string
        required: true
      version:
        type: string
        required: true
node_types:
  org.onap.policy.clamp.acm.Participant:
    version: 1.0.1
    derived_from: tosca.nodetypes.Root
    properties:
      provider:
        type: string
        requred: false
  org.onap.policy.clamp.acm.AutomationCompositionElement:
    version: 1.0.1
    derived_from: tosca.nodetypes.Root
    properties:
      provider:
        type: string
        required: false
        metadata:
          common: true
        description: Specifies the organization that provides the automation composition element
      participant_id:
        type: onap.datatypes.ToscaConceptIdentifier
        requred: true
        metadata:
          common: true
      participantType:
        type: onap.datatypes.ToscaConceptIdentifier
        required: true
        metadata:
          common: true
        description: The identity of the participant type that hosts this type of Automation Composition Element
      startPhase:
        type: integer
        required: false
        constraints:
          - greater_or_equal: 0
        metadata:
          common: true
        description: A value indicating the start phase in which this automation composition element will be
started, the
```

```
          first start phase is zero. Automation Composition Elements are started in their start_phase order and
stopped
          in reverse start phase order. Automation Composition Elements with the same start phase are started
and
          stopped simultaneously
      uninitializedToPassiveTimeout:
        type: integer
        required: false
        constraints:
          - greater_or_equal: 0
        default: 60
        metadata:
          common: true
        description: The maximum time in seconds to wait for a state chage from uninitialized to passive
      passiveToRunningTimeout:
        type: integer
        required: false
        constraints:
          - greater_or_equal: 0
        default: 60
        metadata:
          common: true
        description: The maximum time in seconds to wait for a state chage from passive to running
      runningToPassiveTimeout:
        type: integer
        required: false
        constraints:
          - greater_or_equal: 0
        default: 60
        metadata:
          common: true
        description: The maximum time in seconds to wait for a state chage from running to passive
      passiveToUninitializedTimeout:
        type: integer
        required: false
        constraints:
          - greater_or_equal: 0
        default: 60
        metadata:
          common: true
        description: The maximum time in seconds to wait for a state chage from passive to uninitialized
  org.onap.policy.clamp.acm.AutomationComposition:
    version: 1.0.1
    derived_from: tosca.nodetypes.Root
    properties:
      provider:
        type: string
        required: false
        metadata:
          common: true
        description: Specifies the organization that provides the automation composition element
      elements:
        type: list
        required: true
        metadata:
          common: true
        entry_schema:
          type: onap.datatypes.ToscaConceptIdentifier
        description: Specifies a list of automation composition element definitions that make up this
automation composition definition
  org.onap.policy.clamp.acm.K8SMicroserviceAutomationCompositionElement:
    version: 1.0.1
    derived_from: org.onap.policy.clamp.acm.AutomationCompositionElement
    properties:
      chart:
        type: string
        required: true
      configs:
        type: list
        required: false
      requirements:
```

```
        type: string
        requred: false
      templates:
        type: list
        required: false
        entry_schema:
      values:
        type: string
        requred: true
topology_template:
  node_templates:
    org.onap.policy.clamp.acm.KubernetesParticipant:
      version: 2.3.4
      type: org.onap.policy.clamp.acm.Participant
      type_version: 1.0.1
      description: Participant for K8S
      properties:
        provider: Ericsson
    org.onap.domain.linkmonitor.OruAppK8SMicroserviceAutomationCompositionElement:
      # Chart from new repository
      version: 1.2.3
      type: org.onap.policy.clamp.acm.K8SMicroserviceAutomationCompositionElement
      type_version: 1.0.0
      description: Automation composition element for the K8S microservice for PMSH
      properties:
        provider: ONAP
        participant_id:
          name: K8sParticipant0
          version: 1.0.0
        participantType:
          name: org.onap.policy.clamp.acm.KubernetesParticipant
          version: 2.3.4
        chart:
          chartId:
            name: oru-app
            version: 0.1.0
          releaseName: oru-app
          repository:
            repoName: nginx-proxy
            address: https://nginx-proxy:443
          namespace: nonrtric
          overrideParams:
            image.repository: nexus3.o-ran-sc.org:10004/o-ran-sc/nonrtric-rapp-orufhrecovery
            image.tag: 1.1.0
            messagerouter.host: http://message-router.onap
            messagerouter.port: 3904
            sdnr.host: http://sdnr-simulator
            sdnr.port: 9990
    org.onap.domain.linkmonitor.MessageGeneratorK8SMicroserviceAutomationCompositionElement:
      # Chart from new repository
      version: 1.2.3
      type: org.onap.policy.clamp.acm.K8SMicroserviceAutomationCompositionElement
      type_version: 1.0.0
      description: Automation composition element for the K8S microservice for PMSH
      properties:
        provider: ONAP
        participant_id:
          name: K8sParticipant0
          version: 1.0.0
        participantType:
          name: org.onap.policy.clamp.acm.KubernetesParticipant
          version: 2.3.4
        chart:
          chartId:
            name: message-generator
            version: 0.1.0
          releaseName: message-generator
          repository:
            repoName: nginx-proxy
            address: https://nginx-proxy:443
          namespace: nonrtric
```

```
        overrideParams:
          image.repository: registry.nordix.org/onap/message-generator
          image.tag: 1.0.0
          messagerouter.host: http://message-router.onap
          messagerouter.port: 3904
  org.onap.domain.linkmonitor.SdnrSimulatorK8SK8SMicroserviceAutomationCompositionElement:
    # Chart from new repository
    version: 1.2.3
    type: org.onap.policy.clamp.acm.K8SMicroserviceAutomationCompositionElement
    type_version: 1.0.0
    description: Automation composition element for the K8S microservice for PMSH
    properties:
      provider: ONAP
      participant_id:
        name: K8sParticipant0
        version: 1.0.0
      participantType:
        name: org.onap.policy.clamp.acm.KubernetesParticipant
        version: 2.3.4
      chart:
        chartId:
          name: sdnr-simulator
          version: 0.1.0
        releaseName: sdnr-simulator
        repository:
          repoName: nginx-proxy
          address: https://nginx-proxy:443
        namespace: nonrtric
        overrideParams:
          image.repository: registry.nordix.org/onap/sdnr-simulator
          image.tag: 1.1.0
          messagerouter.host: http://message-router.onap
          messagerouter.port: 3904
  org.onap.domain.sample.GenericK8s_AutomationCompositionDefinition:
    version: 1.2.3
    type: org.onap.policy.clamp.acm.AutomationComposition
    type_version: 1.0.1
    description: Automation composition for Hello World
    properties:
      provider: ONAP
      elements:
        - name: org.onap.domain.linkmonitor.OruAppK8SMicroserviceAutomationCompositionElement
          version: 1.2.3
        - name: org.onap.domain.linkmonitor.MessageGeneratorK8SMicroserviceAutomationCompositionElement
          version: 1.2.3
        - name: org.onap.domain.linkmonitor.SdnrSimulatorK8SK8SMicroserviceAutomationCompositionElement
          version: 1.2.3
```

This control loop will bring up three micro-services in the nonrtric namespace: oru-app (running the actual logic of the usecase), message-generator (sending the LinkFailure messages at random intervals), and sdnr-simulator (for receiving the REST calls made by oru-app). Make sure that the sdnr-simulator is not already running in the nonrtric namespace, otherwise the control loop instantiation might fail.

NOTE: The default hostname/port for sdnr and message-router are specified in **overrideParams** of the above file. They should be replaced with actual values if using different hostname/port.f

Before commissioning this tosca template, some preparations need to be done in the kubernetes-participant component of the clamp.

- First step is to copy the kube config file of the cluster inside the kubernetes-participant. Find the pod-name of this component using:

```
kubectl -n onap get pod | grep k8s-ppnt
```

Log into the k8s-ppnt pod and create the following directories

```
mkdir -p ~/.kube
mkdir ~/ssl
```

Copy the config file using this command:

```
kubectl cp ~/.kube/config onap/<POD-NAME-k8s-ppnt>:/home/policy/.kube/config
```

In order to make sure that the kubernetes-participant is properly configured, get into the pod using "kubectl -n onap exec -it <POD-NAME-k8s-ppnt> sh" and run the following command:

```
kubectl get ns
```

This should show all the namespaces in the cluster where ONAP is deployed.

Next step is setup a https proxy from chartmuseum and push the charts

- Create tls certs using onap cet manager kubectl apply -f certificate.yaml (Replace NodeIP with your control plane IP)
- Install the nginx proxy to run in front of ONAP chartmuseum: kubectl apply -f nginx.yaml
- Retrieve chartmuseum username and password using kubectl get secret onap-chartmuseum-registrycred -o=go-template='{{$login := .data.login| base64decode}}{{$pw := .data.password| base64decode}}{{printf "%s:%s" $login $pw }}'

Create the helm charts for all 3 components and push them to chartmuseum

command

`cd orufhrecovery/scriptversion/helm/sdnr-simulator/`
`helm package .`
`curl -u <username>:<password> --data-binary "@sdnr-simulator-0.1.0.tgz" http://<NodeIP>:30088/api/charts`
 	
`cd orufhrecovery/scriptversion/helm/message-generator/`
`helm package .`
`curl -u <username>:<password> --data-binary "@message-generator-0.1.0.tgz" http://<NodeIP>:30088/api/charts`
 	
`cd orufhrecovery/scriptversion/helm/oru-app/`
`helm package .`
`curl -u <username>:<password> --data-binary "@oru-app-0.1.0.tgz" http://<NodeIP>:30088/api/charts`

Retrieve the ca.crt from the secret and copy it to the k8s-ppnt pod :

```
kubectl get secret nginx-tls -o jsonpath="{.data.ca\.crt}" | base64 -d > ca.crt
cp ~/certs/ca.crt onap/<POD-NAME-k8s-ppnt>:/home/policy/ssl
```

Log into the k8s-ppnt pod using "kubectl -n onap exec -it <POD-NAME-k8s-ppnt> sh" and run the following commands:

```
helm repo add nginx-proxy https://nginx-proxy:443 --ca-file /home/policy/ssl/ca.crt
helm repo update
```

Once the kubernetes-participant is set up, the tosca template can be commissioned. After that, the control loop can be instantiated using the steps described in the sub-section Commission/Instantiate control loop via GUI. Once the control loop is in PASSIVE state, check that all three micro-services have been created in the nonrtric namespace.

```
kubectl -n nonrtric get pod
```

In order to test the correct working of the usecase, check logs in each of the three components. There should be messages flowing in this order:

message-generator oru-app sdnr-simulator

Control loops in docker

This section is related to running the control loops in a docker environment. Separate docker-compose files are available in the nonrtric repo of OSC for bringing up the apex policy as well as the script versions of the usecase.

a) Control loop for apex policy version

This sub-section describes the steps for running the control loop for apex policy version of the usecase using docker.

- The first step is to clone the nonrtric repo and start the DmaaP message-router. Then, two topics are created in the message-router: **POLICY-CLRUNTIME-PARTICIPANT** (to be used by controlloop-runtime component of policy/clamp) and **unauthenticated.SEC_FAULT_OUTPUT** (for handling fault notification events).

```
git clone "https://gerrit.o-ran-sc.org/r/nonrtric"
git checkout f-release --track origin/f-release

cd nonrtric/test/auto-test
./startMR.sh remote docker --env-file ../common/test_env-oran-e-release.sh

docker rename message-router onap-dmaap

curl -X POST -H "Content-Type: application/json" -d "{"topicName": "POLICY-CLRUNTIME-PARTICIPANT"}"
http://localhost:3904/events/POLICY-CLRUNTIME-PARTICIPANT

curl -X POST -H "Content-Type: application/json" -d "{"topicName": "unauthenticated.SEC_FAULT_OUTPUT"}"
http://localhost:3904/events/unauthenticated.SEC_FAULT_OUTPUT
```

- After creating the topics in the message-router, start the ONAP Policy Framework using the docker-compose file available in nonrtric repo.

```
cd nonrtric/docker-compose/docker-compose-policy-framework
docker-compose up -d
```

- The next step is to start the controlloop-runtime and policy-participant components of the clamp.

```
cd orufhrecovery/apexpolicyversion/LinkMonitor/docker-compose-controlloop
docker-compose up -d
```

Check the logs of policy-participant using the command "docker logs -f policy-participant" and wait until these messages start appearing in the logs:

"com.att.nsa.apiClient.http.HttpClient : --> HTTP/1.1 200 OK"

- Once all the components get up and running, the control loop can be commissioned and instantiated. This can be done by making a REST call to the controlloop-runtime component of the clamp. The tosca template for commissioning and the instantiation payload are provided in this directory of the nonrtric repo:

```
cd orufhrecovery/apexpolicyversion/LinkMonitor/controlloop-rest-payloads
```

Commission the tosca template using this REST call:

```
curl -X POST -k -u 'healthcheck:zb!XztG34' -H Content-Type:application/yaml https://localhost:6969/onap
/controlloop/v2/commission/ --data-binary @commission.yaml
```

It should give the following response:

{"errorDetails":null,"affectedControlLoopDefinitions":[{"name":"org.onap.domain.linkmonitor.LinkMonitorPolicyControlLoopElement","version":"1.2.3"},
{"name":"org.onap.domain.linkmonitor.LinkMonitorControlLoopDefinition0","version":"1.2.3"},{"name":"org.onap.policy.controlloop.
PolicyControlLoopParticipant","version":"2.3.1"}]}

Make the following REST call to instantiate the control loop:

```
curl -X POST -k -u 'healthcheck:zb!XztG34' -H Content-Type:application/json https://localhost:6969/onap
/controlloop/v2/instantiation/ --data-binary @instantiation.json
```

It should give the following response:

{"errorDetails":null,"affectedControlLoops":[{"name":"LinkMonitorInstance0","version":"1.0.1"}]}

Change the control loop from default UNINITIALISED state to PASSIVE using the following REST call:

```
curl -X PUT -k -u 'healthcheck:zb!XztG34' -H Content-Type:application/json https://localhost:6969/onap
/controlloop/v2/instantiation/command/ --data-binary @instantiation-command.json
```

It should give the same response as above.

Next step is to change the control loop from PASSIVE to RUNNING state. Edit the "instantiation-command.json" file and replace PASSIVE with RUNNING. Making the above REST call once again will change the control loop to RUNNING state.

- Once the control loop is in RUNNING state, check whether the apex policy has been deployed successfully in the policy framework. Making the below REST call to policy-api component should return the deployed policy.

```
curl -u 'healthcheck:zb!XztG34' -X GET "http://localhost:6869/policy/api/v1/policytypes/onap.policies.
controlloop.operational.common.Apex/versions/1.0.0/policies/operational.apex.linkmonitor/versions/1.0.0"
```

Make the below REST call to policy-pap component and make sure that it returns a state of "SUCCESS" for the deployed policy.

```
curl -u 'healthcheck:zb!XztG34' -X GET "http://localhost:6868/policy/pap/v1/policies/status"
```

- Start the sdnr-simulator in a docker container that will receive the REST call made by apex policy when a link failure event is received.

```
docker run --rm --name sdnr-sim --network nonrtric-docker-net -e MR-HOST="http://onap-dmaap" -e MR-PORT="3904"
registry.nordix.org/onap/sdnr-simulator:1.0.0
```

- Send the example link failure event.

```
cd orufhrecovery/apexpolicyversion/LinkMonitor

curl -X POST -H accept:application/json -H Content-Type:application/json "http://localhost:3904/events
/unauthenticated.SEC_FAULT_OUTPUT/" -d @./events/LinkFailureEvent.json
```

The logs of sdnr-simulator should show that the following REST call is received:

"PUT /rests/data/network-topology:network-topology/topology=topology-netconf/node=HCL-O-DU-1123/yang-ext:mount/o-ran-sc-du-hello-world:network-function/du-to-ru-connection=ERICSSON-O-RU-11225 HTTP/1.1" 200 -

- In order to stop the docker containers and free up resources on the host machine, use the following commands:

```
cd nonrtric/docker-compose/docker-compose-policy-framework
docker-compose down

cd nonrtric/test/usecases/oruclosedlooprecovery/apexpolicyversion/LinkMonitor/docker-compose-controlloop
docker-compose down

docker stop sdnr-sim
docker rm sdnr-sim

docker volume rm docker-compose-policy-framework_db-vol
```

b) Control loop for script version

This sub-section describes the steps for running the control loop for script version of the usecase using docker. This version of the control loop will bring up four micro-services in the nonrtric namespace: oru-app (running the actual logic of the usecase), message-generator (sending the LinkFailure messages at random intervals), sdnr-simulator (for receiving the REST calls made by oru-app), and dmaap-mr (a message-router stub where the LinkFailure messages will be sent).

NOTE: The below instructions refer to bringing up the micro-services in a minikube cluster on the host machine, and it is assumed that the minikube is already up and running. The instructions should be modified accordingly when using a different environment.

- The first step is to clone the nonrtric repo and start the DmaaP message-router. Then, a topic named **POLICY-CLRUNTIME-PARTICIPANT** is created in the message-router (to be used by controlloop-runtime component of policy/clamp).

```
git clone "https://gerrit.o-ran-sc.org/r/nonrtric"
git checkout e-release --track origin/e-release

cd nonrtric/test/auto-test
./startMR.sh remote docker --env-file ../common/test_env-oran-e-release.sh

docker rename message-router onap-dmaap

curl -X POST -H "Content-Type: application/json" -d "{"topicName": "POLICY-CLRUNTIME-PARTICIPANT"}"
http://localhost:3904/events/POLICY-CLRUNTIME-PARTICIPANT
```

- Build a docker image for each of the four micro-services and make it available for use inside the minikube. Open a new terminal window (keep it separate and do not run any other commands except the ones given below) and run the following commands:

```
eval $(minikube docker-env)

cd orufhrecovery/scriptversion/app
docker build -t oru-app .

cd orufhrecovery/scriptversion/simulators
docker build -f Dockerfile-sdnr-sim -t sdnr-simulator .
docker build -f Dockerfile-message-generator -t message-generator:v2 .

cd nonrtric/test/mrstub/
docker build -t mrstub .
```

Make sure that all four docker images have been successfully created by running the "docker images" command.

- Next step is to prepare the kube config file of minikube for mounting it inside the k8s-participant component of policy/clamp. First of all, copy the kube config file inside the config directory used by docker-compose file that runs k8s-participant.

```
cd orufhrecovery/scriptversion/docker-compose-controlloop

cp ~/.kube/config ./config/kube-config
```

Open the copied kube-config file (located at nonrtric/test/usecases/oruclosedlooprecovery/scriptversion/docker-compose-controlloop/config/kube-config) and make the following changes:

1. replace everything under "cluster" with these two lines:
   server: https://host.docker.internal:<PORT>

   insecure-skip-tls-verify: true
2. replace <PORT> with the port in original kube-config file before editing (i.e., before doing the above step)
3. replace last two lines in the file with:

   client-certificate: /home/policy/.minikube/profiles/minikube/client.crt

   client-key: /home/policy/.minikube/profiles/minikube/client.key

- Open the docker-compose file (located at nonrtric/test/usecases/oruclosedlooprecovery/scriptversion/docker-compose-controlloop/docker-compose.yml) and replace the last line under volumes of k8s-participant with these two lines:

  - ./config/kube-config:/home/policy/.kube/config:ro

  - ~/.minikube/profiles/minikube:/home/policy/.minikube/profiles/minikube

- Start all the components using this docker-compose file:

```
docker-compose up -d
```

Check the logs of k8s-participant using the command "docker logs -f k8s-participant" and wait until these messages start appearing in the logs:

"com.att.nsa.apiClient.http.HttpClient : --> HTTP/1.1 200 OK"

- Once all the components get up and running, the control loop can be commissioned and instantiated. This can be done by making a REST call to the controlloop-runtime component of the clamp. The tosca template for commissioning and the instantiation payload are provided in this directory of the nonrtric repo:

```
cd orufhrecovery/scriptversion/controlloop-rest-payloads
```

Commission the tosca template using this REST call:

```
curl -X POST -k -u 'healthcheck:zb!XztG34' -H Content-Type:application/yaml https://localhost:6969/onap
/controlloop/v2/commission/ --data-binary @commission.yaml
```

It should give the following response:

{"errorDetails":null,"affectedControlLoopDefinitions":[{"name":"org.onap.domain.linkmonitor.LinkMonitorControlLoopDefinition1","version":"1.2.3"},{"name":"org.onap.k8s.controlloop.K8SControlLoopParticipant","version":"2.3.4"},{"name":"org.onap.domain.linkmonitor.OruAppK8SMicroserviceControlLoopElement","version":"1.2.3"},{"name":"org.onap.domain.linkmonitor.MessageGeneratorK8SMicroserviceControlLoopElement","version":"1.2.3"},{"name":"org.onap.domain.linkmonitor.SdnrSimulatorK8SMicroserviceControlLoopElement","version":"1.2.3"},{"name":"org.onap.domain.linkmonitor.DmaapMrK8SMicroserviceControlLoopElement","version":"1.2.3"}]}

Make the following REST call to instantiate the control loop:

```
curl -X POST -k -u 'healthcheck:zb!XztG34' -H Content-Type:application/json https://localhost:6969/onap
/controlloop/v2/instantiation/ --data-binary @instantiation.json
```

It should give the following response:

{"errorDetails":null,"affectedControlLoops":[{"name":"LinkMonitorInstance1","version":"1.0.1"}]}

Change the control loop from default UNINITIALISED state to PASSIVE using the following REST call:

```
curl -X PUT -k -u 'healthcheck:zb!XztG34' -H Content-Type:application/json https://localhost:6969/onap
/controlloop/v2/instantiation/command/ --data-binary @instantiation-command.json
```

It should give the same response as above.

Next step is to change the control loop from PASSIVE to RUNNING state. Edit the "instantiation-command.json" file and replace PASSIVE with RUNNING. Making the above REST call once again will change the control loop to RUNNING state.

- Once the control loop is in RUNNING state, check that all four micro-services have been created in the nonrtric namespace.

  ```
  kubectl -n nonrtric get pod
  ```

  In order to test the correct working of the usecase, check logs in each of the four components. There should be messages flowing in this order:

  message-generator dmaap-mr oru-app sdnr-simulator

- In order to stop the docker containers and free up resources on the host machine, use the following commands:

```
cd orufhrecovery/scriptversion/docker-compose-controlloop
docker-compose down

docker volume rm docker-compose-controlloop_db-vol
```