ONAP: RAN DO - Slicing use case

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LF NETWORKING

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Agenda

- Overview

- RAN DO PoC from DT

  - ONAP impacted components

  - Next steps

Overview

Our proposal is to build an O-RAN specific Macro flow-based NSSMF which can integrate with an external NSMF.

What's the difference ??

- Current ONAP slicing use case is using 3GPP 28.531 APIs (Slice-Specific APIs) And we are proposing 3GPP 28.532 APIs (as per Generic Provisioning APIs based on Managed Object Instances (MOI))

- We propose changes in SO Macro flow building blocks to implement slicing workflows

RAN DO PoC from DT
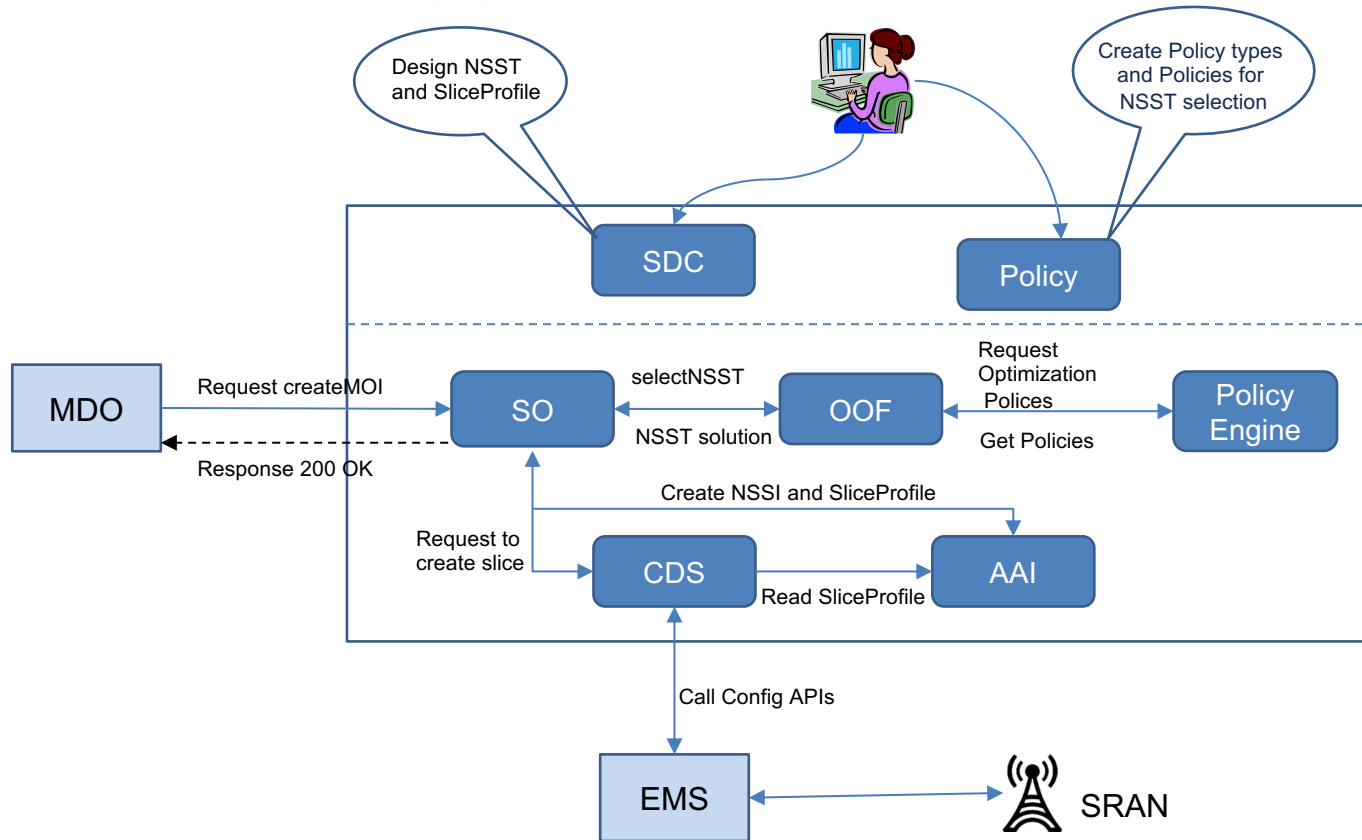
SDC, Policy and AAI components

SDC:
No change in designing NSST and sliceProfile. The existing community slicing use case functionality is reused

AAI:
No changes AAI, existing objects like SliceProfile is reused.
Use of service-instance object to represent nssi service instance and slice profile service instance is same.

Policy:
We have pushed NSST policies which can be referred by OOF at a runtime for NSST selection
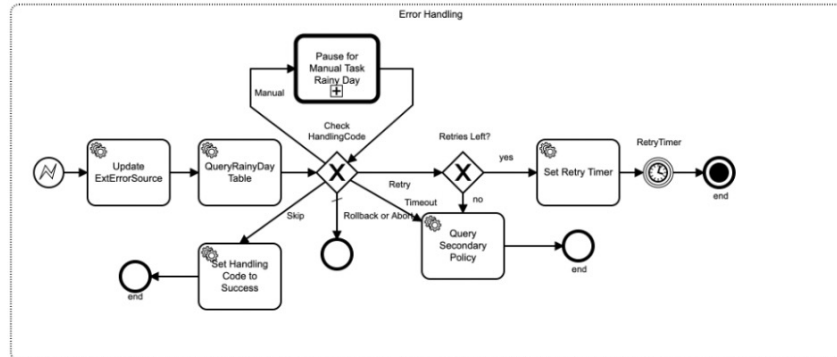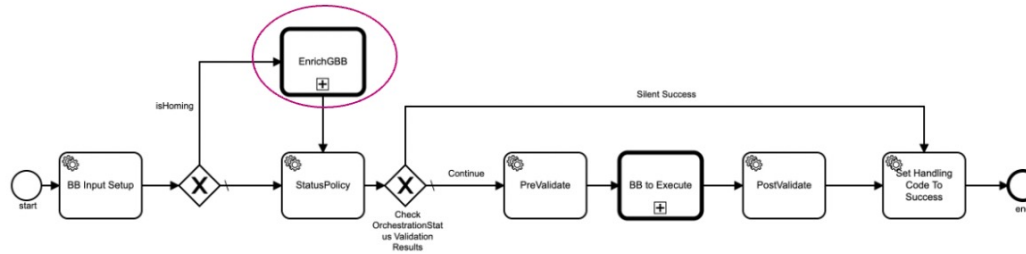
Microsoft Word
Document

SO Macro flow and OOF integration

In the existing ExecuteBuildingBlock BPMN, a new subprocess EnrichGBB is added.

In the SO request if Homing_Solution value is true then flow will execute EnrichGBB process to find the optimisation solution.

SO and OOF integration

EnrichGBB BPMN:

The purpose of the this bpmn is to preparing request and trigger OOF API. Also, handle OOF async response. Right now we are preparing OOF request for NSST selection only, going forward we will enhance the code to other solutions like cloud details

Existing OSDF APIs are not have API for NSST section.
In our use case, we have a requirement to select NSST at runtime.
Hence a new API is required "selectNSST".

```
curl --location --request POST 'https://{{k8s}}:30248/api/oof/v1/selection/nsst' \
--header 'Content-Type: application/json' \
--header 'Authorization: Basic dGVzdDp0ZXN0cHdk' \
--header 'Cookie: JSESSIONID=8873161B92F94EA8FA15E5E87108B76F' \
--data-raw '{
    "requestInfo": {
        "transactionId": "c86b3019-39f4-4cd3-b847-b22afe9f36dc",
        "requestId": "c86b3019-39f4-4cd3-b847-b22afe9f36dc",
        "sourceId": "so",
        "timeout": 600,
        "callbackUrl": "http://0.0.0.0:9000/callback/"
    },
    "sliceProfile": {
        "latency" : 20,
        "areaTrafficCapDL" :800
    }
}'
```

Changes in Service Orchestrator

SO api-handler

new package ManagedObject3gppServiceInstances is created, highlights of the functionality:

- Expose new endpoints for 3GPP 28.532
- Validate the request
- Do service_recipe table lookup
- Create infraActiveRequest in requestDB
- Prepare ServiceInstanceRequest with new Resource = nssi

SO bpmn

New module so-bpmn-moi is created.

- In WorkflowAction class: added new workflowType = NetworkSliceSubnet
- New BPMN workflows:
    - AssignRANNssiBB
    - ActivateRANNssiBB
    - ModifyRANNssiBB
    - DeleteRANNssiBB

Sample requests

createMOI request to SO
PUT /api/rest/provMns/{apiVersion}/NetworkSliceSubnet/{id}

```
{
   "attributes":{
      "sliceProfileList":[
         {
            "plmnInfoList":[
               {
                  "plmnId":{
                     "mcc":262,
                     "mnc":78
                  },
                  "snssai":{
                     "sst":"01",
                     "sd":"200"
                  }
               }
            ],
            "RANSliceSubnetProfile":{
               "coverageAreaTAList":999,
               "latency":20,
               "areaTrafficCapDL":800,
               "resourceSharingLevel":"SHARED",
               "serviceType":"eMBB",
               "maxNumberofUEs":2000
            }
         }
      ]
   }
}
```

ServiceInstanceRequest with new Resource = nssi
POST http://so-bpmn-infra.onap:8081/mso/async/services/WorkflowActionBB

```
{
   "requestDetails":{
      "requestInfo":{
         "productFamilyId":"5G",
         "source":"MO",
         "instanceName":"ran_nssi_bdfe7eb0-d12b-4a35-a81b-b715502ffd1c",
         "suppressRollback":false,
         "requestorId":"MO"
      },
      "subscriberInfo":{
         "globalSubscriberId":"5GCustomer"
      },
      "requestParameters":{
         "subscriptionServiceType":"5G",
         "userParams":[
            {
               "nssi":{
                  "sliceProfileList":[
                     {
                        "plmnInfoList":[
                           {
                              "plmnId":{
                                 "mcc":262,
                                 "mnc":78
                              },
                              "snssai":{
                                 "sst":01,
                                 "sd":200 } },
                           "RANSliceSubnetProfile":{
                              "coverageAreaTAList":999,
                              "resourceSharingLevel":"SHARED",
                              "serviceType":"eMBB",
                              "maxNumberofUEs":2000,
                              "latency":20,
                              "areaTrafficCapDL":800
                           } } ] } },
               {
                  "Homing_Solution":true
               }
            ],
            "aLaCarte":false
         },
         "project":{
            "projectName":"basicnw-project"
         },
         "owningEntity":{
            "owningEntityId":"67f2e84c-734d-4e90-a1e4-d2ffa2e75849",
            "owningEntityName":"OE-5GCustomer"
         } } }
```

SO to CDS request payload

```
Input payload: fields {
  key: "create-sliceprofile-request"
  value {
    struct_value {
      fields {
        key: "nssiId"
        value {
          string_value: " ran_nssi_bdfe7eb0-d12b-4a35-a81b-b715502ffd1c "
        }
      }
      fields {
        key: "nssiName"
        value {
          string_value: " ran_nssi_bdfe7eb0-d12b-4a35-a81b-b715502ffd1c "
        }
      }
      fields {
        key: "sliceProfileInstanceId"
        value {
          string_value: "f94e5309-0d3b-4262-b6ea-574c56c260c0"
        }
      }
      fields {
        key: "nsId"
        value {
          string_value: "nssi-id"
        }
      }
    }
  } }
```

Updates in CatalogDB

service_recipe table

```
+-----+---------------+-------------+---------------------------------+-----------------------------------+-----------------+---------------------+--------------------------------------+
| id  | ACTION        | VERSION_STR | DESCRIPTION                     | ORCHESTRATION_URI                 | RECIPE_TIMEOUT  | CREATION_TIMESTAMP  | SERVICE_MODEL_UUID                   |
+-----+---------------+-------------+---------------------------------+-----------------------------------+-----------------+---------------------+--------------------------------------+
| 547 | createRanSlice | 1          | Gr api recipe for RAN slicing  | /mso/async/services/WorkflowActionBB |            180 | 2022-09-16 06:28:48 | dfcd7471-16c7-444e-8268-d4c50d90593a |
| 550 | modifyRanSlice | 1          | Gr api recipe for RAN slicing  | /mso/async/services/WorkflowActionBB |            180 | 2022-09-16 10:36:10 | dfcd7471-16c7-444e-8268-d4c50d90593a |
| 553 | deleteRanSlice | 1          | Gr api recipe for RAN slicing  | /mso/async/services/WorkflowActionBB |            180 | 2022-09-16 10:45:21 | dfcd7471-16c7-444e-8268-d4c50d90593a |
+-----+---------------+-------------+---------------------------------+-----------------------------------+-----------------+---------------------+--------------------------------------+
```

northbound_request_ref_lookup table

```
+-----+------------------+-------------------+----------------+-------------+-----------------+-----------------+-----------------+-------------+--------------+
| id  | REQUEST_SCOPE    | MACRO_ACTION      | ACTION         | IS_ALACARTE | MIN_API_VERSION | MAX_API_VERSION | IS_TOPLEVELFLOW | CLOUD_OWNER | SERVICE_TYPE |
+-----+------------------+-------------------+----------------+-------------+-----------------+-----------------+-----------------+-------------+--------------+
| 184 | NetworkSliceSubnet | Slice-Macro-Create | createRanSlice |          0 |               1 |               7 |               1 | DEFAULT     | *            |
| 187 | NetworkSliceSubnet | Slice-Macro-modify | modifyRanSlice |          0 |               1 |               7 |               1 | DEFAULT     | *            |
| 190 | NetworkSliceSubnet | Slice-Macro-delete | deleteRanSlice |          0 |               1 |               7 |               1 | DEFAULT     | *            |
+-----+------------------+-------------------+----------------+-------------+-----------------+-----------------+-----------------+-------------+--------------+
```

Updates in CatalogDB

orchestration_flow_reference table

id	COMPOSITE_ACTION	SEQ_NO	FLOW_NAME	FLOW_VERSION	NB_REQ_REF_LOOKUP_ID	SCOPE	ACTION
1051	Slice-Macro-Create	1	AssignRANNssiBB	1	184	NULL	NULL
1054	Slice-Macro-Create	2	ControllerExecutionBB	1	184	nssi	create-sliceprofile
1057	Slice-Macro-Create	3	ActivateRANNssiBB	1	184	NULL	NULL
1069	Slice-Macro-delete	1	ControllerExecutionBB	1	190	nssi	delete-sliceprofile
1066	Slice-Macro-delete	2	DeleteRANNssiBB	1	190	NULL	NULL
1060	Slice-Macro-modify	1	ModifyRANNssiBB	1	187	NULL	NULL
1063	Slice-Macro-modify	2	ControllerExecutionBB	1	187	nssi	modify-sliceprofile

building_block_detail table

id	BUILDING_BLOCK_NAME	RESOURCE_TYPE	TARGET_ACTION
415	AssignRANNssiBB	NO_VALIDATE	CUSTOM
418	ModifyRANNssiBB	NO_VALIDATE	CUSTOM
421	DeleteRANNssiBB	NO_VALIDATE	CUSTOM
424	ActivateRANNssiBB	NO_VALIDATE	CUSTOM

Sample data in AAI

NSSI in AAI

```
{
    "service-instance-id": "nsst-0811",
    "service-instance-name": "ran_nsst-0811",
    "service-type": "nssi",
    "model-invariant-id": "317dd757-3459-42bd-86f1-9fc458fac5a2",
    "model-version-id": "f5ec1d82-46e9-44a9-a098-352f740934fb",
    "resource-version": "1667899117698",
    "orchestration-status": "Active",
    "relationship-list": {
        "relationship": [
            {
                "related-to": "allotted-resource",
                "relationship-label": "org.onap.relationships.inventory.Uses",
                "related-link": "/aai/v24/business/customers/customer/5GCustomer/service-subscriptions/service-
subscription/5G/service-instances/service-instance/b332d604-fcbd-4976-9e26-3eab8b6a92d8/allotted-resources/allotted-
resource/5efea64e-2bf8-4bdd-8b4d-69d99ca64388",
                "relationship-data": [
                    {
                        "relationship-key": "customer.global-customer-id",
                        "relationship-value": "5GCustomer"
                    },
                    {
                        "relationship-key": "service-subscription.service-type",
                        "relationship-value": "5G"
                    },
                    {
                        "relationship-key": "service-instance.service-instance-id",
                        "relationship-value": "b332d604-fcbd-4976-9e26-3eab8b6a92d8"
                    },
                    {
                        "relationship-key": "allotted-resource.id",
                        "relationship-value": "5efea64e-2bf8-4bdd-8b4d-69d99ca64388"
                    }
                ],
                "related-to-property": [
                    {
                        "property-key": "allotted-resource.description"
                    },
                    {
                        "property-key": "allotted-resource.allotted-resource-name"
                    }
                ]
            }
        ]
    },
    "operational-status": "UNLOCKED"
}
```

```
{
    "service-instance-id": "b332d604-fcbd-4976-9e26-3eab8b6a92d8",
    "service-instance-name": "slice-profile-nsst-0811",
    "service-type": "eMBB",
    "service-role": "slice-profile",
    "environment-context": "128-22",
    "service-instance-location-id": "262-1",
    "resource-version": "1667899118257",
    "orchestration-status": "ACTIVE",
    "allotted-resources": {
        "allotted-resource": [
            {
                "id": "5efea64e-2bf8-4bdd-8b4d-69d99ca64388",
                "resource-version": "1667899002035",
                "relationship-list": {
                    "relationship": [
                        {
                            "related-to": "service-instance",
                            "relationship-label": "org.onap.relationships.inventory.Uses",
                            "related-link": "/aai/v24/business/customers/customer/5GCustomer/service-subscriptions/service-subscription/5G/service-
instances/service-instance/nsst-0811",
                            "relationship-data": [
                                {
                                    "relationship-key": "customer.global-customer-id",
                                    "relationship-value": "5GCustomer"
                                },
                                {
                                    "relationship-key": "service-subscription.service-type",
                                    "relationship-value": "5G"
                                },
                                {
                                    "relationship-key": "service-instance.service-instance-id",
                                    "relationship-value": "nsst-0811"
                                }
                            ],
                            "related-to-property": [
                                {
                                    "property-key": "service-instance.service-instance-name",
                                    "property-value": "ran_nsst-0811"
                                }]}]}}}]
    },
    "slice-profiles": {
        "slice-profile": [
            {
                "profile-id": "151391b2-74a1-4c79-a7be-7fe9d8c24aa1",
                "latency": 20,
                "max-number-of-UEs": 1,
                "coverage-area-TA-list": "65329",
                "resource-sharing-level": "SHARED",
                "area-traffic-cap-DL": 800,
                "resource-version": "1667899001630"
            }
        ]
    }, "operational-status": "UNLOCKED"
}
```

Next steps

- Test RAN DO for O-RAN
  - Deploy a gNB service with all its xNFs at one time using a single order
  - Support shared and non-shared RAN slice.
- Use TMF APIs for service/slice order
  - Support RAN slice life cycle using TMF APIs
  - RAN DO should send notifications to MDO like: createMOINotification, modifyMOINotification, deleteMOINotification