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CNFO – Guilin CNF Improvements Overview

Seshu Kumar M (Huawei)
Lukasz Rajewski (Orange)
Konrad Bańka (Samsung)

CNFO - Summary for the requirement subcommittee

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Executive Summary - Provide CNF orchestration support through integration of K8s adapter in ONAP SO

- Support for provisioning CNFs using an external K8s Manager
- Support the Helm based orchestration
- leverage the existing functionality of Multi cloud in SO
- Bring in the advantages of the K8s orchestrator and
- Set stage for the Cloud Native scenarios

REQ-341

Owners: Lukasz Rajewski (Orange), Seshu Kumar M (Huawei), Srini Addepalli (Intel)

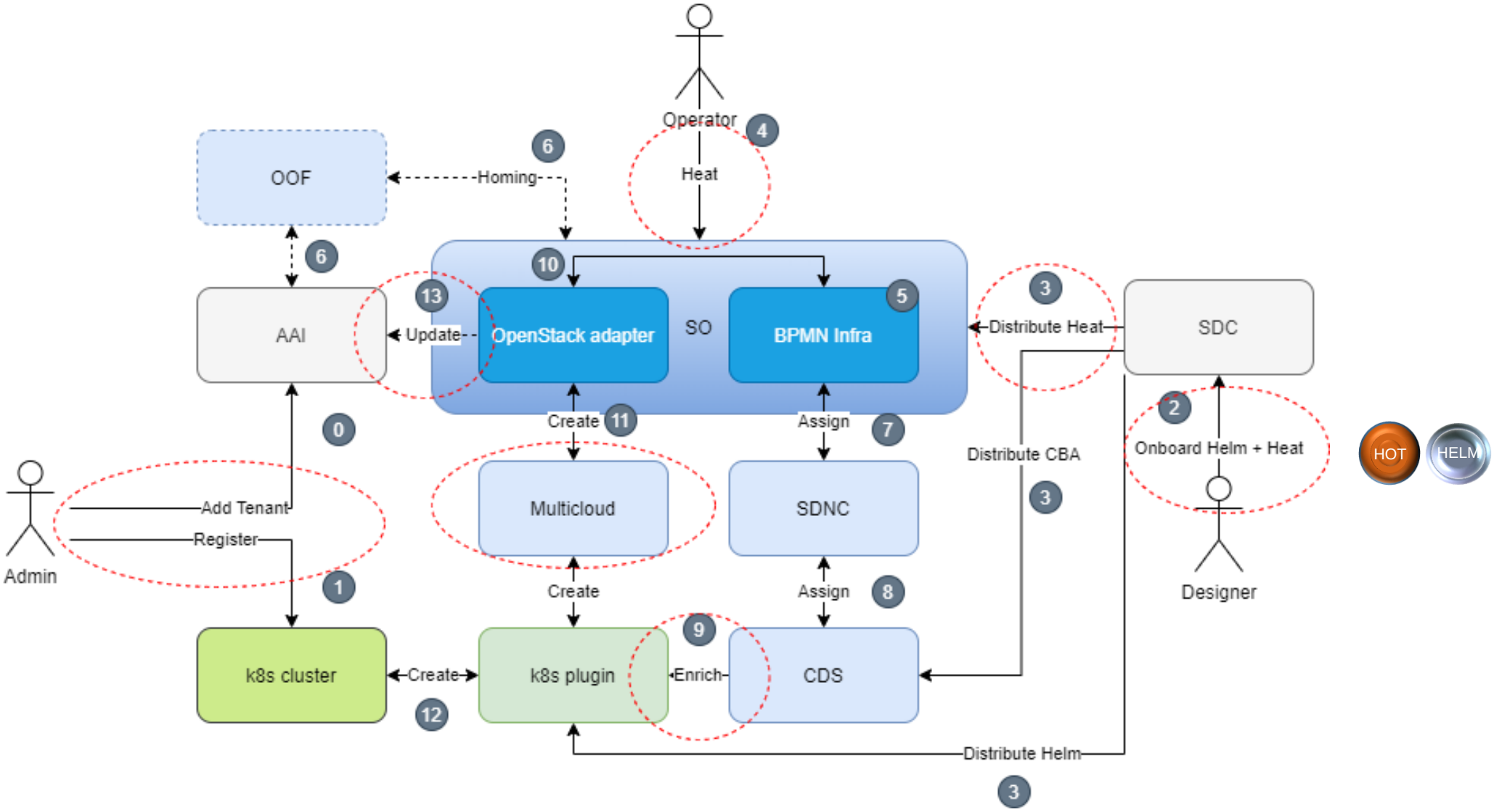
Business Impact - Enables operators and service providers to orchestrate CNFs based services along with the VNFs and PNFs

Business Markets - All operators and service providers that are intended to use the CNFs along with PNFs / VNFs

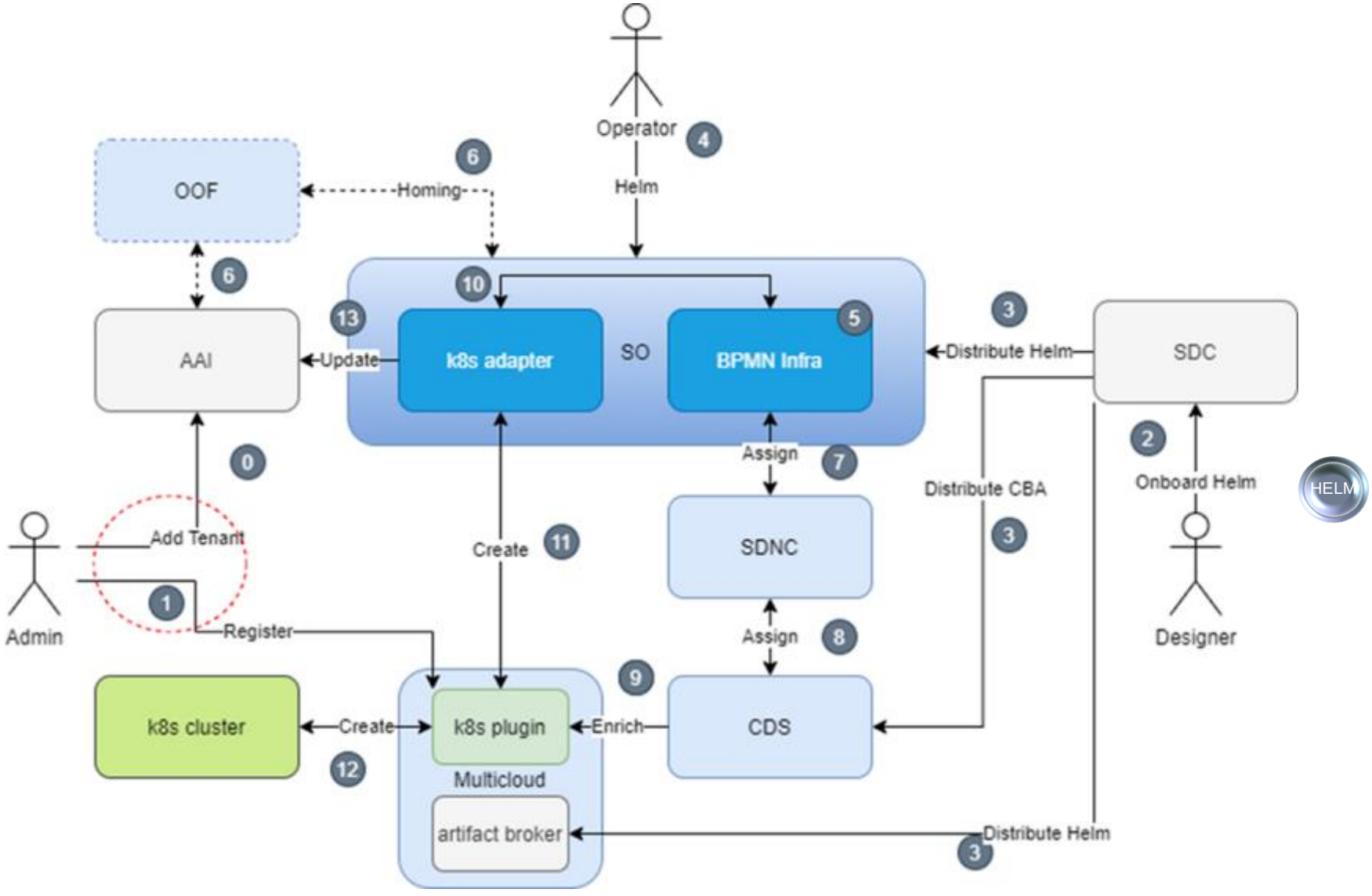
Funding/Financial Impacts - Reduction in the footprint of the ONAP for CNF support.

Organization Mgmt, Sales Strategies - *There is no additional organizational management or sales strategies for this requirement outside of a service providers "normal" ONAP deployment and its attendant organizational resources from a service provider.*

Frankfurt – CNF/Helm Day0/1 Flow



Guilin – CNF/Helm Day0/1 Flow



Guilin – Design and Implementation Grounds

- Instantiation of Helm Package with existing VNF model
- Status and synchronization of instantiated k8s resources
  - ✓ Helm Resource Artifact in SDC/SO
  - ✓ Update of AAI Information by SO: vf-module
- SO Orchestrates Helm Package -> not Heat Template
- K8s Plugin as a standalone MS
  - ✓ K8s Adapter in SO to interact directly with the K8s Plugin
  - ✓ Enhance it to support the functions like the monitoring resources and status update (stretch)
- Improvements in Helm customization/enrichment
- Backward compatibility with CNF Macro Instantiation Workflow [Frankfurt] -> cvFW Example
- Validation through flows cvFW Use Case

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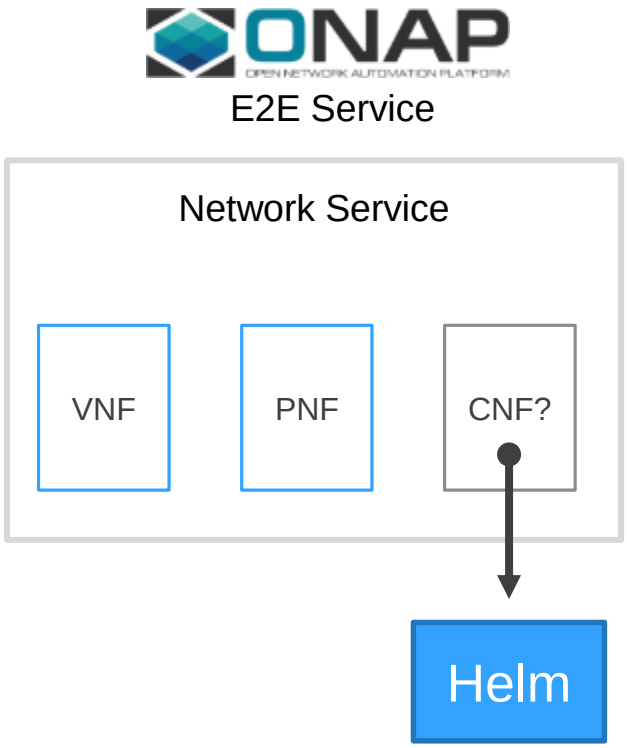
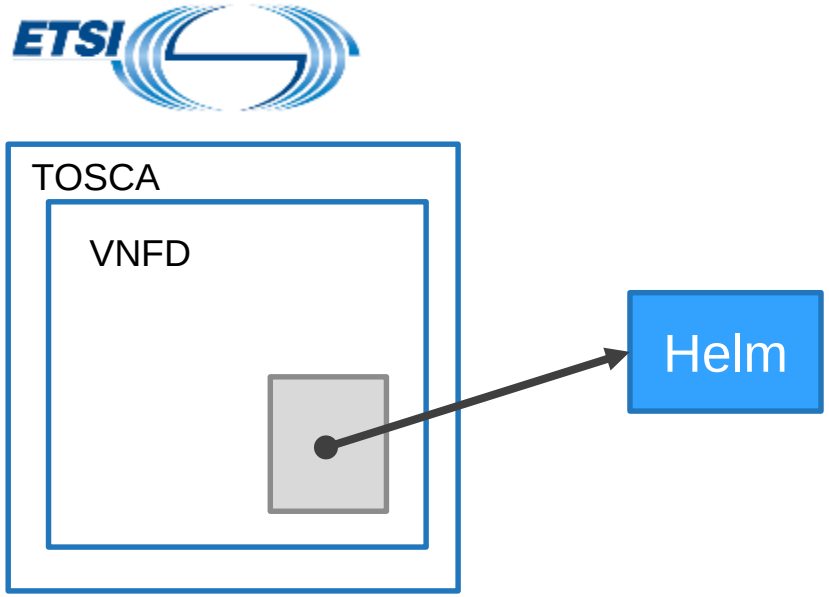
Improved Helm Distribution & Instantiation

ONAP - ETSI model Alignment

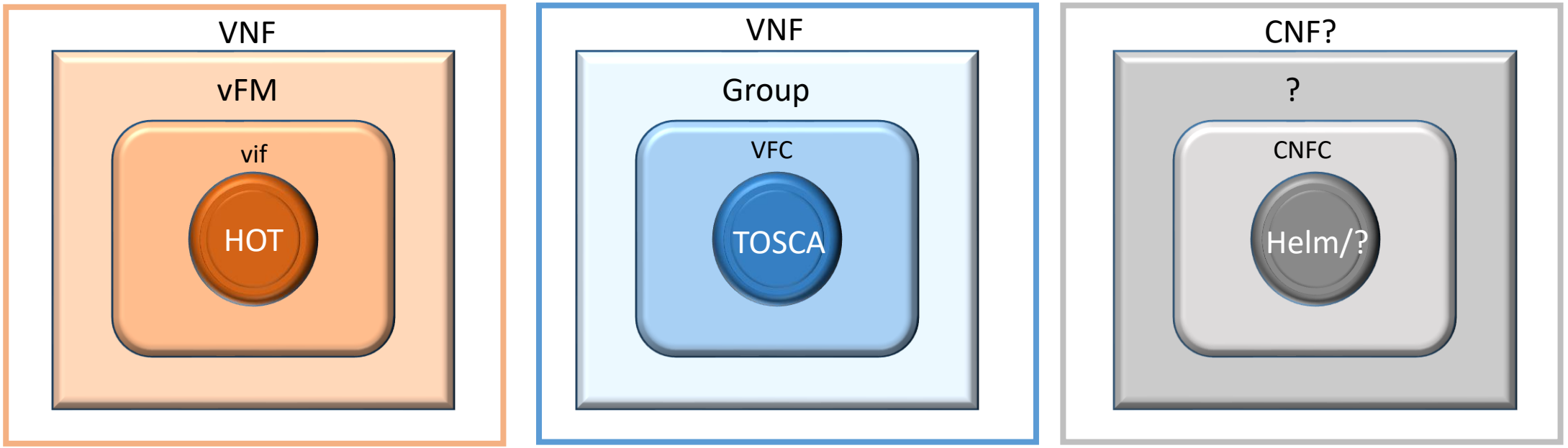




Integration of Native (K8s Adapter) with ETSi (SOL003 Adapter) paths in SO

Design/AAI CNF Model?

CNF Model - Future



New model type into the SDC, AAI built over the helm charts as an input and would be distributed to the other ONAP components

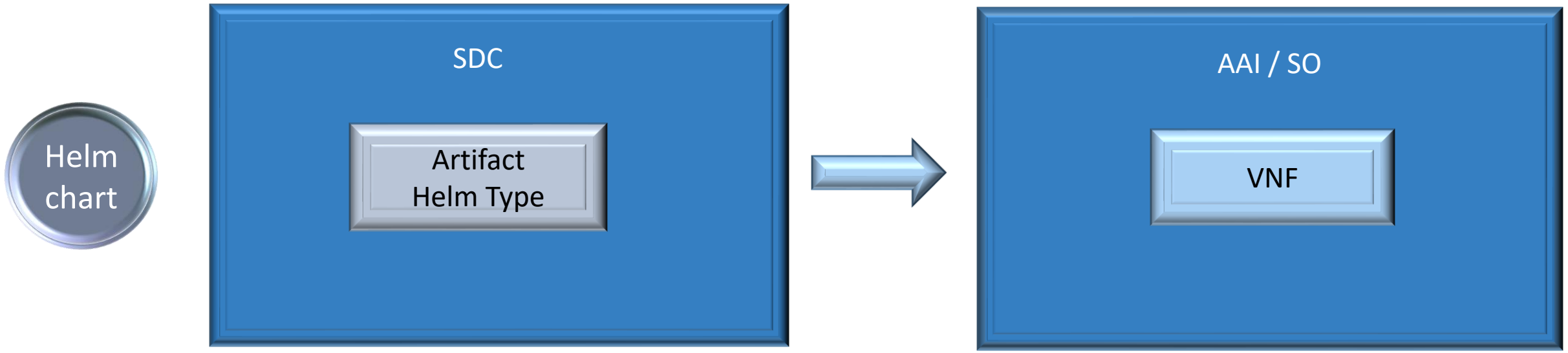
Pros

- ✓ Onboard a design template to the SDC and create a new resource from that
- ✓ Requires a new model to be introduced
- ✓ Will be inline to the existing models of the heat and TOSCA based VNFs
- ✓ Can also be extended to other formats for CNF modeling

Cons

- ✓ Initial analysis for understanding the standard model
- ✓ Requires more effort and may span across multiple ONAP releases
- ✓ The grouping model currently used in ONAP may pose a one-one mapping to the other standard formats

CNF Model - Guilin



Helm Chart on-boarded as an artifact type to the SDC and distributed to ONAP, AAI would persist it as existing VNF
Helm chart would be stored as flat file and add it to the CSAR package to be distributed.

Pros

- ✓ Easy to develop comparing with Approach 1
- ✓ Better reuse of the existing functional code

Cons

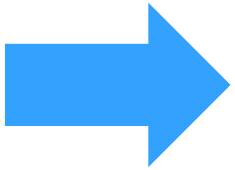
- ✓ Initial analysis for AAI persisting the CNF instance – Extend the VNF
- ✓ Very specific implementation and non extendable (non-helm)

SDC - Onboarding Package with Helm

VSP Manifest with Helm in Frankfurt

```
{
    "name": "virtualFirewall",
    "description": "",
    "data": [
        {
            "file": "base_template.yaml",
            "type": "HEAT",
            "isBase": "true",
            "data": [
                {
                    "file": "base_template.env",
                    "type": "HEAT_ENV"
                }
            ]
        },
        {
            "file": "base_template_cloudtech_k8s_charts.tgz",
            "type": "CLOUD_TECHNOLOGY_SPECIFIC_ARTIFACT"
        }

    ]
}
```



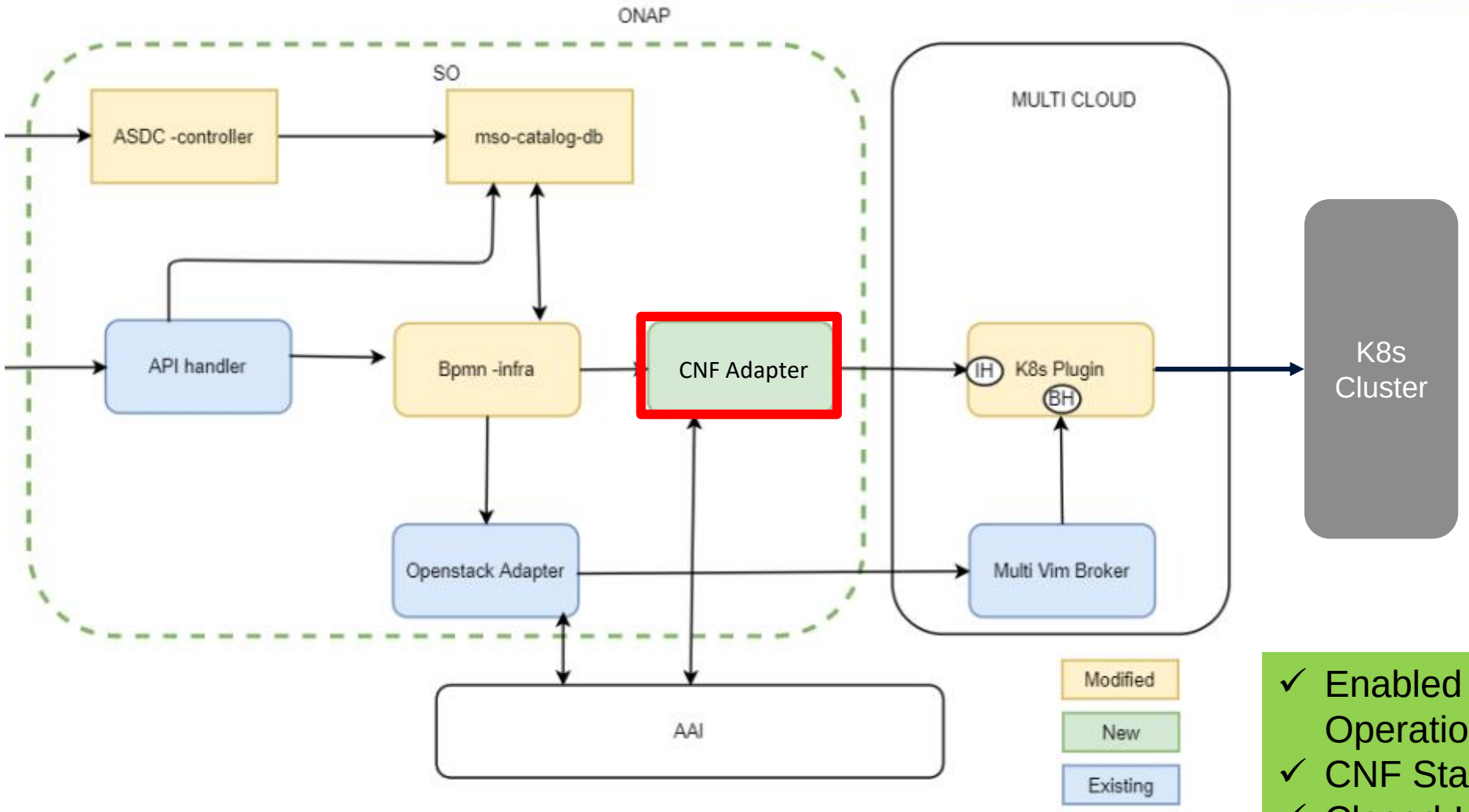
VSP Manifest with Helm in Guilin

```
{
    "name": "virtualFirewall",
    "description": "",
    "data": [
        {
            "file": „helm_base_template.tgz",
            "type": "HELM",
            "isBase": "true"
        }

    ]
}
```

… from „small” change

SO – Native Orchestration of Helm



- ✓ Enabled Native CNF Day2 Operations
- ✓ CNF Status AAI Synchronization
- ✓ Closed-Loop Integration

… towards „big” things

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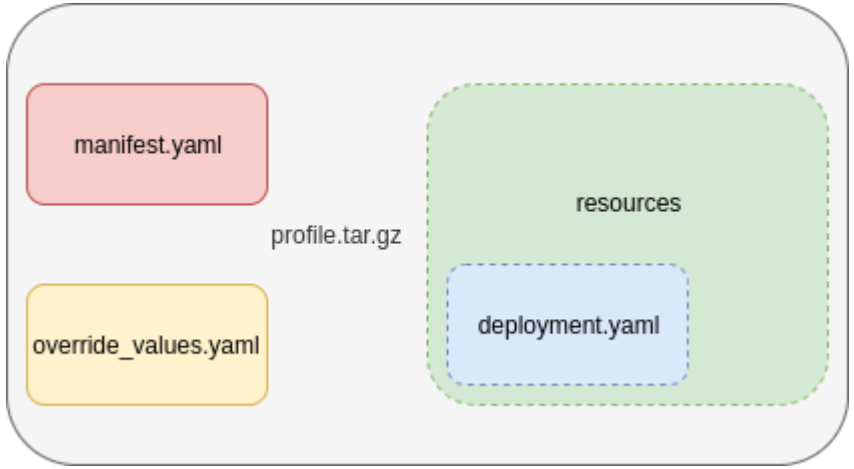
Improved Helm Enrichment

RB Profile – Helm Enrichment Package

Example of RB Profile's manifest

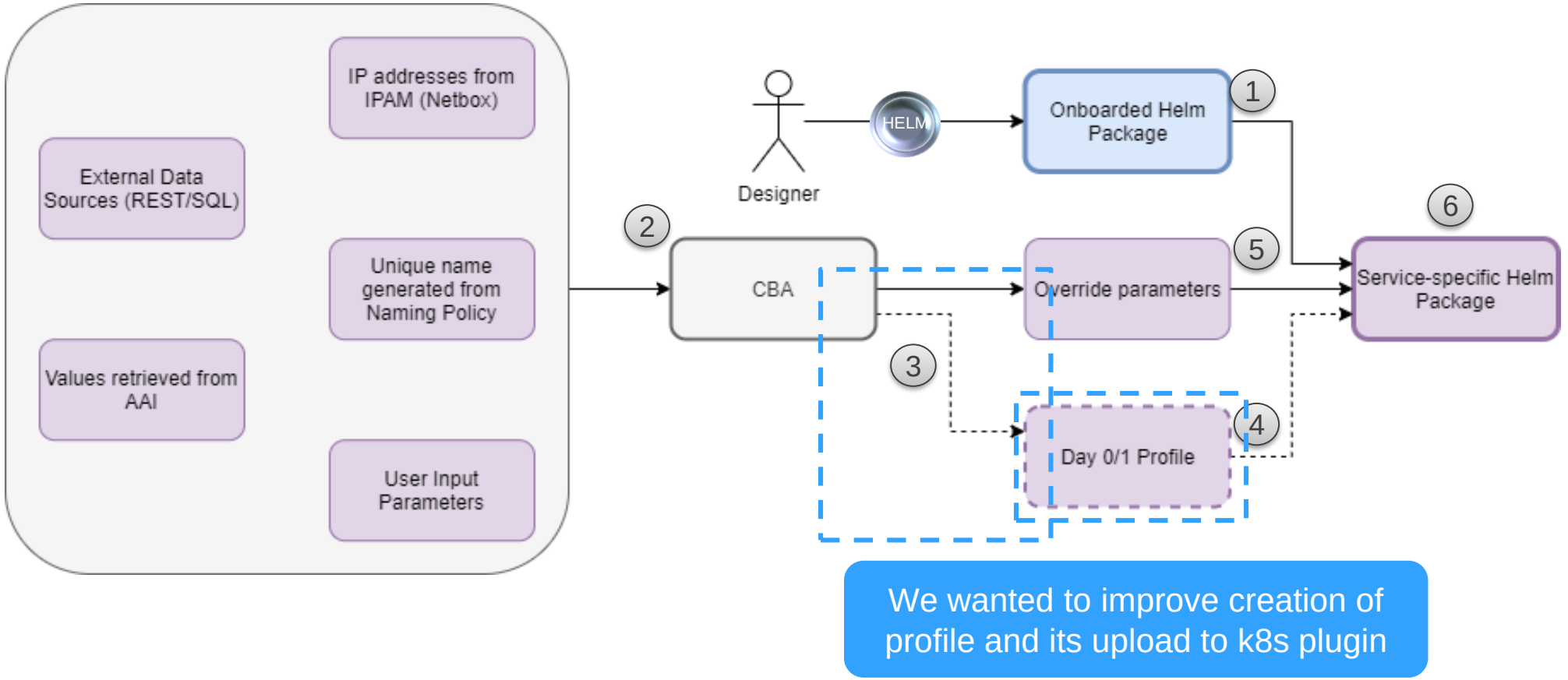
```
---
version: v1
type:
  values: override_values.yaml
  configresource:
    - filepath: resources/deployment.yaml
      chartpath: templates/deployment.yaml
```

Example of profile's structure



- K8s Plugin Requires profile to be archived as tar.gz file Complex Structure
- Profile contains Manifest + additional files
  - Files: override.yaml + optional extra resources
  - Extra resources: deployments.yaml, configmap.yaml etc.
  - Extra resources replace existing helm templates or add new ones
  - Values file gets merged with values file from helm package

Enrichment of Helm Package with CDS



Helm → Profile → Inst. Overrides

Helm Package – Values


```
title: "My WordPress Site" # Sent to the WordPress template

global:
  app: MyWordPress

mysql:
  global:
    app: MyWordPress
  max_connections: 100 # Sent to MySQL
  password: "secret"

apache:
  global:
    app: MyWordPress
  port: 8080 # Passed to Apache
```


- Complex Structure of parameters
- Keys like .mysql.global.app
- Arrays in key names

- Too complex for simple key-value input from SO to k8s Plugin
- Good for Profile Templating in CDS

Helm Package - Structure


```
|-Chart.yaml
|-templates
|   |-network_attachment_definition.yaml
|   |-onap-private-net.yaml
|   |-protected-private-net.yaml
|   |-unprotected-private-net.yaml
|-values.yaml
```

- Yaml syntax
- Complex Structure
  - ✓ Chart descriptor
  - ✓ Templates
  - ✓ Override values file
  - ✓ [Nested Helm charts]
- Override values
  - ✓ Full Yaml structure possible
  - ✓ Flat key - value map is only one option
  - ✓ Nested values.yaml

```
|-Chart.yaml
|-charts
|   |-packetgen
|   |   |-Chart.yaml
|   |   |-templates
|   |   |   |-deployment.yaml
|   |   |   |-service.yaml
|   |   |   |-_helpers.tpl
|   |   |-values.yaml
|   |-sink
|   |-Chart.yaml
|   |   |-templates
|   |   |   |-configmap.yaml
|   |   |   |-deployment.yaml
|   |   |   |-service.yaml
|   |   |   |-_helpers.tpl
|   |   |-values.yaml
|-templates
|   |-deployment.yaml
|   |-onap-private-net.yaml
|   |-protected-private-net.yaml
|   |-unprotected-private-net.yaml
|   |-_helpers.tpl
|-values.yaml
```

We need flexibility to adapt Helm Charts provided by Helm application provider

RB Profile Working Upload [Frankfurt]


```
"profile-modification": {
    "type": "component-resource-resolution",
    "interfaces": {
        "ResourceResolutionComponent": {
            "operations": {
                "process": {
                    "inputs": {
                        "artifact-prefix-names": [
                            "ssh-service"
                        ]
                    }
                }
            }
        }
    },
    "artifacts": {
        "ssh-service-template": {
            "type": "artifact-template-velocity",
            "file": "Templates/k8s-profiles/ssh-service-template.vtl"
        },
        "ssh-service-mapping": {
            "type": "artifact-mapping-resource",
            "file": "Templates/k8s-profiles/ssh-service-mapping.json"
        }
    }
},
"profile-upload": {
    "type": "component-script-executor",
    "interfaces": {
        "ComponentScriptExecutor": {
            "operations": {
                "process": {
                    "inputs": {
                        "script-type": "kotlin",
                        "script-class-reference": "org.onap.ccsdk.cds.blueprintsprocessor.services.execut
                        "dynamic-properties": "*profile-upload-properties"
                    }
                }
            }
        }
    }
},
```

```
override suspend fun processNB(executionRequest: ExecutionServiceInput) {
    log.info("executing K8s Profile Upload script")

    val baseK8sApiUrl = getDynamicProperties("api-access").get("url").asText()
    val k8sApiUsername = getDynamicProperties("api-access").get("username").asText()
    val k8sApiPassword = getDynamicProperties("api-access").get("password").asText()

    val prefixList: ArrayList<String> = getTemplatePrefixList(executionRequest)

    for (prefix in prefixList) {
        if (prefix.toLowerCase().equals("vnf")) {
            log.info("For vnf-level resource-assignment, profile upload is not performed")
            continue
        }

        val assignmentParams = getDynamicProperties("assignment-params")
        val payloadObject = JacksonUtils.jsonNode(assignmentParams.get(prefix).asText()) as Ob

        log.info("Uploading K8S profile for template prefix $prefix")

        val vfModuleModelInvariantUuid: String = getResolvedParameter(payloadObject, "vf-modul
        val vfModuleModelUuid: String = getResolvedParameter(payloadObject, "vf-module-model-v
        val k8sRbProfileName: String = getResolvedParameter(payloadObject, "k8s-rb-profile-nam
        val k8sRbProfileNamespace: String = getResolvedParameter(payloadObject, "k8s-rb-profil

        val api = K8sApi(k8sApiUsername, k8sApiPassword, baseK8sApiUrl, vfModuleModelInvariant

        if (!api.hasDefinition()) {
            throw BluePrintProcessorException("K8s RB Definition (${vfModuleModelInvariantUuid
        }

        log.info("k8s-rb-profile-name: $k8sRbProfileName")
        if (k8sRbProfileName.equals("")) {
            throw BluePrintProcessorException("K8s rb profile name is empty! Either define pro
        }
        if (k8sRbProfileName.equals("default") and api.hasProfile(k8sRbProfileName)) {
            log.info("Using default profile - skipping upload")
        } else {
```

RB Profile Native Upload [Guilin]

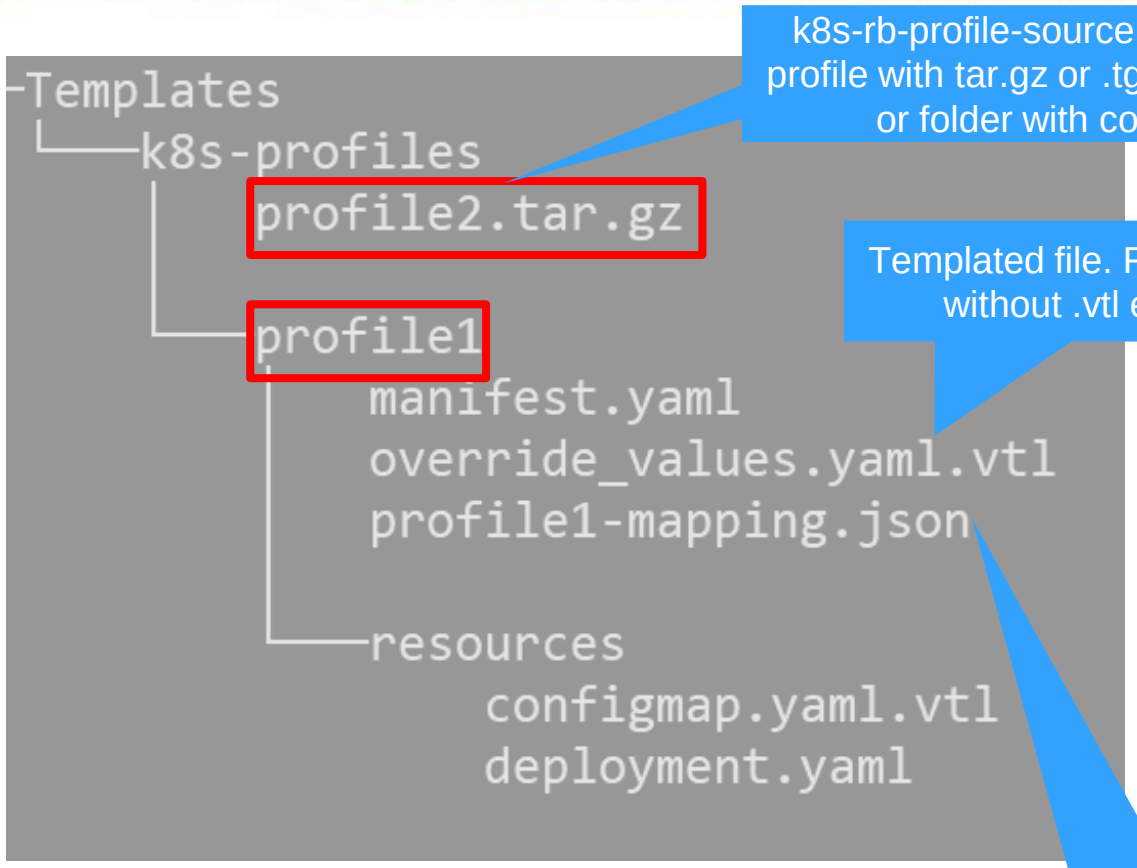

```
"k8s-profile-upload": {
    "type": "component-k8s-profile-upload",
    "interfaces": {
        "K8sProfileUploadComponent": {
            "operations": {
                "process": {
                    "inputs": {
                        "artifact-prefix-names": {
                            "get_input": "template-prefix"
                        },
                        "resource-assignment-map": {
                            "get_attribute": [
                                "resource-assignment",
                                "assignment-map"
                            ]
                        }
                    }
                }
            }
        }
    },
    "artifacts": {
        "vfw-cnf-cds-base-profile": {
            "type": "artifact-k8sprofile-content",
            "file": "Templates/k8s-profiles/vfw-cnf-cds-base-profile.tar.gz"
        },
        "vfw-cnf-cds-vpkg-profile": {
            "type": "artifact-k8sprofile-content",
            "file": "Templates/k8s-profiles/vfw-cnf-cds-vpkg-profile"
        },
        "vfw-cnf-cds-vpkg-profile-mapping": {
            "type": "artifact-mapping-resource",
            "file": "Templates/k8s-profiles/vfw-cnf-cds-vpkg-profile/ssh-service-mapping.json"
        }
    }
},
```

Here the k8s-rb* inputs will be taken from resource-assignment-map

Each profile source must be listed as artifact-k8sprofile-content artifact

If profile source is a folder it needs to have associated a mapping file

RB Profile Native Upload – Profile Manifest



k8s-rb-profile-source: complete profile with tar.gz or .tgz extension or folder with content

Templated file. Final file name without .vtl extension

Profile will contain only files mentioned in the manifest

```
---
version: v1
type:
  values: override_values.yaml
  configresource:
    - filepath: resources/deployment.yaml
      chartpath: templates/deployment.yaml
    - filepath: resources/configmap.yaml
      chartpath: templates/deployment.yaml
```

CBA profiling content

Definitions of values used for Velocity (vtl) templating

Manifest for profile1 source

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K8splugin's Enhancements

K8splugin’s v1 Enhancements

- New endpoint – Status API – with live information of content of instantiated resources
- Support for release-name provisioning at instantiation time
- Enhanced support for labeling of nested resource template

K8splugin’s v1 Status API - overview

Instance API (Get)

- Provide details of instantiation request (e.g. override parameters)
- Provide information about vf-module’s instance release-name
- Provide information about resources namespace in k8s cluster
- Lists all resources assigned in k8s cluster provided in Helm Chart (specifying their name and GVK)

Status API

- Provide details of instantiation request (e.g. override parameters)
- Provides total number of vf-module’s resources created in cluster
- Provides all details of resources defined in Helm Chart as well as Pods created for given vf-module instance (similar to `kubectl describe X Y` command).

K8splugin's v1 Status API - overview

Instance API (Get):


```
{
    "id": "goofy_merkle",
    "request": {
        "rb-name": "vfw",
        "rb-version": "plugin_test",
        "profile-name": "test_profile",
        "release-name": "",
        "cloud-region": "kud",
        "labels": {…
        },
        "override-values": {…
        }
    },
    "namespace": "plugin-tests-namespace",
    "release-name": "test-release",
    "resources": [
        {
            "GVK": {
                "Group": "",
                "Version": "v1",
                "Kind": "ConfigMap"
            },
            "Name": "sink-configmap"
        },
        {
            "GVK": {
                "Group": "",
```


Status API:


```
{
    "request": {
        "rb-name": "vfw",
        "rb-version": "plugin_test",
        "profile-name": "test_profile",
        "release-name": "",
        "cloud-region": "kud",
        "labels": {…
        },
        "override-values": {…
        }
    },
    "ready": false,
    "resourceCount": 12,
    "resourcesStatus": [
        {
            "name": "sink-configmap",
            "GVK": {…
            },
            "status": {
                "apiVersion": "v1",
                "data": {
                    "protected_net_gw": "192.168.20.100",
                    "protected_private_net_cidr": "192.168.10.0/24"
                },
                "kind": "ConfigMap",
                "metadata": {
                    "creationTimestamp": "2020-10-06T13:45:43Z",
                    "labels": {
                        "k8splugin.io/rb-instance-id": "goofy_merkle"
```

K8splugin’s v1 Status API - details

Currently only Pods are listed in Status API resources apart from these defined directly in Helm Chart

Status API result can be used i.e. to determine

- Image names used in Deployment/Pods
- Status of Deployment/Pods
- Content of ConfigMaps/Secrets
- Assigned dynamic NodePort of Service
- Metadata/Annotations of Pods (e.g. to see custom, runtime assigned CNI network addresses)

K8splugin’s Status API - demo

K8splugin's Status API - demo

- Image names used in Deployment/Pods
- Status of Deployment/Pods
- Content of ConfigMaps/Secrets
- Assigned dynamic NodePort of Service
- Metadata/Annotations of Pods (e.g. to see custom, runtime assigned CNI network addresses)


```
"status": {
    "availableReplicas": 1,
    "conditions": [···
    ],
    "observedGeneration": 1,
    "readyReplicas": 1,
    "replicas": 1,
    "updatedReplicas": 1
}
```

```
"containers": [
    {
        "image": "virtlet.cloud/ubuntu/16.04:latest",
```

```
"data": {
    "protected_net_gw": "192.168.20.100",
    "protected_private_net_cidr": "192.168.10.0/24"
},
```

```
"ports": [
    {
        "nodePort": 30831,
        "port": 2831,
        "protocol": "TCP",
        "targetPort": 2831
    }
```

```
"k8s.plugin.opnfv.org/nfn-network": "{ \"type\": \"ovn4nfv\", \"interface\":[ { \"name\": \"unprotected-private-net\", \"ipAddress\":
    \"192.168.10.2\", \"interface\": \"eth1\" , \"defaultGateway\": \"false\"}, { \"name\": \"onap-private-net-test\", \"ipAddress\":
    \"10.0.100.2\", \"interface\": \"eth2\" , \"defaultGateway\": \"false\"} ]}",
```

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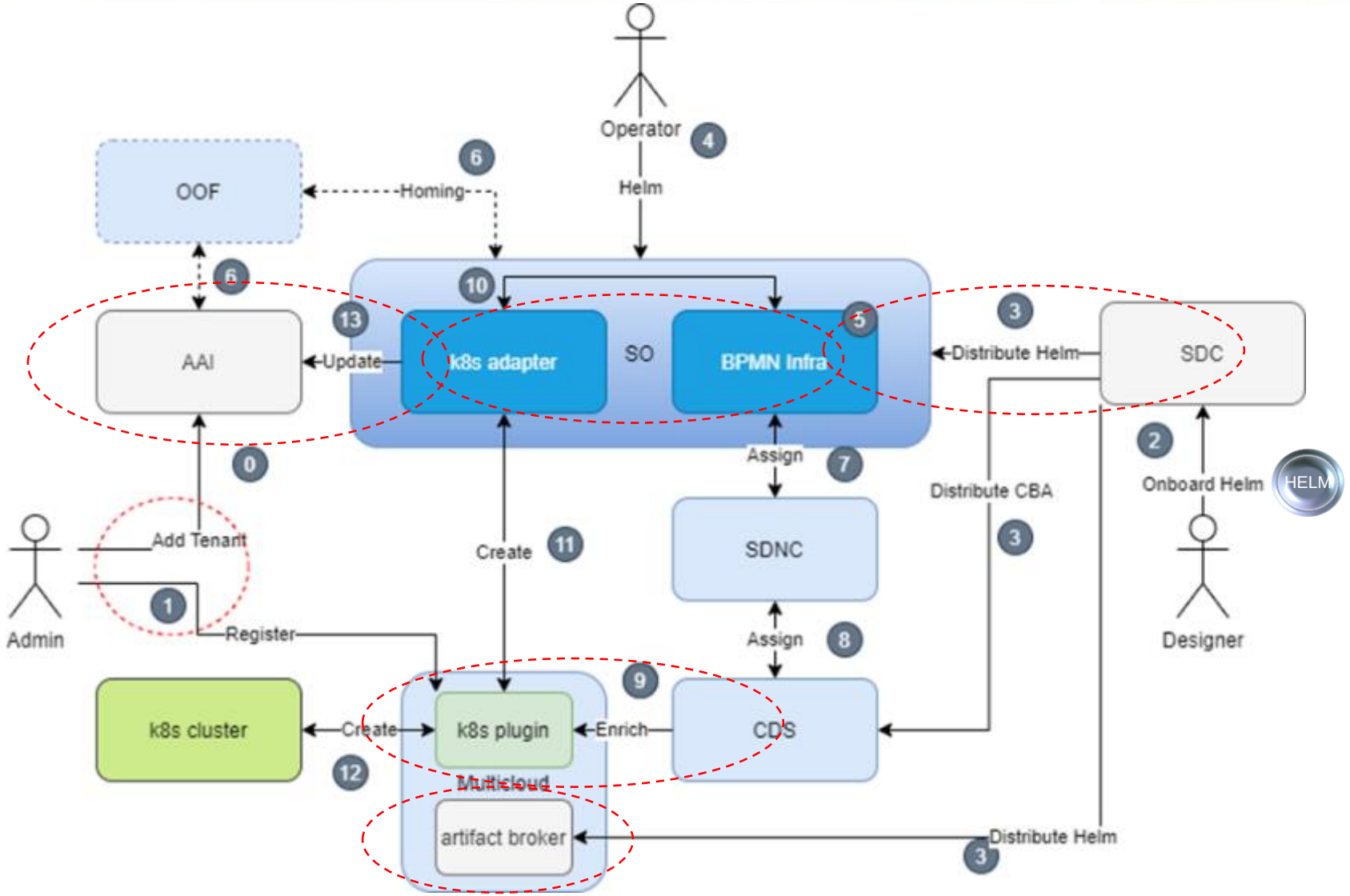
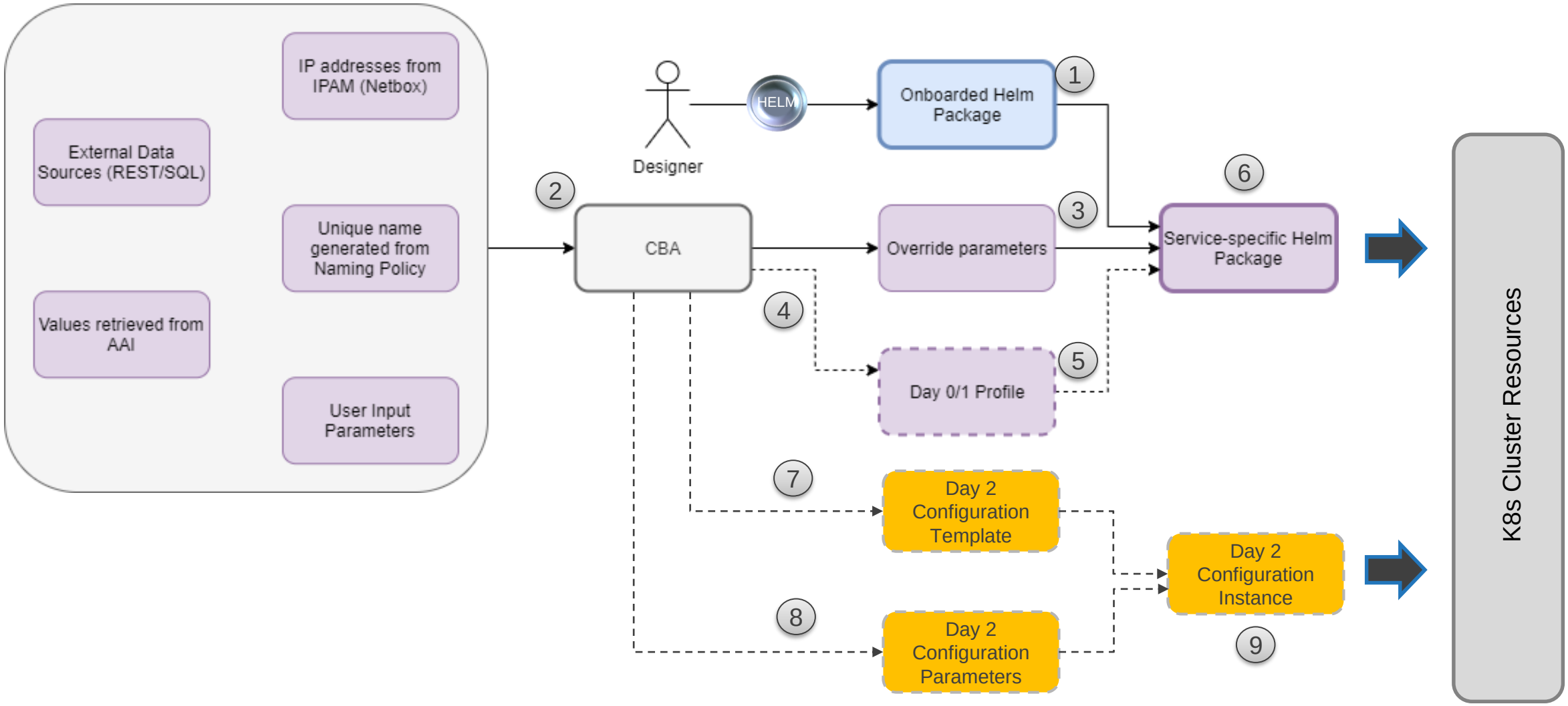
Guilin - K8s Adapter (Helm) Flow Day 0/1



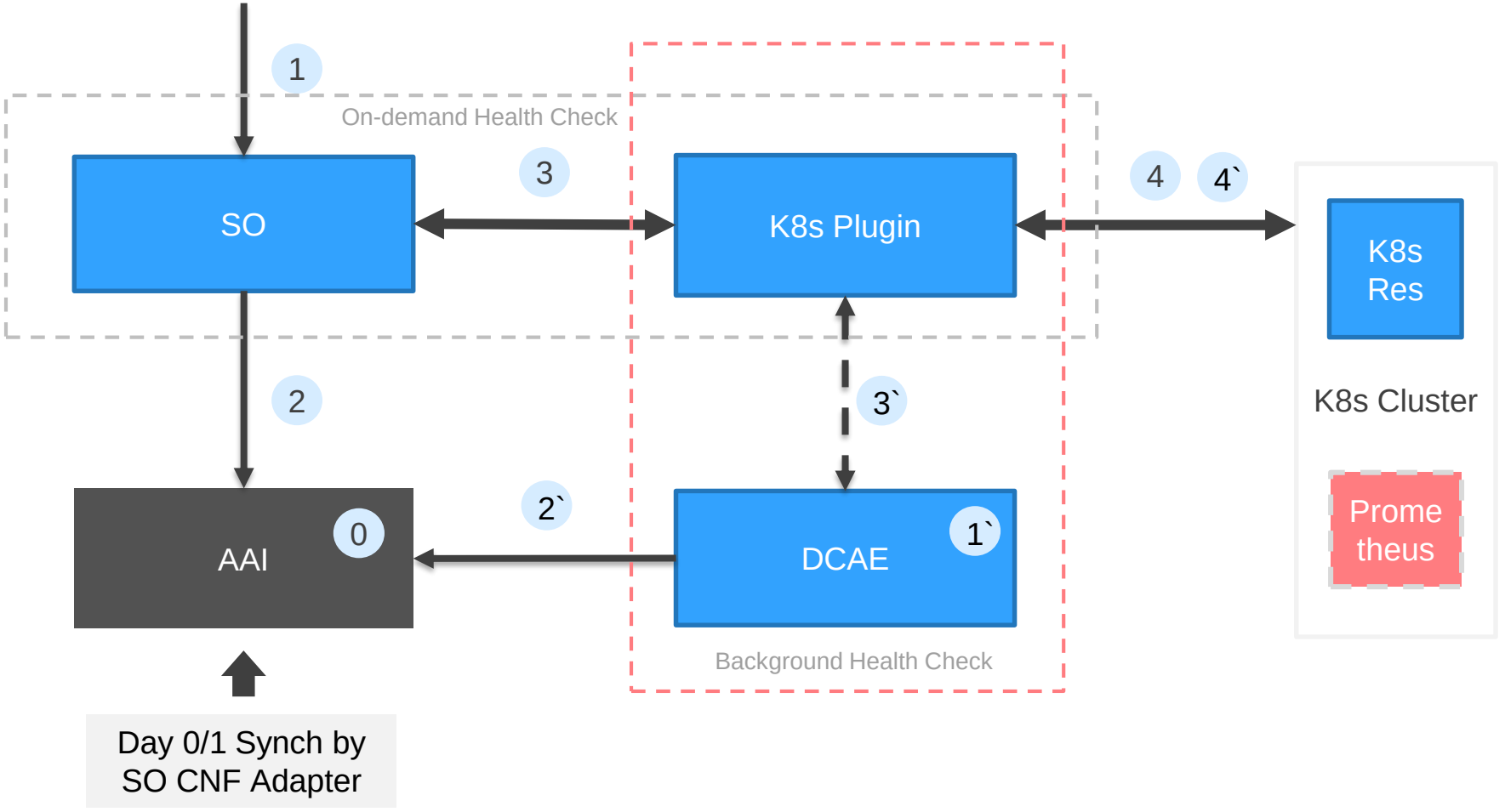
Focus on Native Day2 Operations

- AAI model changes
- SO AAI Data Update
- SO CNF Status
- SDC Distribution
- Helm Validation
- K8s Plugin – v2 APIs
- Native Day2 for CNF in CDS

Helm Package Day 0/1 + Day2



Day2 CNF Health Flow - ONAP

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Thank You!