vF2F ONAP DDF (2020-06-24) presentation following:

R7 Architecture Review AR-0009-R7-052020

R7 HARMONIZATION: ONAP/3GPP & O-RAN ALIGNMENT: STANDARDS DEFINED NOTIFICATIONS OVER VES

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ONAP/3GPP & O-RAN Alignment

Standards Defined Notifications over VES - - Overview

- The proposed contribution is part of the Harmonization Use Case between 3GPP, ONAP and O-RAN.
  - This contribution addresses modifications needed in ONAP resulting from an agreement between ONAP, 3GPP and O-RAN to address a 3GPP liaison statement S5-197831.
    - 3GPP Compliant NFs emitting notifications sent to DCAE should retain their native notification format/schema as defined by 3GPP.
    - ONAP/VES header added to the notification as defined by ONAP.
    - Goal to decouple the 3GPP payload from the overall event format defined by ONAP/VES and allow more independent evolution in 3GPP and ONAP.

ONAP/3GPP & O-RAN Alignment

Standards Defined Notifications over VES—Overview cont.

- The proposal introduces a generic capability to ***collect*** events defined by standards organizations (3GPP, IETF etc.), in DCAE:
  - Initial release will support 3GPP Notifications ***collection***.
  - Key Changes:
    - VES Header Changes: new domain field enumeration value for standards defined notifications and new field that supports the routing of these notifications to the appropriate DMaaP topic.
    - 3GPP will define and publish the valid contents for the new routing-related field.
- The proposal introduces an optional second stage of validation on the event payload to confirm it conforms to a valid data schema from the standards organization.
  - Schemas to be published by 3GPP using openAPI 3.0 format, using a publicly available repository. There is a translation between openAPI and JSON schema possible here, which would be used.

Requirements updates to Drive Component Changes

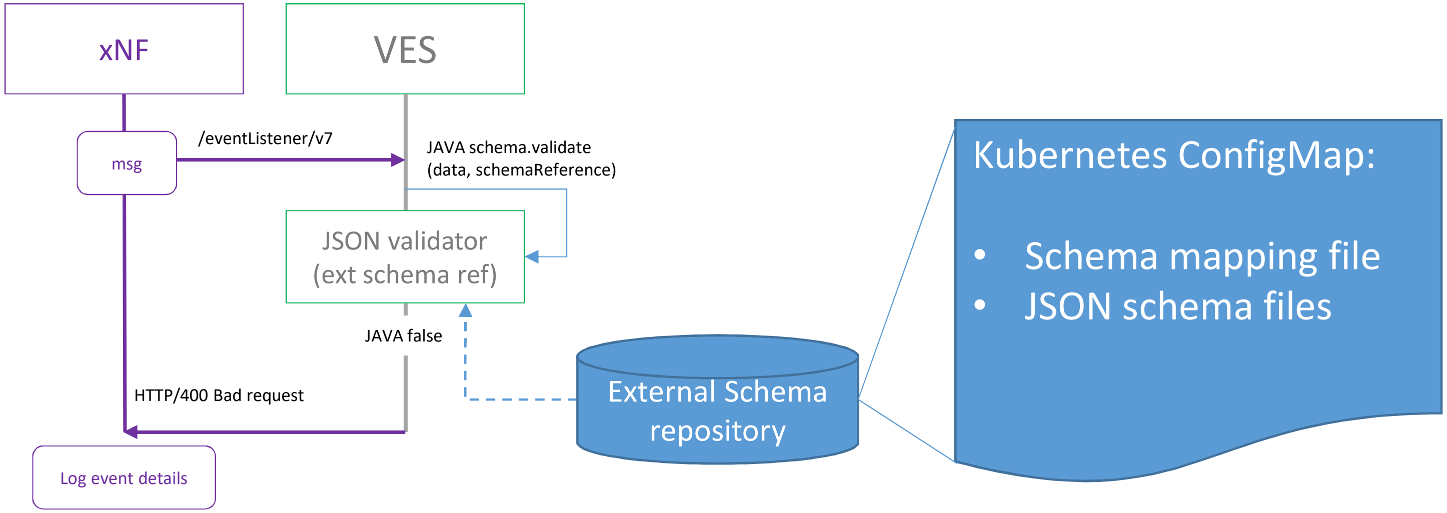
VES Specifications in VNF Requirements Project will be updated to:

- Add a new domain field enumeration value stndDefined (indicating that the event is complying with the schema defined by a standards body).
- Add a new field in the common header, stndDefinedNamespace which is only populated when the stndDefined domain is selected.
- A new field structure, stndDefinedFields will be added to the VES common event schema with three properties
  - stndDefinedFieldsVersion (type = string, enum)
  - schemaReference (type = string, format = uri)
  - data (JSON „object”)

ONAP schema submission: https://gerrit.onap.org/r/c/vnfrqts/requirements/+/109199

New Component Capabilities in Guilin

- DCAE VES Collector/EventListener will be updated to support the new requirements added to the VES Specifications (see slide 4).
- Extend DCAE to use contents of the new stndDefinedNamespace field to route events to appropriate DMaaP topics, *only in case of stndDefined domain*
- Extend VES collector to execute 2nd stage of event validation, using built-in validator.



Kubernetes ConfigMap:

- Schema mapping file
- JSON schema files

A schemaRepo will be provided using a K8S ConfigMap

- Will be attached to each VES collector instance
- Will be used to load the external schemas at startup
- ConfigMap can be modifed in operators environment
- Default ConfigMap to be provided with ONAP/DCAE

New Component Capabilities in Guilin—slide 2

- VES Collector extended to perform Stage 2 validation (optional).
  - validates that the data in the stndDefinedFields.data property conforms to a valid JSON schema uploaded to the VES schemaRepo.
  - Schema to use for validation is identified by the schemaReference field in the event.
    - If the schemaReference is present → execute 2nd stage validation,
    - If the schemaReference is absent → no 2nd stage validation
    - An additional config parameter to control the 2nd stage validation (enabled by default)

- DCAE CFY blueprint plugin to be enhanced
  - Allows to use a ConfigMap in a DCAE component deployment
  - Extend relevant DCAE application TOSCA models (e.g. type: dcae.nodes.ContainerizedPlatformComponent)

New Component Capabilities in Guilin—slide 3

- schemaRepo function (a simplified version of schemaBroker)
  - Contains a schemaRepo manifest file
  - Contains schema references in manifest file (translated from openAPI descriptions in 3GPP repo)

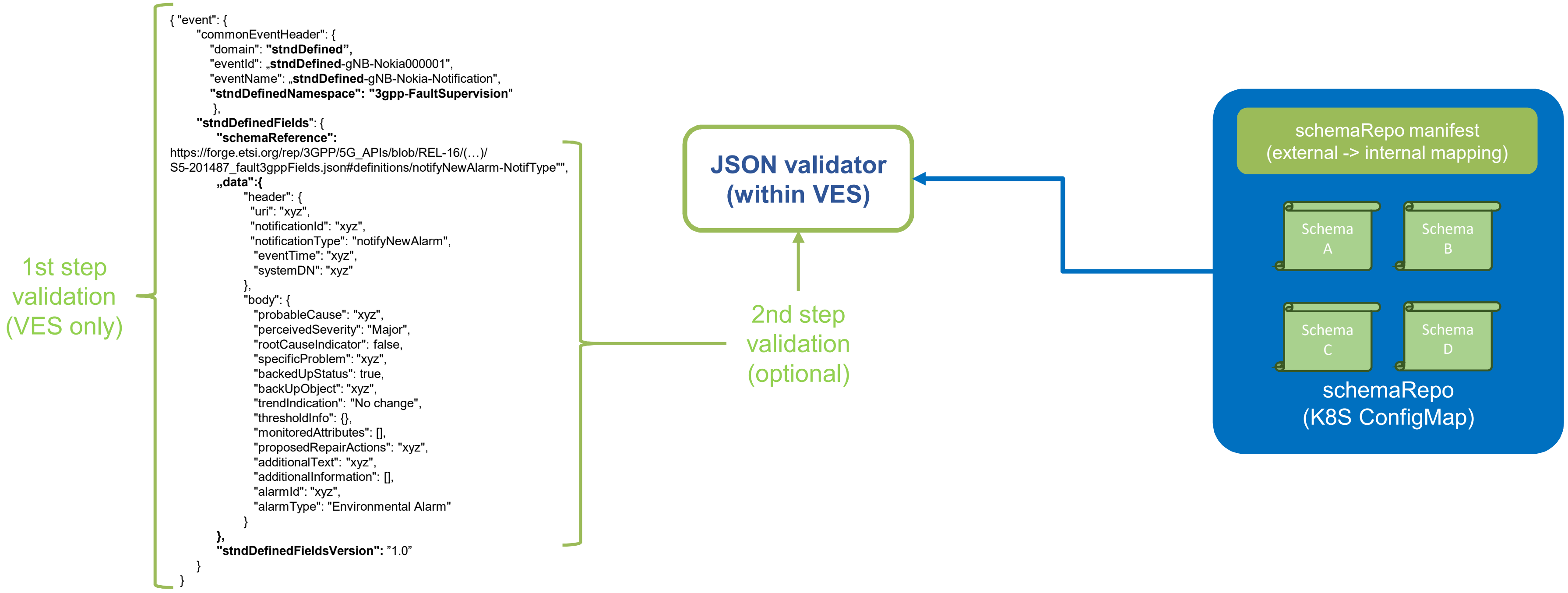
- schemaRepo manifest file
  - Maps external schema references (e.g. https://forgetETSI.org/3gpp/schemas/...) to local file references
  - Based on networknt.com JSON validator mapping (see example here)

- Provided to VES collector as a K8S configMap
  - Config map contains both – manifest and schema files
  - ConfigMap contents generated in an on-demand Jenkins CI job adding a schema

stndDefined Event Validation—more detailed view

1st Step Validation required (Existing)

2nd Step Validation (Optional) verifies data corresponds to valid schema (NEW)



```
{ "event": {
        "commonEventHeader": {
            "domain": "stndDefined",
            "eventId": „stndDefined-gNB-Nokia000001",
            "eventName": „stndDefined-gNB-Nokia-Notification",
            "stndDefinedNamespace": "3gpp-FaultSupervision"
             },
        "stndDefinedFields": {
              "schemaReference":
https://forge.etsi.org/rep/3GPP/5G_APIs/blob/REL-16/(…)/
S5-201487_fault3gppFields.json#definitions/notifyNewAlarm-NotifType"",
              „data":{
                    "header": {
                      "uri": "xyz",
                      "notificationId": "xyz",
                      "notificationType": "notifyNewAlarm",
                       "eventTime": "xyz",
                       "systemDN": "xyz"
                    },
                    "body": {
                       "probableCause": "xyz",
                       "perceivedSeverity": "Major",
                       "rootCauseIndicator": false,
                       "specificProblem": "xyz",
                       "backedUpStatus": true,
                       "backUpObject": "xyz",
                       "trendIndication": "No change",
                       "thresholdInfo": {},
                       "monitoredAttributes": [],
                       "proposedRepairActions": "xyz",
                       "additionalText": "xyz",
                       "additionalInformation": [],
                       "alarmId": "xyz",
                       "alarmType": "Environmental Alarm"
                    }
              },
              "stndDefinedFieldsVersion": ”1.0”
        }
  }
```

1st step validation (VES only)
2nd step validation (optional)
JSON validator (within VES)
schemaRepo manifest (external -> internal mapping)
Schema A
Schema B
Schema C
Schema D
schemaRepo (K8S ConfigMap)

New Component Capabilities in Guilin—slide 3

- Create a K8S configMap artifact in DCAE (store schema definitions and schemaRepo manifest file)
  - Jenkins job in ONAP-CI (will produce a K8S ConfigMap artifact)
    - Will connect to 3GPP schema repo & download the schemas,
    - generate the schemaRepo manifest file
    - store the data in a configMap
  - When VES collector is starting during deployment
    - ConfigMap will be attached to VES collector instance to load the schemaRepo
    - Same schemaRepo to be used for each collector instance (standard K8S behavior)
    - ConfigMap can be modified locally, before VES collector is deployed

Goal:
Make sure, that the external schemas are available
in off-line environments

New or Modified Interfaces and Backwards Compatibility

- VES Common Event Schema
  - Add new ENUM to domain field called stndDefined (this new domain is generic, allowing this to be readily extended for events from other standards bodies without modification to the VES Header).
  - Add new field stndDefinedNamespace populated only if stndDefined domain ENUM is entered.
    - Contains valid values as defined by the standards organization.
    - 3GPP has defined *3GPP-Provisioning*, *3GPP-Heartbeat*, *3GPP-FaultSupervision*, and *3GPP-PerformanceAssurance*. (VES specification does not need to document these, these will be considered as VES collector configuration).
- Changes to the Common Header are backward compatible.
  - New domain ENUM does not invalidate existing domain ENUMS.
  - New field required only if new domain ENUM(stndDefined) is used.
  - stndDefinedFields is a new section in the VES common schema so backwards compatible.
- Proposed changes to DCAE Blueprints/component_specs are backwards compatible (new parameters are added, no change to how existing parameters are processed)

Published API Impacts

Project	API	Notes
DCAE	VES Event Listener	See slide 6
DCAE	schemaRepo K8S configMap	See slide 5 and 7

REFERENCES TO INTERFACES (existing interfaces)

DCAE-VES Header:
https://docs.onap.org/en/latest/submodules/dcaegen2.git/docs/sections/apis/ves.html

The schema definition for each of VES model are referenced here: https://docs.onap.org/en/latest/submodules/dcaegen2.git/docs/sections/services/ves-http/architecture.html#ves-schema-validation

VES Common Event schema (VES 7.2 – Guilin planned release):
https://git.onap.org/vnfrqts/requirements/tree/docs/Chapter8/ves_7_2/CommonEventFormat_30.2_ONAP.json

Deltas for the VES Common Header

Comparison for JSON schema supporting VES 7.1.1 and modified schema which the proposed changes from this Use Case.

Common Header before Deltas for this Use case

CommonEventSchema_30.0.1.json

Common Header after Deltas for this Use case +stndDefinedFields

CommonEventSchema_30.0.1_w_stndDefined.json

Official submission: https://gerrit.onap.org/r/c/vnfrqts/requirements/+/109199

Testing Impacts

Unit Testing

- VES collector - Unit testing (new validation capabilities)
- Provide Unit testing on all updated components

Dev to Dev Testing (CSIT)

- DCAE VES collector - CSIT testing (1st step of validation for new „domain" and stndDefinedFields)
- DCAE VES collector - CSIT testing (Routing of stndDefined to a DMaaP topic)
- DCAE VES collector – CSIT testing (2nd step of validation), optionally DCAE „pairwise" with TestContainers

Integration testing

- E2E test with 2-stage validation (e.g. 3GPP-HeartBeat namespace, using „external" 3GPP HeartBeat schema)

Involved Use Cases

- ***5G Use Case:*** first implementation of this use case will allow 3GPP compliant NFs to send 3GPP notifications to ONAP following VES event listeners guidelines but retaining the notification schema as defined by 3GPP.
- ***Configuration and Persistency Use Case:*** will use provisioning notifications.
- ***Closed Loop analytics applications:*** provided with additional events sent by 3GPP compliant network functions (can be extended to support NFs complying to other standards bodies).
  - Allows 3GPP aware analytics applications to be used within Closed Loop in DCAE.

JIRA items in DCAE (existing – will be refactored)

EPIC (REQ project):

- https://jira.onap.org/browse/REQ-327 **ONAP/3GPP & O-RAN Alignment-Standards Defined Notifications over VES**

VNF Requirements project:

- https://jira.onap.org/browse/VNFRQTS-885 Update VES Common Event Format - add stndDefined domain
- https://jira.onap.org/browse/VNFRQTS-892 Standards Defined Notifications over VES - VNF Requirements update

DCAEGEN2 project:

- https://jira.onap.org/browse/DCAEGEN2-1771 Enhance routing in VES - support stndDefinedNamespace based routing
- https://jira.onap.org/browse/DCAEGEN2-2254 Align VES Collector configuration, after stndDefined domain is added to VES Common Event Schema
- https://jira.onap.org/browse/DCAEGEN2-2264 Implement 2nd stage of validation in VES Collector
- https://jira.onap.org/browse/DCAEGEN2-2265 ReadTheDocs pages for stndDefined domain
- DCAEGEN2-XYZ-1 Provide schemaRepo as a Kubernetes ConfigMap
- DCAEGEN2-XYZ-2 Enhance DCAE Bluprint plugin to support Kubernetes ConfigMap assignments to DCAE apps.

Integration project:

- https://jira.onap.org/browse/INT-1258 Add E2E integration tests to cover new stndDefined VES events

More detailed information

„Backup” slides

„stndDefined” domain: Motivation

Characteristic	Option 2 („standard-specific”)	Option 4 („stndDefined”)
New domains	As many as many supported organizations (expected <5 ?)	Only 1 domain for everything non-VES
Restrictiveness	Event checking against an external JSON schema (restrictive)	Event checking against a JSON object (less restrictive)
Traceability (xNF perspective)	High (source schema violations known to the xNF, they can be stored in xNF logs)	Low (xNF not aware of source schema violations, no indications in logs/alarms, that sth is wrong).

The traceability (xNF) aspect changed the direction of investigation here:

- If a generated event is not validated against a schema on the receiving side, then correlation of errors with possible scenarios generating these errors on xNFs might be difficult.
- Thus it makes sense to validate events sent to ONAP/DCAE on the collector side, and not only on an event consumer side.
- This shall simplify troubleshooting for xNF providers, as everything, that`s needed is available in these xNF instances logs

- All-in-all, capability of an xNF to log errors received from ONAP/DCAE collectors is important, and needs schema validation on the collector side, and not only on the consuming application side (assumed – Analytics).

„stndDefined” domain - Benefits

stndDefined domain approach - benefits

- ✓ A single domain for all the possible standard bodies / eventSources defined

- ✓ A dedicated namespace identifier allowing for routing (e.g. 3GPP-FaultSupervision)

- ✓ A schema reference allowing to identify a specific schema to be used
  - ✓ Standards based (3GPP, IETF, BBF)

- ✓ Early validation of events against event schema
  - ✓ Simplifies correlation of xNF activities and xNF errors for troubleshooting purposes

- ✓ Schema sources – dynamically loaded:
  - ✓ Standard organizations (per-loaded in a container build process)
  - ✓ [future] Onboarded with xNFs in onboarding packages
  - ✓ [future] Loaded dynamically in run-time

stndDefined – Accepted (embeded source event with schemaReference).

An example VES event with 3GPP fault event inside

```
{ "event": {
    "commonEventHeader": {
      "domain": "stndDefined",
      "eventId": „stndDefined-gNB-Nokia000001",
      "eventName": „stndDefined-gNB-Nokia-Notification",
      "stndDefinedNamespace": "3gpp-FaultSupervision"
      },
   "stndDefinedFields": {
      "schemaReference": "TS28532_generic_fault_supervision.json
                          #components/schemas/notifyNewAlarm-NotifType",
      „data":{
                          "header": {
                            "uri": "xyz",
                            "notificationId": "xyz",
                            "notificationType": "notifyNewAlarm",
                             "eventTime": "xyz",
                             "systemDN": "xyz"
                          },
                          "body": {
                             "probableCause": "xyz",
                             "perceivedSeverity": "Major",
                             "rootCauseIndicator": false,
                             "specificProblem": "xyz",
                             "correlatedNotifications": [],
                             "backedUpStatus": true,
                             "backUpObject": "xyz",
                             "trendIndication": "No change",
                             "thresholdInfo": {},
                             "stateChangeDefinition": [],
                             "monitoredAttributes": [],
                             "proposedRepairActions": "xyz",
                             "additionalText": "xyz",
                             "additionalInformation": [],
                             "alarmId": "xyz",
                             "alarmType": "Environmental Alarm"
                          }
      },
      „stndDefinedFieldsVersion":"1.0"
    }
 }
```

ONAP/DCAE defined

3gpp defined

- A new domain is created (stndDefined):
  - Comes with a CommonHeader.stndDefinedNamespace field
    This field is used for message routing (and not the domain)
- A new field structure is defined (stndDefinedFields):
  - Contains a schemaReference, to be used to validate contents
  - Contains a data container (structure), storing the notification itself
- Assumption: JSON notifications are supported.
- stndDefinedFieldsVersion added to support froward compatibility
- schemaReference value is an example. 3GPP commits to having the valid schemas available on their repo by the end of June 2020: https://forge.etsi.org/rep/3GPP/5G_APIs (GitLAB, versionized)

stndDefined: 2-step validation

An example VES event with 3GPP fault event „inside”

1st validation step

event/stndDefinedFields/data: object

We just check, if a complete event is a valid JSON object

```
{ "event": {
     "commonEventHeader": {
       "domain": "stndDefined",
       "eventId": „stndDefined-gNB-Nokia000001",
       "eventName": „stndDefined-gNB-Nokia-Notification",
       "stndDefinedNamespace": "3gpp-FaultSupervision"
       },
     "stndDefinedFields": {
        "schemaReference": "TS28532_generic_fault_supervision.json
                        #components/schemas/notifyNewAlarm-NotifType",
        „data":{
                        "header": {
                         "uri": "xyz",
                         "notificationId": "xyz",
                         "notificationType": "notifyNewAlarm",
                          "eventTime": "xyz",
                          "systemDN": "xyz"
                        },
                        "body": {
                          "probableCause": "xyz",
                          "perceivedSeverity": "Major",
                          "rootCauseIndicator": false,
                          "specificProblem": "xyz",
                          "correlatedNotifications": [],
                          "backedUpStatus": true,
                          "backUpObject": "xyz",
                          "trendIndication": "No change",
                          "thresholdInfo": {},
                          "stateChangeDefinition": [],
                          "monitoredAttributes": [],
                          "proposedRepairActions": "xyz",
                          "additionalText": "xyz",
                          "additionalInformation": [],
                          "alarmId": "xyz",
                          "alarmType": "Environmental Alarm"
                        }
        },
        „stndDefinedFieldsVersion”:”1.0”
     }
  }
```

2nd validation step (optional)

event/stndDefinedFields/data validated against schema references in „stndDefinedFields/schemaReference”

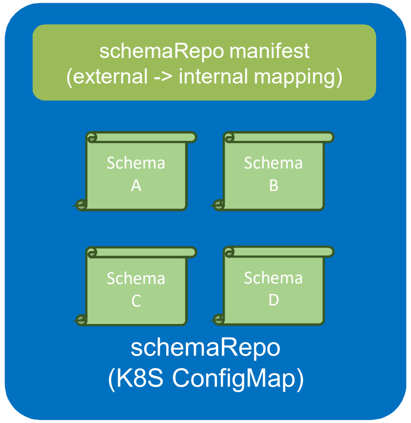
This step is optional, and depends on the existence of „schemaReference” parameter in an event. schemaReference is an optional parameter in an event schema.

stndDefined – schemaRepo - Requirements

Schema repo needs to store schema, using the schema repo manifest file

- Stores the source-specific (standard-specific) schemas permanently in a K8S configMap
- Supports JSON documents, accessible via a manifest/mapping file (external schema URI → local URN)

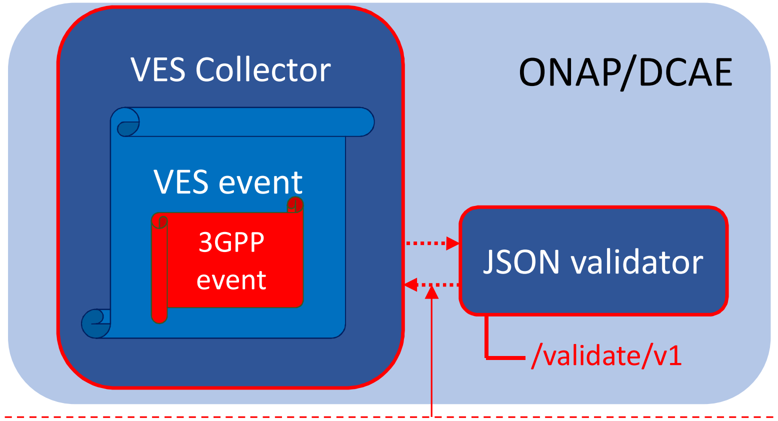
- Exposes the schemas to different applications (as a filesystem mount):
  - ONAP/ VES collector (schema validation for received xNF events)
  - [optionally] ONAP/ Analytics applications (schema validations, and DB schema generation)
  - [optionally] ONAP/ DCAE/MOD, CLAMP (Closed Loop Configurations)



JSON schema validator – Challenges

JSON schema validator as a DCAE micro-service, or as a library?

- In principle, JSON schema validator could be delivered as a **library** or a micro-service
  - **If the JSON schema validator is delivered as a micro-service, the following is going to happen in data processing path:**



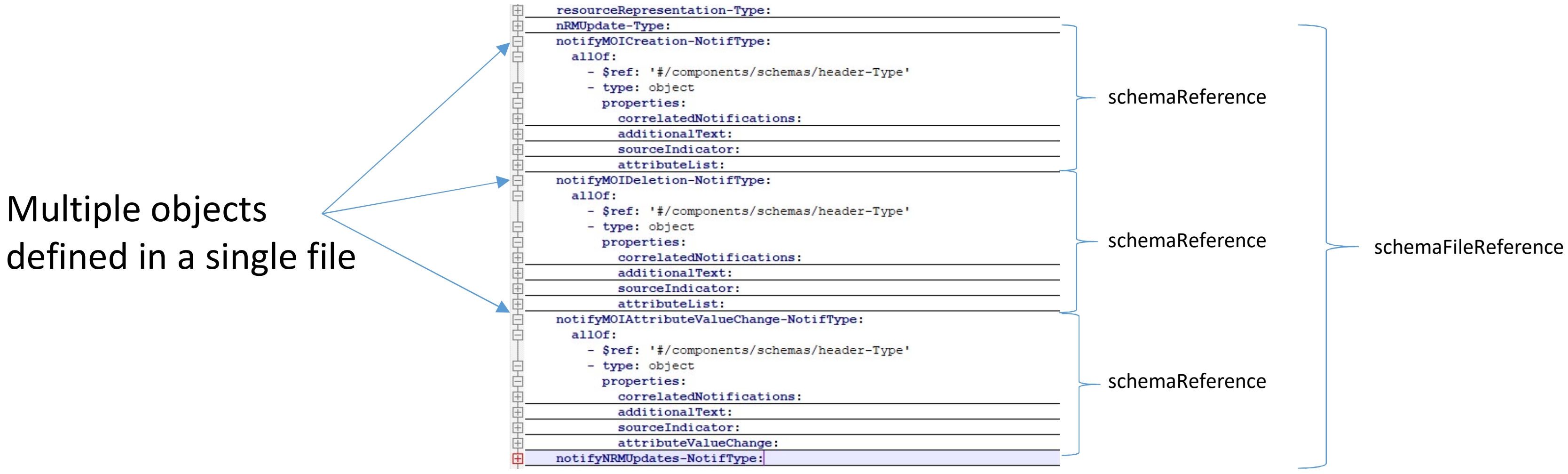
```
{
  "jsonDoc":{
      "schemaReference": "https://schemareference.org/v1/schemaExample1.json",
      "data": {
                        "header": {
                          "headerKey": "headerKeyValue"
                        },
                        „body": {
                          "bodyKey": "bodyKeyValue"
                        }
    }
}
```

- JSON validator uS is expected to:
  - Establish a HTTP(S) connection,
  - Read a REST request (JSON as well),
  - Validate it on JSON schema validator side
- It is estimated to consume significant compute capacity in relation to the target JSON schema validation
- Alternative & Proposal:
  JSON validator, to be a Java library rather than an mS
- Potentially re-use the <networknt.com json-validator> (used in VES today) to support exetrnal schemaReference in offline environments

Schema Broker – schemaReference vs schemaFileReference

Schema broker needs to store and expose schemas, using the schemaFileReference as a key

- Schema identifier in the SchemaBroker and within the VES stndDefined messages …are different things…
  - **schemaRepo.publicURL** will be used in schemaRepo to refer public JSON schema files (which might contain schema definitions for multiple objects)
  - **VES.stndDefinedFields.schemaReference** will be used in VES messages to identify a specific JSON schema object, which shall be used for validation of events.



```
resourceRepresentation-Type:
nRMUpdate-Type:
notifyMOICreation-NotifType:
  allOf:
    - $ref: '#/components/schemas/header-Type'
    - type: object
      properties:
        correlatedNotifications:
        additionalText:
        sourceIndicator:
        attributeList:
notifyMOIDeletion-NotifType:
  allOf:
    - $ref: '#/components/schemas/header-Type'
    - type: object
      properties:
        correlatedNotifications:
        additionalText:
        sourceIndicator:
        attributeList:
notifyMOIAttributeValueChange-NotifType:
  allOf:
    - $ref: '#/components/schemas/header-Type'
    - type: object
      properties:
        correlatedNotifications:
        additionalText:
        sourceIndicator:
        attributeValueChange:
notifyNRMUpdates-NotifType:
```

3GPP Provisioning MNS

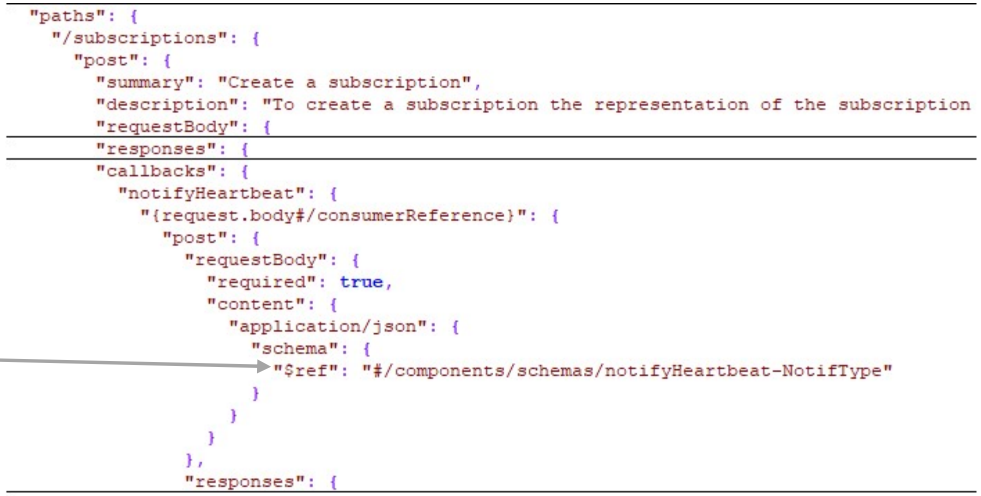
3GPP MnS schemas usage in stndDefined domain

stndDefinedFields used, schema reference points to Fault3gppFields.json and Heartbeat3gppFields.json

```
{"event": {
    "commonEventHeader": {
      "domain": "stndDefined",
      "eventId": "stndDefined-3GPP-heartBeat000001",
      "eventName": "stndDefined-gNB-Nokia-HeartBeat",
      "lastEpochMicrosec": 0,
      "priority": "Normal",
      "reportingEntityName": "NOK123456",
      "sourceName": "NOK123456",
      "sequence": 0,
      "startEpochMicrosec": 0,
      "stndDefinedNamespace":"3GPP-Heartbeat"
      "version": "5.0.0",
      "vesEventListenerVersion": "8.0.0"
    },
    "stndDefinedFields": {
      "schemaReference":"https://www.3gpp.org/FTP/Specs/archive/OpenAPI/Rel-16-2/S5-
201487_heartbeat3gppFields.json#definitions/notifyHeartbeat-NotifType",
      "data": {
                  "header": {
                    "uri": "xyz",
                    "notificationId": "xyz",
                    "notificationType": "notifyHeartbeat",
                    "eventTime": "xyz"
                  },
        "body": {
                    "systemDN" : "xyz",
                    "heartbeatPeriod": "123456789"
        }
      },
      "stndDefinedFieldsVersion": "1.0"
    } }
}
```

3GPP

3GPP TS 28.532 HeartBeat MnS (16.2) schema



```
"paths": {
  "/subscriptions": {
    "post": {
      "summary": "Create a subscription",
      "description": "To create a subscription the representation of the subscription
      "requestBody": {
      "responses": {
      "callbacks": {
        "notifyHeartbeat": {
          "{request.body#/consumerReference}": {
            "post": {
              "requestBody": {
                "required": true,
                "content": {
                  "application/json": {
                    "schema": {
                      "$ref": "#/components/schemas/notifyHeartbeat-NotifType"
                    }
                  }
                }
              },
              "responses": {
```