



LF NETWORKING

Developer & Testing Forum

Radio Access Network Function Configuration Management (CM) Update in ONAP London Release

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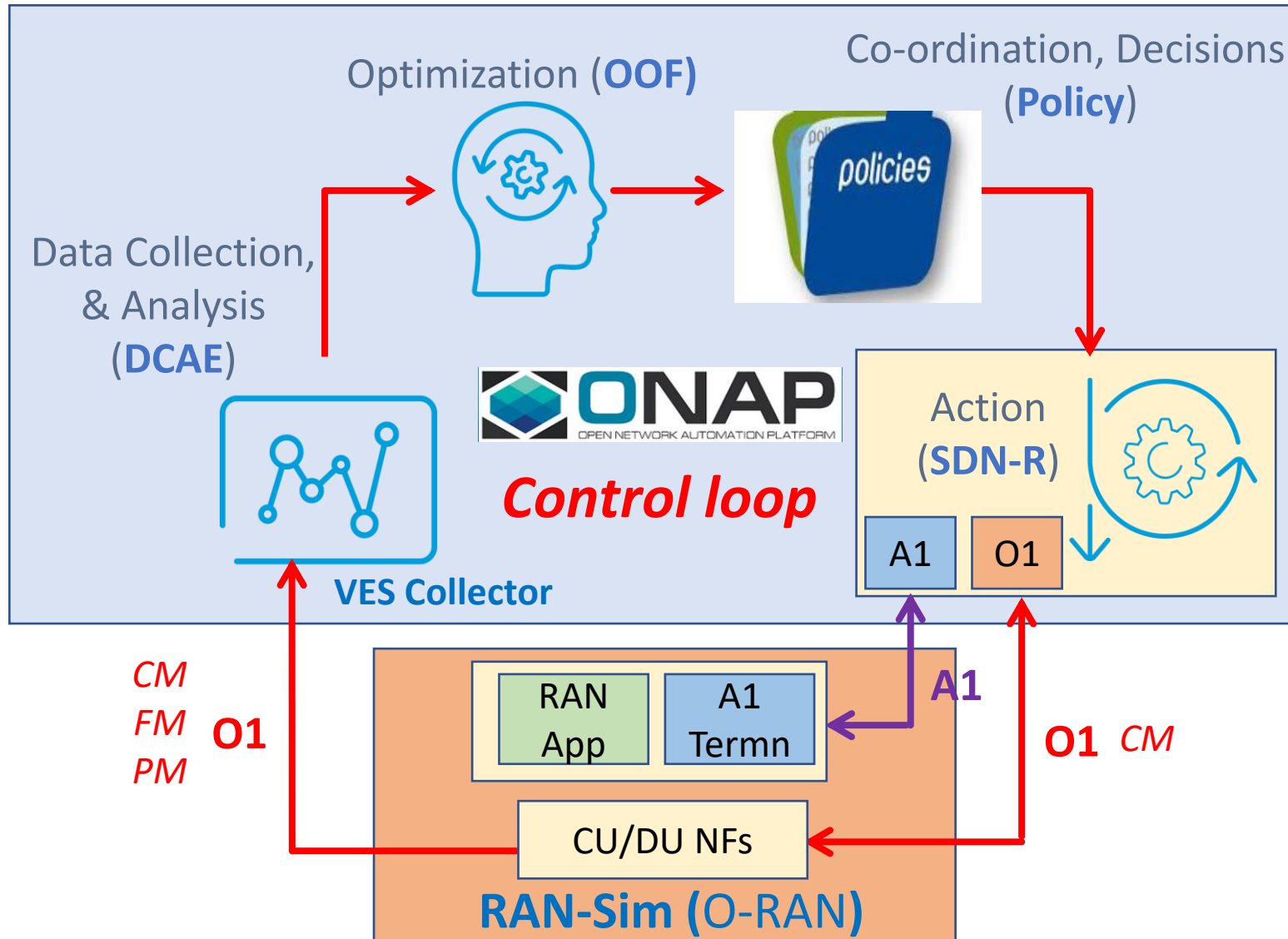
Companies: CapGemini, Ericsson, Wipro, highstreet technologies, Rutgers Winlab, AT&T

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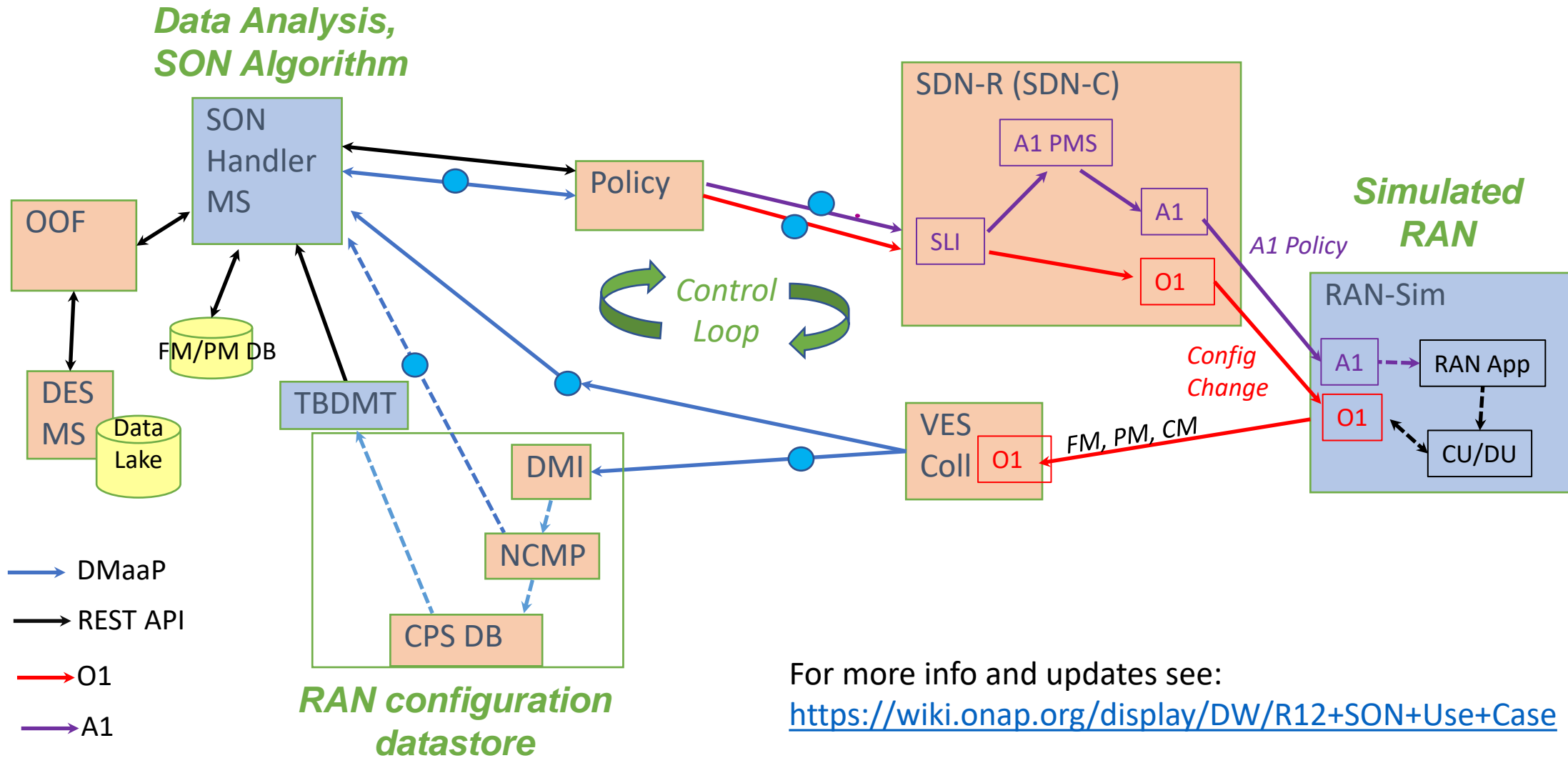


ONAP SON Use Case



- ONAP SON Use Case focus: control loop flow for management and optimization of O-RAN network
- Aligned with O-RAN interfaces and architecture
- “ONAP Layer” maps to O-RAN SMO
- O1 interface supported for several ONAP releases
- A1 interface added in Kohn release

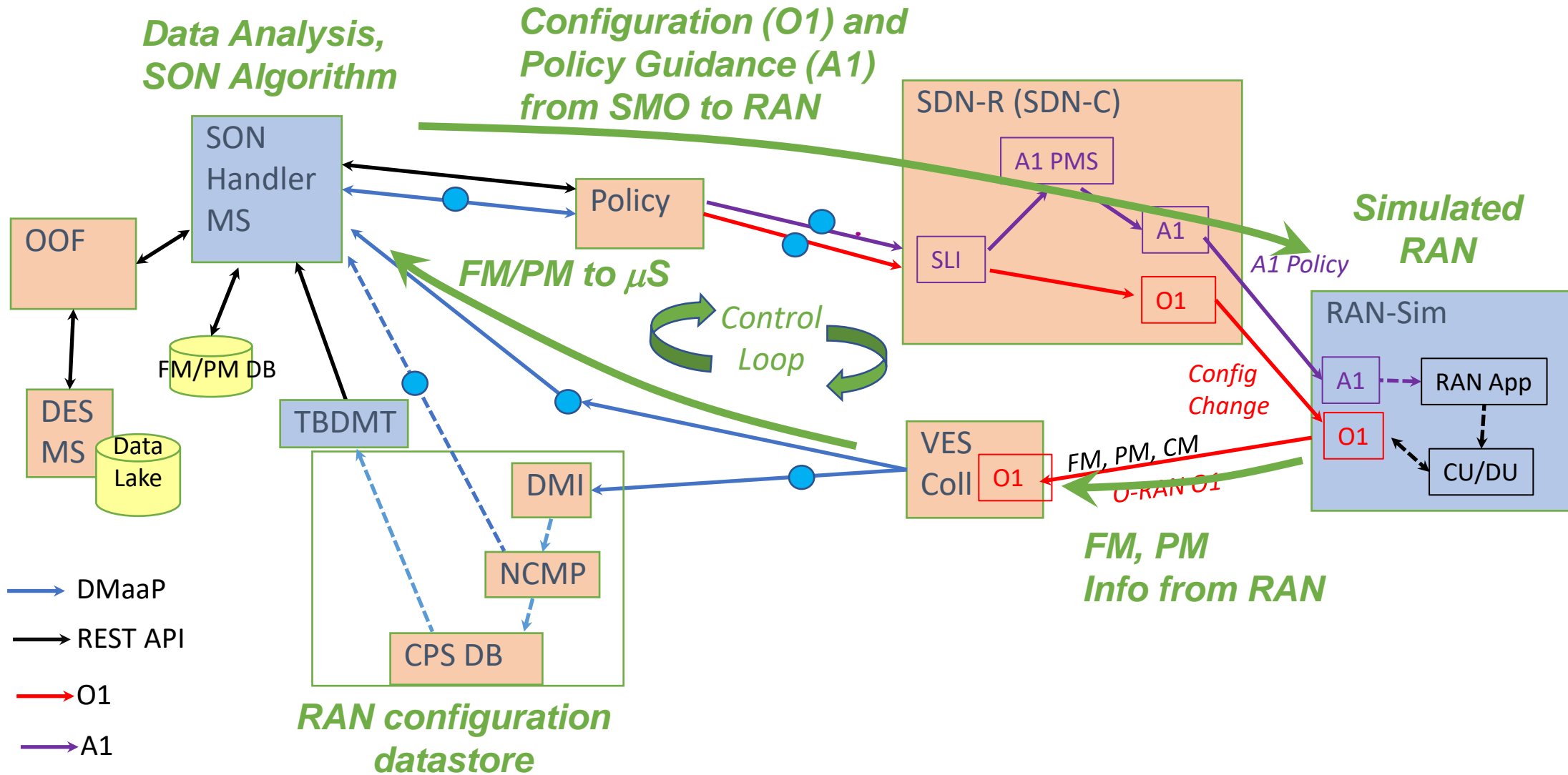
ONAP SON Use Case



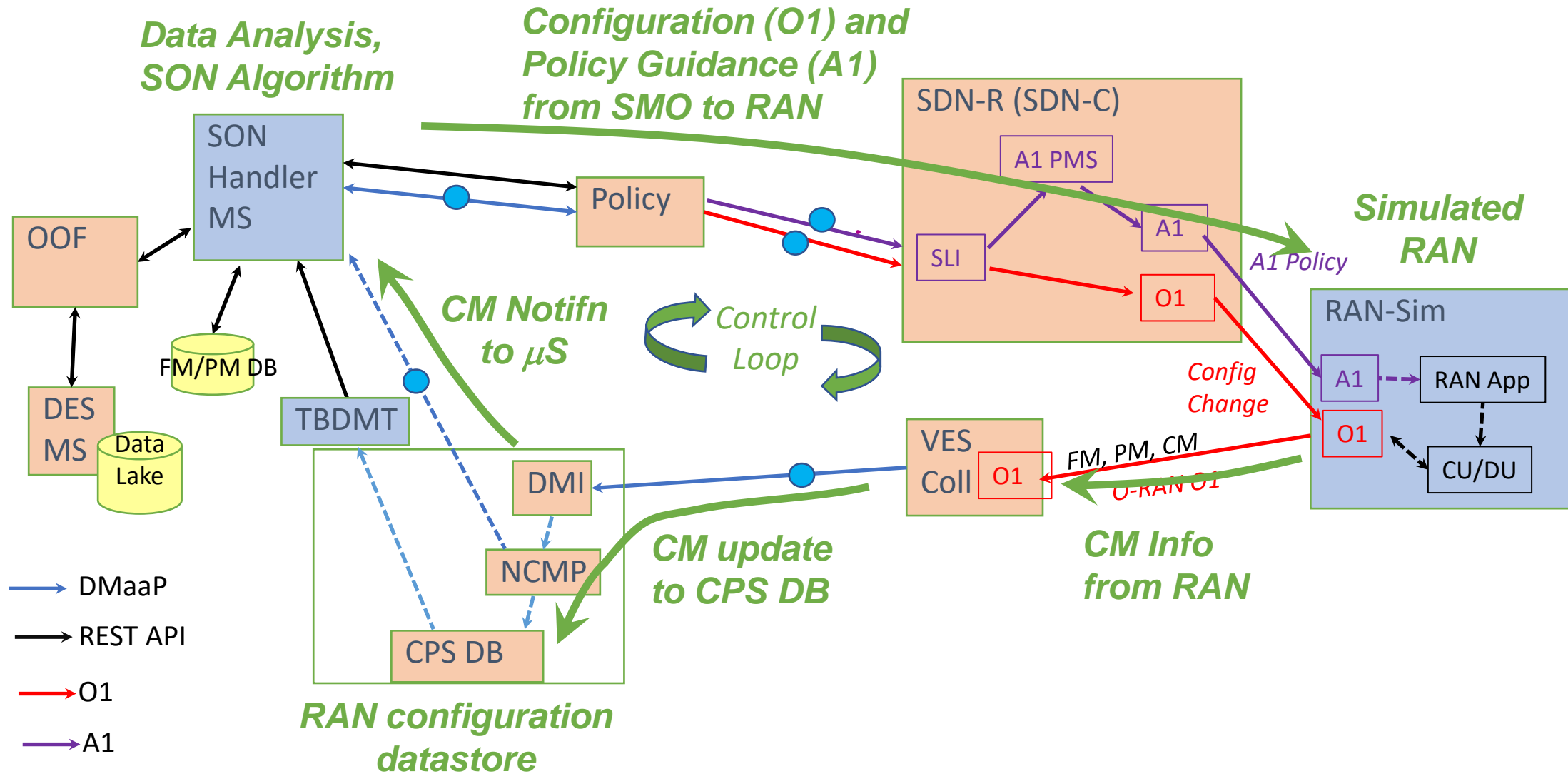
For more info and updates see:

<https://wiki.onap.org/display/DW/R12+SON+Use+Case>

ONAP SON Use Case – FM and PM event data



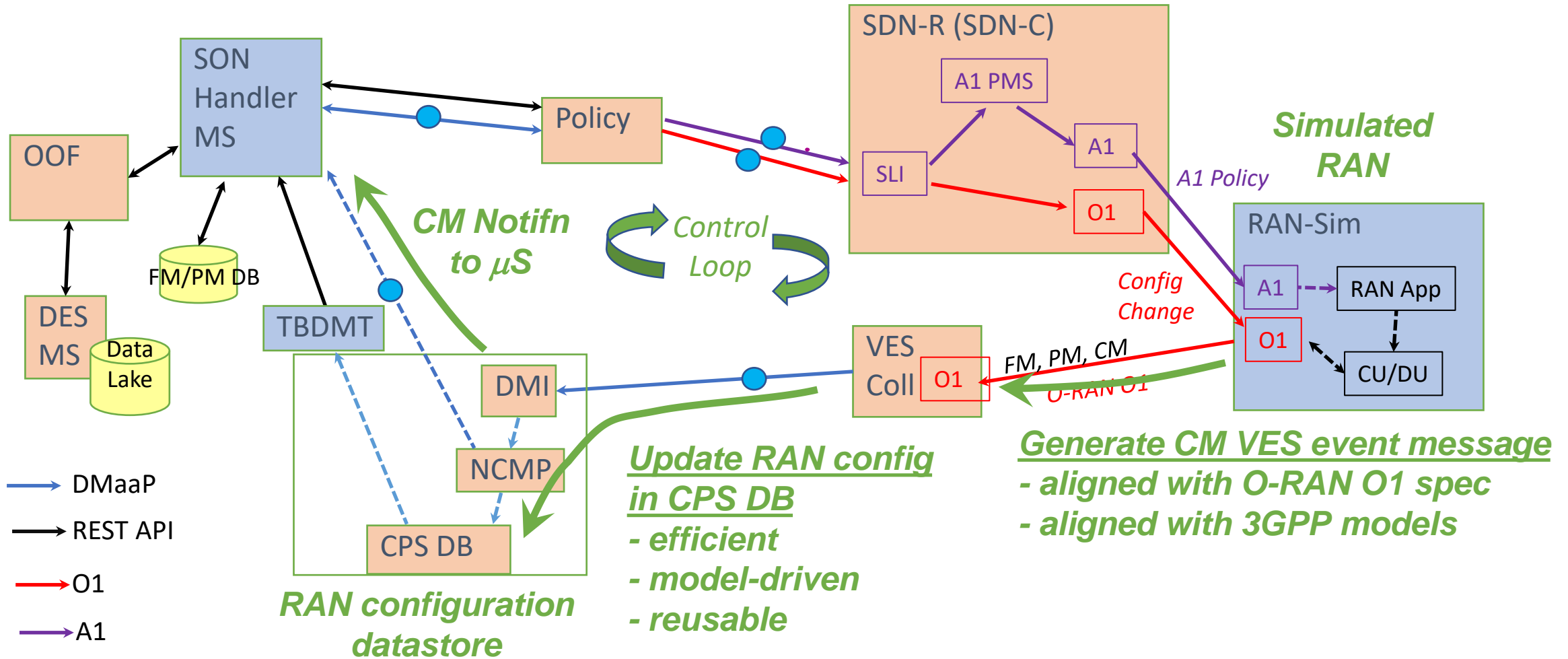
ONAP SON Use Case – CM event data



RAN NF Configuration Management Updates: Problem formulation

- CPS DB keeps a consistent copy of RAN NF configuration
- RAN NF config change may be done by SDN-R over O1, or other mechanism
- All RAN NF config changes generate CMNotify VES event message over O1
- CPS DB consistency requires efficient updates based on CMNotify VES message
- After config update to CPS DB, CPS publishes CPS update notification on DMaaP
 - Used by use case applications as needed
- CPS DB uses same yang model as RAN NF – “primary yang model”
- CPS DB can also have supplementary information:
 - RAN NF config-like information which is not in the “primary” yang model
 - Pending or planned config changes
 - Solution for secondary yang model (using TBDMT) out of scope for London release

ONAP SON Use Case – London release focus on CM update process

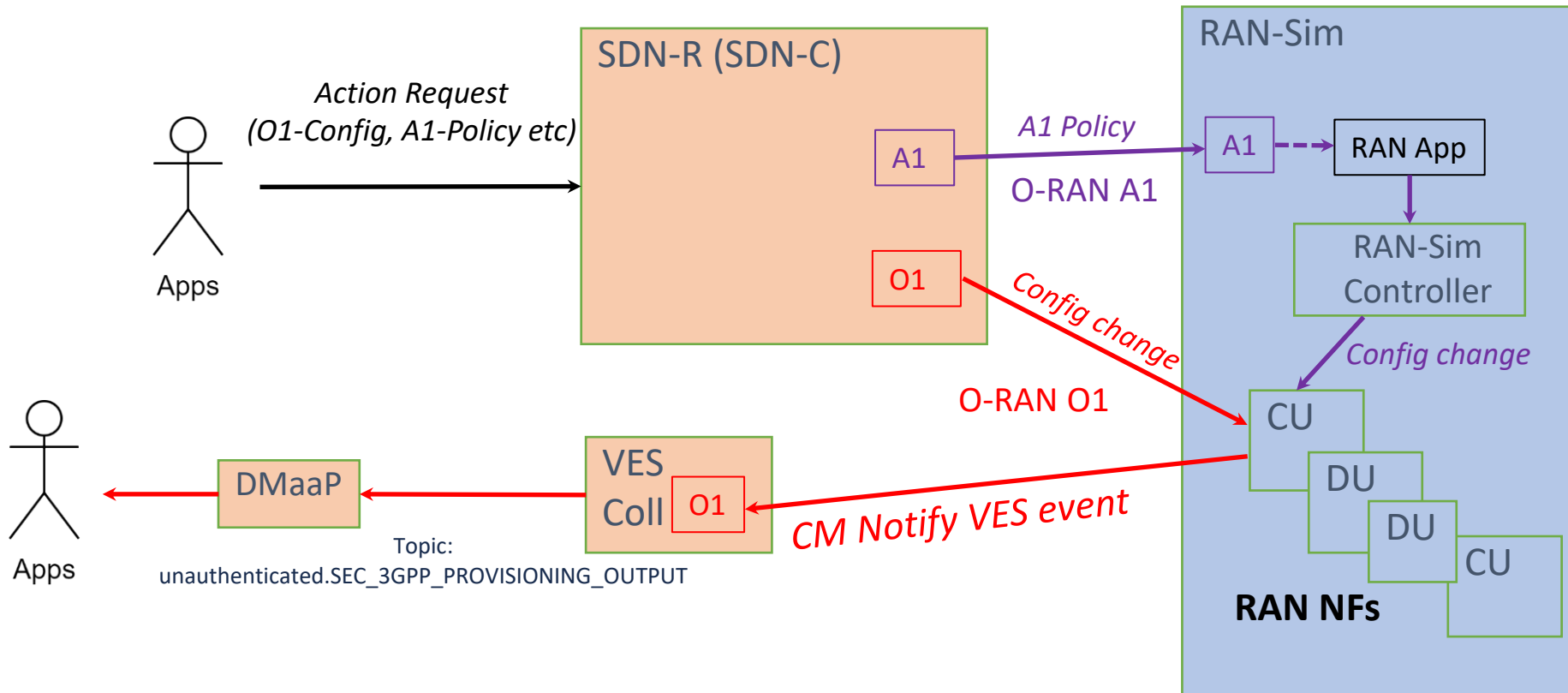




CM VES Event Generation



CM VES Event Message Generation



- RAN Simulator generates a CM VES event whenever any config change happens on the RAN Simulator whether its O1(direct) or A1(indirect) config change request.
- As the data tree gets modified, RAN simulator CU/DU triggers the CM event generation and sends it over the configured VES collector endpoint.
- CM VES event message format aligned with 3GPP 28.532 specification

CM VES Message Specification

RAN Simulator generates CM Notification VES message of type notifyMOIChanges (28.532 clause 11.1.1.11) which can report different types of possible NRM updates:

- Creation and deletion of an object.
- Creation and deletion of an attribute, attribute field, attribute element and attribute field element.
- Replacement of an attribute value, attribute field value, attribute element and attribute field element.

Below are the input parameters that will be reported in notifyMOIChanges notification (from 3GPP clause 11.1.1.11.2).

Parameter Name	S	Information Type / Legal Values	Comment
objectClass	M	It shall carry the ManagedEntity class name.	Identifies the classe name of a common ancestor object of the objects for which changes are reported. A MnS producer may set this parameter always to the class name of the parent of the local root object in the MIB.
objectInstance	M	It shall carry the DN of the ManagedEntity.	Identifies the instance of a common ancestor object of the objects for which changes are reported. A MnS producer may set this parameter always to the instance of the parent of the local root object in the MIB.
notificationId	M	This is an identifier for the notification, which may be used to correlate notifications.	See clause 11.1.1.7.2
notificationType	M	It specifies the type of provisioning management services related notifications. The value "notifyMOIChanges" shall be carried.	See clause 11.1.1.7.2
eventTime	M	It indicates the MOI change event time.	See clause 11.1.1.7.2
systemDN	M	See clause 11.1.1.7.2	See clause 11.1.1.7.2
mOIChanges	M	SEQUENCE OF SET {notificationId (M), correlatedNotifications (O), additionalText (O), sourceIndicator (O), path (M), operation (M), value (CM)}	This parameter describes the NRM updates to be reported. The notificationId is an identifier of one MOI change. The path specifies the MOI created or deleted, or the MOI with replaced attribute values. The path may identify also parts of an attribute in case the attribute is a structured data type. ... See 3GPP clause 11.1.1.11.2 for remaining text ...

CM VES Event Message Format

- We have a fully specified sample for O-RAN O1 CM VES event message format (Thanks to @Martin and @John!)
- Details will be refined in ongoing implementation work.
- We hope it will be useful to other projects, and will plan to contribute example to O-RAN O1 Spec (Annex)

```
{
  "event": {
    "commonEventHeader": {
      "domain": "stdDefined",
      "eventId": "stddefined000001",
      "eventName": "stddefined_Metrics",
      "lastEpochMicrosec": 1670938742757000,
      "nfNamingCode": "NFC",
      "nfVendorName": "Capgemini Engineering",
      "priority": "Normal",
      "reportingEntityId": "nearrtric-22_cucpserver2",
      "reportingEntityName": "honeycomb",
      "sequence": 0,
      "sourceId": "nearrtric-22_cucpserver2",
      "sourceName": "Capgemini Engineering",
      "startEpochMicrosec": 1670938742757000,
      "stdDefinedNamespace": "3GPP-Provisioning",
      "timeZoneOffset": "UTC+05:30",
      "version": "4.0.1",
      "vesEventListenerVersion": "7.2"},
    "stdDefinedFields": {
      "schemaReference": "https://forge.3gpp.org/rep/sa5/MnS/blob/Rel16/OpenAPI/provMnS.yaml#/components/schemas/NotifyMoiChanges",
      "data": {
        "href": "172.16.100.130",
        "notificationId": 1,
        "notificationType": "notifyMOIChanges",
        "eventTime": "2021-08-23T11:52:10.6Z",
        "systemDN": "xyz",
        "moiChanges": [{
          "notificationId": 123,
          "correlatedNotifications": [],
          "additionalText": "AdditionalTextDetails",
          "sourceIndicator": "MANAGEMENT_OPERATION",
          "path": "/restconf/data/ran-network:ran-network/NearRTRIC=22/GNBCUCPFunction=cucpserver2/NRCellCU=15549/NRCellRelation=14427/isHOAllowed",
          "operation": "REPLACE",
          "value": {
            true}
        }
      ]},
      "stdDefinedFieldsVersion": "1.0"
    }
  }
}
```

CM VES Event Message

- Selected fields showing **object** and its **attribute change** ("isHOAllowed" modified with new value as "true")

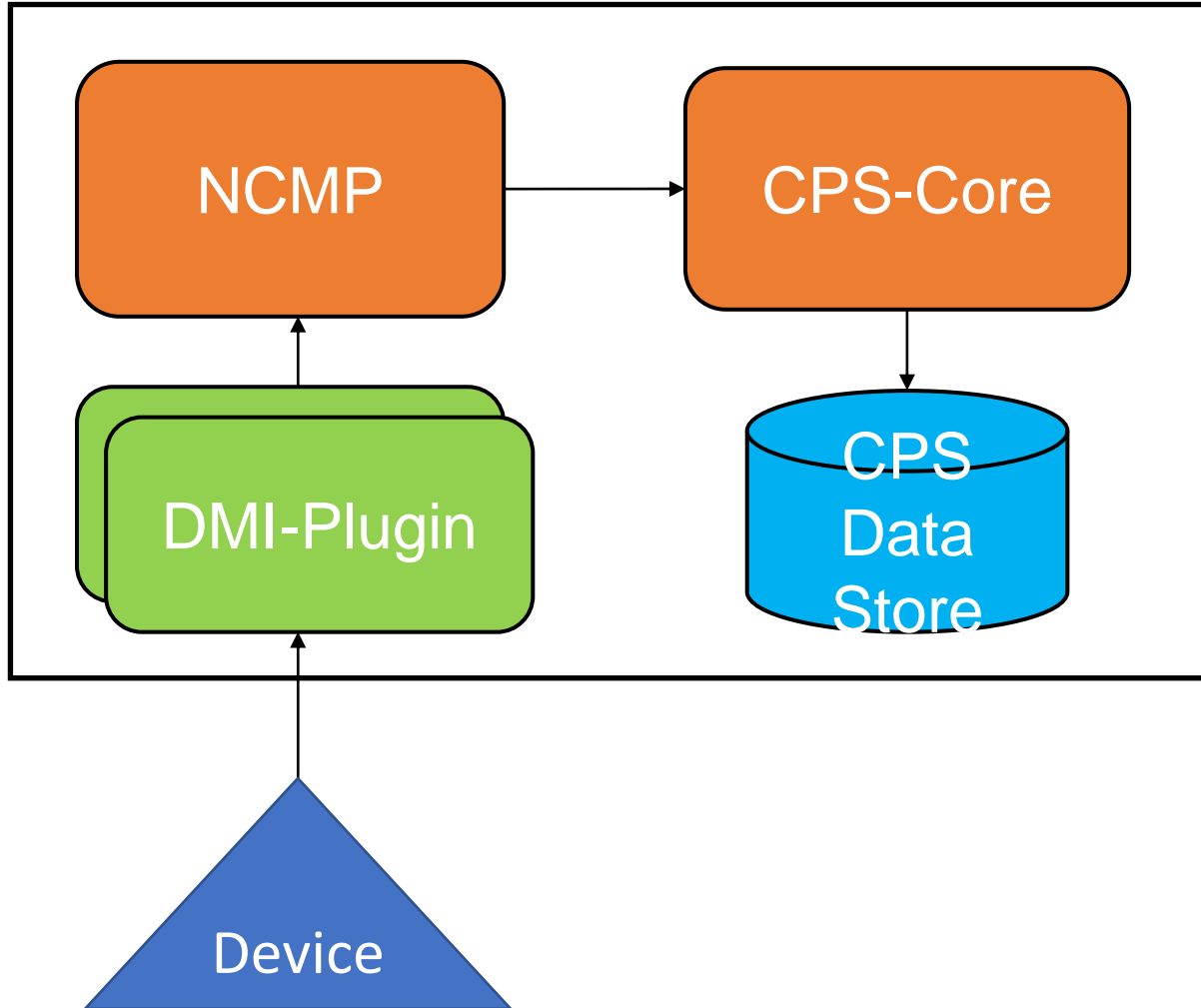
```
{
  "event": {
    "commonEventHeader": {
      "domain": "stdDefined",
      "version": "4.0.1",
      "vesEventListenerVersion": "7.2"
    },
    "stdDefinedFields": {
      "schemaReference": "https://forge.3gpp.org/rep/sa5/MnS/blob/Rel16/OpenAPI/provMnS.yaml#/components/schemas/NotifyMoiChanges",
      "data": {
        "href": "172.16.100.130",
        "notificationId": 1,
        "notificationType": "notifyMOIChanges",
        "eventTime": "2021-08-23T11:52:10.6Z",
        "systemDN": "xyz",
        "moiChanges": [
          {
            "notificationId": 123,
            "correlatedNotifications": [],
            "additionalText": "AdditionalTextDetails",
            "sourceIndicator": "MANAGEMENT_OPERATION",
            "path": "/restconf/data/ran-network:ran-network/NearRTRIC=22/
              GNBCUCPFunction=cucpserver2/NRCellCU=15549/NRCellRelation=14427/isHOAllowed",
            "operation": "REPLACE",
            "value": {
              "isHOAllowed": "true"
            }
          }
        ]
      }
    }
  }
}
```



CPS DB CM Update

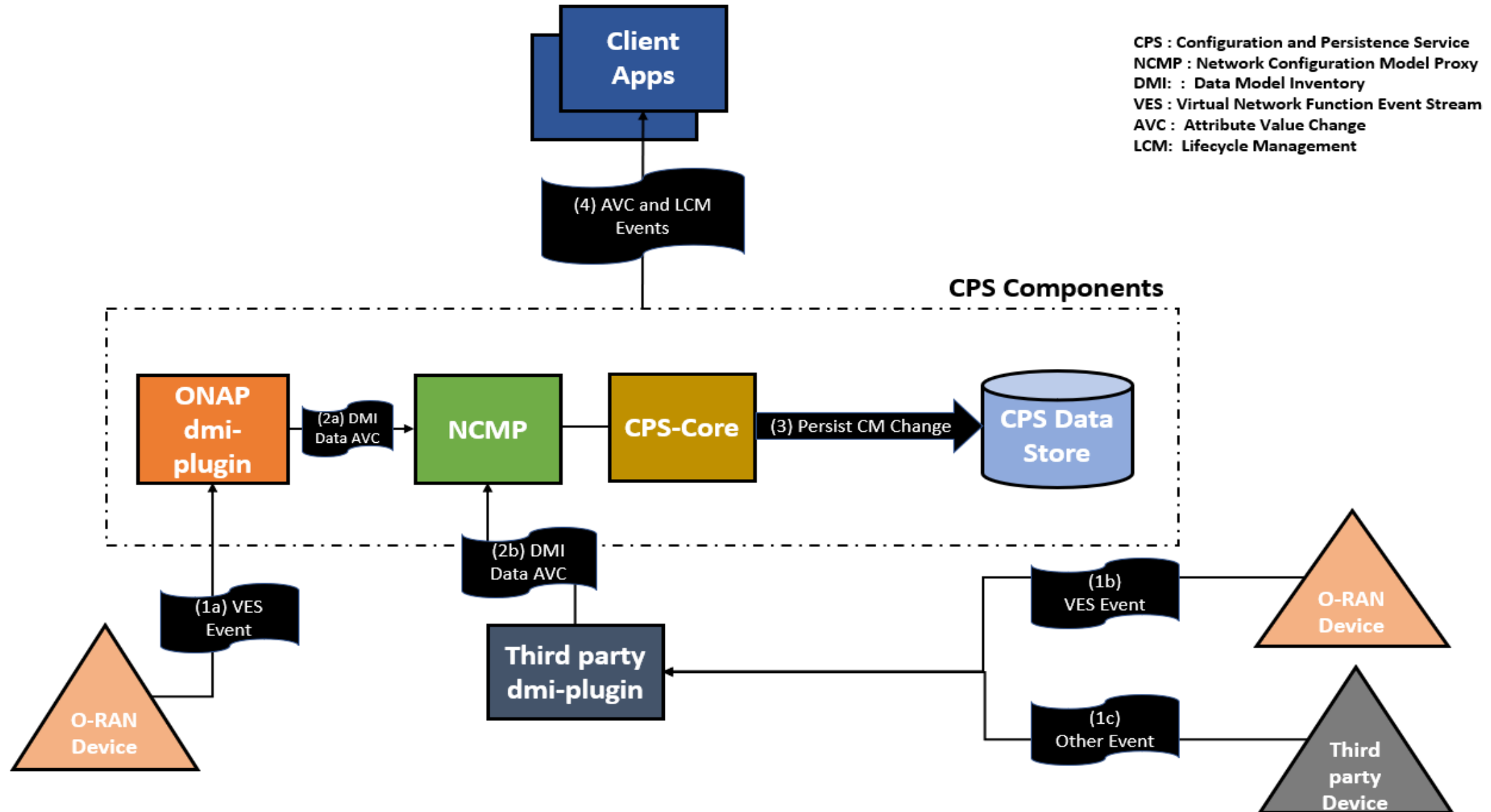


CPS Components



CPS – Configuration and Persistency Service
NCMP – Network Configuration Model Proxy
DMI – Data Model Inventory

CPS Datastore CM Update



- DMI Data AVC follows the [RFC-8641](#) specification (Subscription to YANG Notifications for Datastore Updates)

```
{
  "eventId"       : "9999",
  "eventCorrelationId" : "cmhandleId-001",
  "eventTime"     : "2021-11-16T16:42:25-04:00",
  "eventSource"   : "org.onap.ncmp",
  "eventType"     : "org.onap.ncmp.cm-network-avc-event",
  "eventSchema"   : "org.onap.ncmp:cm-network-avc-event.rfc8641",
  "eventSchemaVersion" : "1.0",
  "event": {
    <RFC 8641-yang-datastore-notification-payload>
  }
}
```


DMI Data AVC Example

```
{
  "eventId"      : "9999",
  "eventCorrelationId" : "cmhandleId-001",
  "eventTime"    : "2022-12-16T16:42:25-04:00",
  "eventSource"  : "ncmp-datastore:passthrough-operational",
  "eventType"    : "org.onap.ncmp.cm-network-avc-event",
  "eventSchema"  : "org.onap.ncmp:cm-network-avc-event.rfc8641",
  "eventSchemaVersion" : "1.0",
  "event": {
    "push-change-update": {
      "datastore-changes": {
        "ietf-yang-patch:yang-patch": {
          "patch-id": "34534ffd98", # Some unreadable patch id generated by the machine
          "edit": [
            {
              "edit-id": "ded43434-1",
              "operation": "create",
              "target": "/_3gpp-common-managed-element:ManagedElement=XYZ-001/_3gpp-nr-nrm-gnbdufunction:GNBDUFunction=1/_3gpp-nr-nrm-nrcelldu:NRCelIDU=1",
              "value": {
                "_3gpp-nr-nrm-nrcelldu:NRCelIDU": [
                  {
                    "id": 1,
                  }
                ]
              }
            }
          ]
        }
      }
    }
  }
}
```

Conclusion

- RAN rApps and use cases require availability of consistent RAN NF configuration - provided here by CPS DB
- We have converged on a good design for CM update of RAN NF configuration data in CPS DB
 - CM VES message notification from RAN NF in alignment with O-RAN O1 and 3GPP
 - Efficient update of configuration in CPS DB based on CM VES message
 - Implementation details will be finalized as part of ongoing work
- Our work should be reusable for:
 - CM of RAN NF in other use cases in ONAP, OSC, LFN projects, etc
 - CM of any yang-based NF in ONAP
- For more info, see: <https://wiki.onap.org/display/DW/R12+SON+Use+Case>