ONAP SON use case: Control Loops

Optimization (**OOF**)

Co-ordination, Decisions (**Policy**)

policies

Data Collection, & Analysis (**DCAE**)

ONAP
OPEN NETWORK AUTOMATION PLATFORM

Control loop

Action (**SDN-R**)

RIC (non-RT)

A1 status, Data, FM, PM

RIC (near RT)

A-1/O-1

Config ack
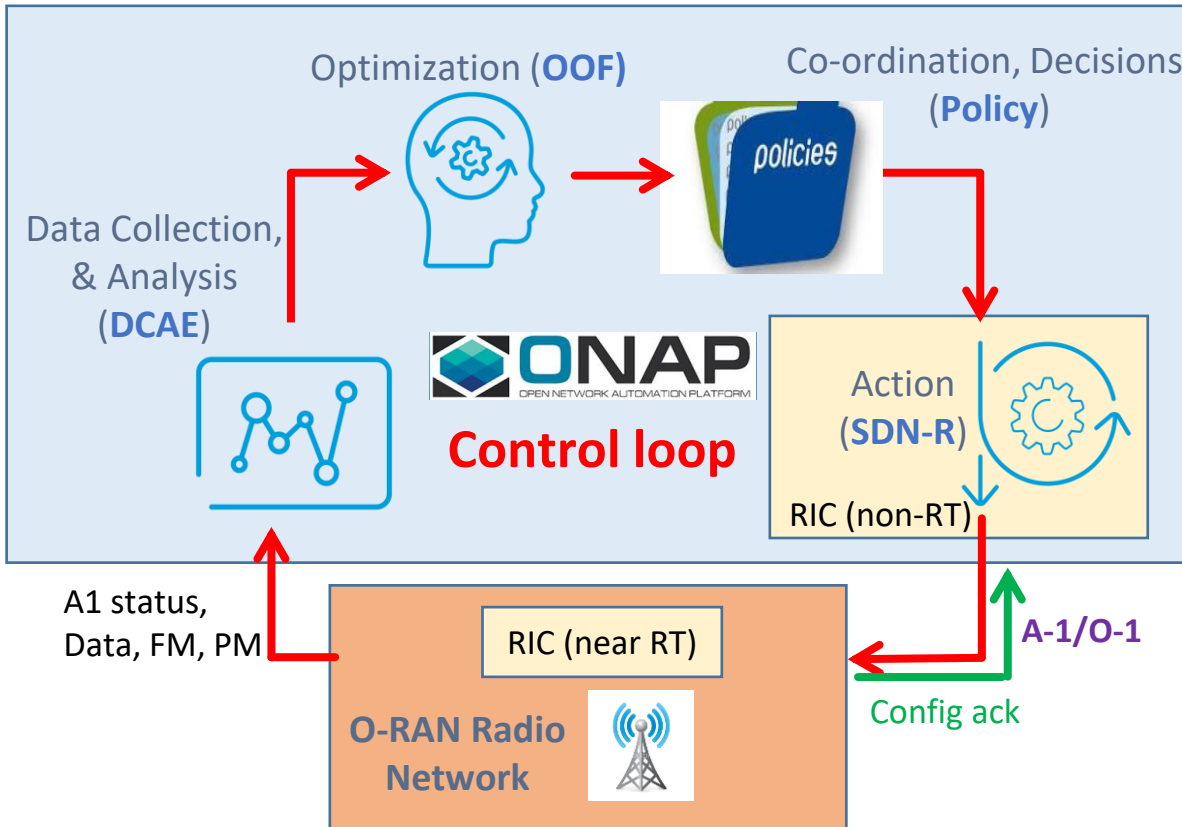
O-RAN Radio Network

- OOF-SON use case has built a foundation for ONAP/O-RAN integration

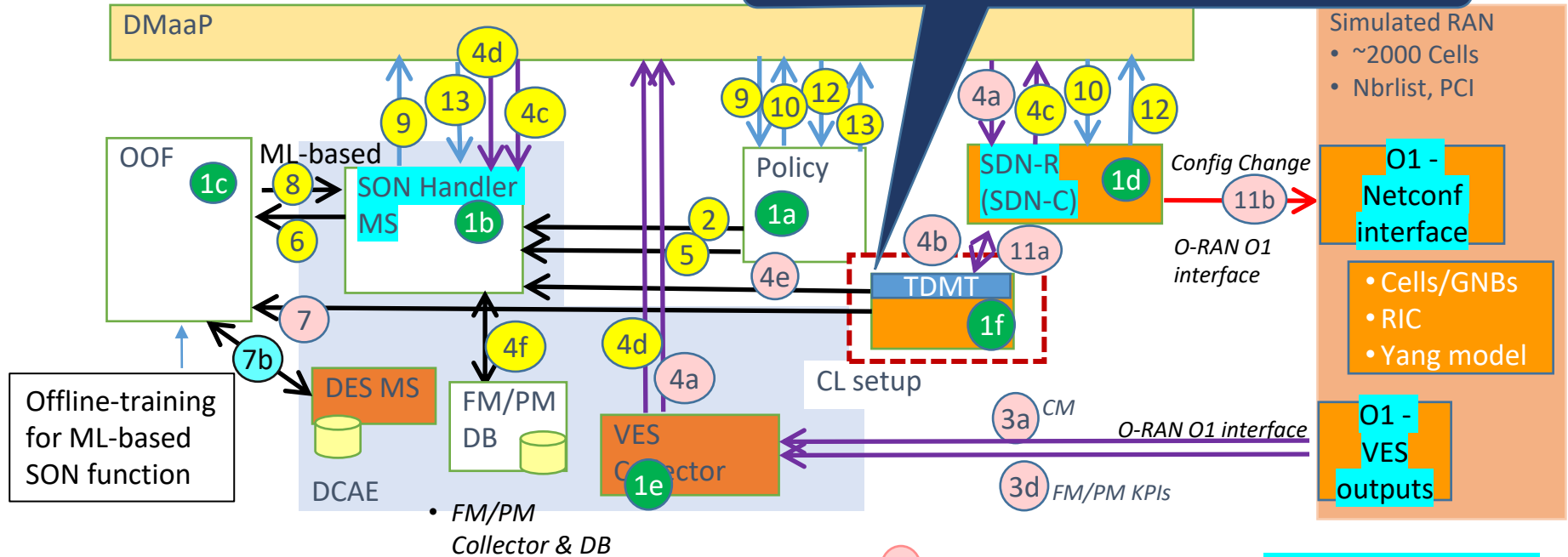- Radio network uses common netconf/yang model

Data flows:

- SDN-R to RAN: netconf-based configuration

- RAN to DCAE: VES format for FM alarms, PM KPI, CM Notifn

- RAN to SDN-R: Netconf ack

ONAP SON use case

- CM via VES collector
- CPS DB model based on O-RAN network yang model

5G use case for CPS, intention is to have an API mapper that maps existing APIs to appropriate Xpath queries

DMaaP

OOF (1c)

ML-based

8
6
SON Handler MS (1b)

9 13 4d 4c

Policy (1a)

9 10 12 13

2
5
4e

SDN-R (SDN-C) (1d)

4a 4c 10 12

Config Change

11b *O-RAN O1 interface*

4b 11a

TDMT (1f)

7
7b

DES MS

FM/PM DB

4f

VES Collector (1e)

4d 4a

CL setup

DCAE

- *FM/PM Collector & DB*

3a *CM*

3d *FM/PM KPIs*

O-RAN O1 interface

Offline-training for ML-based SON function

Simulated RAN
- ~2000 Cells
- Nbrlist, PCI

O1 - Netconf interface

- Cells/GNBs
- RIC
- Yang model

O1 - VES outputs

TDMT = Template-based Data Model Transformer

n Interface enhancement

Functional enhancement

→ REST API   → DMaaP Control Loop messages   → CM-FM-PM messages from RAN   → Config updated to RAN (netconf)

ONAP Network Slicing use case: Closed Loop
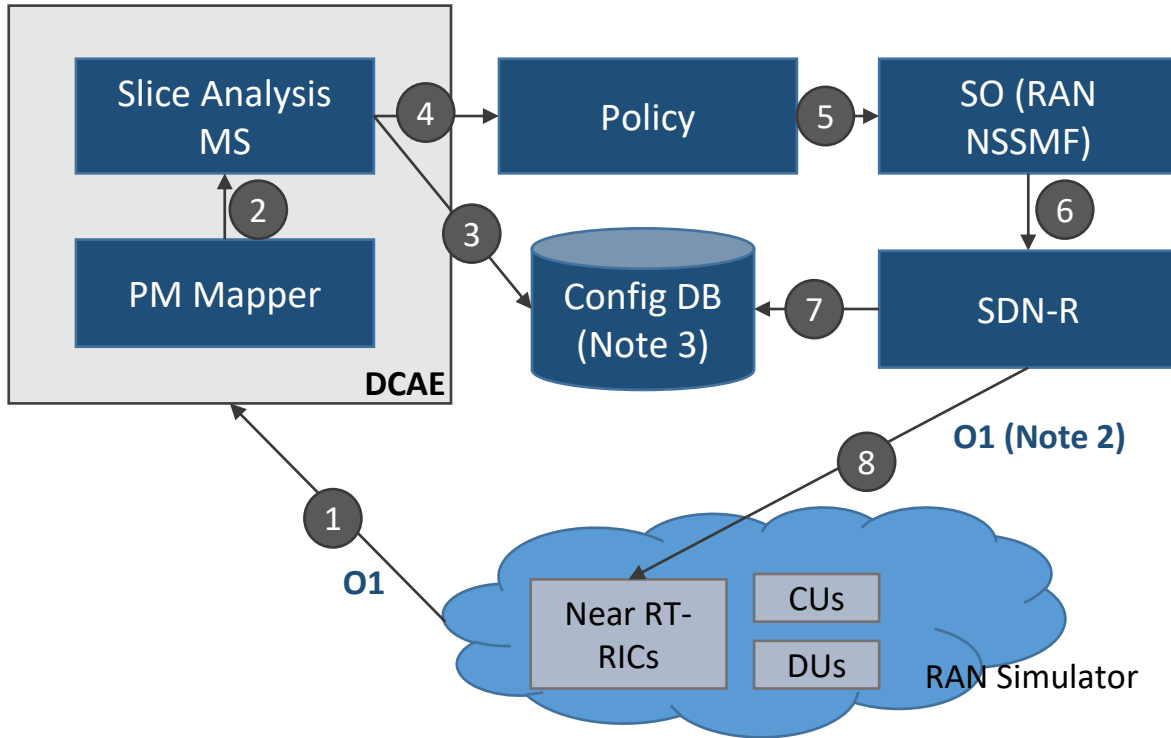
- The PM data collected from RAN in Step 1 is DL/UL PRB used for data traffic.
- The configuration update determined by Slice Analysis MS and triggering Policy in Step 4 is slice specific throughput guidance for Near-RT coverage area (i.e., at Near-RT RIC level).

Notes
1. DFC and VES Collector are not shown in the flow but are used.
2. Step 8 is over O1, it will be over A1 in H-release.
3. In G-release this was realized using Config DB.

# ONAP Network Slicing use case: ML-based Closed Loop
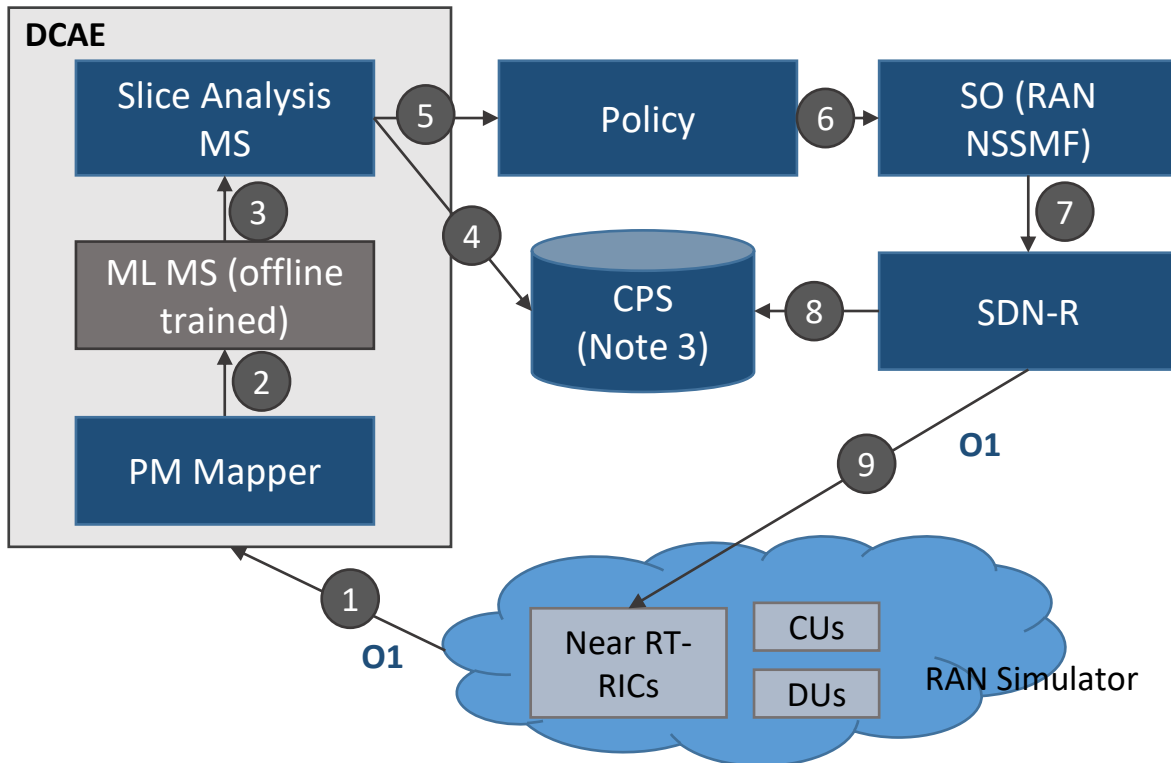
- The PM data collected from RAN in Step 1 is PDU sessions requested, setup successfully & failures.
- The configuration update determined by ML MS and triggering Slice Analysis MS in Step 3 is slice specific maxNumberofConns for each cell (i.e., cell level for each S-NSSAI).

Notes
1. DFC and VES Collector are not shown in the flow but are used.
2. ML MS is onboarded to DCAE, but not an official ONAP component. Later we will onboard using Acumos DCAE adaptor.
3. In G-release this was realized using Config DB.

- **A1 Adapter**
  - A1 REST southbound
  - RESTCONF Northbound
  - Can be included in an any controller based on ONAP CCSDK
- **A1 Policy Management Service**
  - RAN-wide multi-version management of A1 Policy information
  - Query A1 Policy Types in near-RT-RICs
  - Status/Create/Query/Update/Delete A1 Policy Instances in near-RT-RICs
  - Optional re-synchronization after inconsistencies or near-RT-RIC restarts
  - Unified REST & DMaaP NBI
  - Optionally deploy without A1 Adaptor to connect direct to near-RT-RICs
- Used directly in OSC NONRTRIC project
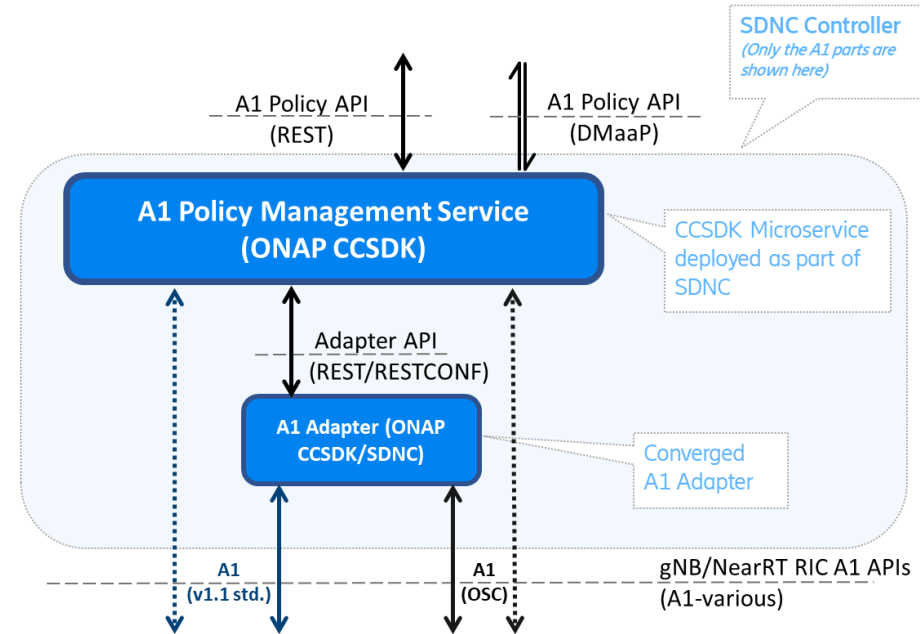
- Examine the possibility of an aligned use case to help leverage and drive requirements for ONAP functions and OSC's Non-RT-RIC, SMO, OAM and Near-RT RIC projects.
  - Might also involve realizing **AI/ML based Closed Loops** where the training is done in ONAP and the trained models are sent over **A1** to Near-RT RIC.
  - Network Slicing use case could be seen as a starting point for this from ONAP perspective.

- Several modelling collaborations may be possible, e.g. app modelling, xNF modelling, topology, etc.

- As CPS gains momentum, it's applicability in O-RAN use cases in OSC and ONAP should be examined.

- Continue the collaboration for RAN Slicing
  - A1 policies alignment with latest O-RAN specs
  - Closed Loop automation
  - Instantiation of RAN NFs (O2 interface)
  - …

- The O-RAN Alliance specifies the usage of
  - ONAP VES as streaming interface
  - NetConf/YANG for configuration
- The Data Models for VES are well defined in ONAP and its (standard defined extensions) from 3GPP.
- For configuration (CM) there are two flavours of YANG data models
  - YANG data models for most of the O-RAN components bases on 3GPP data models with O-RAN extensions (yang:augment)
  - YANG data models from O-RAN OpenFronthaul Management Plane – based on ietf-interfaces

Why YANG?

Augmentation (Extension)

The capability to add data model to others without modification on previous one.

```
augment /system/login/user {
  when "class != 'wheel'";
  leaf uid {
    type uint16 {
      range "1000 .. 30000";
    }
  }
}
```

One for more

YANG is the data modeling languge for several protocols.

- NetConf (ssh|tls/xml)   O-RAN ALLIANCE

- RestConf (http/json)

- gNMI/gNOI (http2/Protobuf|json)

Copyright and Licenses

All the data models reused from whatever entity (SDO) most likely do not follow open-source Copyright and License.

Current Workarounds

- Implementation of the yang data models but only of demo and validation purposes

- Definition of similar data models for use cases only

- Usage of similar data models from other SDOs

OSC/ONAP Weekly meeting

- We host a weekly co-located meeting:
  - Wiki page
    - ONAP Wiki -> TSC Subcommittees -> Requirements subcommittee -> ONAP/O-RAN-SC/SMO Meetings
    - https://wiki.onap.org/pages/viewpage.action?pageId=24641575
  - OSC projects discuss plans, weekly progress, community support, comments, discussion & questions
  - ONAP community discuss ONAP topics relevant for O-RAN OAM/SMO/Non-RT-RIC/Simulations
  - Wednesdays
    - https://lists.onap.org/g/onap-meetings/calendar & https://lists.o-ran-sc.org/g/main/calendar
    - (Winter) 9am PDT | 12pm EDT | 16:00 UTC | 17:00 BST | 18:00 CEST | 19:00 EEST | 21:30 IST | 00:00 CST (Thurs) | 01:00 JST (Thurs)

Questions, Inputs, Comments???

- Please share your inputs & feedback as we go to the respective Requirements Sub-committee & TSC with our updates & recommendations

Meet us

- Weekly Meetings
- Topics are related to
    - ONAP CCSDK
    - ONAP DCAE (VES collector, File Collector)
    - ONAP DMaaP
    - ONAP OOM
    - ONAP Modeling
    - O-RAN-SC RSAC (Requirements & Software Architecture & use cases)
    - O-RAN-SC Non-RealTime RAN Intellegent Controller (NONRTRIC)
    - O-RAN-SC Service Management and Orchestration (SMO)
    - O-RAN-SC Operation and Management (OAM)
    - O-RAN-SC Simulations (SIM)
- Slack