ONAP: A1 Adapter in OSC and ONAP

Converging A1 Control in ONAP (Guilin)

24 June 2020

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O-RAN & the A1 Interface
O-RAN Alliance

Aim
• Industry initiative to transforming radio access networks towards open, intelligent, virtualised and fully interoperable RAN

Principles (from webpage)
• Openness bringing service agility and cloud scale economics
• Intelligence for self-driving networks with AI-optimized closed-loop automation

Creation
• Announced at MWC in Feb 2018 and MWC Shanghai in Jun 2018
• First WG meetings and symposium in Sep 2018

O-RAN Source Community
• Collaboration between Linux Foundation & O-RAN Alliance
• Manage all software development, code storage, tooling and developer integration testing aligned with the architecture specified by O-RAN Alliance
• 2 license models – default is Apache 2 for open-source development

Leading the industry towards open, interoperable interfaces and RAN virtualization

-26 operator members (TSC)
-130+ additional contributors

O-RAN official web-page: [www.o-ran.org](http://www.o-ran.org)
The O-RAN Logical Architecture

Service Management and Orchestration Framework

Non-Real Time RIC

Near-Real Time RAN Intelligent Controller (RIC)

O-eNB

Open Fronthaul M-Plane

O-DU

Open Fronthaul CUS-Plane

O-RU

Open Fronthaul M-Plane

O-Cloud
The O-RAN Logical Architecture
A1 in O-RAN Architecture for Disaggregated RAN

High Level Architecture of O-RAN
From ORAN-WG1 Architecture Description - v01.00.00 - https://www.o-ran.org/specifications
The O-RAN architecture introduces a new management interface - “A1 interface” - between the network management system and the radio access network (RAN)

- A1-AP (Application Protocol) specified by O-RAN Alliance WG2
  https://www.o-ran.org/specifications

An A1 interface enables vendor-agnostic policy-based guidance (“A1 Policies”) to be sent to underlying RAN elements from the management system.

- “A1-EI” will also support transmission of enrichment information from the management platform to the RAN elements (Still being defined – currently out of scope)
- “A1-ML/AI” may also assist with ML Model management in the RAN (Still being defined – currently out of scope)

The A1 interface connects Non-RealTime-RIC logical function in OAM/SMO layer with the Near-RealTime-RIC logical function in the RAN.
Functions available in OSC / ONAP for A1 interface
Current A1 Functions in ONAP (Frankfurt) / OSC (Bronze)
Current A1 Functions in OSC (Bronze)
A1 Adapter in ONAP Frankfurt

• Implemented as an SDNC/CCSDK extension to terminate & expose A1 interface

• [https://wiki.onap.org/display/DW/A1+Adapter+in+ONAP](https://wiki.onap.org/display/DW/A1+Adapter+in+ONAP)

• Developed for Release Requirement (REQ-38): 5G / ORAN & 3GPP Standards Harmonization

• Can be used by other ONAP functions to perform A1 Policy Operations over A1 Interface

• Provides DMaaP northbound interface, and REST (A1) southbound interface
A1 functions in ONAP (Guilin +)
Planned A1 Functions in ONAP (Guilin +)

- **A1 Policy Management Service (ONAP CCSDK)**
- **A1 Policy API (REST)**
- **A1 Policy API (DMaP)**
- **A1 Adapter (ONAP CCSDK/SDNC)**
- Adapter API (REST/RESTCONF)
- Adapter API (DMaP TBC)
- **Converged A1 Adapter**
- **A1 (WG2 1.1 std.)**
- **A1 (OSC)**
- gNB/NearRT RIC A1 APIs (A1- various)

**SDNC Controller**
(Only the A1 parts are shown here)

CCSDK Microservice that can be deployed as part of SDNC
Enhancements for Guilin Release

• Add additional support for standardized A1 protocol (O-RAN A1-AP v1.1)
  • Current (Frankfurt) supports only O-RAN-SC’s (draft) non-spec version of A1 Application Protocol
  • Will add support for upcoming A1 standard spec evolution
  • Will add support for multiple versions for different A1 connections

• Managing A1 Policies
  • Operations:
    • Query A1 Policy Types in near-RT-RICs
    • Create/Query/Update/Delete A1 Policy Instances in near-RT-RICs
    • Query Status for A1 Policy Instances
    • Maintain transient cache of RAN’s A1 Policy information
    • Support RAN-wide view of A1 Policy information
    • Streamline A1 traffic
    • Enable (optional) re-synchronization after inconsistencies / near-RT-RIC restarts

• Add support for multiple near-RT-RICs (with multi-version support)

• Unified REST & DMaaP NBI

• Add support for TLS/HTTPS REST for southbound A1 interfaces (and NBIs)
  • Leverage existing ONAP cert management approaches

• Converge ONAP & O-RAN-SC A1 Adapter/Controller functions in ONAP SDNC/CCSDK
  • Proposed functionality is currently available as 2 functions in O-RAN-SC
    • Basic A1 Adapter is an ODL extension & Policy Management is a separate microservice
A1 Policies - Northbound Interface (REST & DMaaP) Proposed

Policy Types / Policy Instances / Policy Status Operations (REST)

/policies?ric=yy&service=zz&type=xx (GET)
  • PolicyInfo[]

/policy?id=ww (GET, PUT, DELETE)
  • Policy

/policy_types?ric=zz (GET)

/policy_schema?id=xx (GET)
  • Schema

/policy_schemas?ric=yy (GET)
  • Schema[]

/policy_status?id=ww (GET)
  • Status
**DMaaP**

**Inbound request (Topic can be configured)**

```
{
  "type": "string",
  "correlationId": "string",
  "target": "string",
  "timestamp": "timestamp",
  "apiVersion": "string",
  "originatorId": "string",
  "requestId": "string",
  "operation": "string",
  "url": "string",
  "body": "string"
}
```

**Example**

To get all policy types for a specific Near-RT RIC:

```
{
  "type": "request",
  "correlationId": "xyz123",
  "target": "policy-agent",
  "timestamp": "<timestamp>",
  "apiVersion": "1.0",
  "originatorId": "12345",
  "requestId": "6789",
  "operation": "GET",
  "url": "/policy_schemas?ric=ric_1"
}
```

**DMaaP**

**Outbound Response (Topic can be configured)**

```
{
  "requestId": "string",
  "correlationId": "string",
  "originatorId": "string",
  "type": "string",
  "message": "string",
  "status": "string",
  "timestamp": "timestamp"
}
```

**Example**

The response containing all policy types for a specific Near-RT:

```
{
  "requestId": "6789",
  "correlationId": "xyz123",
  "originatorId": "12345",
  "type": "response",
  "message": "<response – in this case an array of Policy type schemas>",
  "timestamp": "<timestamp>",
  "status": "200 OK"
}
```

Propose to deprecate / phase out existing A1 Adapter DMaaP Interface

**O-RAN Alliance (spec) v1.1.3 (Proposed)**

/A1-P/v1/policies (GET)
/A1-P/v1/policies/{policyId} (GET, PUT, DELETE)
/A1-P/v1/policies/{policyId}/status (GET)

**O-RAN-SC A1 (non-spec) v2.1.0 (Existing)**

/a1-p/healthcheck (GET)
/a1-p/policytypes (GET)
/a1-p/policytypes/{policy_type_id} (GET, DELETE, PUT)
/a1-p/policytypes/{policy_type_id}/policies (GET)
/a1-p/policytypes/{policy_type_id}/policies/{policy_instance_id} (GET, DELETE, PUT)
/a1-p/policytypes/{policy_type_id}/policies/{policy_instance_id}/status (GET)
Using A1
• Synchronize A1 Policy Information in RAN
• A1 Policy Type / Instance Operations
• A1 Policy Instance Status Operations
Other impacts / requirements in ONAP (Guilin +)
Other Impacts 1/2

Affected ONAP Functions:
- SDNC / CCSDK only

Integration of bordering ONAP components:
- Guilin: None required – Studies only
  - Stretch Goal: “Hello world” demonstrations with other ONAP components
- Honolulu: A&AI, RuntimeDB, DCAE, CLAMP, Policy. (TBC)
  - Will form part of cross-project 5G integration use cases envisioned for Honolulu (TBC)

Interfaces:
- Northbound Interface – See earlier slide
  - Add/Change SDNC NBI for A1 Policy Management (REST & DMaaP)
    - REST (New)
    - DMaaP (New – Deprecate Existing – goes beyond existing A1 interface message mediation)
- Southbound Interfaces – See earlier slide
  - OSC A1 v2.1 (Existing)
  - O-RAN A1 v1.1 (New)

Usage outside ONAP:
- Used in O-RAN-SC NONRTRIC Project (Downstream)
- Southbound Interface: O-RAN A1 Interface + Information Model is specified and maintained by O-RAN Alliance
Other Impacts 2/2

Modelling Impacts:
- Currently being studied

Test:
- Current (Frankfurt) tests against OSC near-RT-RIC
- Add support to also test with OSC A1-Simulator (multiple A1 versions)
- Add full suite of unit & function tests for all aspects

Other Impacts:
- Update Documentation with A1 interface aspects
- Update Integration & Existing Test requirements
Thank You!