ONAP: A1 Adapter in OSC and ONAP

Converging A1 Control in ONAP (Guilin)

24 June 2020

John Keeney, Michela Bevilacqua

Ericsson

ONAP
OPEN NETWORK AUTOMATION PLATFORM

O-RAN & the A1 Interface

O-RAN Alliance

Aim

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

Creation

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

Principles (from webpage)

- *Openness* bringing service agility and cloud scale economics
- *Intelligence* for self-driving networks with AI-optimized closed-loop automation

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

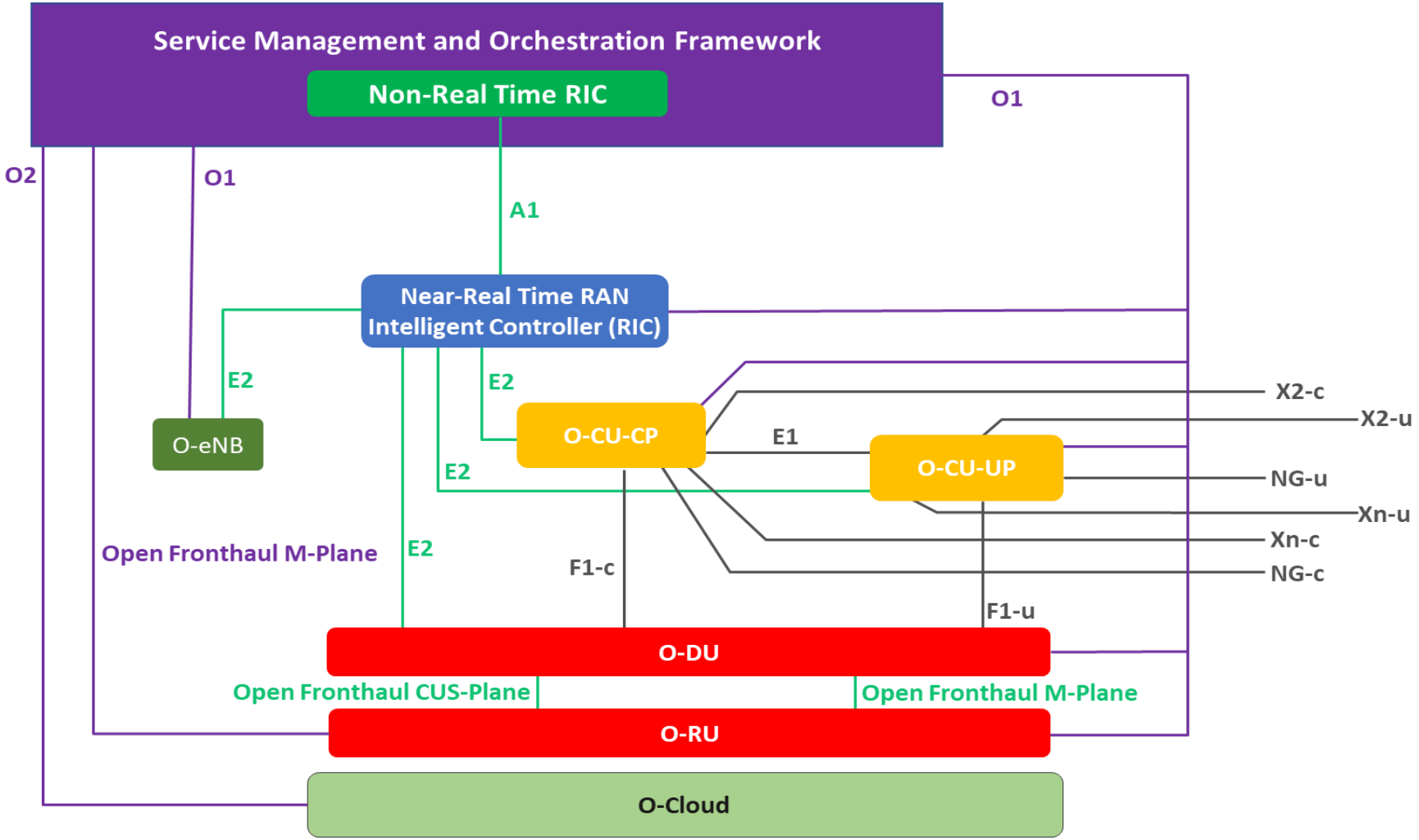
O-RAN ALLIANCE

Leading the industry towards open, interoperable interfaces and RAN virtualization

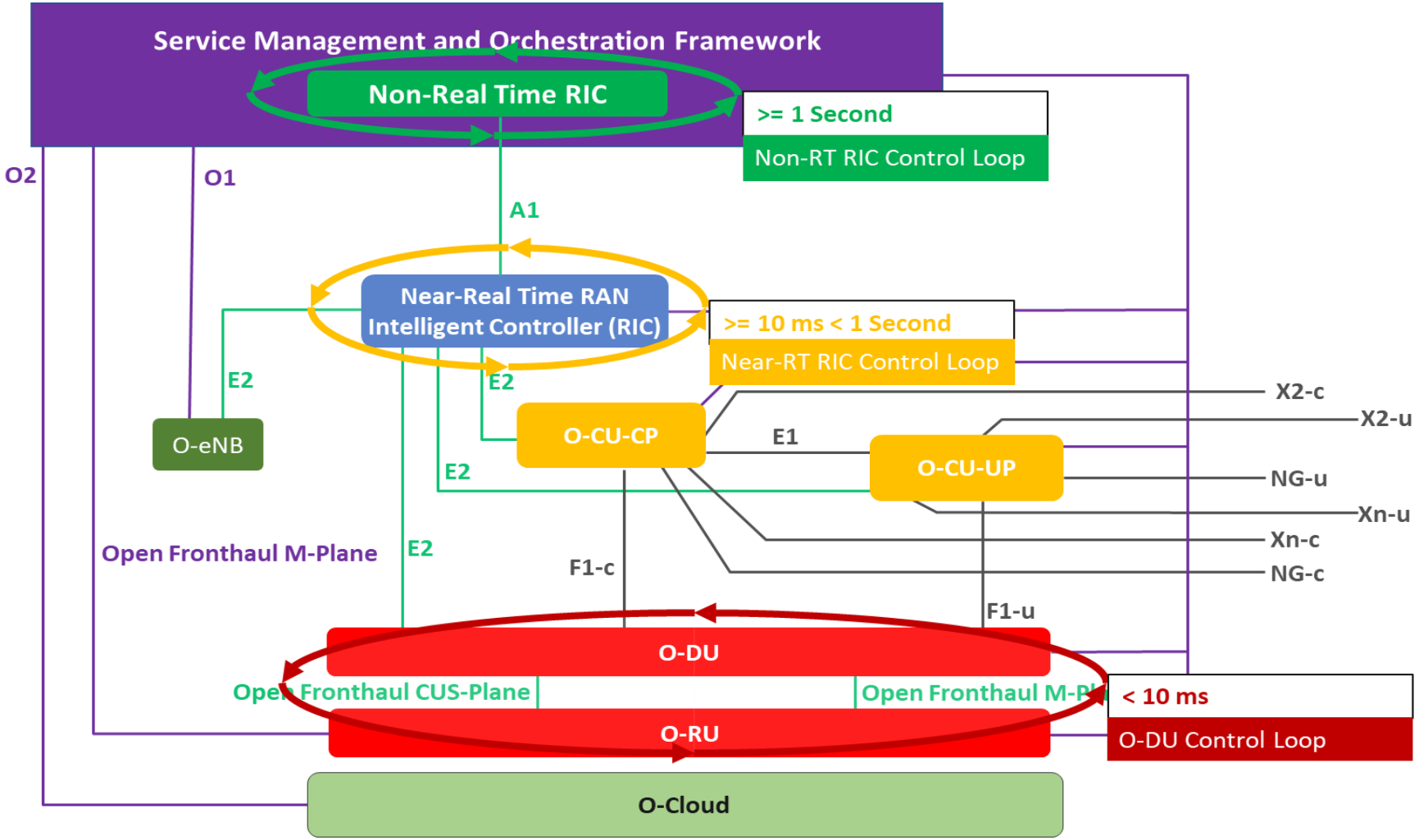
–26 operator members (TSC)
–130+ additional contributors

O-RAN official web-page: www.o-ran.org

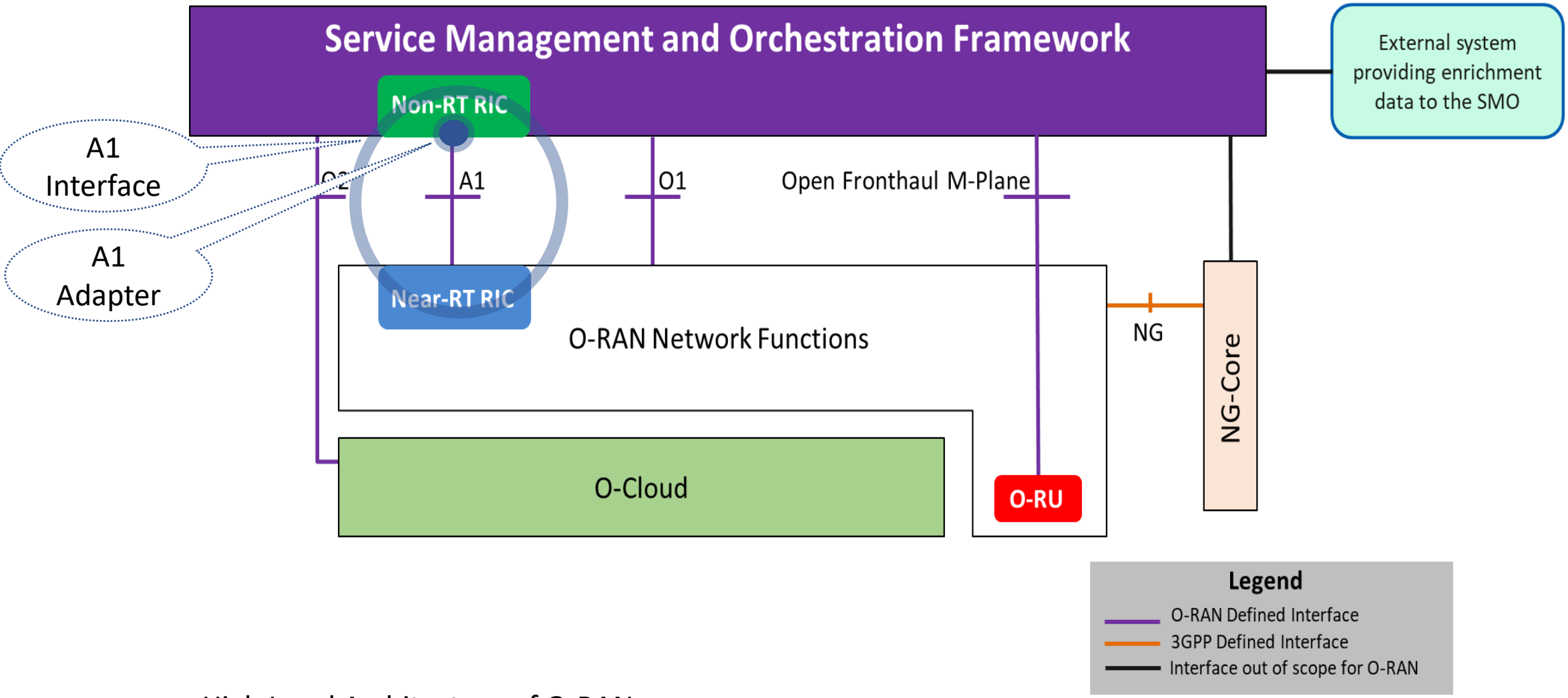
The O-RAN Logical Architecture



The O-RAN Logical Architecture



A1 in O-RAN Architecture for Disaggregated RAN



High Level Architecture of O-RAN

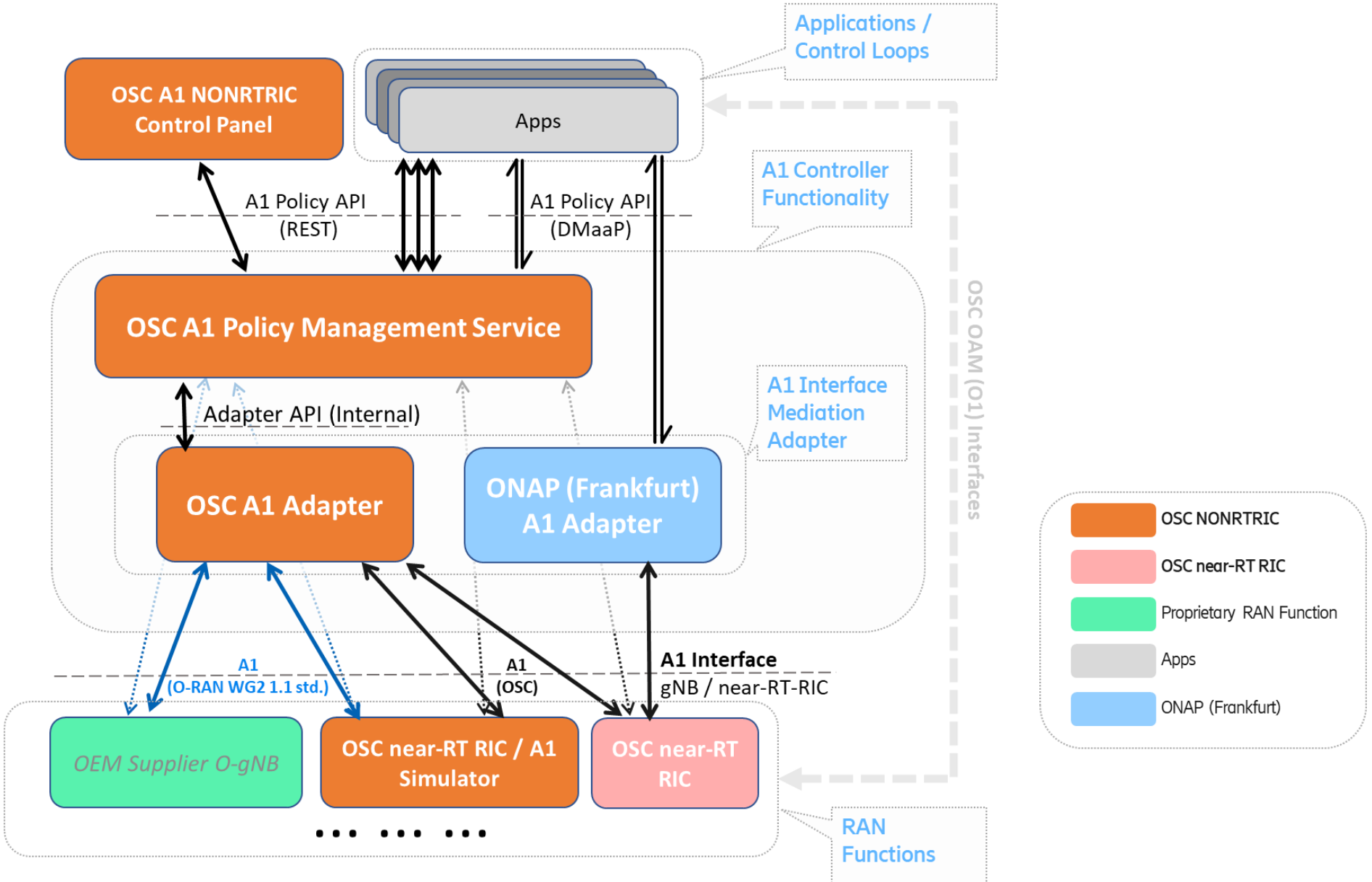
From ORAN-WG1 Architecture Description - v01.00.00 - https://www.o-ran.org/specifications

O-RAN A1 Interface

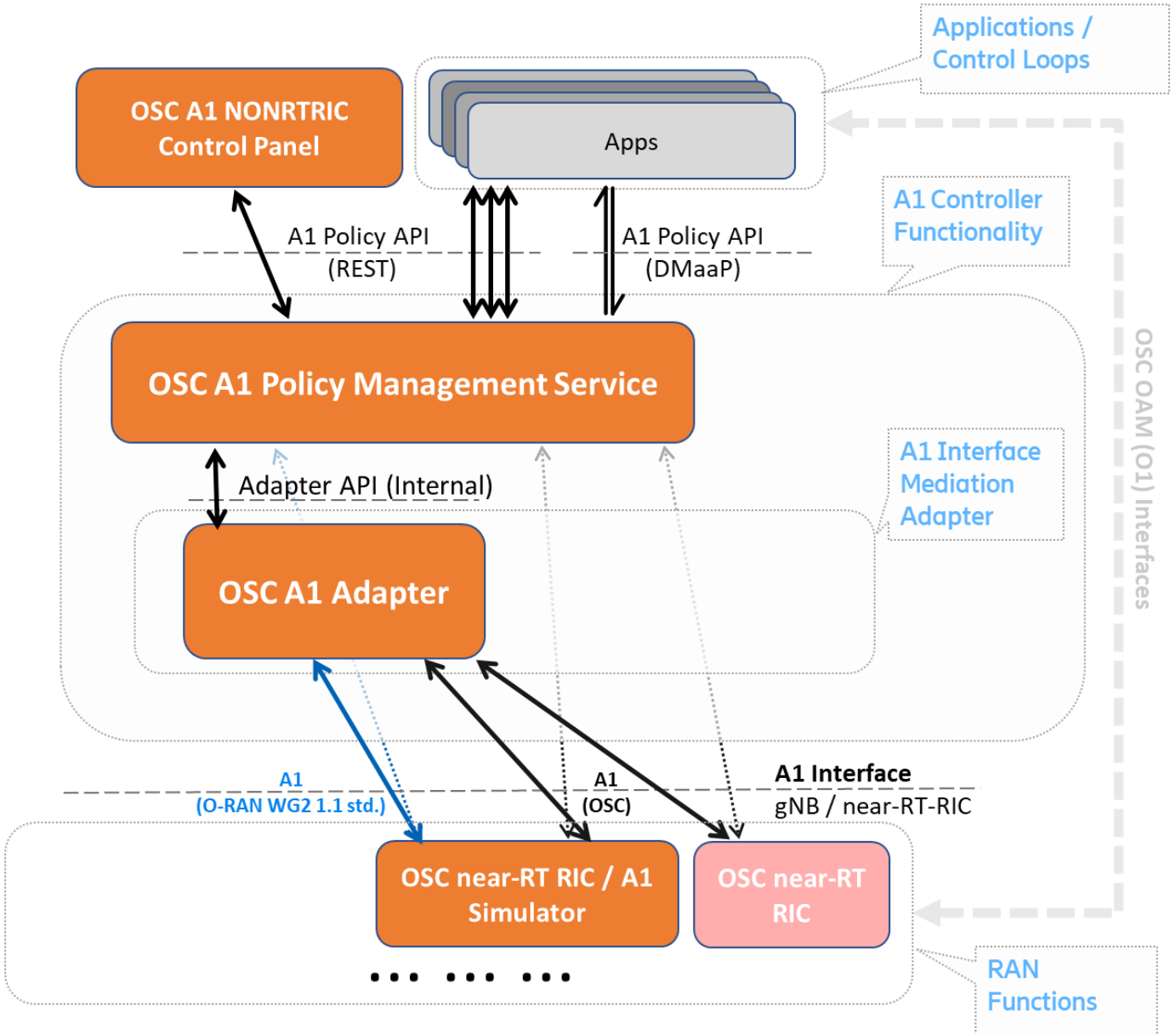
- The O-RAN architecture introduces a new management interface - “A1 interface” - between the network management system and the radio access network (RAN)
  - A1-AP (Application Protocol) specified by O-RAN Alliance WG2 https://www.o-ran.org/specifications
- A1 interface enables vendor-agnostic policy-based 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

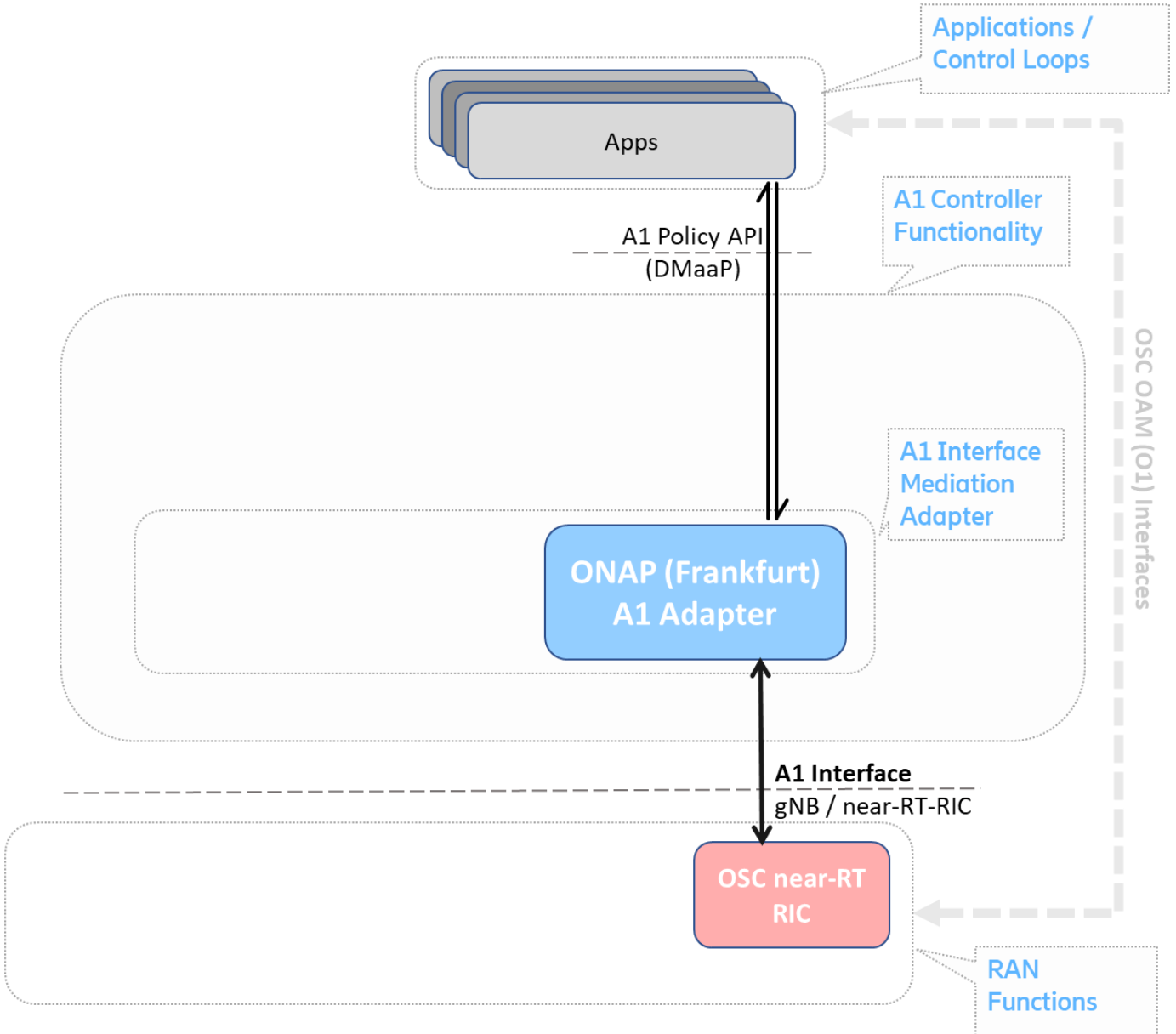
Current A1 Functions in ONAP (Frankfurt) / OSC (Bronze)



Current A1 Functions in OSC (Bronze)



Current A1 Functions in ONAP (Frankfurt)

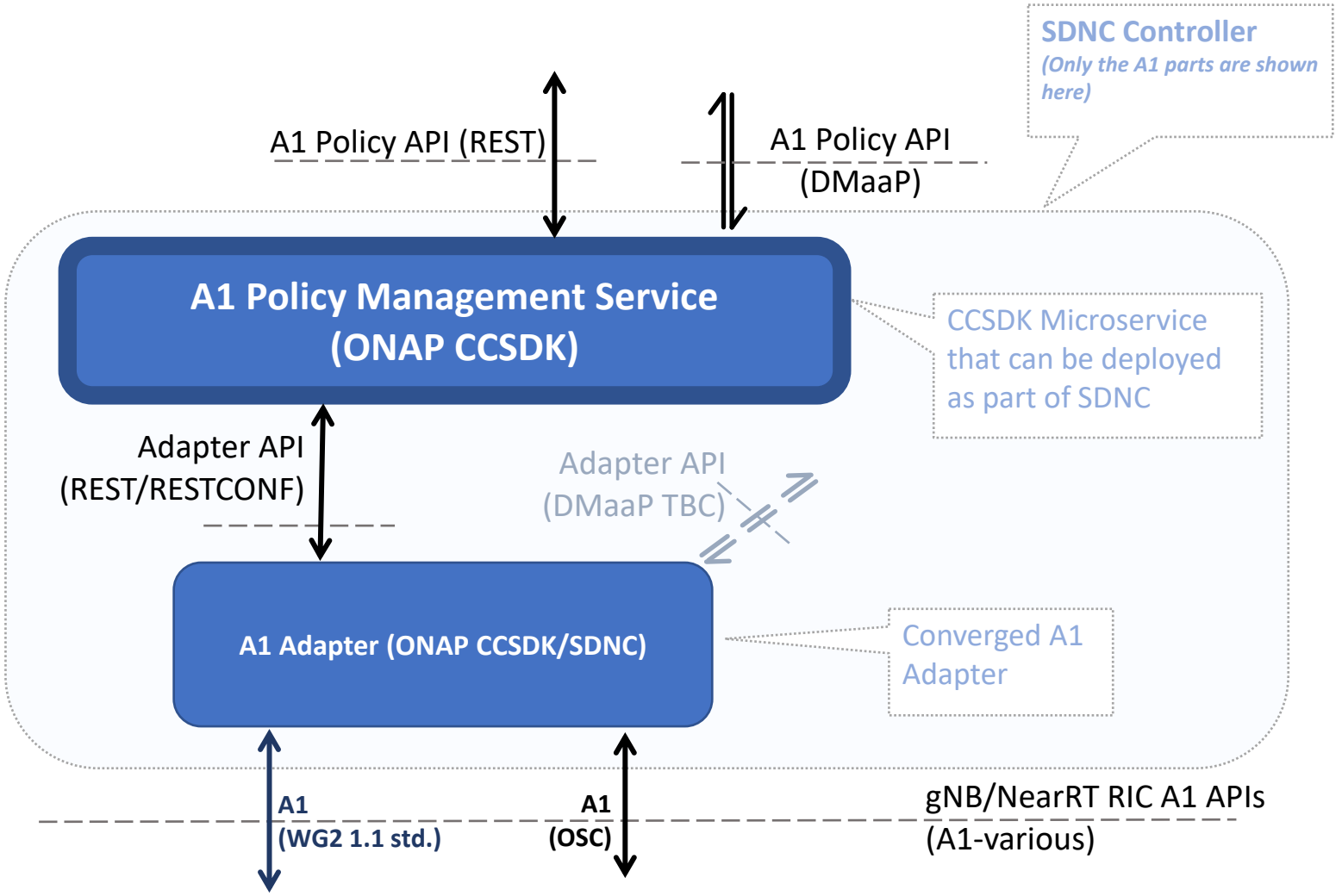


A1 Adapter in ONAP Frankfurt

- Implemented as an SDNC/CCSDK extension to terminate & expose A1 interface
- https://wiki.onap.org/display/DW/A1+Adapter+in+ONAP
- 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 +)



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*

A1 Policies - Northbound Interface (REST & DMaaP) Proposed

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",
  "type": "string",
  "timestamp": "string",
  "status": "string"
}
```

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

A1 Policies – Southbound (A1-P Application Protocol)

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)

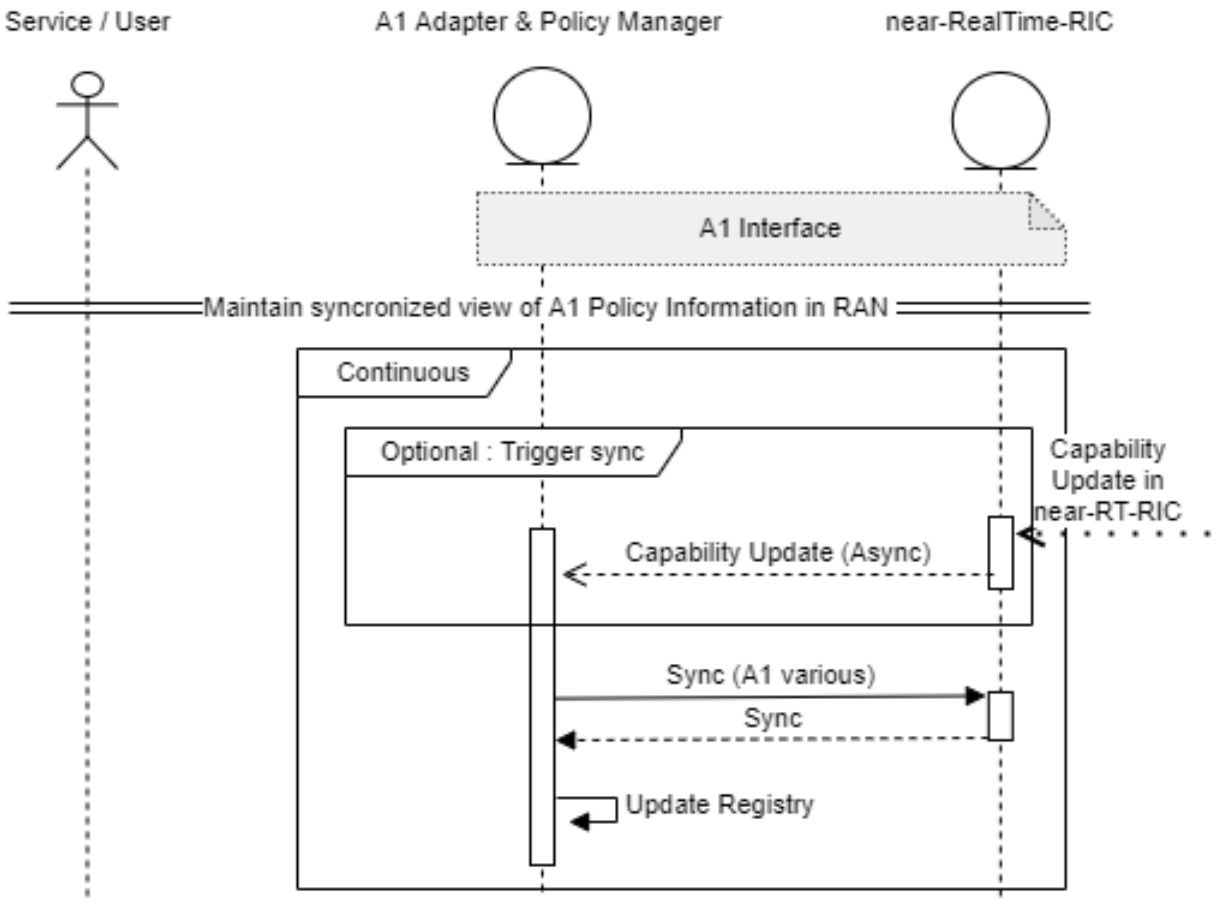
/a1-p/policytypes/{policy_type_id}/policies/{policy_instance_id} (GET, DELETE, PUT)

/a1-p/policytypes/{policy_type_id}/policies/{policy_instance_id}/status (GET)

Using A1

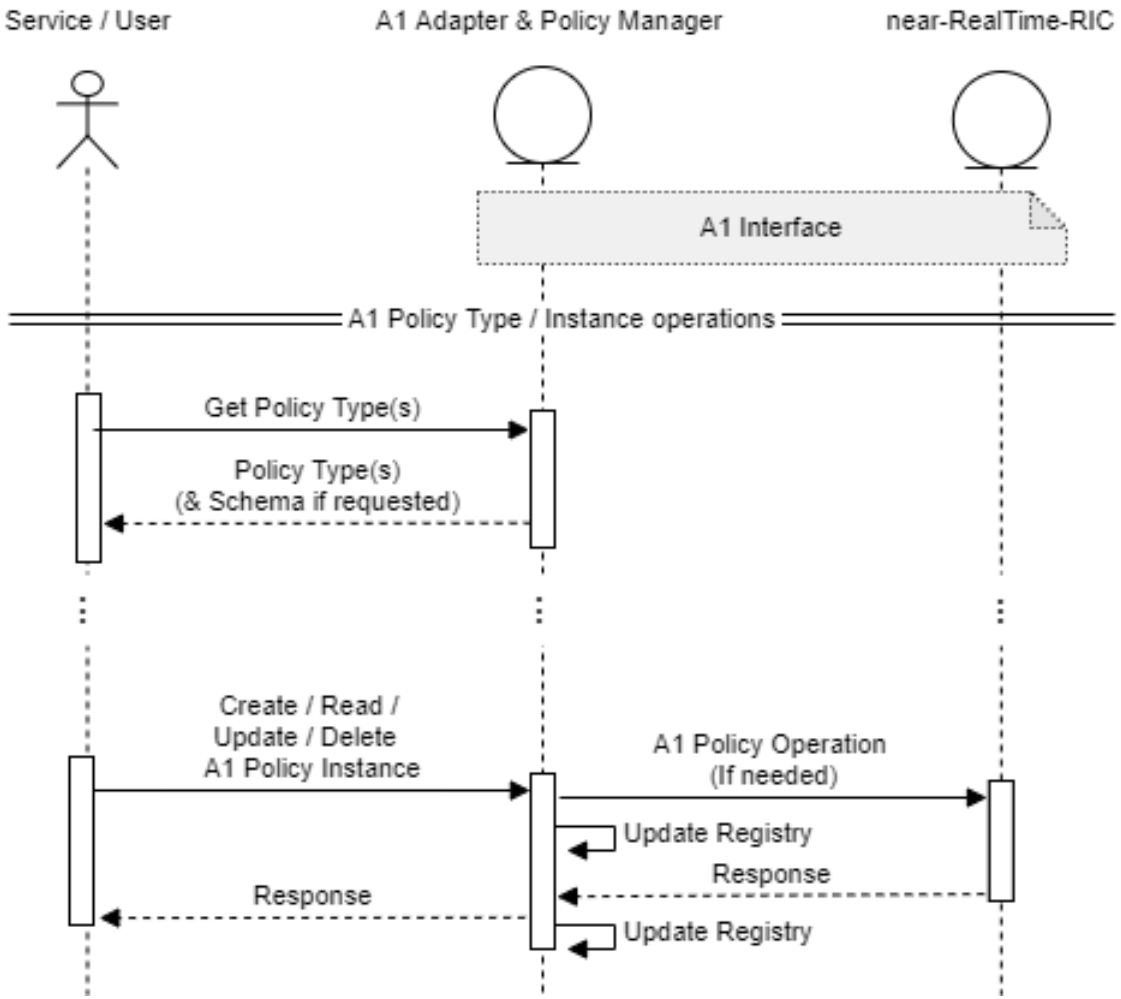
Flow chart / use cases (1/3)

- Synchronize A1 Policy Information in RAN



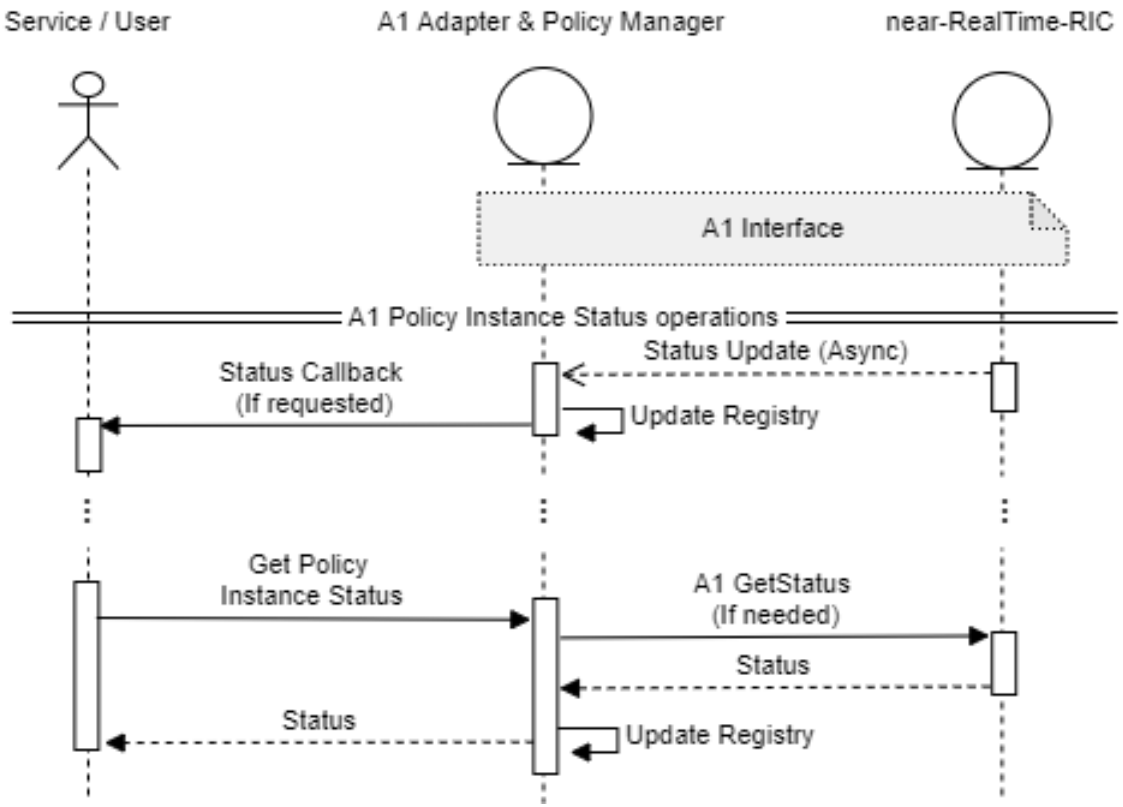
Flow chart / use cases (2/3)

- A1 Policy Type / Instance Operations



Flow chart / use cases (3/3)

- 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!