

SD-RAN v1.5 Techinar

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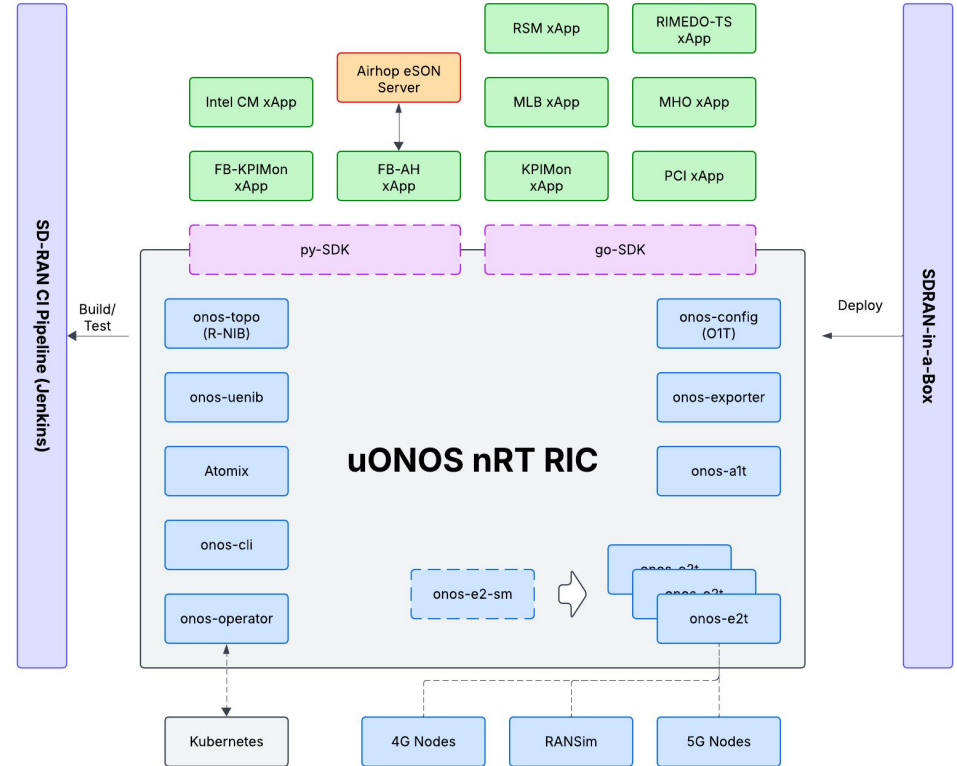
Overview of SD-RAN v1.5

- Updating xApps to replace ONF community SM with O-RAN RC SM
 - ONF RC-Pre Service Model: onos-pci, onos-mlb → O-RAN RC Service Model
 - ONF MHO Service Model: onos-mho → O-RAN RC Service Model
- SD-RAN RIC with OAI 5G RAN stack
- New CI Pipeline: GitHub Action
- Aether On-Ramp for SD-RAN

Overview of SD-RAN v1.5

v1.4 vs v1.5

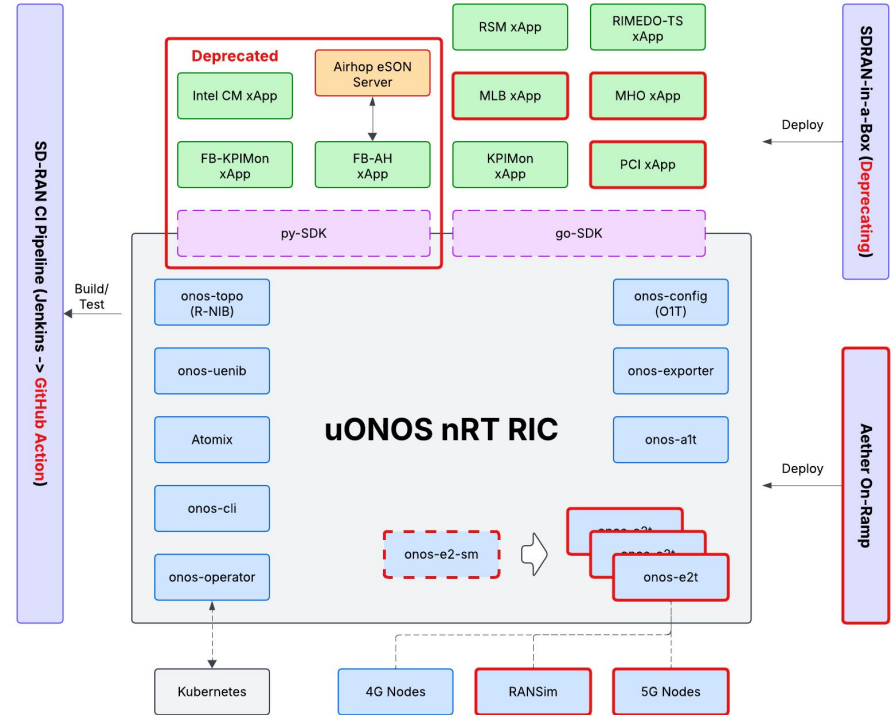
- Key components of SD-RAN v1.4
 - New component:
 - A1T
 - RIMEDO-TS xApp - traffic steering
 - Intel connection management xApp
 - 5G-SA Sercomm gNB with SD-RAN nRT-RIC



Overview of SD-RAN v1.5

v1.4 vs v1.5

- Key changes in v1.5
 - New component:
 - ONF OAI 5G RAN (Pronto)
 - Aether On-Ramp SD-RAN blueprint
 - Updated
 - PCI, MLB, MHO xApps' service model
 - Deprecating
 - SDRAN-in-a-Box (in about next 1-2 releases)
 - Deprecated
 - Python-related components



Overview of SD-RAN v1.5

SD-RAN v1.5 Use-Cases and Versions

Use Case	xApps	Service Model	SD-RAN/OAI CU/DU	RAN-Sim
KPI Monitoring	onos-kpimon	O-RAN E2SM-KPM v2.00.03	4G: E2-AP v2.0 5G: E2-AP v2.0	E2-AP v2.0
PCI Conflict Resolution	onos-pci	O-RAN E2SM-RC v1.02.03	N/A	E2-AP v2.0
Mobility Load Balancing	onos-mlb	O-RAN E2SM-RC v1.02.03	N/A	E2-AP v2.0
Mobile Handover	onos-mho	O-RAN E2SM-RC v1.02.03	N/A	E2-AP v2.0
RAN Slicing Management	onos-rsm	ONF RSM v1.0	4G: E2-AP v2.0	E2-AP v2.0
Policy Driven Traffic Steering	rimedots	ONF MHO v2.0	N/A	E2-AP v2.0

O-RAN RC Service Model Integration

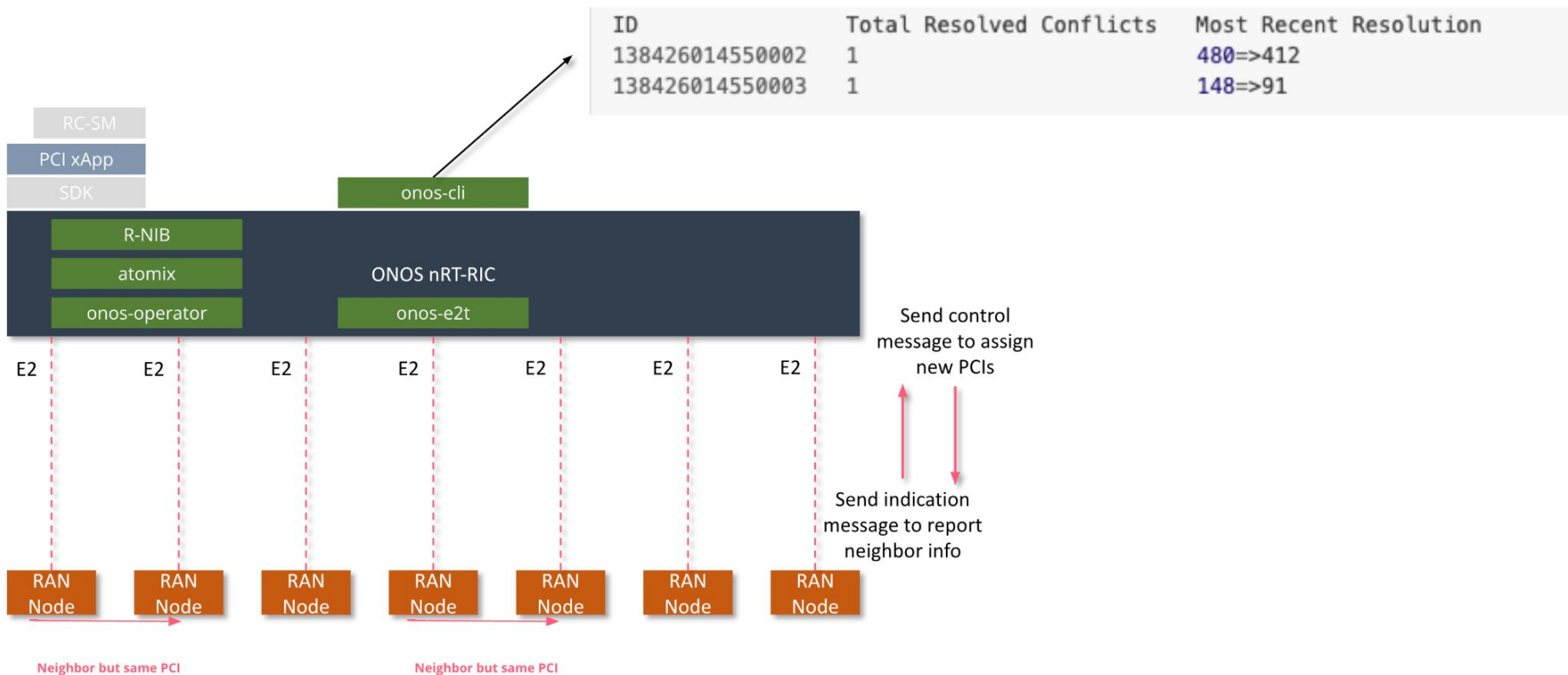
- Goals

- Replace the community service model with the official O-RAN service model
- To expand the support coverage

- Scope

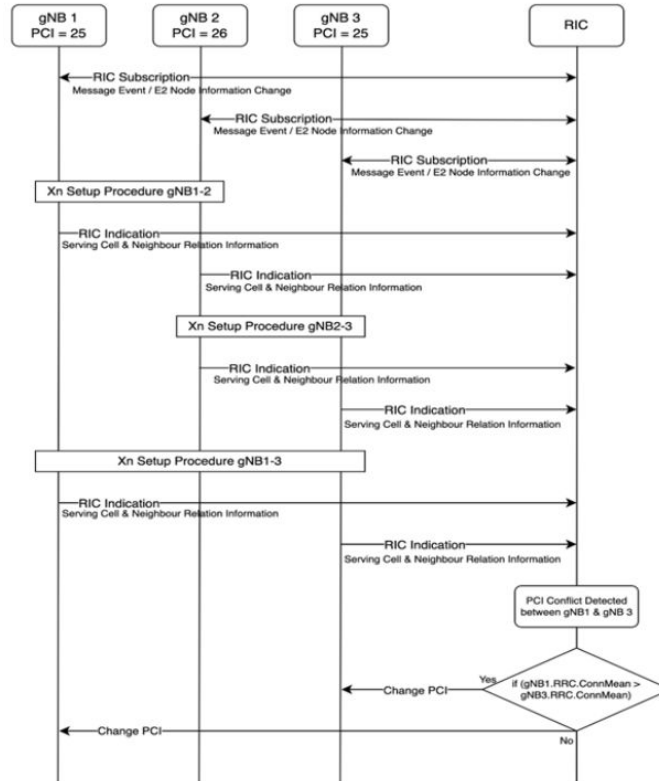
- onos-pci: ONF RC-Pre service model → O-RAN RC service model
- onos-mlb: ONF RC-Pre service model → O-RAN RC service model
- onos-mho: ONF MHO service model → O-RAN RC service model

O-RAN RC Service Model Integration PCI xApp



O-RAN RC Service Model Integration

PCI xApp - Overall



O-RAN RC Service Model Integration

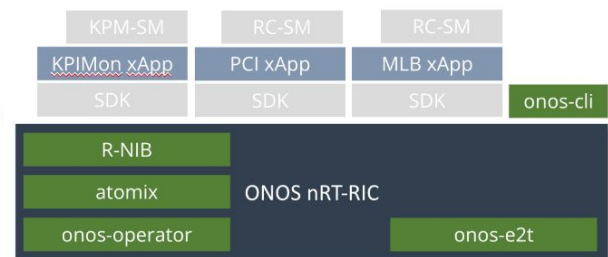
MLB xApp

sCell node ID	sCell PLMN ID	sCell cell ID	sCell object ID	nCell PLMN ID	nCell cell ID	Ocn [dB]
e2:1/5153	138426	1454c001	13842601454c001	138426	1454c002	0
e2:1/5153	138426	1454c001	13842601454c001	138426	1454c003	0
e2:1/5154	138426	1454c002	13842601454c002	138426	1454c001	0
e2:1/5154	138426	1454c002	13842601454c002	138426	1454c003	0
e2:1/5155	138426	1454c003	13842601454c003	138426	1454c001	0
e2:1/5155	138426	1454c003	13842601454c003	138426	1454c002	0

Install Ocn policy
if Ocn should be
updated

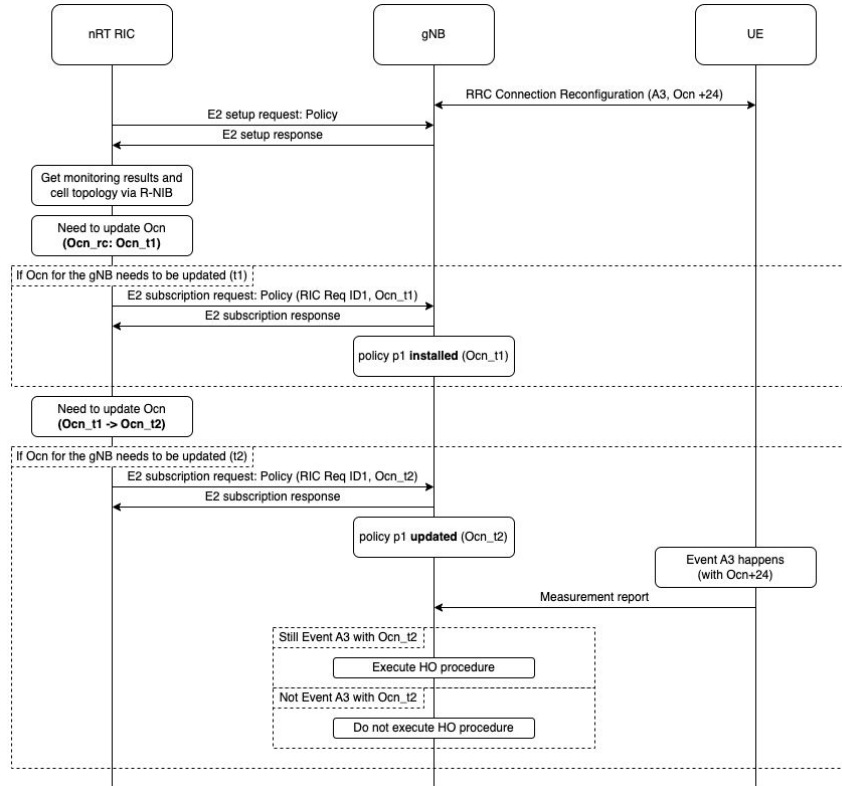


Send indication message
to report KPI and
neighbor info



O-RAN RC Service Model Integration

MLB xApp - Overall

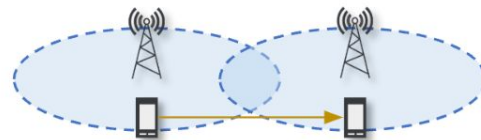
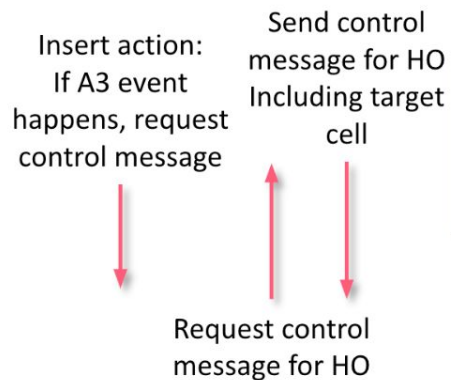


O-RAN RC Service Model Integration

MHO xApp

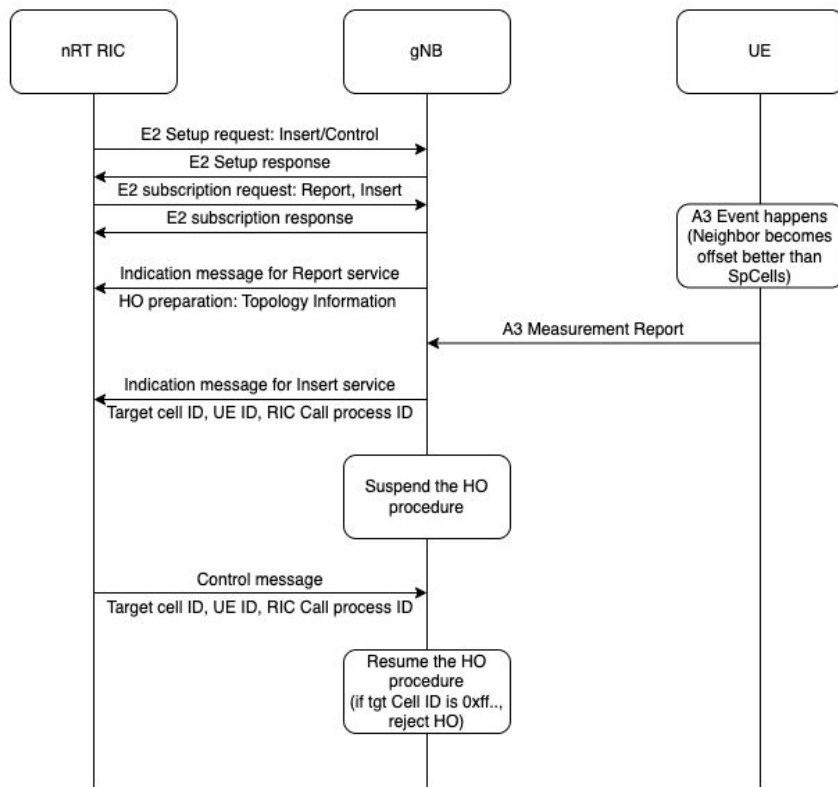
*** Get MHO result through CLI - Cells ***

CGI	Num UEs	Handovers-in	Handovers-out
13842601c054140	1	3	3
138426010055140	0	3	3

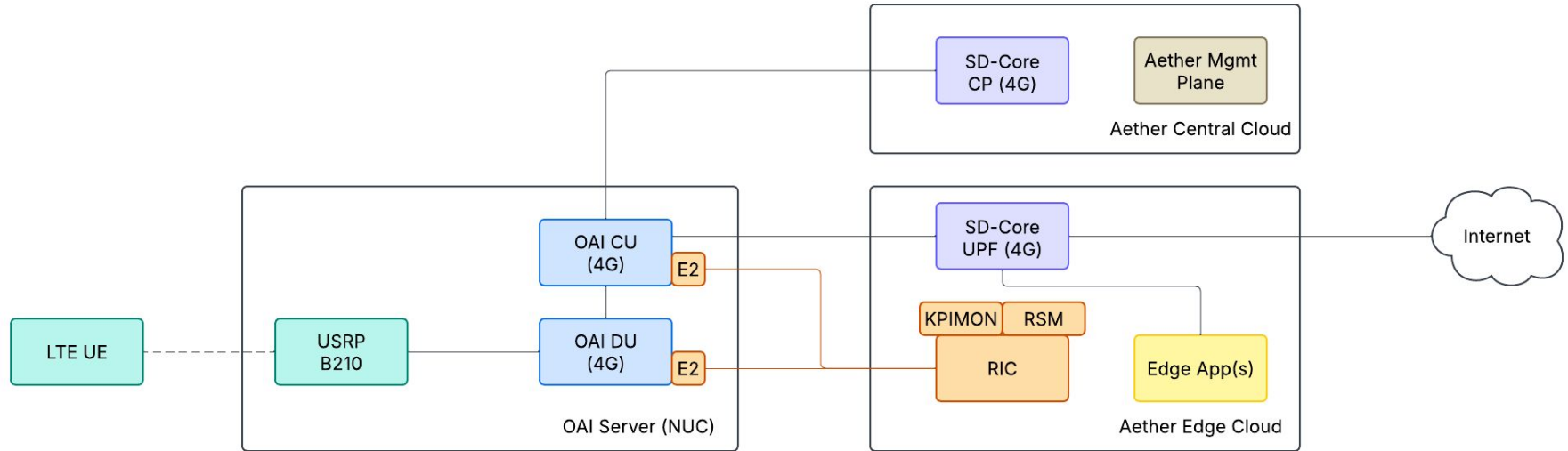


O-RAN RC Service Model Integration

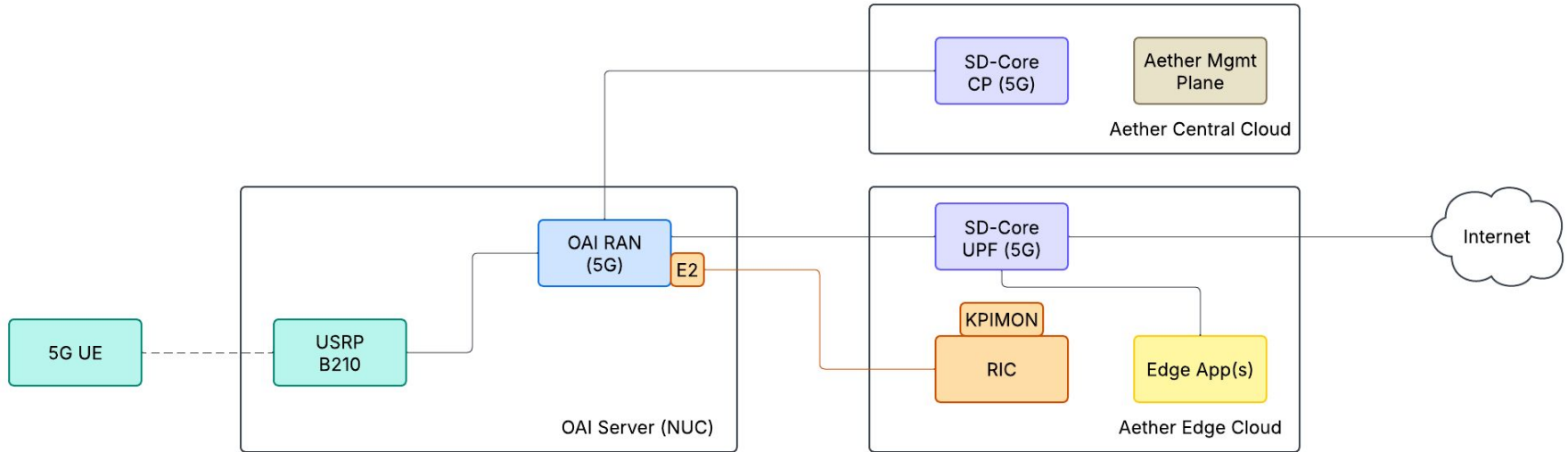
MHO xApp - Overall



SD-RAN with OAI 5G RAN & USRP - 4G



SD-RAN with OAI 5G RAN & USRP - 5G



GitHub Action - New SD-RAN CI Pipeline

- As of v1.4
 - Use Jenkins CI
 - Provision a VM on AWS
 - Run CI pipeline
 - Build, Test, Publish
- From v1.5
 - Fully migrate Jenkins CI into GitHub Action
 - Free and fast
 - Same scope: Build, Test, Publish, etc.

Aether On-Ramp for SD-RAN

Misc. Update

- Python-based SDK
 - Deprecating
- Python-based xApps
 - Deprecating
- User documentation - WIP
 - Hardware installation part (will be done in March)

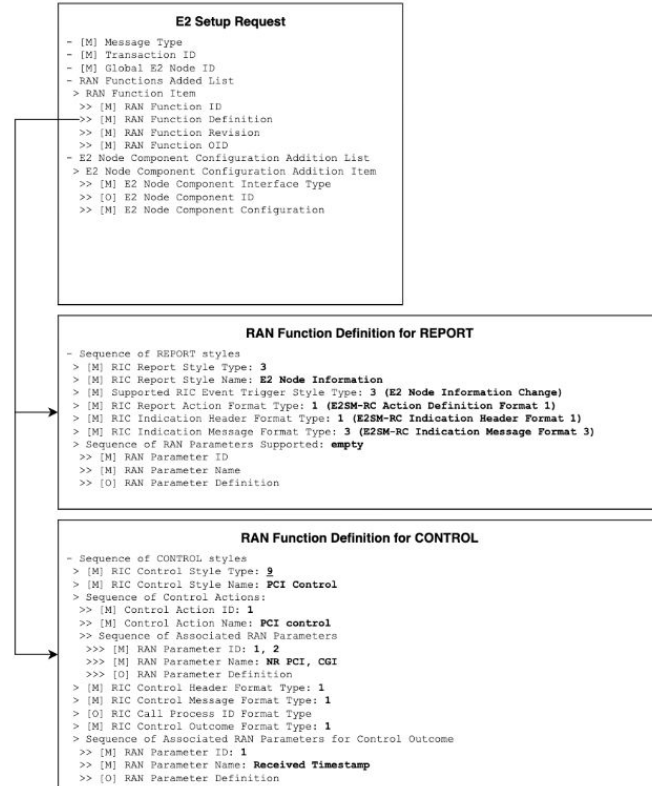
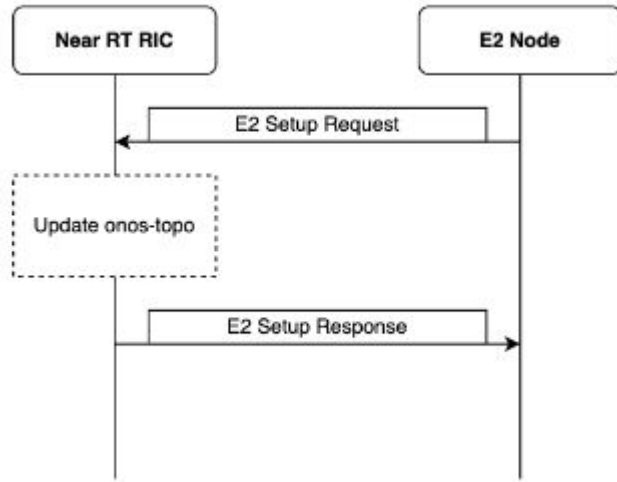
Conclusion & Future Work

- SD-RAN v1.6 Scope
 - Bump up go version, submodule version, etc. up to date
 - Integrate official OAI 5G RAN and srsRAN
 - Integrate nonRT RIC
 - Propose and PoC nonRT RIC and application use-case
 - Propose RANSIM v2.0 - microservice-based RANSIM
- Timeline
 - SD-RAN v1.6: Q3-Q4 2025
- Contact
 - Slack #sdran-dev
 - Engineering team: woojoong.m.kim@gmail.com

Q&A

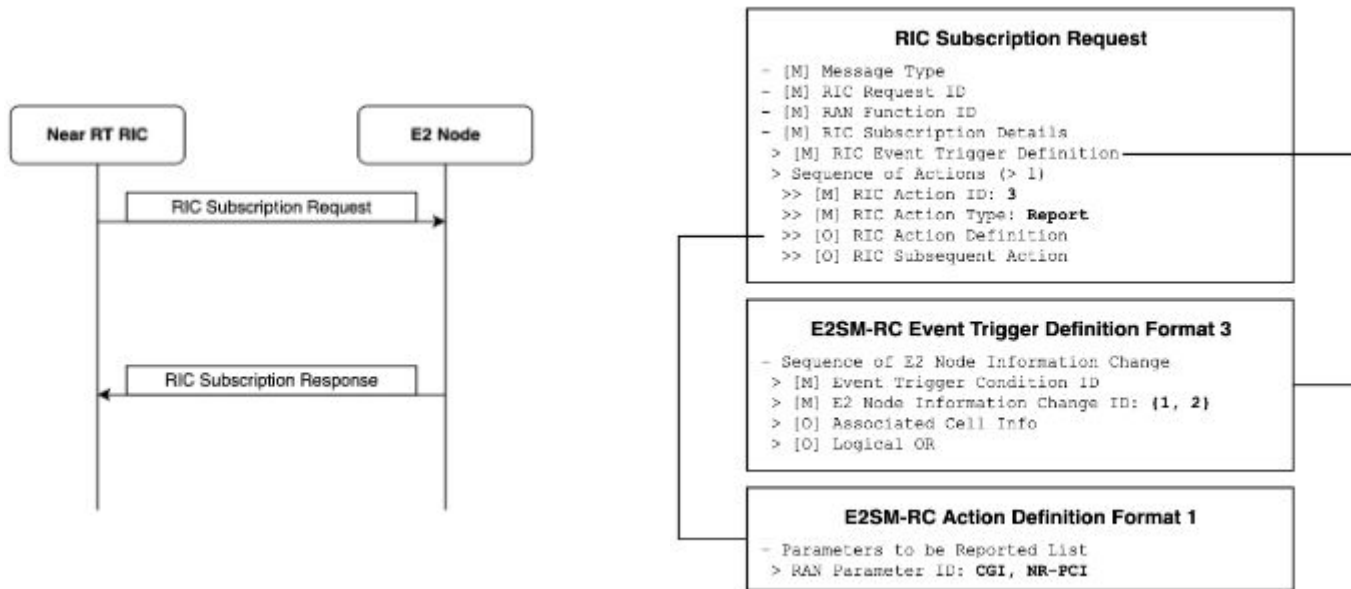
O-RAN RC Service Model Integration

PCI xApp - E2 Setup



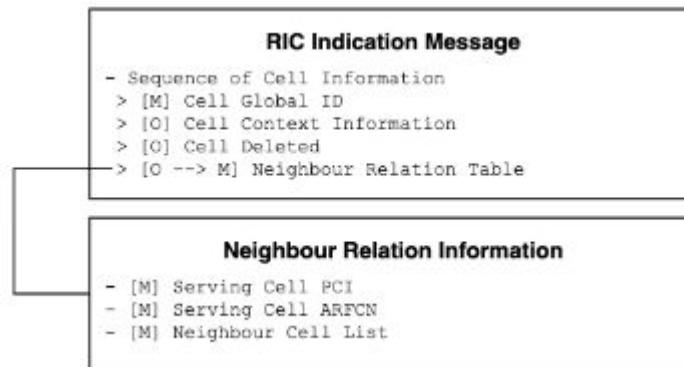
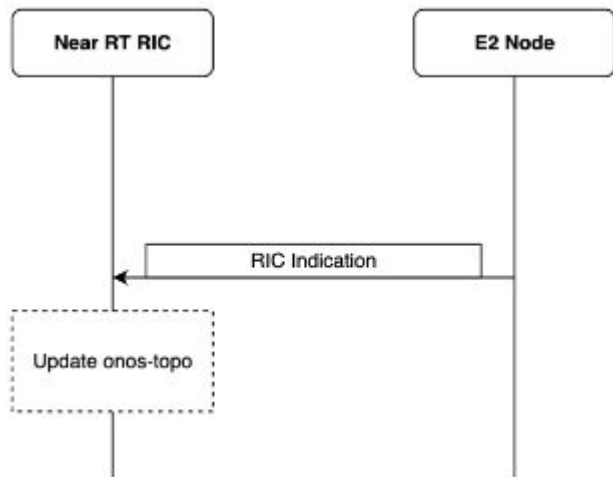
O-RAN RC Service Model Integration

PCI xApp - E2 Subscription



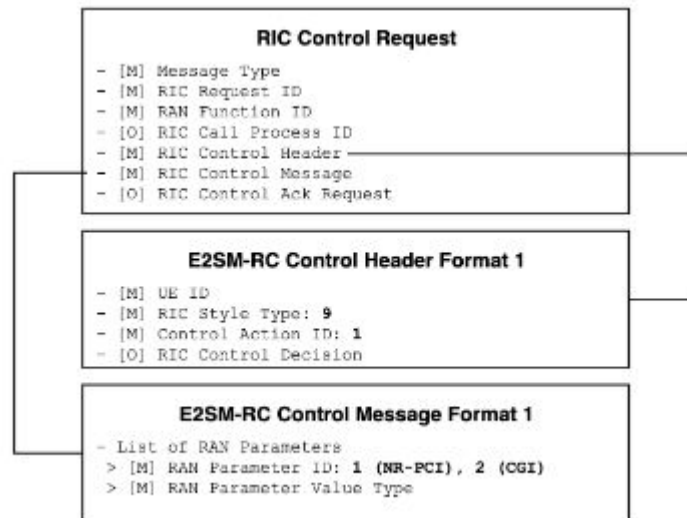
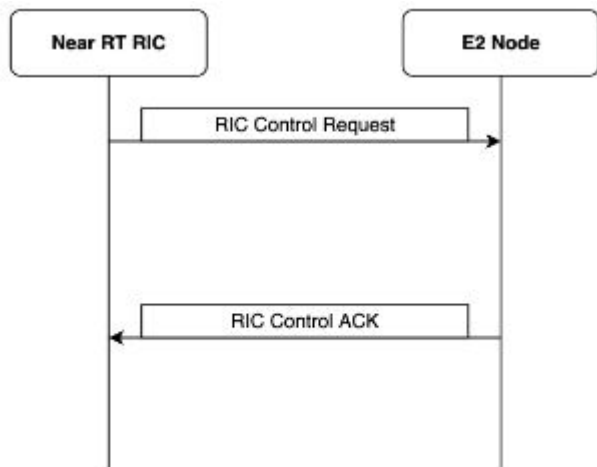
O-RAN RC Service Model Integration

PCI xApp - Report



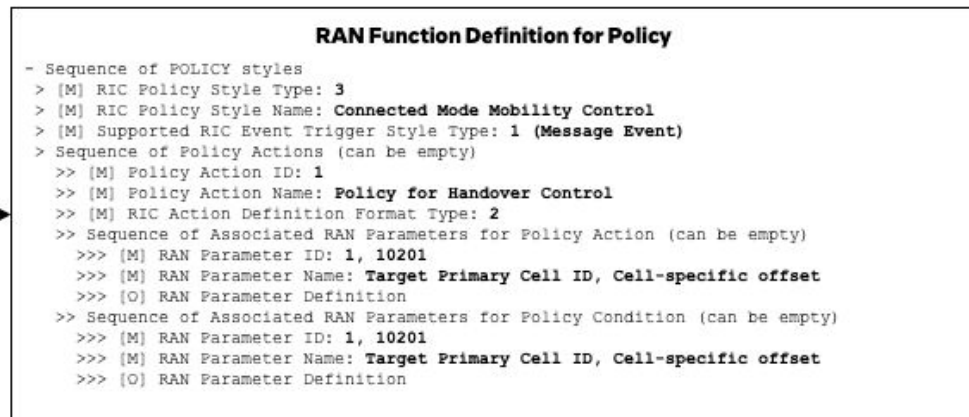
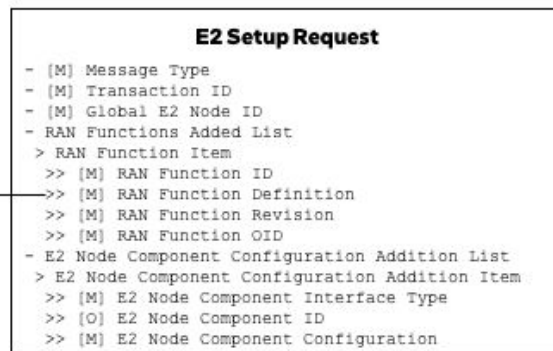
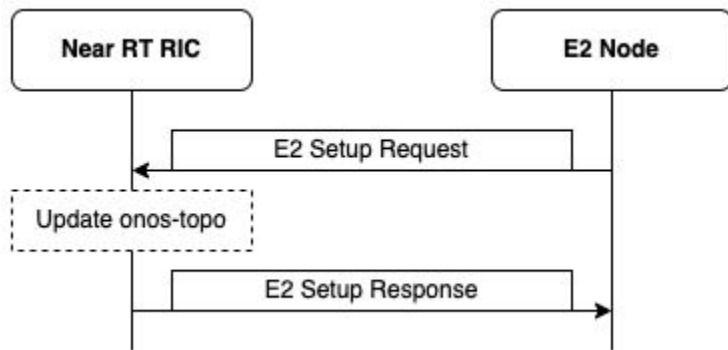
O-RAN RC Service Model Integration

PCI xApp - Control



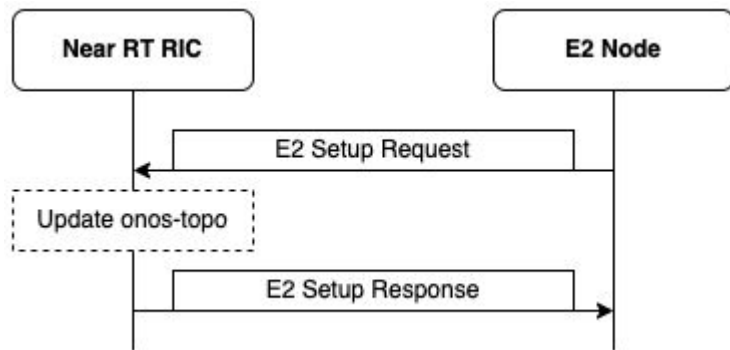
O-RAN RC Service Model Integration

MLB xApp - E2 Setup



O-RAN RC Service Model Integration

MHO xApp - E2 Setup



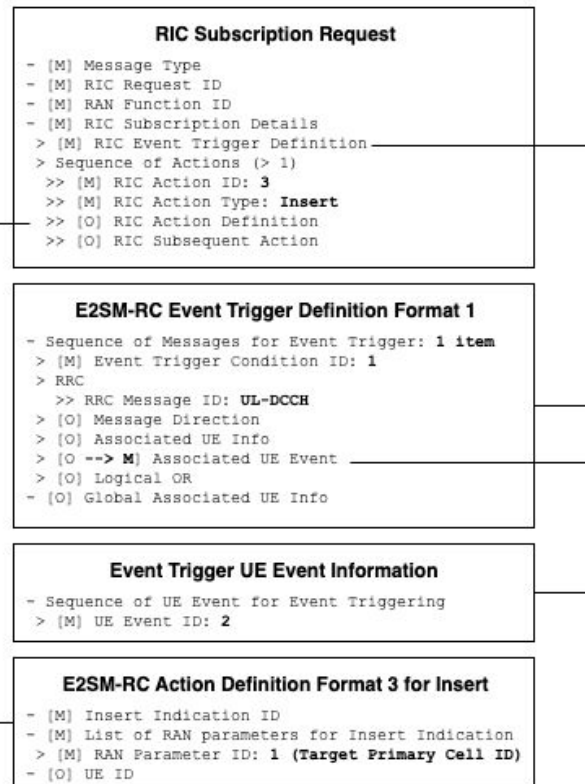
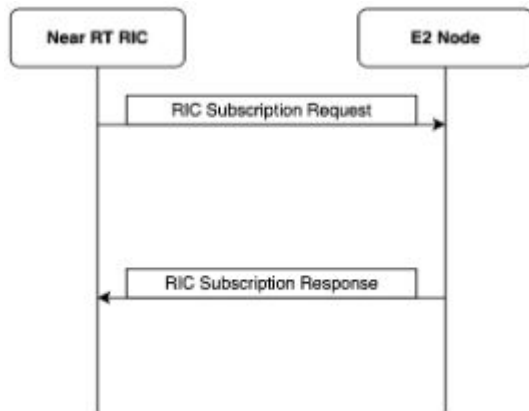
```
E2 Setup Request  
- [M] Message Type  
- [M] Transaction ID  
- [M] Global E2 Node ID  
- RAN Functions Added List  
> RAN Function Item  
>> [M] RAN Function ID  
>>> [M] RAN Function Definition  
>>> [M] RAN Function Revision  
>>> [M] RAN Function QID  
- E2 Node Component Configuration Addition List  
> E2 Node Component Configuration Addition Item  
>> [M] E2 Node Component Interface Type  
>> [O] E2 Node Component ID  
>> [M] E2 Node Component Configuration
```

```
RAN Function Definition for INSERT  
- Sequence of INSERT styles  
> [M] RIC Insert Style Type: 3  
> [M] RIC Insert Style Name: Connected Mode Mobility Control Request  
> [M] Supported RIC Event Trigger Style Type: 1 (Message Event)  
> [M] RIC Action Definition Format Type: 3  
> Sequence of Insert Indications <0,...,max>  
>> [M] Insert Indication ID: 1  
>>> [M] Insert Indication Name: Handover Control Request  
>>> Sequence of Associated RAN Parameters: empty  
>>>> [M] RAN Parameter ID  
>>>> [M] RAN Parameter Name  
>>>> [O] RAN Parameter Definition  
> [M] RIC Indication Header Format Type: 2  
> [M] RIC Indication Message Format Type: 5  
> [M] RIC Call process ID Format Type: 1
```

```
RAN Function Definition for CONTROL  
- Sequence of CONTROL styles  
> [M] RIC CONTROL Style Type: 3  
> [M] RIC Control Style Name: Connected Mode Mobility  
> Sequence of Control Actions:  
>> [M] Control Action ID: 1  
>>> [M] Control Action Name: Handover Control  
>>> Sequence of Associated RAN Parameters  
>>>> [M] RAN Parameter ID: 1-6  
>>>> [M] RAN Parameter Name: Target Primary Cell ID  
>>>> [O] RAN Parameter Definition  
> [M] RIC Control Header Format Type: 1  
> [M] RIC Control Message Format Type: 1  
> [O] RIC Call process ID Format Type: 1  
> [M] RIC Control Outcome Format Type: 1  
> Sequence of Associated RAN Parameters for Control Outcome  
>> [M] RAN Parameter ID: 1  
>>> [M] RAN Parameter Name: Received Timestamp  
>>>> [O] RAN Parameter Definition
```

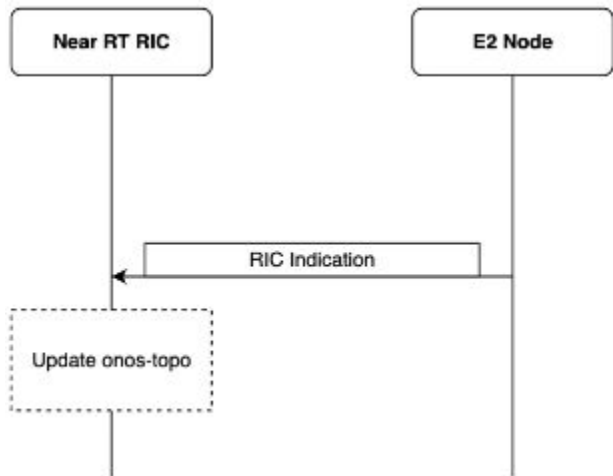
O-RAN RC Service Model Integration

MHO xApp - E2 Subscription



O-RAN RC Service Model Integration

MHO xApp - Report



RIC Indication

- [M] Message Type 9.2.3
- [M] RIC Request ID
- [M] RAN Function ID
- [M] RIC Action ID
- [O] RIC Indication SN
- [M] RIC Indication Type
- [M] RIC Indication Header
- [M] RIC Indication Message
- [O] RIC Call Process ID: **Should be matched with the control message**

RIC Indication Header Format 2 for Insert

- [M] UE ID
- [M] RIC Insert Style Type: 3 (Connected Mode Mobility Control Request)
- [M] Insert Indication ID

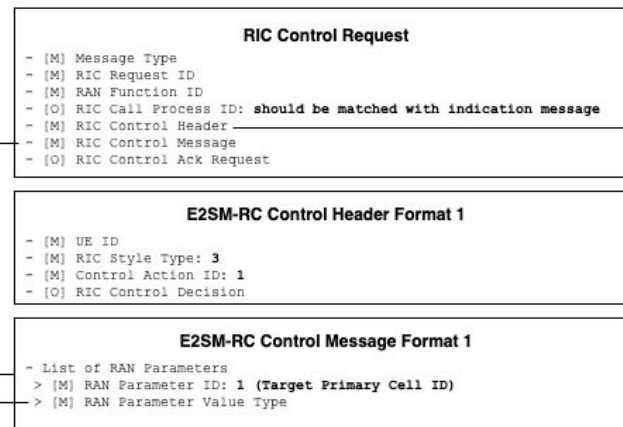
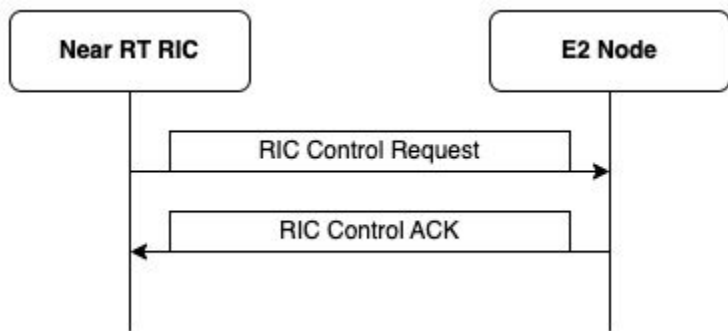
RIC Indication Message Format 5 for Insert

- List of RAN Parameter Requested
- > [M] RAN Parameter ID: 1 (Target Primary Cell ID)
- > [M] RAN Parameter Value Type

RAN Parameter ID	RAN Parameter	RAN Parameter Value Type	Key Flag	RAN Parameter Definition	Semantics Description
1	Target Primary Cell ID	STRUCTURE			Target Cell Global ID IE in TS 38.423 [15] Section 9.2.3.25
2	>CHOICE Target Cell	STRUCTURE			Target Cell IE in TS 38.423 [15] Section 9.2.3.25
3	>>NR Cell	STRUCTURE			NR IE in TS 38.423 [15] Section 9.2.3.25
4	>>>NR CGI	ELEMENT	FALSE	NR CGI IE in TS 38.423 [15] Section 9.2.2.7	
5	>>>E-UTRA Cell	STRUCTURE			E-UTRA IE in TS 38.423 [15] Section 9.2.3.25
6	>>>E-UTRA CGI	ELEMENT	FALSE	E-UTRA CGI IE in TS 38.423 [15] Section 9.2.2.8	

O-RAN RC Service Model Integration

MHO xApp - Control



RAN Parameter ID	RAN Parameter	RAN Parameter Value Type	Key Flag	RAN Parameter Definition	Semantics Description
1	Target Primary Cell ID	STRUCTURE			Target Cell Global ID IE in TS 38.423 [15] Section 9.2.3.25
2	>CHOICE Target Cell	STRUCTURE			Target Cell IE in TS 38.423 [15] Section 9.2.3.25
3	>>NR Cell	STRUCTURE			NR IE in TS 38.423 [15] Section 9.2.3.25
4	>>>NR CGI	ELEMENT	FALSE	NR CGI IE in TS 38.423 [15] Section 9.2.2.7	
5	>>E-UTRA Cell	STRUCTURE			E-UTRA IE in TS 38.423 [15] Section 9.2.3.25
6	>>>E-UTRA CGI	ELEMENT	FALSE	E-UTRA CGI IE in TS 38.423 [15] Section 9.2.2.8	