SD-RAN v1.1. Techinar

April 28, 2021 I 9am PDT

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AirHop

Cory Modlin
Facebook

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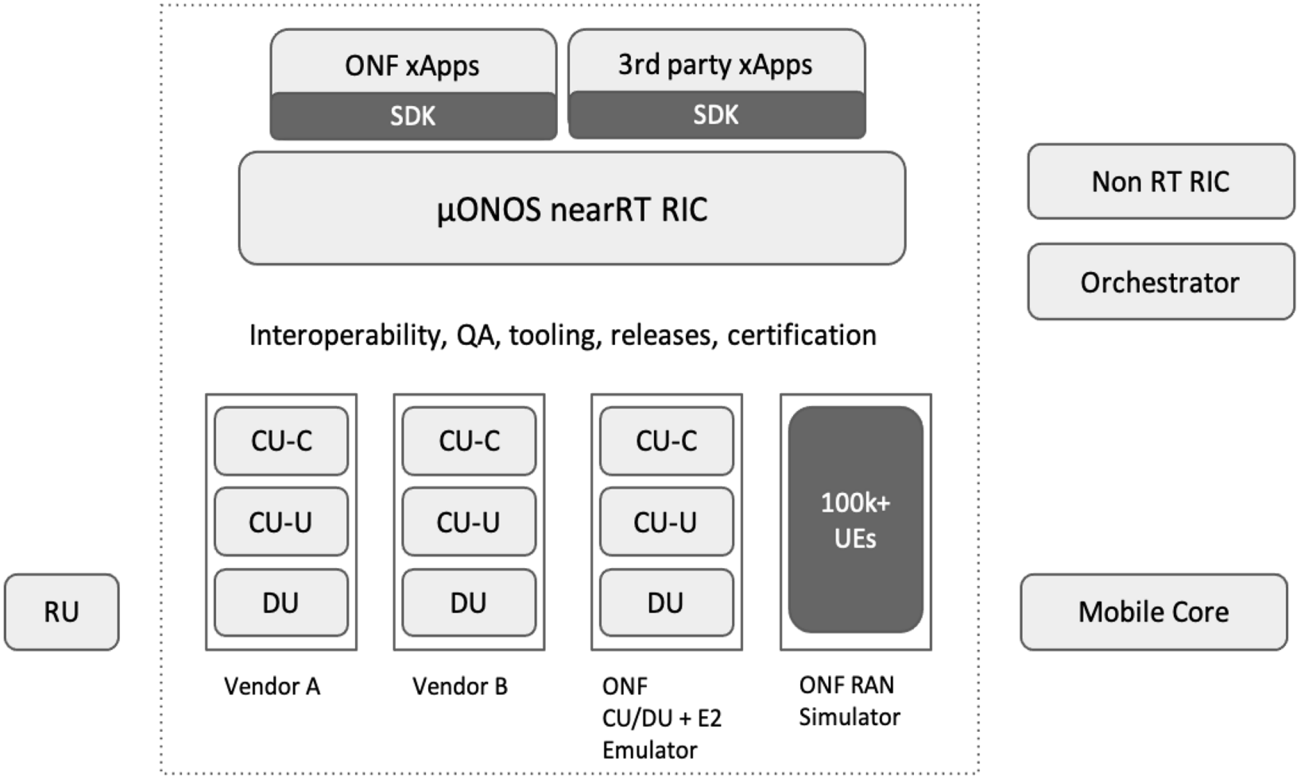
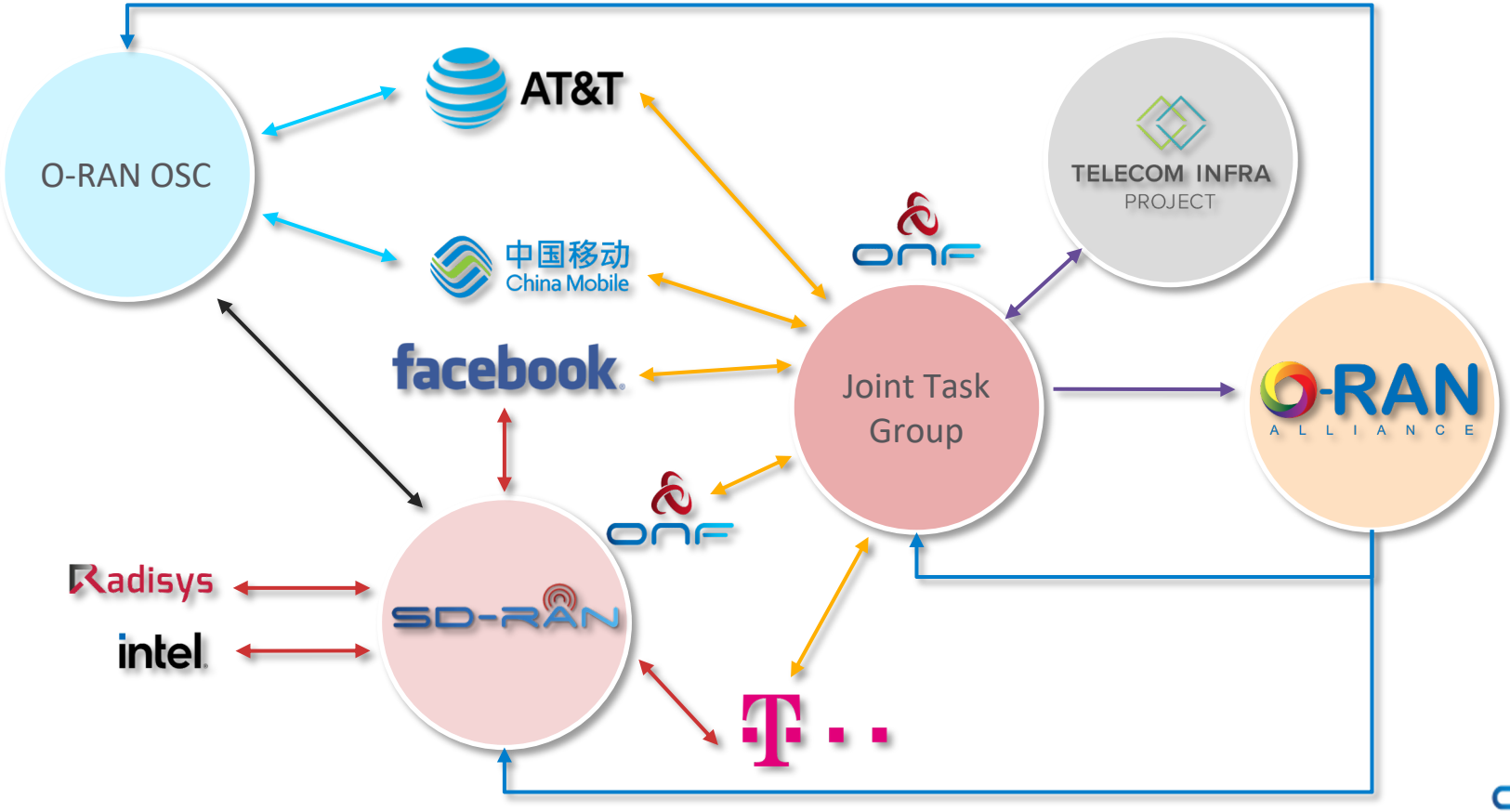
ONF

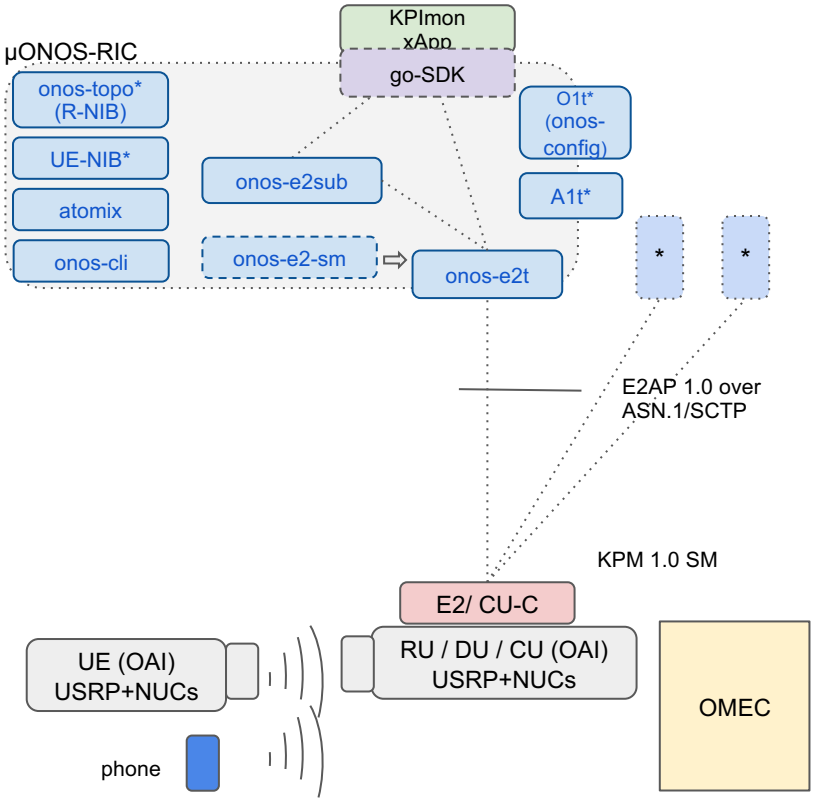
SD-RAN Solution



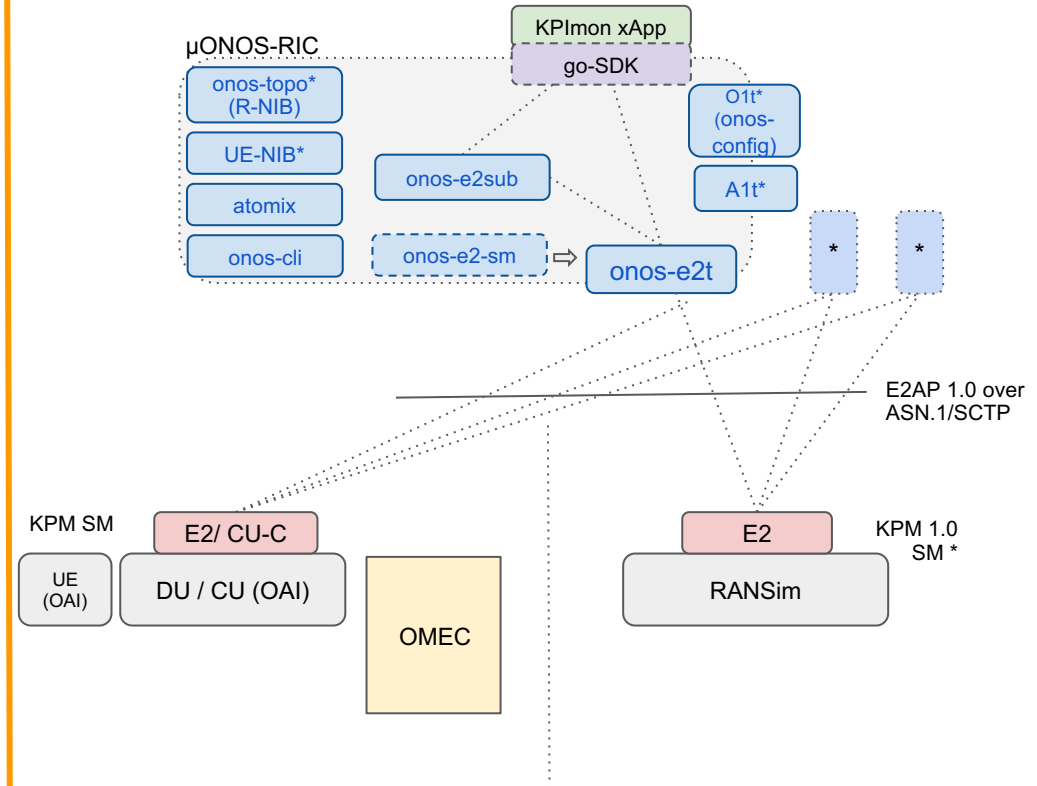
ONF, O-RAN and TIP



SD-RAN v1.0

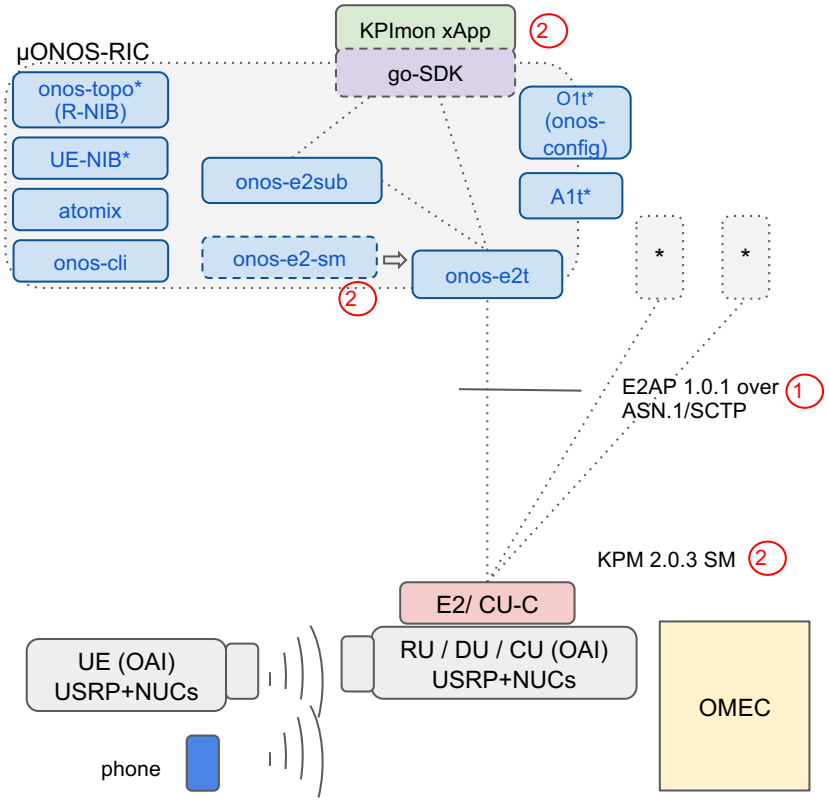


SD-RAN on hardware

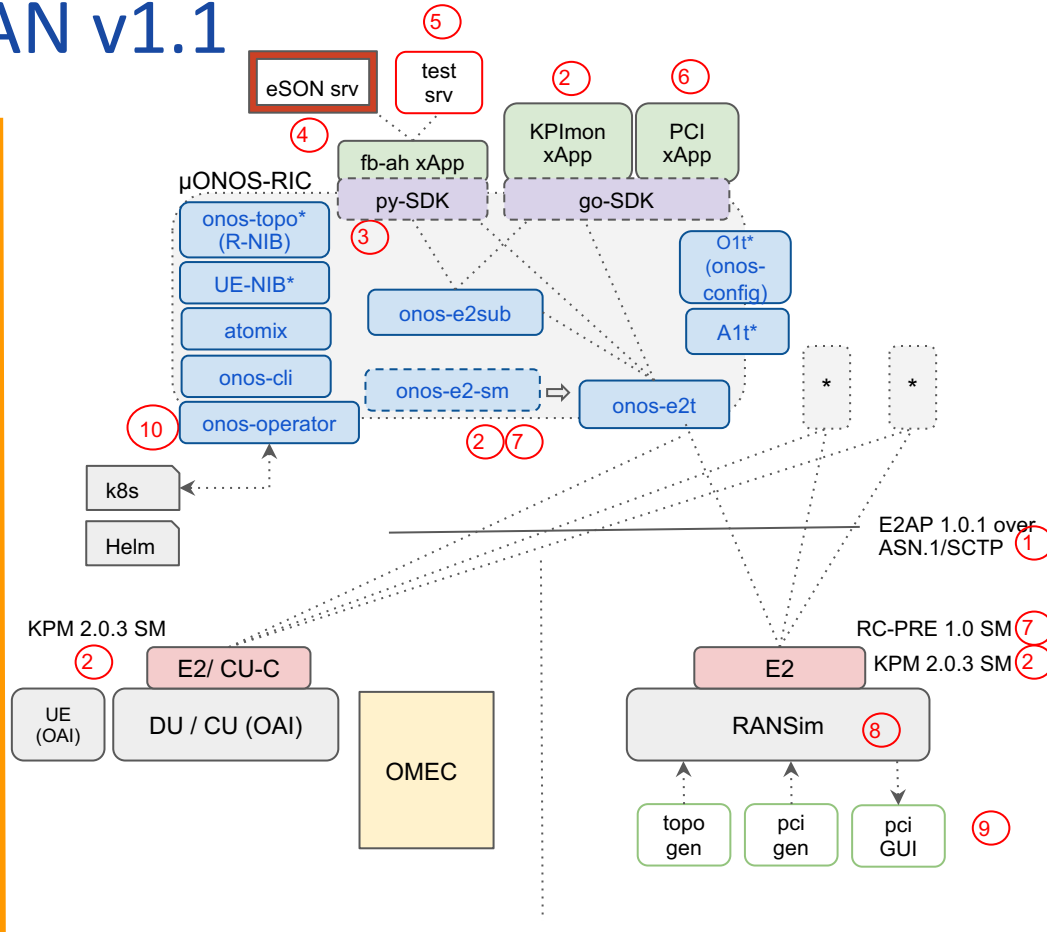


SD-RAN in a Box

SD-RAN v1.1



SD-RAN on hardware



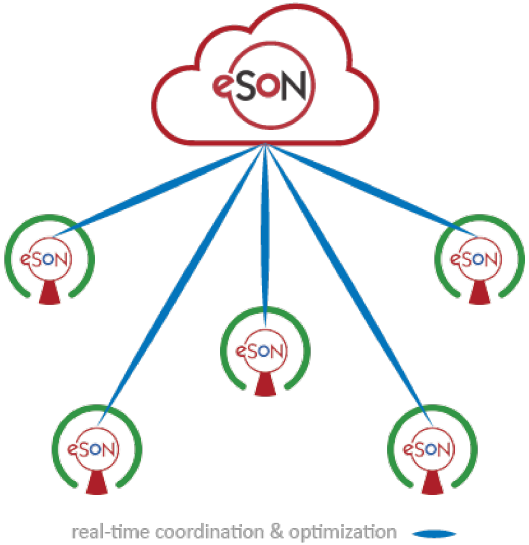
SD-RAN in a Box

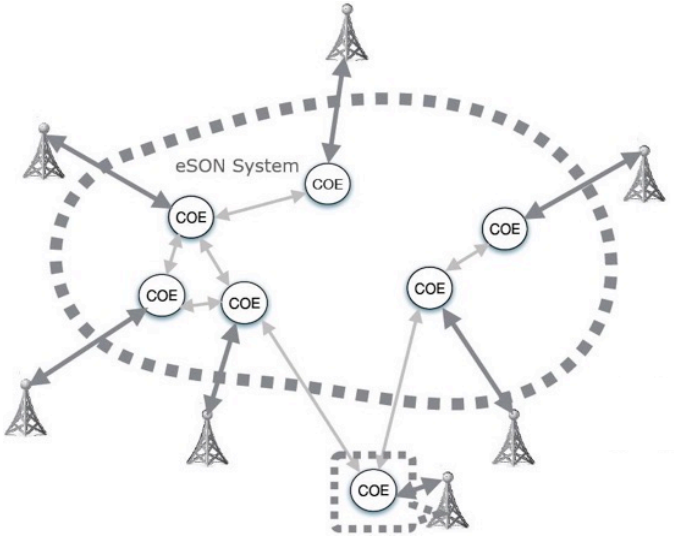
airhop communications

ONF Collaboration

April 28, 2021

AirHop eSON Overview





- 1-to-1 mapping of cells to Cell Optimization Engine (COE) microservices
- Microservices (COE) dynamically coordinate information among influencing cells
- Fully distributed applications resulting in network level optimization decisions

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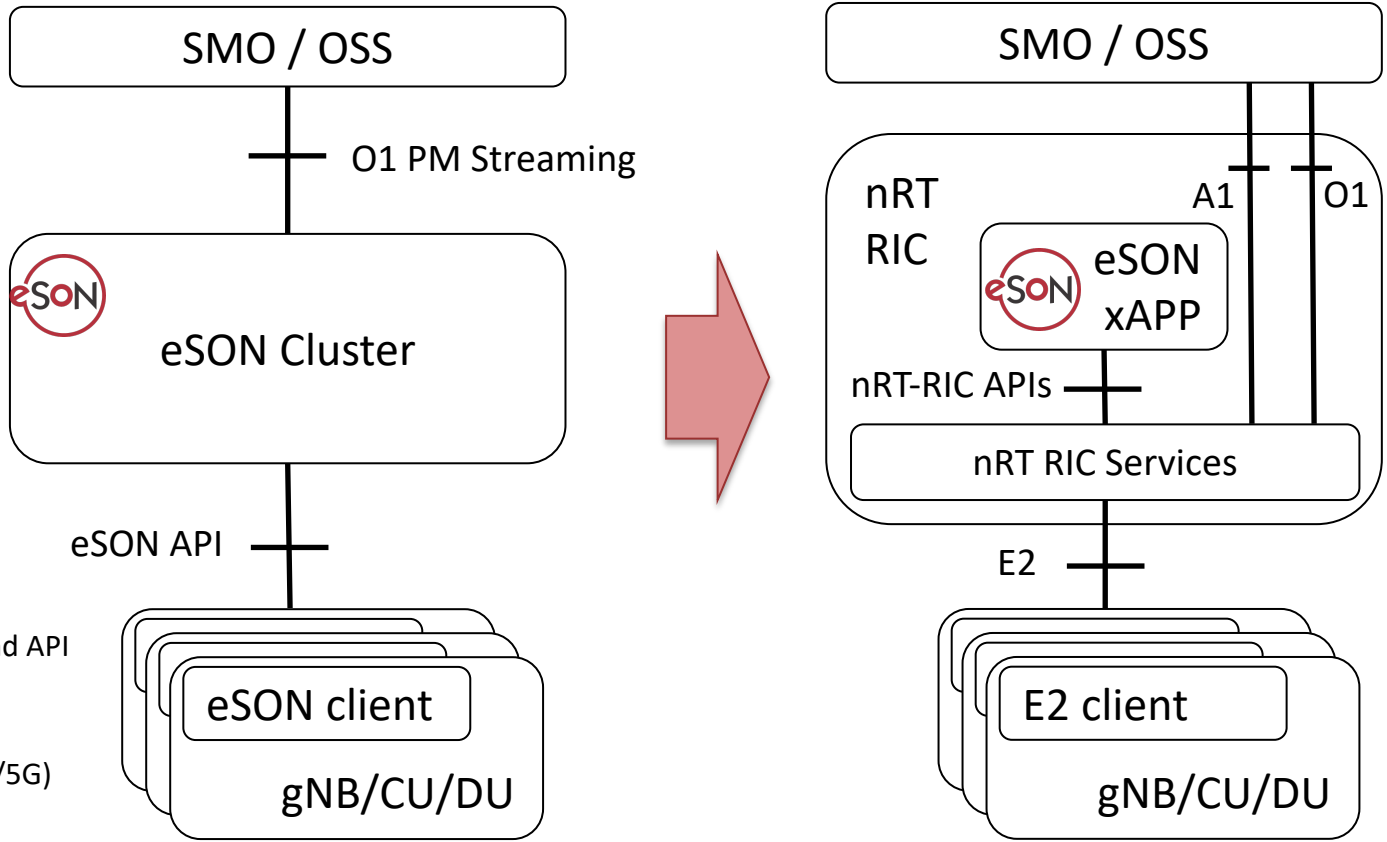
eSON as an xApp on O-RAN aligned nRT-RIC



eSON API Support

- Binary client and API (4G)
- gRPC protobuf definitions (4G/5G)

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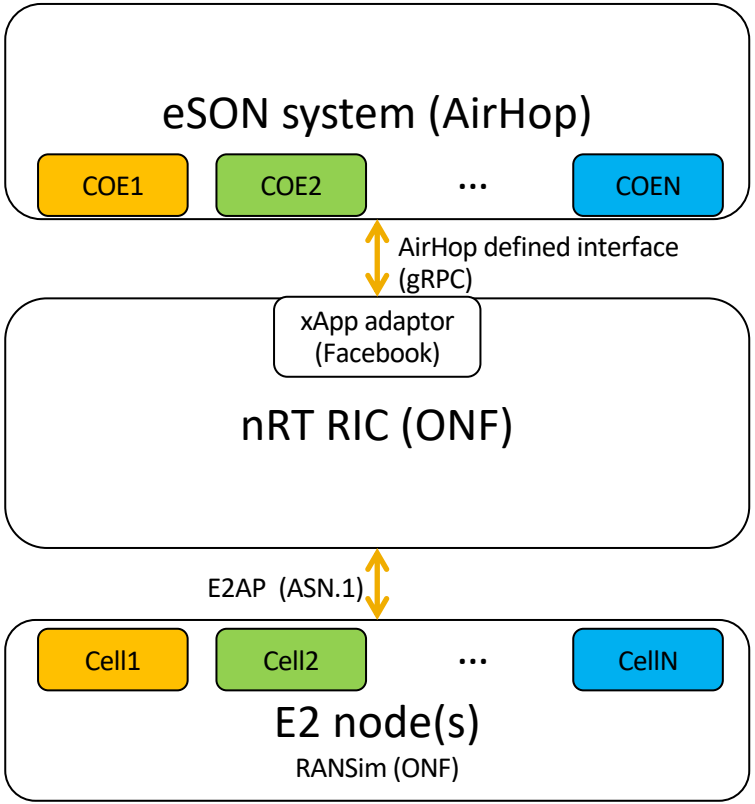
Integration with ONF nRT RIC



eSON system COE-based architecture supports (commercially deployed):

- (near real-time) PCI optimization
- near real-time RACH optimization
- near real-time Mobility Load Balancing
- Mobility Robustness Optimization
- near real-time UL/DL Inter-cell interference coordination
- ...

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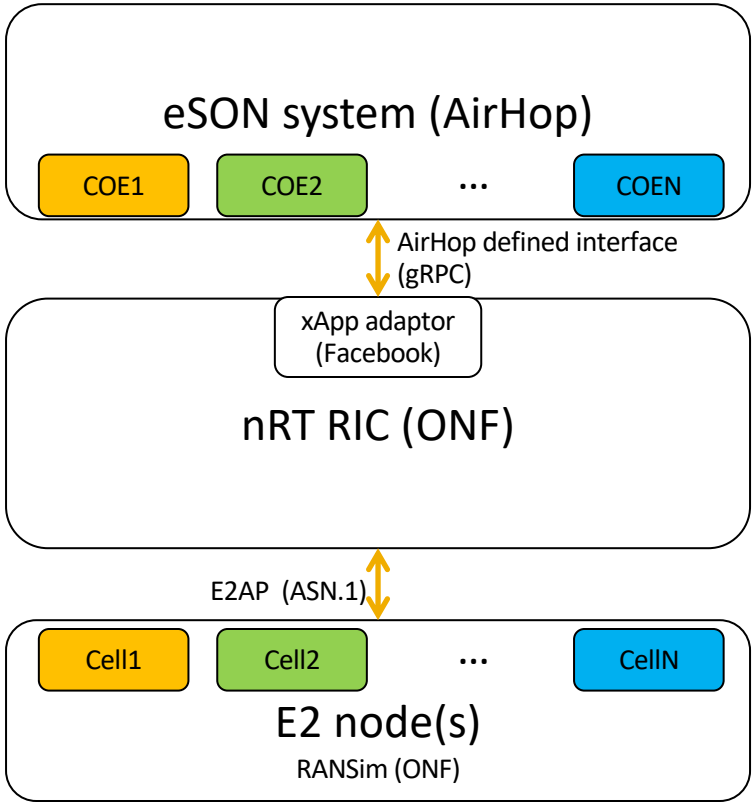
First feature integration: 4G PCI conflict detection and resolution



- In collaboration with Facebook and ONF, a new Service Model was defined (E2-SM-RC-PRE)
- near-real time cell registration with eSON
- near-real time provision of parameters:
  - Cell parameters (ECGI, DL EARFCN, PCI pool)
  - Neighbor Relation Table (NRT)
  - Add/removal of neighbor relations
- near-real time closed loop optimization
  - PCI collision detection and resolution
  - PCI confusion detection and resolution

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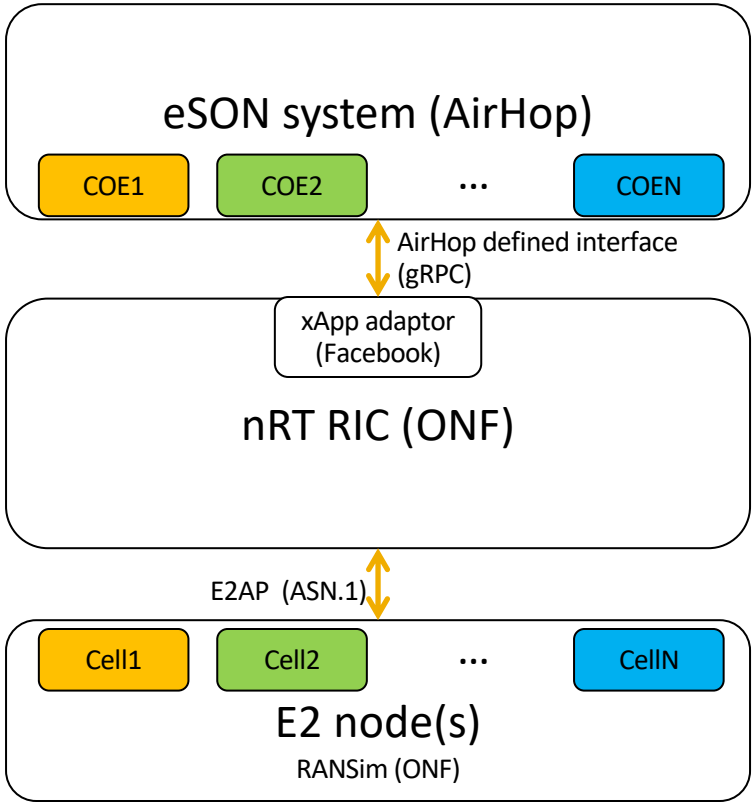
Next steps



Onboarding of all eSON features:

- 5G PCI optimization
- 4G/5G MLB
- …

For each feature (use case) gaps in the existing Service Models (SMs) are identified:

- New service models defined
- Existing service models extended

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Thank You

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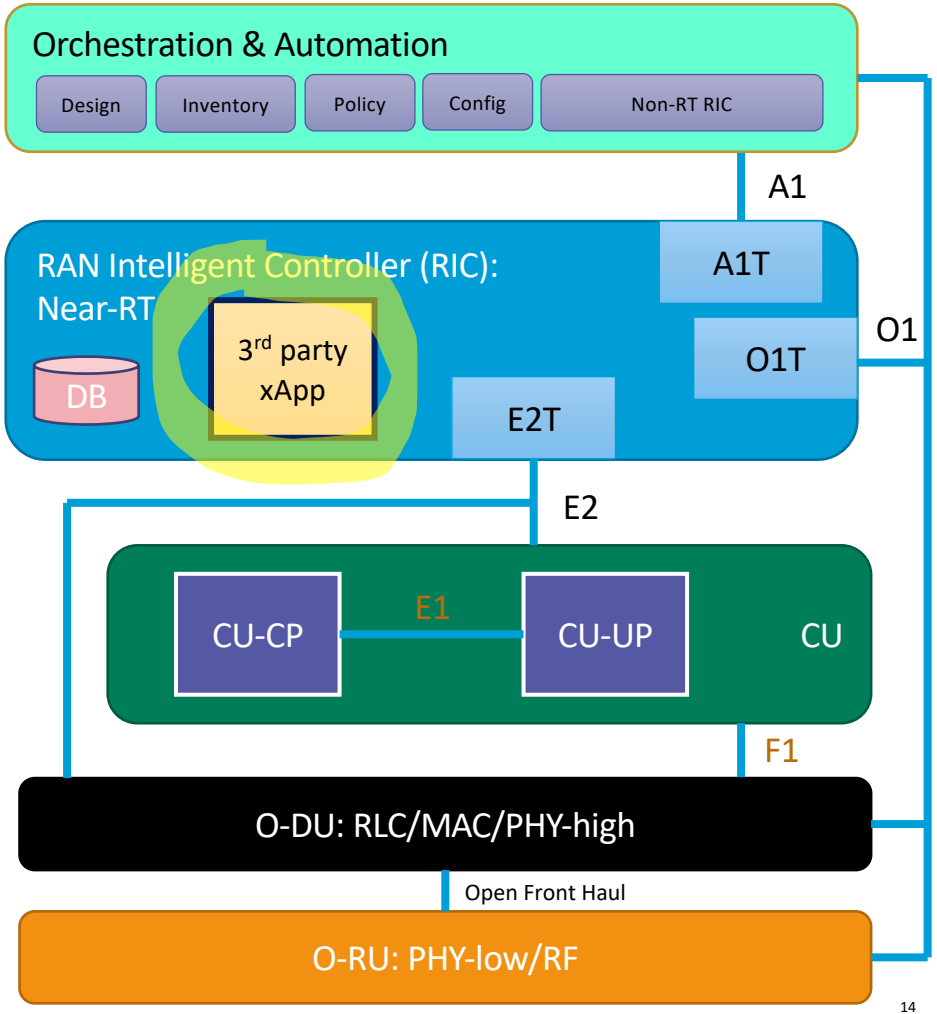
Facebook RIC SDK

Facebook

O-RAN Architecture



TIP-RIA (RAN Intelligence and Automation)

- RIA sub-group overview
  - ✓ Launched in July 2020 as a sub-group of the TIP OpenRAN project group
  - ✓ 311 total members representing 39 operators and 90 vendors
  - ✓ AirHop, ONF and Facebook are contributing members of TIP-RIA
  - ✓ Founding Operators: T-Mobile USA, Vodafone, British Telecom

- RIA Goal
  - ✓ Enable MNOs and Open RAN ecosystem to collaborate on RAN use case development, testing and deployment that leverage the strength of Data Science and AI/ML technologies and open interfaces based on industry standards.

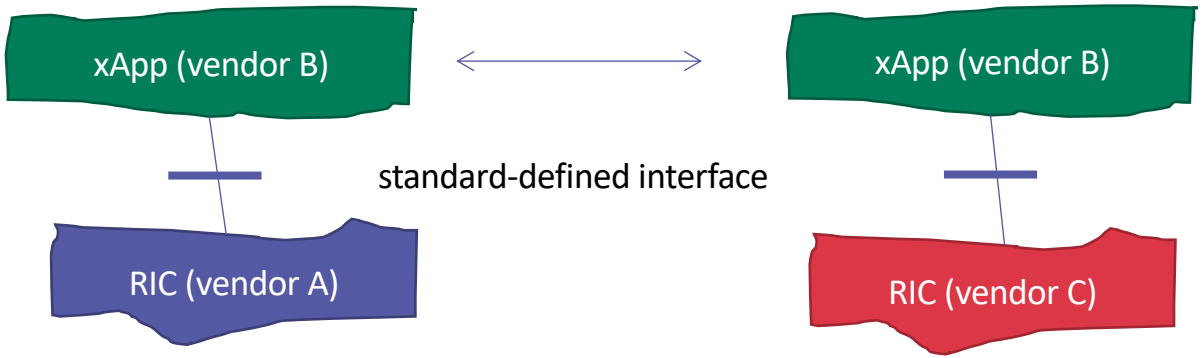
- RIA Use Case Classification & Prioritization
  - ✓ 7 Near-RT and 5 Non-RT use cases contributed by operators and vendors
  - ✓ Trials are currently planned with lead operators to showcase use cases

Software Development Kit (SDK) Vision

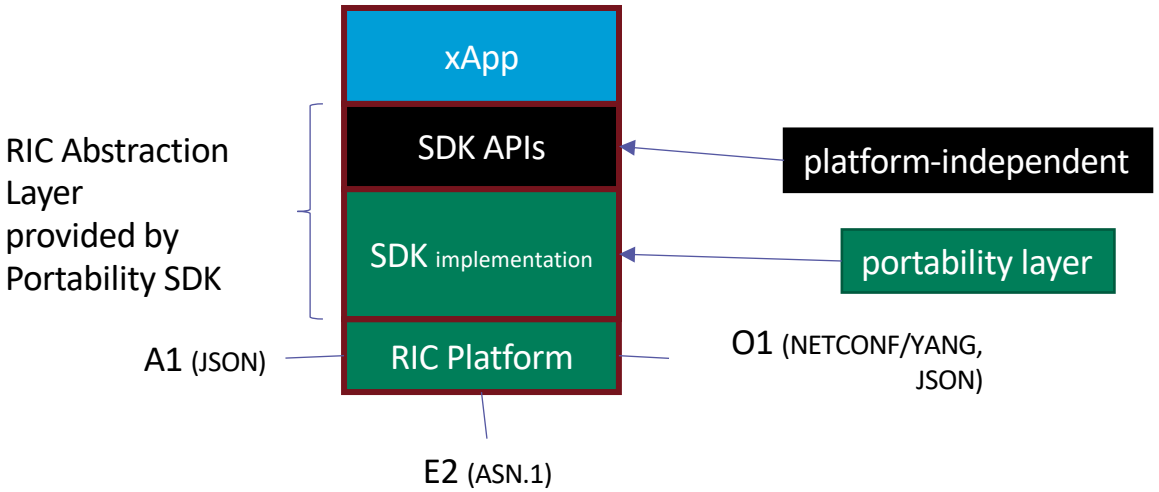
- Open: Make SDK freely available
- Standards-based: SDK is based on O-RAN standard-defined APIs
- Benefits:
  - ✓ app vendors: no need to customize per deployment
  - ✓ OEMs: large number of apps to draw from
  - ✓ operators: access to leading edge AI/ML technology

SDK Goals

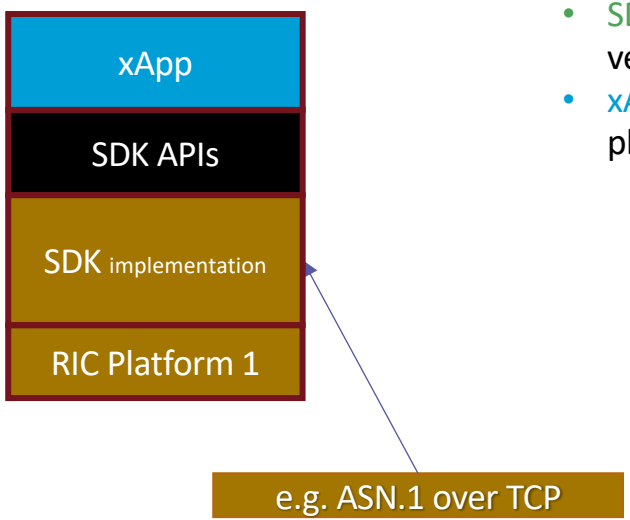
- make apps **simple** to develop/test
- make apps **portable** across RIC platforms



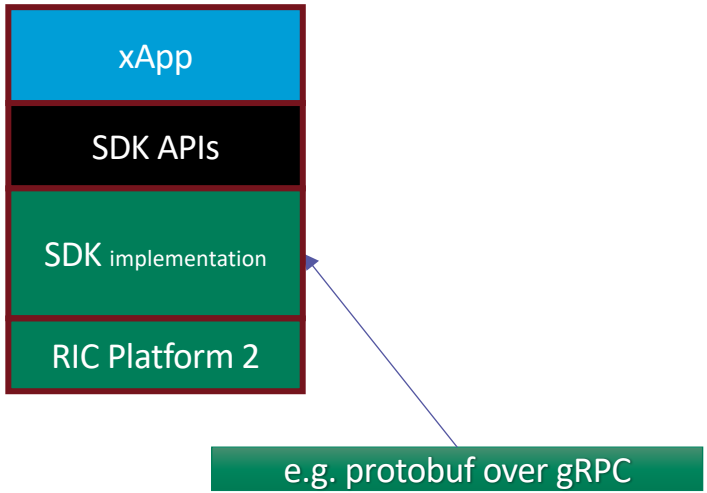
SDK Concept


xApp
SDK APIs
SDK implementation
RIC Platform
RIC Abstraction Layer provided by Portability SDK
platform-independent
portability layer
A1 (JSON)
O1 (NETCONF/YANG, JSON)
E2 (ASN.1)

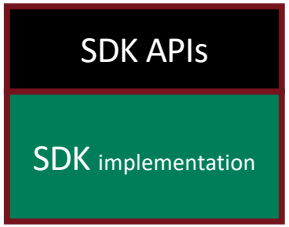
Portability



- SDK implementation is provided by the platform vendor
- xApp and SDK APIs remain the same across platforms

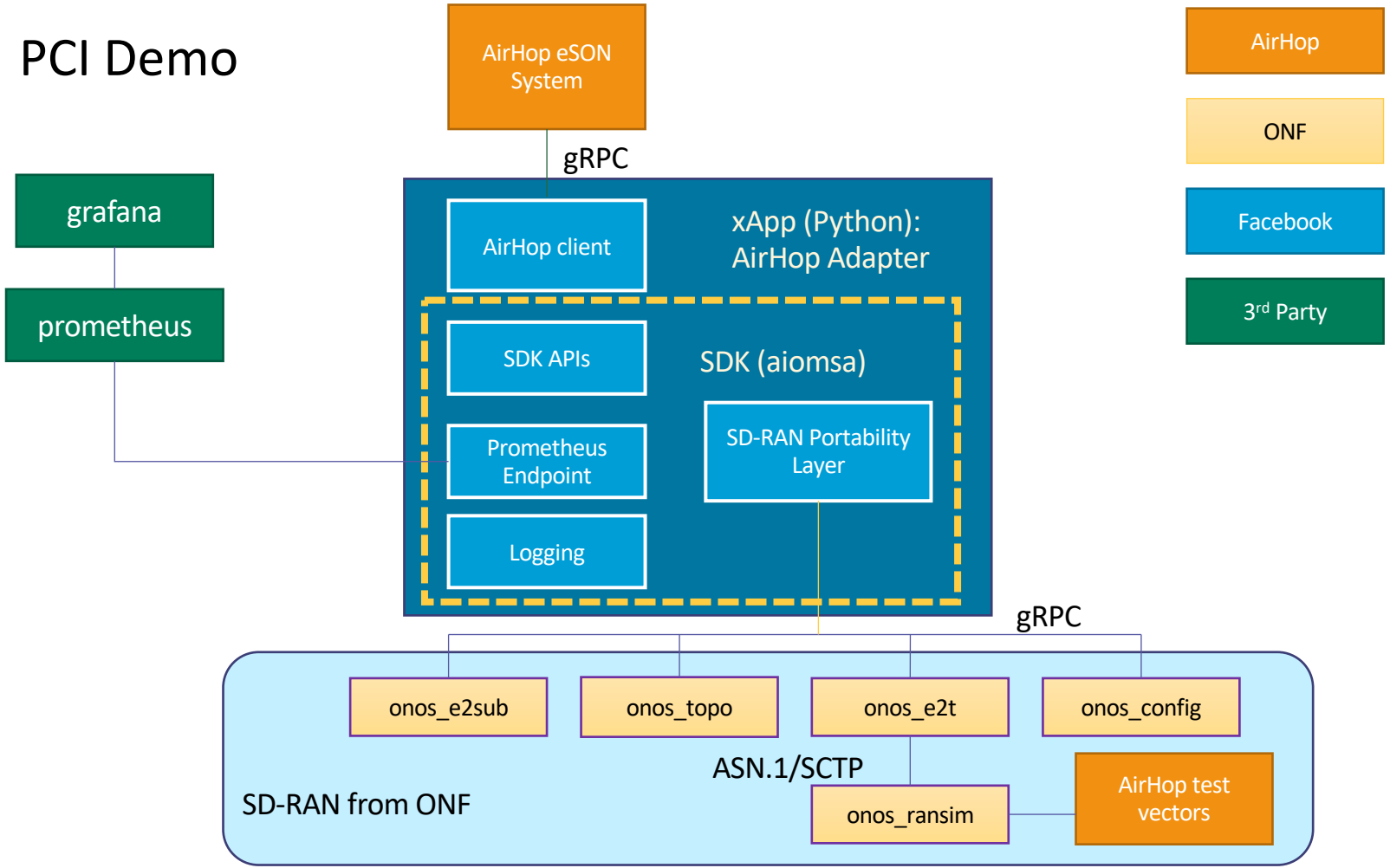


What does the SDK include?

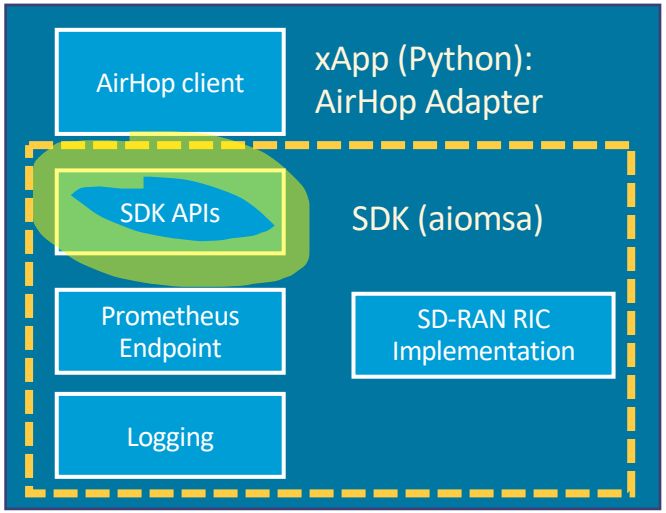


- RIC abstraction layer
  - SDK APIs
  - SDK Implementation
- libraries (e.g. asyncio, Prometheus, HTTP …)
- test framework
- logging framework
- code samples/guides
- tools for ease of deployment/development

PCI Demo


AirHop eSON System
gRPC
grafana
prometheus
AirHop client
xApp (Python): AirHop Adapter
SDK APIs
SDK (aiomsa)
Prometheus Endpoint
SD-RAN Portability Layer
Logging
gRPC
onos_e2sub
onos_topo
onos_e2t
onos_config
ASN.1/SCTP
SD-RAN from ONF
onos_ransim
AirHop test vectors
AirHop
ONF
Facebook
3rd Party

E2 Subscribe Example (preliminary)



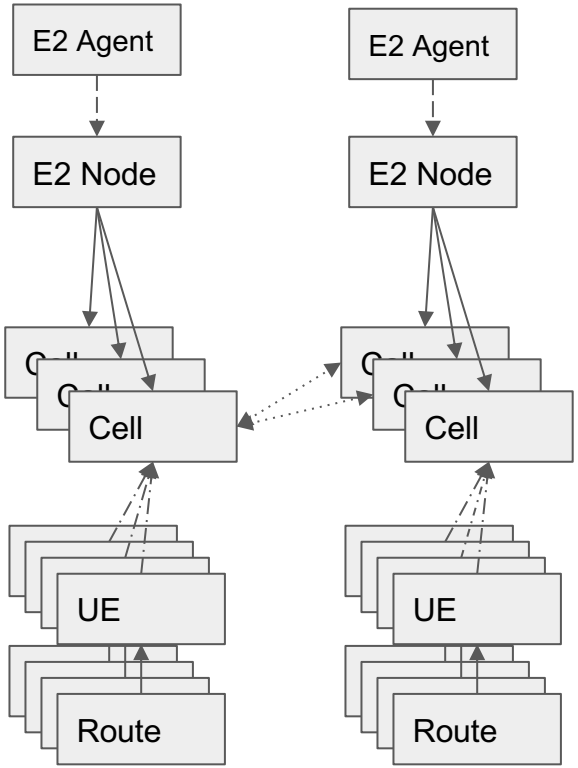

```python
async def main():
    async with E2Client(
        app_id="my_app", e2t_endpoint="e2t:5150", e2sub_endpoint="e2sub:5150"
    ) as e2:
        conns = await e2.list_nodes()
        subscription = await e2.subscribe(
            e2_node_id=conns[0],
            service_model_name="my_model",
            service_model_version="v1",
            trigger=bytes(MyModel(param="foo")),
            actions=[
                Action(
                    id=1,
                    type=ActionType.REPORT,
                    subsequent_action_type=SubsequentActionType.CONTINUE,
                    time_to_wait=TimeToWait.ZERO,
                )
            ],
        )
```

Thank you.

Facebook

RANSim in SD-RAN v1.1

Simulation Model



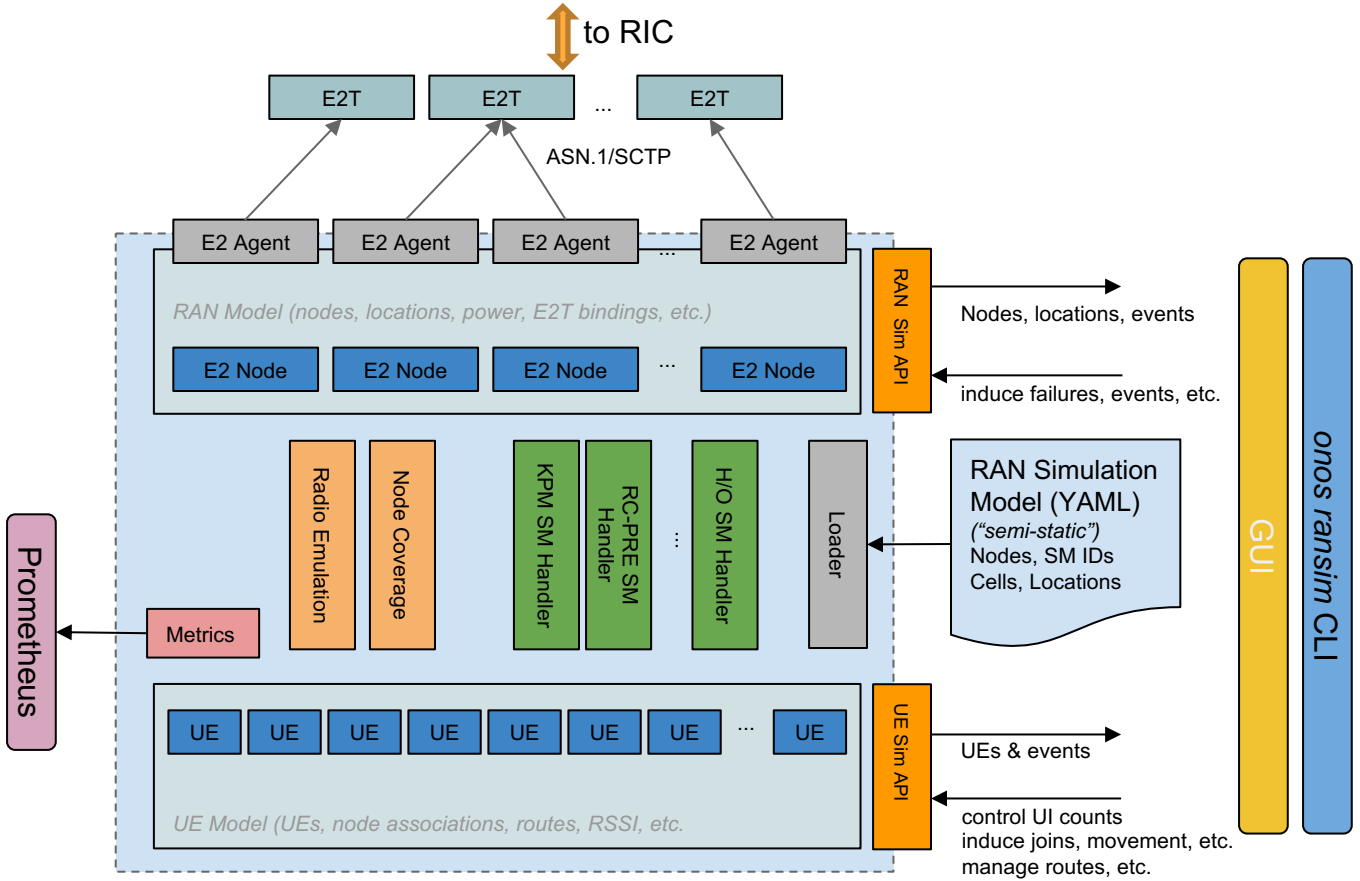
Key Entities

- E2 *Node* is identified by eNBId/gNBId and has a number of associated cells' ECGIs
- *Cell* is identified by an ECGI and has geo location, azimuth, arc width and a list of neighboring cells' ECGIs
- *UE* is identified by IMSI, has a geo location, heading, serving cell ECGI and CRNTI assigned by serving cell
- *Route* is assigned to UE via IMSI and has a set of geo coordinates as waypoints; intended to drive simulation of UE mobility

Metrics

- Set of (Entity ID/Key/Type/Value) tuples, where entity ID can be:
  - EnbID, GEnbID, ECGI or IMSI
- Allows for simulation of arbitrary metrics and data associated with Nodes, Cells or UEs

RAN Simulator Architecture



PCI Conflict Resolution Demo

https://www.youtube.com/watch?v=RJmrXRRGsCM&ab_channel=OpenNetworkingFoundation

What's Next?

Upgrades

- Keeping up with O-RAN Standards
- Moving from 4G to 5G – PCI

New Use-cases

- New Service Models
- Mobility Load Balancing (MLB)
- Mobile HandOver (MHO)

More Integration

- Commercial RAN Vendor(s)
- Aether (https://aetherproject.org/)

Thank You

https://opennetworking.org/sd-ran/