

Adoption of O-RAN SMO Framework

WHITEPAPER



Abstract

Alongside network evolution; service management and operations landscape (operations support and systems) has been evolving. The evolution of network architectures, such as the ORAN initiative, brings about changes in service management and operations. This includes the need for integrating new concepts like orchestration and network observability into traditional service provisioning, fault/performance management, and operations support systems (OSS). Coexistence with existing OSS ecosystems and challenges in the rollout of ORAN service management and orchestration (SMO) components are crucial aspects to consider.

ORAN initiative has brought in true open ness in the wireless access architecture and also has defined how service management and operations could be done for this all-open containerized new wireless architecture. This paper looks at SMO component of ORAN architecture and how would that coexist with existing OSS ecosystem. Challenge in rollout of ORAN SMO.

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Introduction

Telecom network architecture has a long journey starting traditional circuit switch call and proprietary hardware to a diverse service model and fully open and containerized network functions. This migration journey is having different steps like introduction of virtualization, split of control and user plane, and software defined network. These transitions helped to open some of the interfaces that were proprietary and bring much needed cloudification. Most of the initiative is for core network and very few in RAN.

In past few years we saw a big move in RAN area that was dominated by OEMs with their specific hardware and interfaces. This legacy is broken by O-RAN alliance based next generation architecture, which is fully containerized, interoperable and no vendor dependency. O-RAN architecture helps to split the RAN network architecture in multiple component and provider/OEM can select any of the split the way they want to go ahead. The famous O-RAN accepted architecture is split 7.2x.

Below is an overview for O-RAN Architecture. This architecture not only talk about how the network will look like but also give a good view around the supporting functions like RIC, SMO framework, and different interfaces.

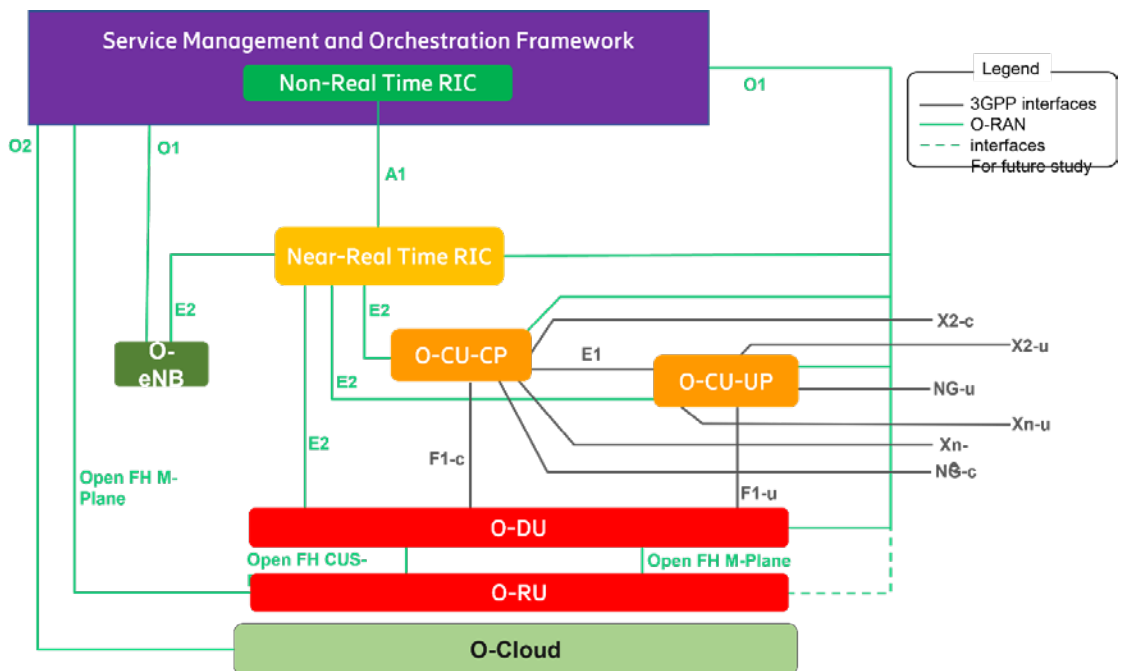


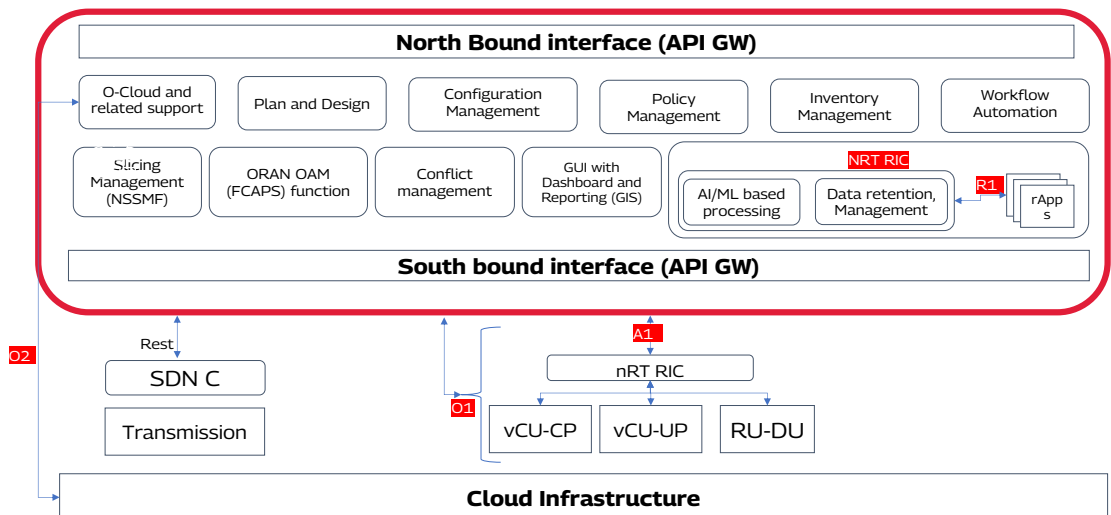
Figure 1 O-RAN architecture overview ^[1]

While O-RAN is majorly focused on RAN architecture re-defining but at the same time it is also talking about the advancement of supporting system like OSS, and SON. While it reuses existing OSS components it also introduced some new components like nRT RIC, NRT RIC with different applications xApps, and rApps.

SMO Overview

We have seen a trend where currently providers/SIs are focusing about unified OSS with cloudification and bringing technologies like AI/ML and cloud native. This exercise will help to reduce the CapEx, OpEx, bring operational efficiency but this is not enough considering upcoming use cases like zero touch, close loop, intent-based and data driven solutions specially talking about RAN. To understand and handle such requirements in better way O-RAN alliance came up with a concept of SMO which is a well-defined framework considering key ask for future like observability, network functions orchestration, and cloudification.

In O-RAN Architecture SMO framework is having different interfaces like O1, O2, A1, and R1 with clear specifications. O1 and O2 are focusing on FCAPS and Configuration of different components and O-Cloud. R1 is to communicate rApps with NRT RIC and A1 is more between both RICs to communicate the policy and related information.



R1 - rApps interface towards Non-RT RIC

O1 - Interface between management entities in service management and orchestration framework and O-RAN managed elements, for operation and management, by which FCAPS management, Software management, File management shall be achieved.

O2 - To manage the platform resources and workload (like resource scaling and FCAPS).

A1 - A1 interface is defined between non-RT RIC and near-RT RIC, to exchange policies, enrichment info, and ML model updates, while from the other hand, Near-RT RIC provides back the policy feedback (i.e. how the policy set by Non-RT RIC works)

Figure 2 SMO Overview

Key Use Cases

Some key use cases for SMO can be

- ▶ As an operation excellence team, I want to Life cycle management of my O-RAN network efficiently so that I can adhere to SLAs with minimum manual effort.
- ▶ As an Architecture team I want to bring openness in my architecture so that I can interoperate between multiple vendors and reduce the proprietary interfaces and vendor lock in.



- ▶ As an CIO organization, I want to have a solution which is totally driven by data to bring efficient in end-to-end management of network and services. Also guide different team about customer experience and improvement area.
- ▶ As CTO organization, I want to bring AI/ML, Automation technology in ecosystem and deploy them where they will impact most and meet our organizations key KRA/SLO/SLA/KPIs.
- ▶ As Infrastructure architect I want to drive infrastructure program to align with company goal towards sustainability and to do so i would like to reduce carbon footprint to efficiently manage my network using technology like O-RAN-SMO framework to manage infrastructure in efficient way.

1. SMO Framework: O-RAN

While responding on different RFPs, customer interaction and representing in various forum and part of O RAN alliance group, we understood that there is a confusion between SMO and OSS and a mis concept is SMO is nothing but OSS only. This is partially correct and additionally SMO is having components like NRT RIC, interface towards rApps which is very well part of network domain but at the same SMO's key role is providing O&M for O-RAN network domain. While this confuses you but surely there is synergy between current OSS solutions and what SMO as a framework is offering. To build SMO we can be re-used existing OSS with some minor changes and some of the component need to be introduce a fresh.

Bringing SMO framework with OSS will not only adhere the requirements for SLAs/SLOs and KPIs but also minimize the changes for overall ecosystem of tools. SMO framework will also help providers/OEMs/SIs to innovate new services and use cases. It will manage customer experience in better way with optimize the expenditure. Below picture is having a good view on how the entire E2E architecture looks like with key interfaces that need to consider while realizing this coexisted architecture.

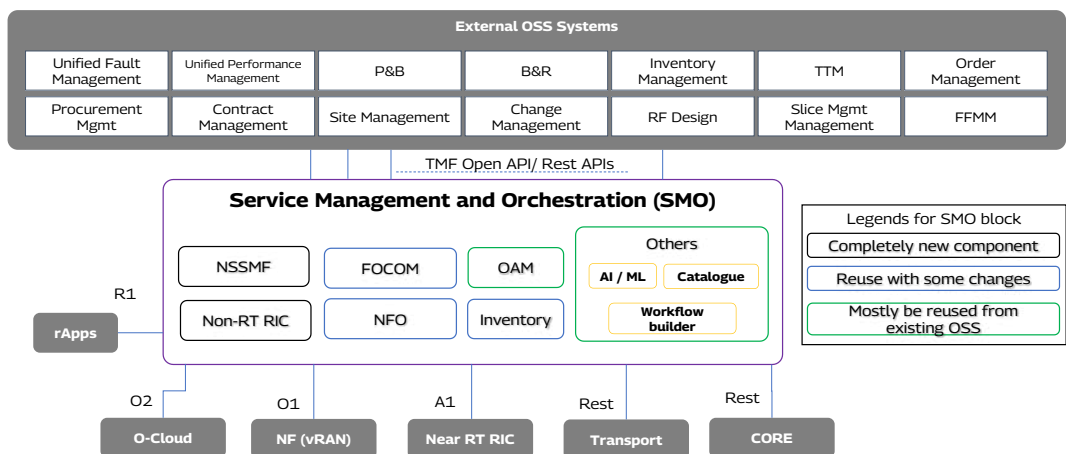


Figure 3 Integrated view between OSS/SMO framework and impact

In above architecture we are trying to depict how these 2 things could stay together. As a roadmap provider must think how they can remove the duplicate components or fit the SMO framework with their ongoing 'transformation of OSS' initiatives. This is a critical and must do exercise to bring the E2E operational efficiency and alignment of standard architecture like ONAP, O-RAN alliance, TMF ODA etc.

Some examples of changes are as below based on simple, medium, and complex complexity.

- ▶ Simple changes - We understood that some of the existing OSS components can be re used with very minimum or no changes. Ideally this should be the first step when we try to build SMO. Considering workflow builder, it will be simple changes as we are already having an end-to-end workflow build which is catering all the different domain and interface with them. So only change provider has to bring here is to integrate with O-RAN related components and configure O-RAN as a options when planning and designing solution.
- ▶ Medium changes - Changes which may require some modification in existing tools sets more than simple configurations changes and may require buy in from vendor as well. Such changes may spread in different OSS component so end to end stitching is required. We consider that building and inventory solution fall in this bucket. It will be a medium change because existing unified inventory is already having all the domains are present and need to enhance the solution to support O-RAN related components. This will be having vendor dependency and readiness.
- ▶ Complex changes - In old generation where SON is trying to bring intelligence in RAN network is having challenge to cope with today expectation and demands, as it is limited with vendors and certain use cases. Now time has changed and considering O-RAN which is vendor agnostics and having unlimited use case required an uplifting of existing SON, which is RIC in O-RAN case. Brining a new component like RIC will be a complex change because it come up with multiple new interfaces, change in flows and policies. So provider has to plan it properly from different aspects like timeline, technology, use case. This is not only complex from bringing a new tool/vendor but also to manage integration and fit with existing OSS transformation journey. But having said that this is an important part to make sure you successful in your journey.

In below table we can see a view between different controller's role based on scenarios. This illustrative view gives us a good understanding how the SMO framework will work together with existing OSS solution and what the boundary defined.

Area	NRT RIC	NRT RIC	OSS
Area of impact	Within local loop	Entire RAN network	Entire Network
Time frame	Within few ms	Within Seconds	Within Minutes or days
Policy coverage	Locally defined policy	RAN defined policies	Overall policy

Table 1 Controller/Close loop view

2. Key Challenges

Considering O-RAN SMO framework, a new and evolving standard having its own complexities to develop and test. On the other hand, providers are having ongoing program like OSS digitization, Observability driven assurance, introduction of

AI/ML, and digital twin which can't be hold so provider need to wisely take a decision on how and where to introduce SMO framework while thinking about RAN evolution towards O-RAN. This introduction also impacts on different aspects like CapEx, OpEx, technology, operation.

It is important to study these challenges and key consideration upfront. Below picture depict the key challenges which we think customer will face. These challenges are broadly around understanding and strategize the O-RAN component's introduction and placements. Additionally, they key points to consider the testing and security before moving towards O-RAN solution. While talking more from provider point of view we must study the readiness and interoperability of vendor provided SMO solution.

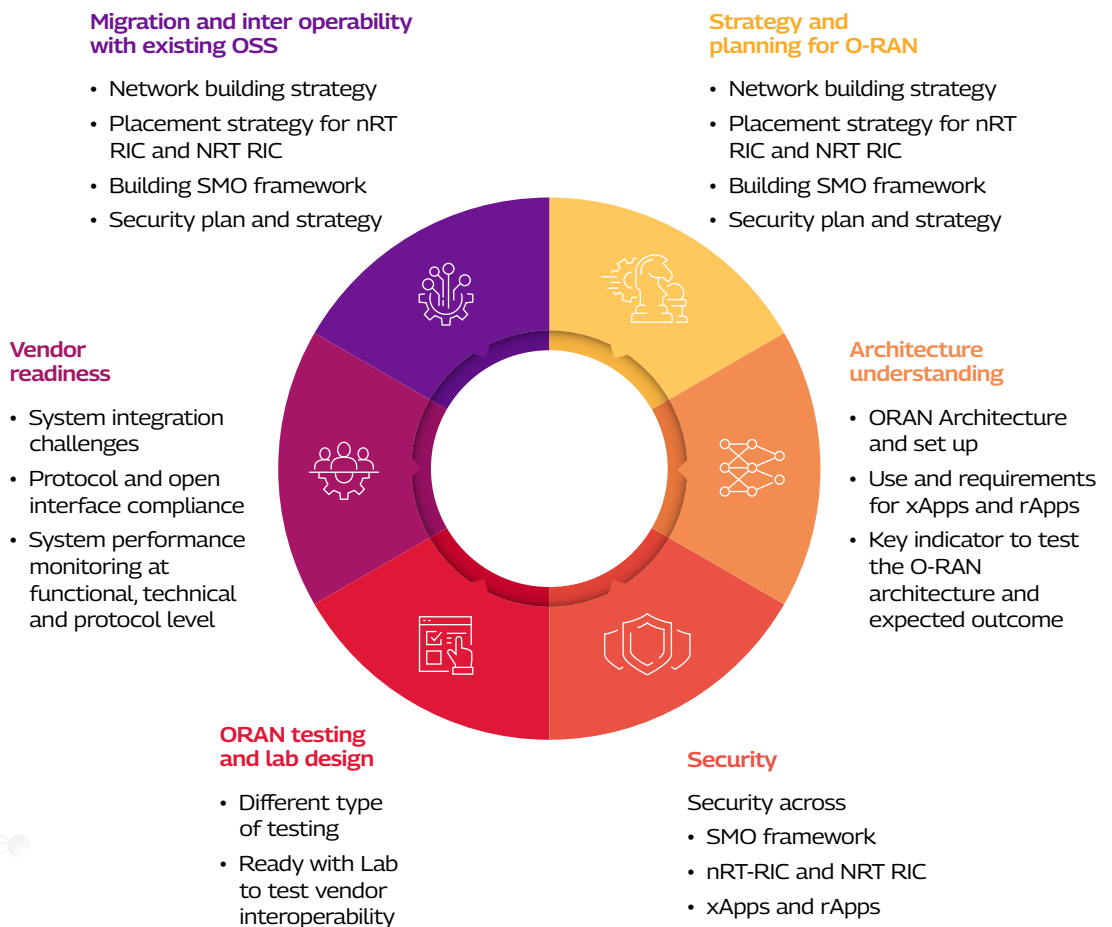


Figure 4 Key challenges

3. Approaches Towards SMO

As we said O-RAN is slowly increasing interest of different service provider and everyone wants to have O-RAN based RAN architecture, we also need to get answers for some key questions like

- ▶ Dedicated team of experts to map business expectations with technology evolution
- ▶ Vendor readiness and interoperability
- ▶ Investments in technology at right time with focused mindset

Below is the high-level view how we should approach for unification of OSS with realize the SMO framework.

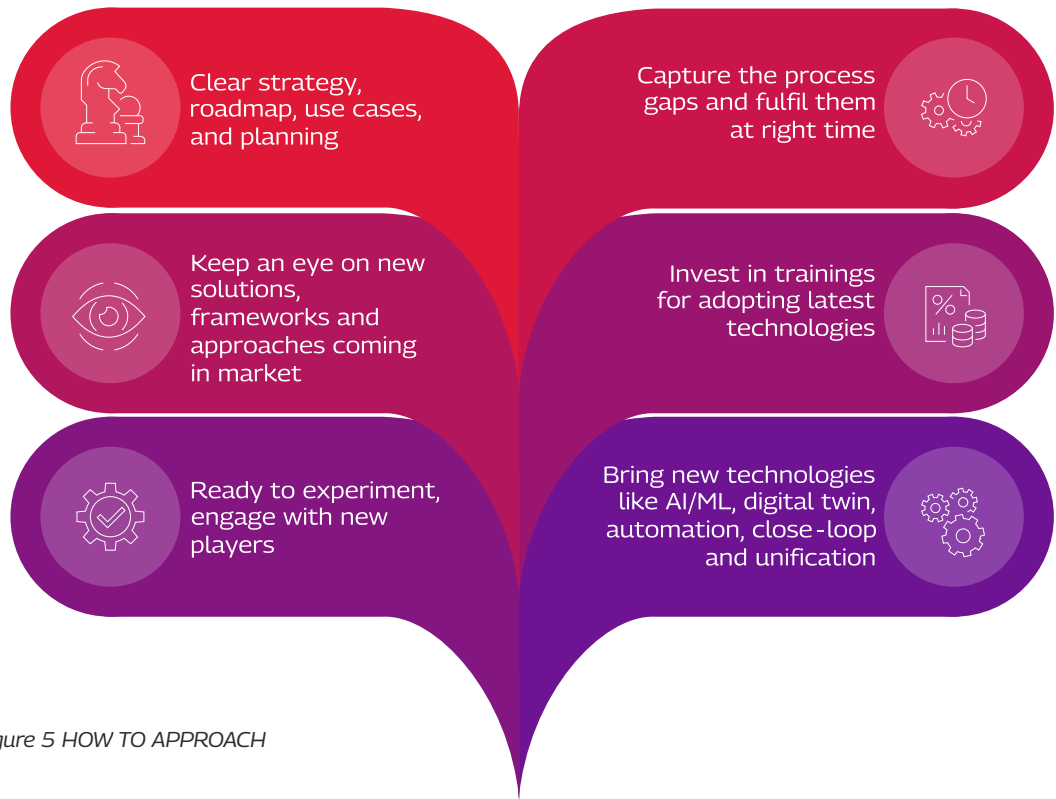


Figure 5 HOW TO APPROACH

4. Tech Mahindra Approach

TechM came up with a unique approach which will help operator to not only analyze their current OSS solution but also help them to build SMO framework. This approach model solves the key challenges using tested methodology.

Overall Program Management				
STRATEGY & PLANNING	READINESS	EXECUTE	OPERATION	OPTIMIZE
<ul style="list-style-type: none"> Vision and guiding principles including sustainability E2E reference architecture focusing OSS but covering aspect of Security, Network, BSS etc. Data derived (business strategy, app discovery, gap analysis), planning for right tool sets, peoples, technologies Execution strategies and Plan like War Room setup Plan for Lab and Digital twin solution 	<ul style="list-style-type: none"> Build a team expert include RAN, ORAN and OSS domain (mix of Tech M and Telco) Ready with high level project plan including cost (OpEx and CapEx) Identify the right tools/Vendor to bridge the gap between current OSS set up and expected ORAN-SMO (aligned with existing OSS/SMO program) List down all the possible use case/service and agree with KPIs and SLAs Ready with Lab and digital twin like solution 	<ul style="list-style-type: none"> Start collaborating with team for execution and stick with <ul style="list-style-type: none"> Project Plan Traffic ingestion plan KPIs/QoS/SLAs Integration with existing tools to have a unified and smooth E2E journey and reduce duplication Quality checks and coordinate with Vendor Start producing reports and analysis of progress 	<ul style="list-style-type: none"> As per plan, start integrating live feed and site operation data to SMO framework Keep measuring and monitoring the KPIs/SLAs/QoS Coordinate with Vendor for any operation issues Using Digital Twin generate reports, dashboards Define the use case and improvement areas 	<ul style="list-style-type: none"> Based on operation feedback and Data Analysis start optimizing the solution Bring process improvement Keep enhancing the solution using technologies like AI/ML, SRE, DevNetOps Automation to reduce error and less human touchpoints Check on cost reduction and customer experience

Tech M as E2E ORAN Partner for Telco

Figure 6 O-RAN - Tech M Approach

Conclusion

Whenever a new journey starts, it came with many unknowns which will not only affect system/network but for different teams as well. Considering it as evolving standards it is important to have a team of expert who can bring industry experience help to move forwards in this journey.

We understand these challenges and knows a proven way forward so that it will be smooth transition for customer and will help to keep going their ongoing strategic programs. Tech Mahindra is having substantial experience in O-RAN space considering E2E program management, design, development, and integration the solutions. Our offering will help customer to develop Labs, building next gen solution like Digital Twins etc.

We have partnered with Key OEMs who are leaders when it comes to define and move towards SMO framework, will surely help our customers to achieve their goals and keep focus on KPIs, innovations and improved NPS. TechM unique solution approach bring technology for purpose keep them ahead of other competitors and improve customer experience with a fully mature digitize solution.

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