SAMSUNG

# Why does Samsung's RIC outperform?

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Samsung Networks

# Contents

# 01. Introduction

The RAN Intelligent Controller (RIC) offers advanced control and management capabilities for the RAN and Cloud infrastructure as part of Service Management and Orchestration (SMO). Consisting of RAN applications (e.g., rApps) and SMO/RIC platform, the RIC delivers numerous benefits, including enhanced network automation, improved RAN performance, better user experiences, and significant OPEX savings. To maximize these advantages, the RIC must seamlessly integrate with underlying RAN systems, fully leveraging available RAN features for performance improvements. In order to stay ahead in today's competitive telecommunications market, Mobile Network Operators (MNOs) must source the best-of-class RIC vendor solutions. However, not all vendors have an equal level of expertise in understanding RAN features. This lack of expertise can significantly affect their ability to provide the best RIC solution.

Samsung, a leading RAN system vendor, has a strong track record of successfully deploying and optimizing 4G and 5G RAN systems in global telecommunications markets. With extensive expertise in resolving operational issues and ensuring RAN Key Performance Indicators (KPIs) across diverse wireless environments, Samsung is now offering the best-of-class RI C by leveraging the proven RAN system and expertise excellence. Samsung's RIC harnesses the power of cutting-edge RAN systems with innovative and differentiated features and provides what non-RAN vendors cannot offer in the following areas:

- **RAN-expertise centered guaranteed quality :** Samsung's RIC leverages Samsung's expertise in wireless networks for optimized RAN operations, resource efficiency, and orchestration of RAN features. Non-RAN vendors may lack an understanding of complex wireless environments, leading to a potential quality impact on customer service issues.

- **Holistic solution utilizing SMO/RIC platform :** Non-RAN vendors lack a full understanding of RAN cell topology, configuration parameters, fault data, and KPIs. Samsung has long played vital roles in resolving RAN KPI issues and identifying root causes with extensive 4G and 5G system experiences. Samsung's SMO/RIC provides automation tools such as RAN topology and inventory management, data collection and management, RAN+Infra provisioning, and conflict management, highlighting why non-RAN vendors may struggle to deliver the required SMO/RIC solution.

- **Single vendor SMO and its integration advantage :** As there is no standardized architectural split between SMO and RIC, integrating and maintaining these components from different vendors poses significant challenges. This lack of definition can lead to duplicated or non-optimal functionality when SMO and Non-Real Time (Non-RT) RIC are integrated together. Different vendor combinations also create a considerable burden on the MNOs. The SMO/RIC solutions from the same RAN vendors can minimize such integration concerns and effort.

The following is a more in-depth argument and explanation of why Samsung's RIC is an optimal choice compared to non-RAN vendors' RIC solutions.

# 02. An in-depth understanding of RAN and its feature orchestration matters

Understanding the complexities of a wireless network environment is crucial for optimizing performance. Factors such as radio characteristics, user demands, and network environment influence wireless network performance. Efficient resource management and intelligent scheduling are essential for maximizing capacity and spectral efficiency. RAN vendors have a unique advantage in providing deep understanding and optimization for wireless communication networks. Their expertise in developing RAN features allows for the implementation of RAN applications that fully leverage network infrastructure capabilities, taking into account various 5G service requirements; e.g., throughput, latency, or both requirements. Samsung, for instance, offers innovative features for controlling and optimizing latency in data transmission. The crux of effective RAN application design lies in orchestrating these features to maximize their effects and minimize potential side effects from concurrently running features. Figure 1 illustrates the several multi-layer, multi-faceted factors that affect the RAN latency and the overall closed-loop operations required to assure a given latency SLA requirement. All of these factors, from radio environment, congestion, L1/L2 protocol, and network topology to power saving, must be understood by the RAN application, an expertise that non-RAN vendors lack.

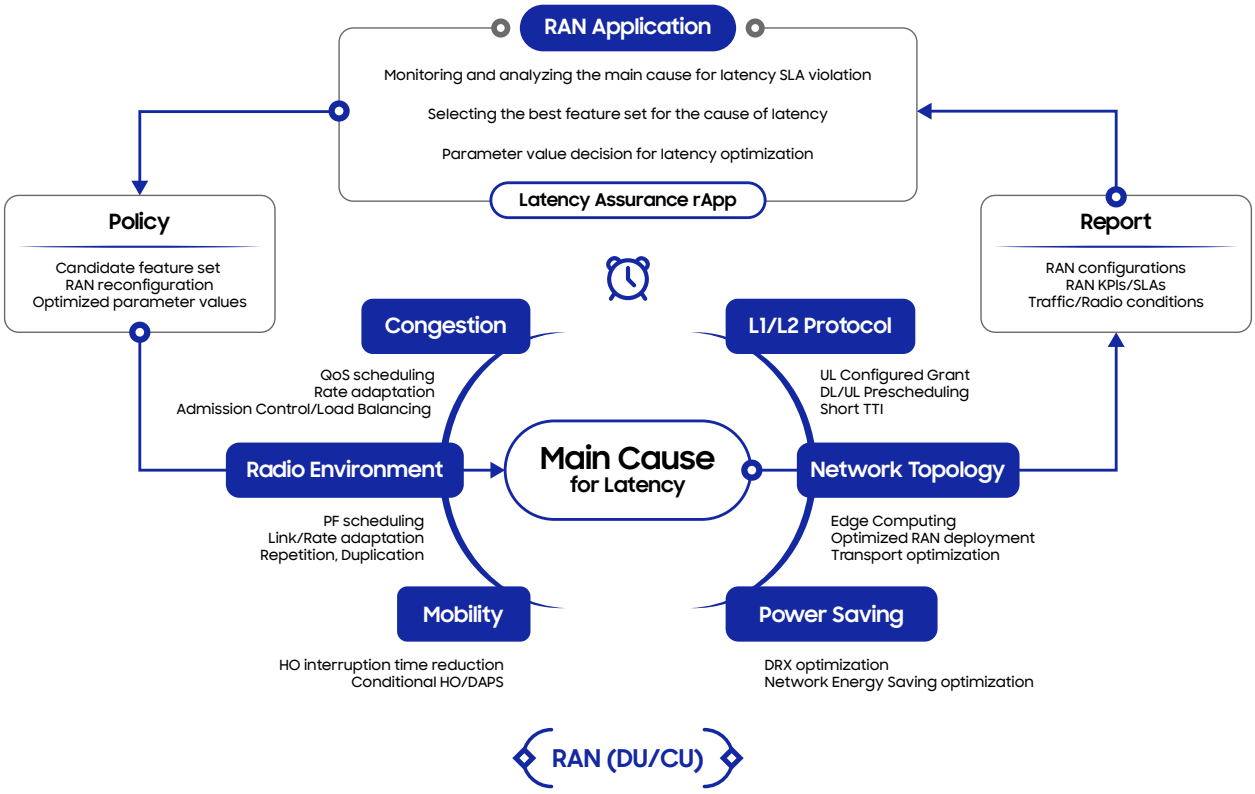



**Figure 1. Closed-loop operation with in-depth understanding of RAN features by RAN application**

# 03. Samsung RIC is different from non-RAN vendors' RIC

In this section, we highlight the key characteristics of Samsung's RIC, emphasizing its deep understanding of RAN and its ability to orchestrate features by leveraging the expertise of a leading RAN vendor.

First, we emphasize the importance of designing RAN applications to be closely integrated with RAN products and features. The Energy Saving Manager (ESM) rApp exemplifies this approach, aiming to achieve maximum energy savings while maintaining RAN key performance indicators (KPIs).

Second, we highlight that RAN application design must orchestrate multiple RAN features. The Load Balancing Manager (LBM) rApp illustrates how intelligent load balancing operations can be implemented by coordinating several RAN features.

Finally, we discuss why RAN applications should be designed with consideration for design time constraints and runtime priorities to ensure optimal performance.

Overall, these elements underscore the sophisticated approach of Samsung's RIC in enhancing RAN functionality, intelligence, and operational efficiency.

## 3.1. RAN application design tightly coupled with RAN products and features

RAN applications do not run alone outside of RAN systems. Taking ESM rApp as an example, it is tempting to think that ESM applies energy-saving operations to a cell by considering the resource usage and KPIs associated with only that particular cell. However, as a wireless network is a multi-carrier network, it is necessary to design a multi-carrier aware ESM that maximizes the energy saving gains while maintaining the required level of RAN KPIs by considering the multi-carrier network configurations in the field.

In order to design a multi-carrier aware ESM, the coverage reached by an individual carrier and the coverage overlap ratio between individual carrier cells should be identified by ESM. Moreover, the single-band or multi-band capability of a Radio Unit (RU) product supporting cells must also be known to ESM; otherwise, shutting down one radio unit causes multiple cells to turn off simultaneously. Thus, ESM should address these concerns by defining a cell or sector group that aggregates resource usage and computes KPIs together. ESM should know the RU product capabilities and the achievable energy saving gains through the available energy saving features such as power amp off, deep sleep mode, and super sleep mode. ESM should also consider the topological relationships between RU and cells. Considering all these RAN products and features together, ESM can provide the maximum energy saving gains while maintaining the RAN KPI at its best performance level.

Samsung's ESM is designed with the above goals and implements intelligent energy savings operations tightly coupled with RAN products and features. ESM reflects the energy saving management policy and considers the RU product capabilities, energy saving features, and topological relationships. It also supports per cell- or sector- group energy saving operations.

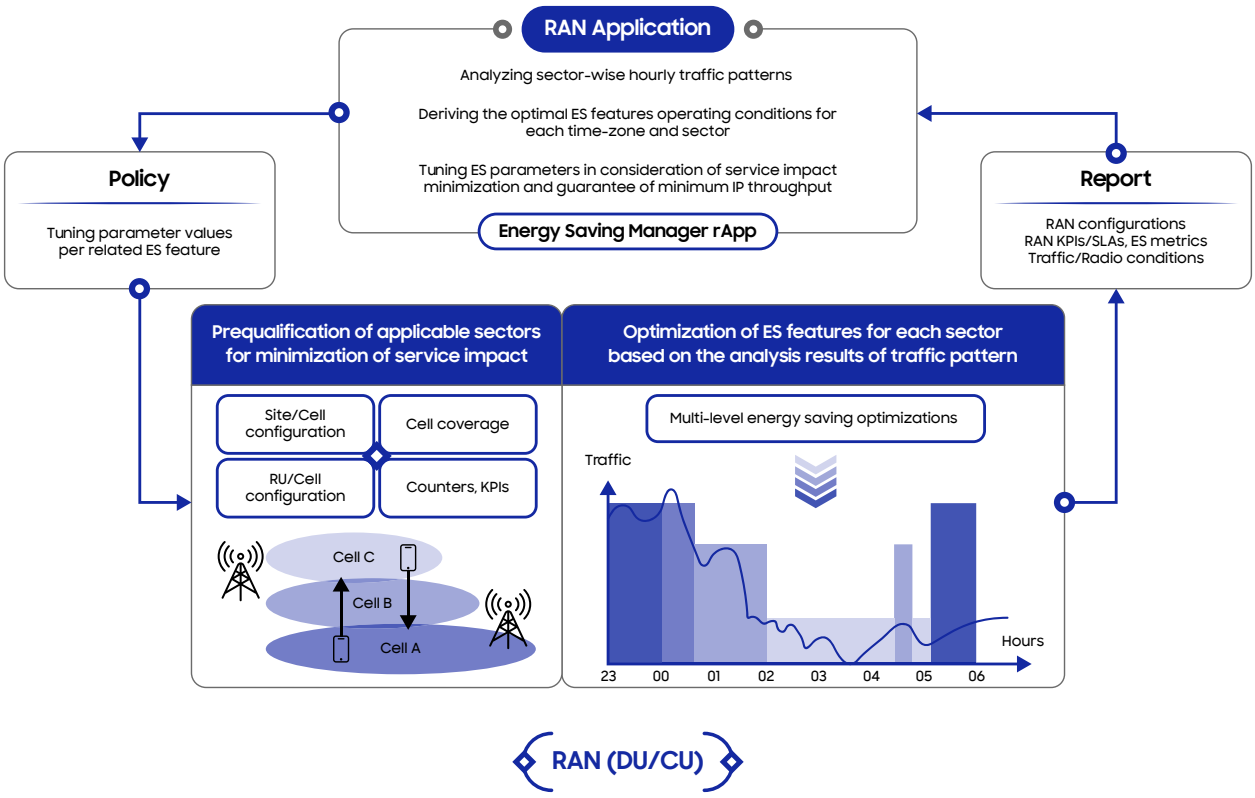



**Figure 2. Energy saving operations by Energy Saving Manager rApp**

## 3.2. RAN application design orchestrating multiple RAN features

A good RIC application design should consider the inter-operability of multiple RAN features. For example, LBM rApp tries to resolve load congestions across cells and tunes various load balancing RAN features triggered by different combinations of UE's idle/connected state, radio condition, carrier property, and loading conditions. The algorithm logic should choose a suitable feature for the given scenario. In addition, the algorithm logic should consider the triggering order of each feature in a step-by-step manner, with an understanding of the impacts from fallback due to poor decision-making.

Figure 3 illustrates the concept of orchestrating multiple load balancing related features. It applies the step-wise load balancing features available in the RAN systems, e.g., idle mode load balancing, mobility load balancing, service-based handover, and frequency-priority-based handover. At each step, appropriate parameters are tuned and compared with load balancing objectives. If there is neither improvement nor degradation, it performs the fallback to the previous stage and tries to find another best load balancing orchestration to reach the best combination.

Samsung's LBM was created to achieve these objectives. The solution implements intelligent load balancing operations by evaluating the network and UE mobility conditions to resolve the load imbalance while maintaining the RAN KPI at its best level.

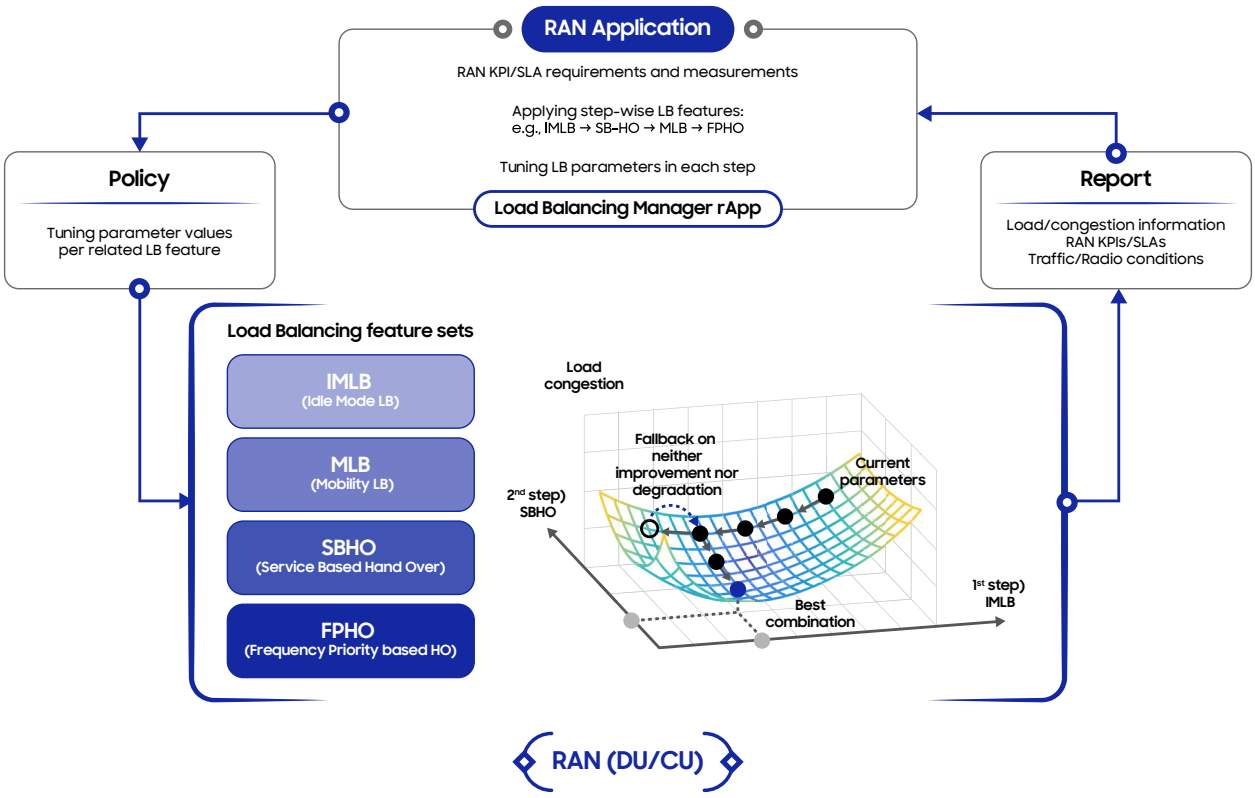



**Figure 3. Load balancing feature orchestrations by Load Balancing Manager rApp**

## 3.3. RAN application design avoiding conflict operations

When multiple rApps operate simultaneously, changes made by a certain rApp may affect the KPIs monitored by others, potentially degrading RAN performance. To prevent such conflicts, it is essential to address these issues during the rApp design phase, particularly regarding when and where multiple rApps will run concurrently. Samsung's rApps are designed with intelligent conflict management, taking into account design time constraints and runtime priorities to ensure optimal performance across the network.

For instance, the ESM rApp aims to maximize energy savings by turning off parts of the network, which may impact coverage. Meanwhile, the LBM rApp seeks to balance network load and User Equipment (UE) distribution based on existing coverage, limiting the chances of cells entering energy-saving states. In addition, the Coverage Manager (COM) rApp adjusts the tilt value of the antenna, further influencing coverage.

If these rApps attempt to operate on the same cells simultaneously, the conflicts regarding coverage must be resolved through arbitration rules or prioritization among the rApps. For example, as illustrated in Figure 4, ESM and LBM can operate as long as COM does not change the coverage of the target cell. Given this fixed coverage period, ESM and LBM will not operate simultaneously on the same cell. However, they can still operate simultaneously on different coverage cells during the same time periods.

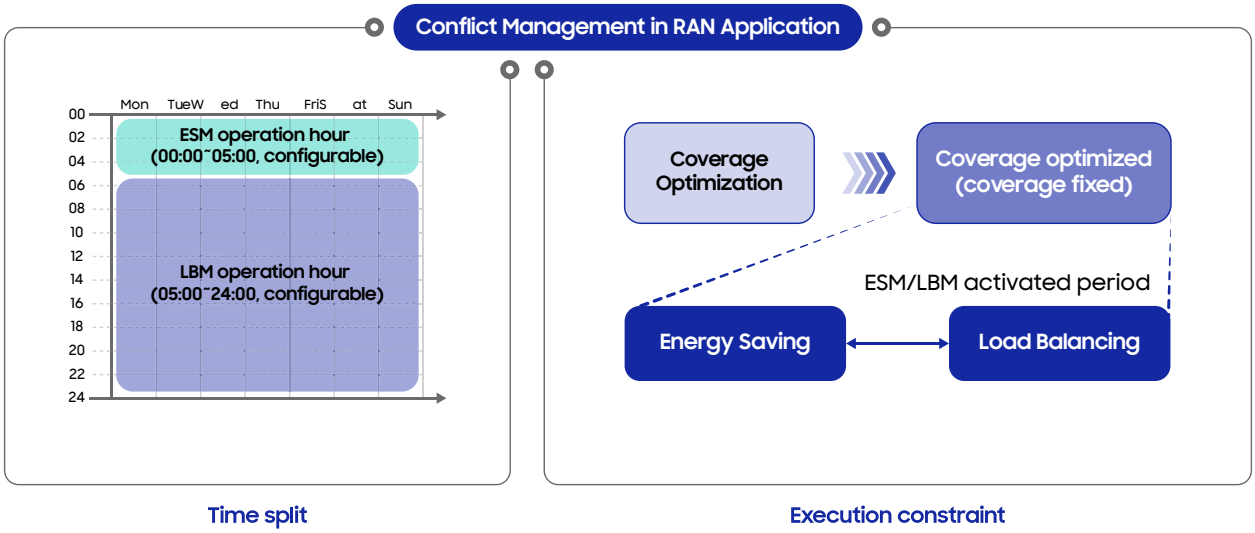



**Figure 4. Conflict management between RIC applications**

# 04. Samsung RAN applications are available now

Samsung has made strides in developing and commercializing applications for various aspects of network operation and optimization automation. The proficiency of RAN vendors in understanding RAN features is crucial for the success of rApp development. As the demand for innovative digital services continues to grow, vendors who prioritize enhancing their knowledge of RAN features will be well-positioned to seize emerging opportunities and deliver significant value for themselves and their customers.

- **Basic network automation applications :** Samsung provides comprehensive monitoring and analysis functionalities through lightweight statistical methodology. In addition, quick and automated detection and troubleshooting are available for KPI degradation and invalid parameter detection.

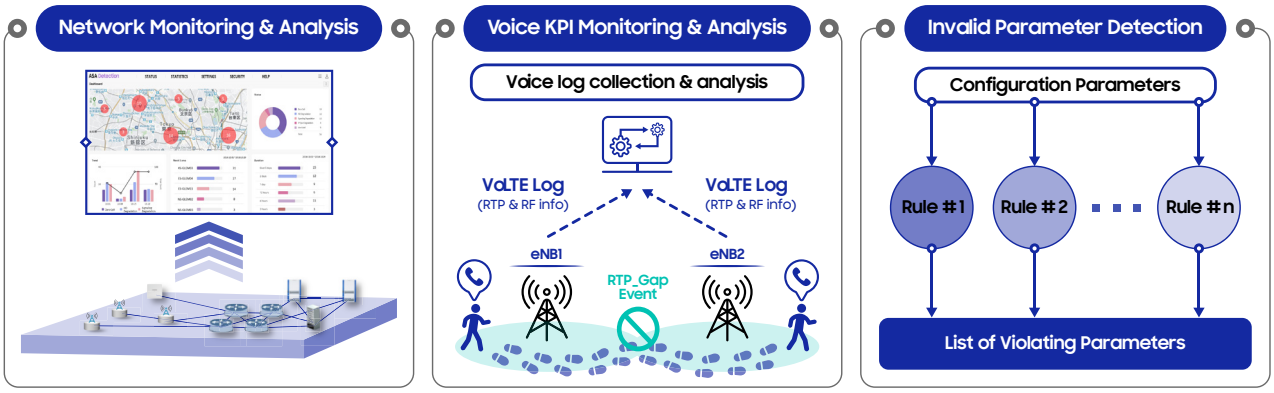



**Figure 5. Basic network automation applications**

- **Closed-loop automation rApps :** Samsung's advanced closed-loop automatic RAN applications ensure optimized network performance and an enhanced user experience. These include the Cell Topology Manager, Service-aware Mobility Manager, and TDD Interference Manager.

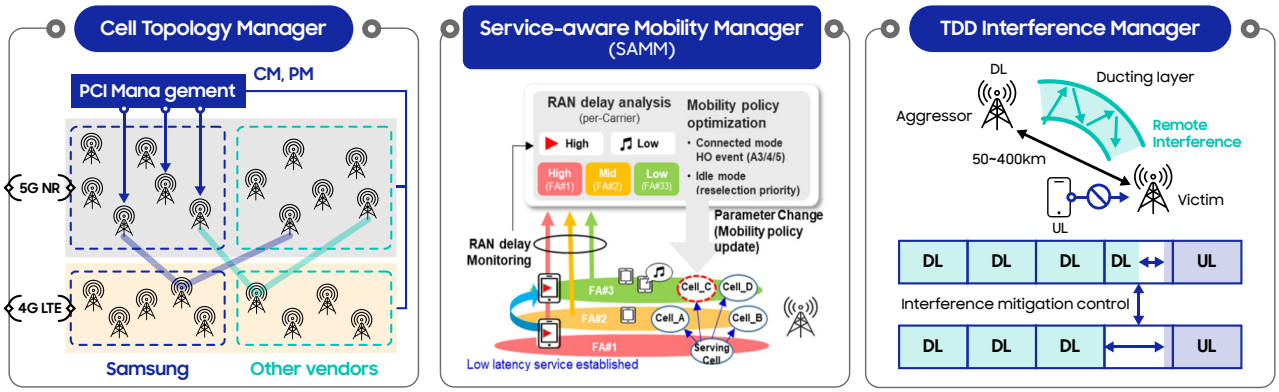



**Figure 6. Closed-loop automation rApps**

- **AI-powered automation rApps :** Samsung offers advanced RAN applications to maximize the intelligence and automation in the network for enabling comprehensive analysis and optimization such as Energy Saving Manager, Load Balancing Manager, Coverage Optimization Manager, and Parameter Recommender.

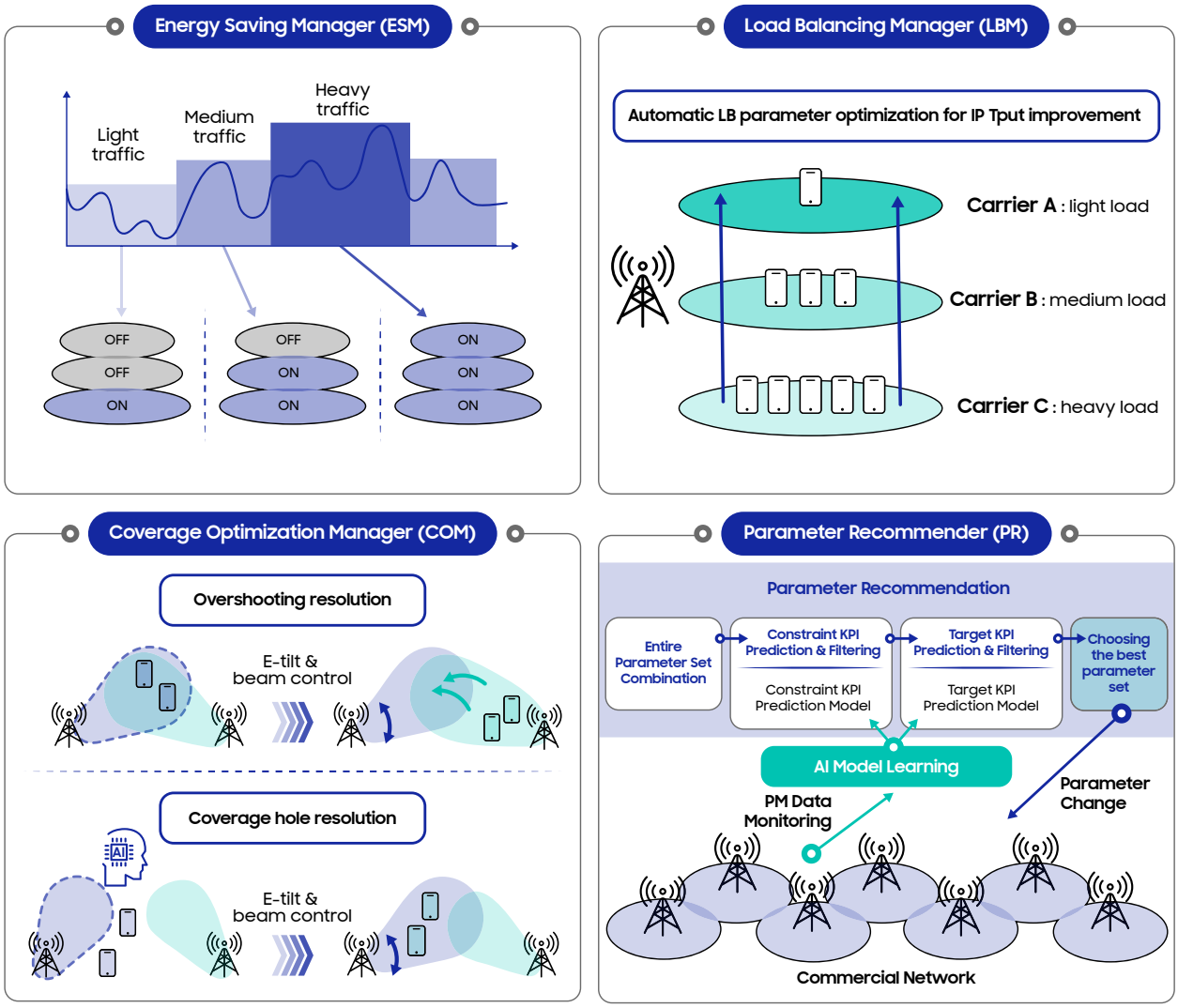



**Figure 7. AI-powered automation rApps**

# 05. Why is a non-RAN vendor's SMO/RIC platform an undesirable choice?

## 5.1. Sub-optimal RAN automation platform impacted by RAN expertise levels

A diverse range of RAN automation applications are responsible for tasks such as RAN resource management, orchestrating RAN features, and optimizing spectrum, energy, and operational efficiencies to enhance the quality of service, quality of experience, and service level agreements for users. These applications rely on the services the SMO/RIC platform provides to collect, monitor, and analyze RAN resource usage states and trending results. For instance, the SMO/RIC platform must support a data collection and management service that aggregates relevant RAN data and KPIs for RAN automation applications. Additionally, the platform should facilitate RAN+Infra control capabilities to enable applications to enact changes to the network infrastructure effectively.

Creating an SMO/RIC platform can pose significant challenges for non-RAN vendors because of the complex interconnection of SMO/RIC service components needed for different RAN automation applications. This difficulty stems from the intricate links between all SMO/RIC platform components and the extensive RAN domain expertise required, which includes data, key performance indicators (KPIs), features, systems, and system integration with RAN vendors.

The development of an SMO/RIC platform by non-RAN vendors may result in a suboptimal RAN automation platform solution, considering the complexity involved in supporting RAN automation and optimization. Non-RAN vendors typically lack the in-depth RAN knowledge required for effective implementation, leading to potential challenges in understanding RAN features and operations. This limitation can impact the quality and efficiency of non-RAN vendor's SMO/RIC platform solutions.

## 5.2. Higher integration and maintenance costs

The development of an SMO/RIC platform by non-RAN vendors necessitates thorough integration and interoperability testing before commercial release. Non-RAN vendors may encounter difficulties in achieving seamless interoperability with existing RAN vendor systems. The process can be challenging due to significant integration hurdles and potential performance issues arising from time-consuming multi-round discussions, inadequate and inaccurate communications, long-standing compatibility issues, and misalignment of the RAN automation platform with RAN system features. These challenges underscore the complexity and critical nature of ensuring smooth integration and interoperability between the SMO/RIC platform developed by non-RAN vendors and the existing RAN vendor systems. Addressing these issues effectively is essential to deliver a robust and efficient RAN automation solution that meets the demands of modern telecommunications networks.

In the commercial field, even after undergoing meticulous integration, non-RAN vendor SMO/RIC platforms may encounter challenges in providing reliable support. Non-RAN vendors often lack extensive experience in RAN automation processes and troubleshooting, and their support services may be fragmented based on their specific expertise areas. Consequently, troubleshooting RAN automation issues heavily rely on the support provided by RAN vendors. This lack of expertise makes it challenging for Mobile Network Operators (MNOs) to identify and resolve RAN automation issues swiftly and effectively.

In contrast, RAN vendor solutions offer a distinct advantage in this regard. RAN vendor SMO/RIC solutions are pre-integrated and thoroughly tested, reducing the complexity and time required for deployment. Moreover, RAN vendors often bring years of experience and a solid reputation to the table, instilling confidence in their ability to deliver cohesive RAN and SMO/RIC solutions and effectively troubleshoot RAN automation issues. RAN vendors' established expertise and support structure can significantly enhance the reliability and efficiency of RAN automation processes for MNOs.

## 5.3. Uncertainty in the long-term viability

Non-RAN vendors may face concerns about their long-term viability and ability to support their solutions over the long term in the RAN automation market. These concerns are because they are often newer or less established in the market, leading to uncertainties about their staying power. In contrast, RAN vendors have a strong track record of investing heavily in research and development, continuously improving their solutions, and incorporating the latest standard features and technological advancements.

The RAN automation market is an essential segment for RAN vendors. The commitment to this market ensures that RAN vendors will continue to provide ongoing support and development for their SMO/RIC platforms as long as they remain dedicated to the RAN equipment market. This ongoing investment in enhancing their solutions and staying competitive in the market further solidifies the reliability and long-term sustainability of RAN vendor-provided RAN automation solutions.

# 06. Samsung SMO/RIC platform leverages extensive RAN vendor expertise

## 6.1. Cohesive SMO/RIC platform for RAN automation applications

Higher-layer SMO automation applications and rApps often seek similar information and require similar control capabilities. Despite different performance objectives in various use cases, these automation applications follow the typical closed-loop operations involving monitoring, analysis, decision, and execution phases. During monitoring, specific target areas, nodes, or cells are identified based on the requested monitoring parameters, such as cells/frequencies, or dynamically determined target scoping. This phase involves querying topology and inventory information for target areas and retrieving resource usage status and trending reports from data collection and management, which is also being engaged in the analysis phase.

In the decision phase, the automation application determines the necessary configurations or policy changes, which are then executed through the platform provided RAN+Infra control functions. These control functions interact with domain controllers like the network function manager, network function orchestrator, etc. to implement the required changes. The SMO/RIC platform provides relevant RAN+Infra data abstractions and Management Services (MnS) to the higher-layer automation applications while abstracting the complexities of RAN control from the automation applications, ensuring a streamlined and efficient provisioning workflow. Refer to Figure 8 down below.

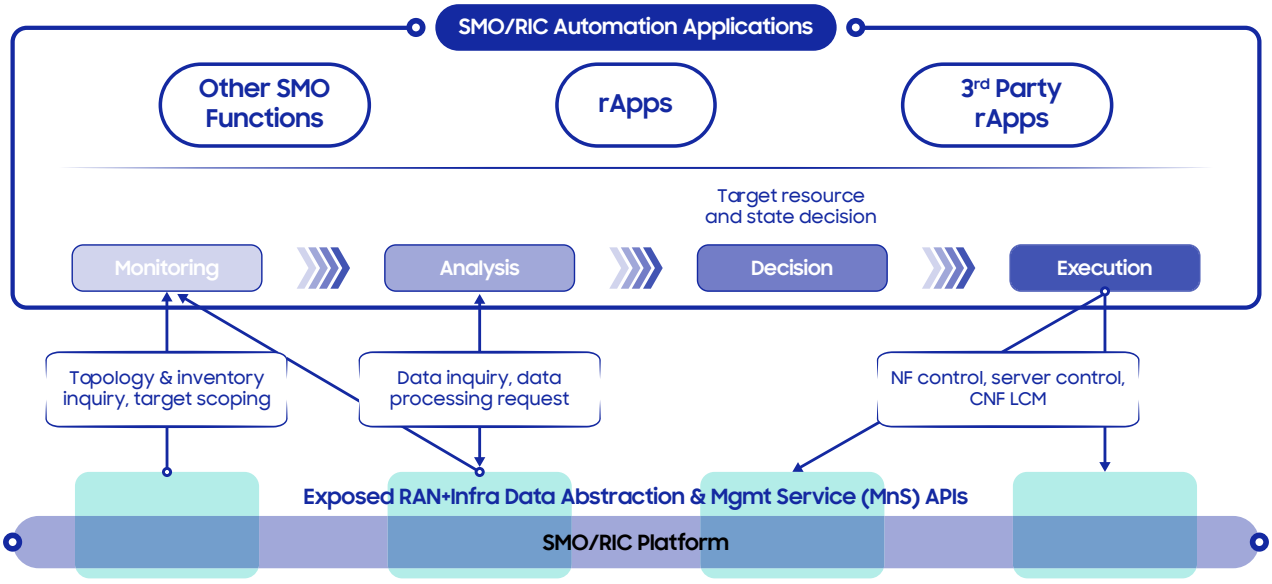
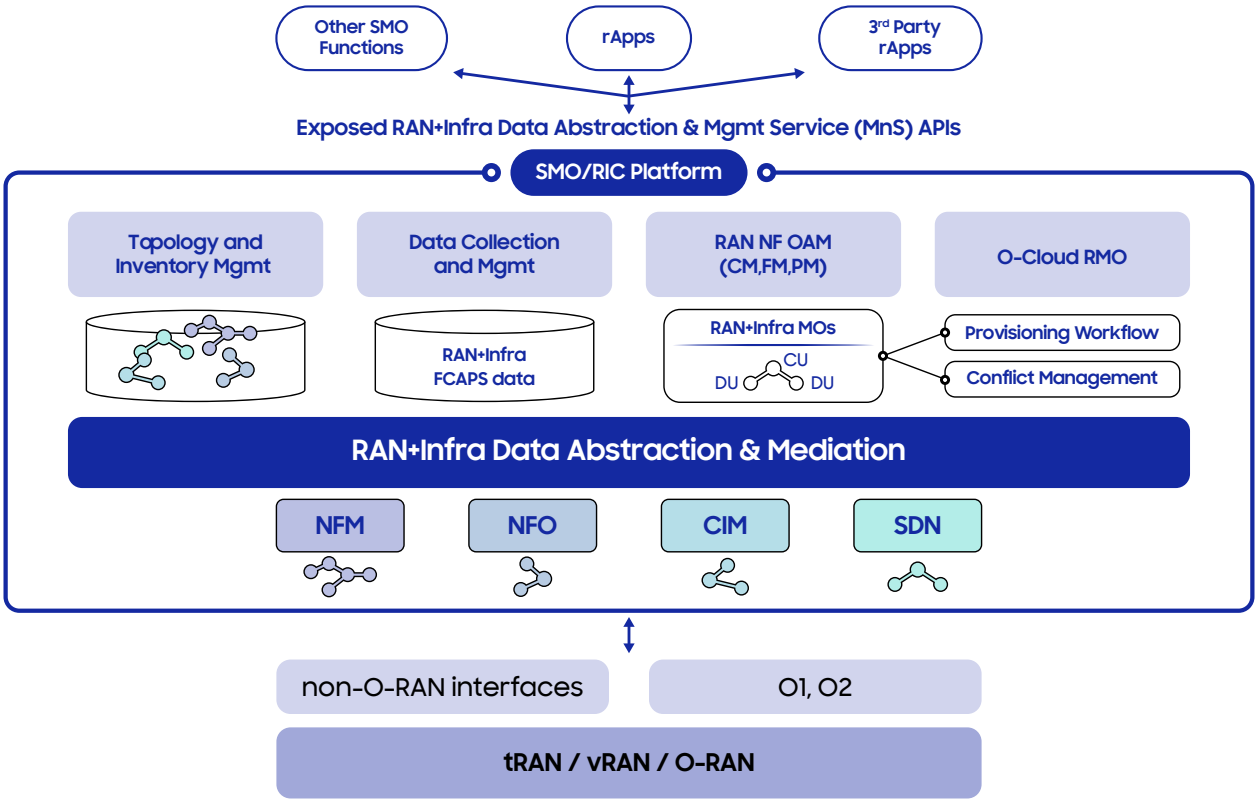



**Figure 8. Typical interactions between SMO/RIC automation applications and SMO/RIC platform**

Samsung offers a cohesive SMO/RIC platform for automating RAN operations, supporting various SMO functions and rApps, including MNO or 3rd Party rApps, with the same interface, as shown in Figure 9. The platform comprises four component services: Topology and Inventory Management, Data Collection and Management, RAN NF (Network Function) OAM (Operations, Administration, and Maintenance), and O-Cloud RMO (Resource Management and

Orchestration) over common RAN+Infra data abstractions and mediations. In addition, domain controllers—NFM (Network Function Manager), SDN (Software Defined Network), CIM (Cloud Infra Manager), and NFO (Network Function Orchestrator)—are integrated to manage specific domains within RAN. Through these components, the platform handles topological queries, synchronizes relationships, collects resource usage data, translates provisioning requests, and manages conflicts efficiently through provisioning workflows and a conflict manager on behalf of higher-layer SMO functions and rApps. These services offered by the platform are directly linked to the RAN-vendors' expertise and specialty, which cannot be obtainable from non-RAN vendors.




**O-Cloud RMO** : O-Cloud Resource Management and Orchestration,
**RAN+Infra MOs** : 3GPP and O-RAN NRM based Managed Objects
**NFM** : NF Manager, **CIM** : Cloud Infra Manager (e.g., O-RAN FOCOM), **NFO** : NF Orchestrator

**Figure 9. Cohesive SMO/RIC platform for both SMO functions and rApps**

## 6.2. Continuously evolving SMO/RIC platform

One of the key indicators of a successful RIC platform lies in its ability to effortlessly support valid network capabilities through handy and accessible tools for rApp development. RAN vendors play a vital role here, as they possess crucial knowledge about the severity of situations, specific configuration parameters that need investigation, and KPIs requiring optimization during such scenarios. Since sources of network problems are not easily isolated, especially in dynamic radio environments, identifying the root cause requires extensive problem-solving experience and an understanding of how each network component and feature is interrelated. Identifying key configuration parameters among thousands of candidates expedites the resolution process. Insights about the amount of network resources and perceived KPIs are also necessary for fine-tuning under diverse traffic conditions and/or wireless network environments. Continuous input and collaboration from RAN vendors are crucial for enhancing and refining the SMO/RIC platform to meet evolving network requirements as well as industry standards.

## 6.3. Integrating field-proven workflows in the platform

The field-proven workflows developed by RAN vendors effectively address specific issues. Integrating these workflows into the SMO/RIC platform simplifies the complexity of network management for developers working on rApps. This seamless integration streamlines the process and ensures that the necessary domain expertise is readily available within the platform, leading to more efficient and effective rApp development. For instance, the RAN cell topology and coverage relationships within cells are indispensable pieces of information for developing diverse rApps. The RAN vendor can furnish pre-computed coverage overlap ratios among different cells, which can be employed to ascertain the candidate cell list for handover in traffic offloading scenarios. When rApps are required to execute numerous configurations across multiple sites, the RIC platform offers provisioning workflows for rApps. This enables rApps to delegate such tasks to the platform and concentrate on their algorithm and business logic.

## 6.4. Supporting conflict management in the platform

Implementing logic and rules to prevent conflicts between actions of multiple rApps is essential for the successful deployment of the RIC platform. Conflict management involves two critical aspects: monitoring and action. When an rApp adjusts a cell, it can affect the metrics of related monitoring or measurement objects. Therefore, it is crucial to conduct monitoring across multiple rApps with a deep understanding of the unique properties of each rApp. Conflicts at the functional level between different rApps must be addressed with clear and well-defined logic during the design phase. Additionally, the subtle impacts on KPIs resulting from multiple actions by multiple rApps necessitate thorough long-term investigation and analysis, underscoring the necessity for the analytical expertise of RAN vendors. Thus, if RAN vendors provide platform-level conflict management, all rApps operating on the platform will benefit.

## 6.5. Optimizing the platform functions

Due to the absence of a standardized architectural split between SMO and RIC, integrating and maintaining components from different vendors presents significant challenges. One such challenge is the vendor-specific different implementations of specific functionality, which can result in duplicated functionality if SMO and RIC are provided by separate vendors, as shown in the red dotted line in Figure 10 below. Therefore, it is crucial to minimize duplicate functions when building SMO and RIC solutions .

[1] The same issue was reported by DT in a document titled “Deutsche Telecom and Partners demonstrate Non-Real Time RAN optimization in a multi-vendor environment”, Sep. 2023.

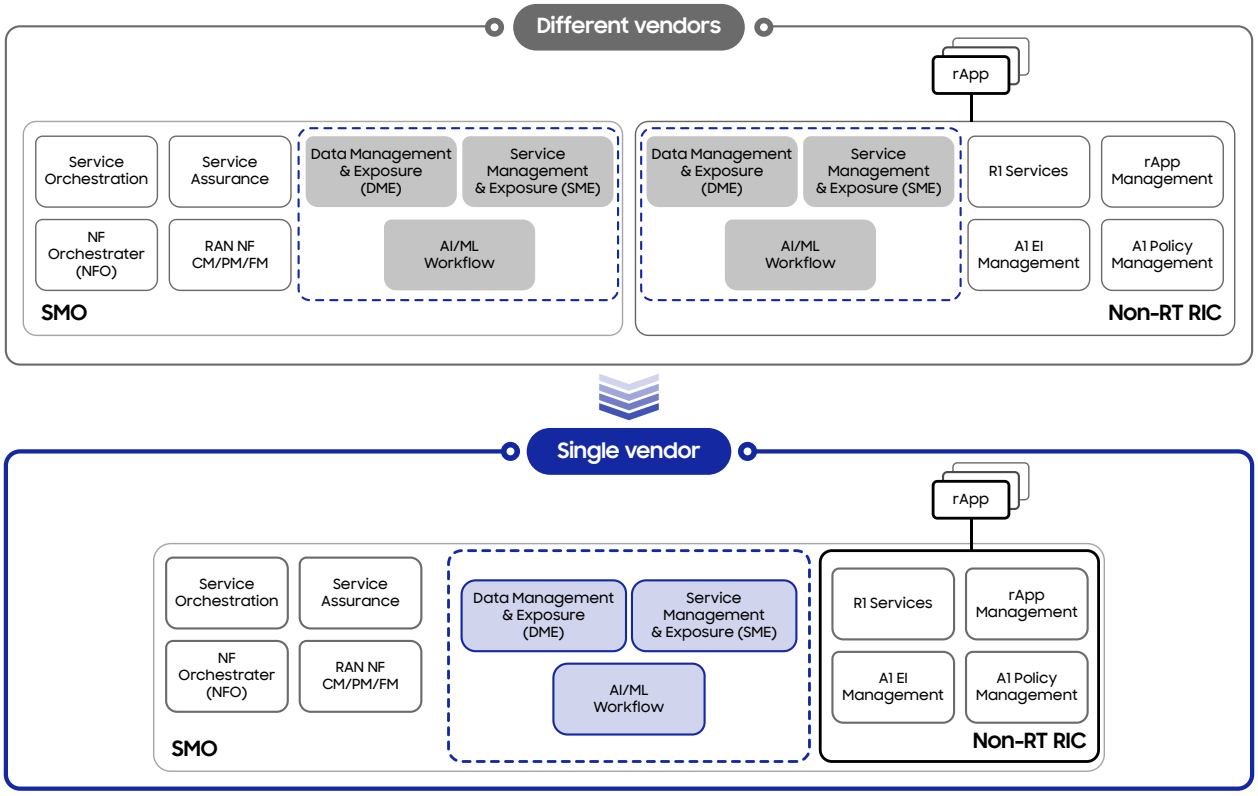



**Figure 10. Integration between SMO and Non-RT RIC**

It also must be highlighted that the platform functions such as configuration action and rollback between SMO and RIC are not clearly defined for network operation efficiency and stability. Operators should consider these aspects to achieve their objectives quickly and successfully, and to eliminate integration inefficiencies. Additionally, a comprehensive understanding of RAN functions and structures designed to optimize efficiency in the SMO/RIC platform is paramount. This approach ensures both maximization of RAN operation efficiency and overall business success.

## 6.6. Supporting multi-vendor RANs

The O-RAN O1 and O2 specifications are still evolving and should be mature enough to provide vendor-neutral FCAPS management. In the meantime, the SMO/RIC platform should adapt to the RAN vendors' standards compliance variations at O1 and O2 interfaces until the O-RAN standards become mature and stable. Consequently, the SMO/RIC platform is progressively aligning with the advancements in the O-RAN standards and adapting to the compliance variations of RAN vendors. Note that the standards evolve at a slower pace than the network operations and optimization issues in the field. Having an SMO from a RAN vendor helps fix things faster and validate them earlier, potentially influencing and impacting future standards.

# 7. Conclusion

Understanding RAN features is significant for staying competitive in the telecommunications market. RAN vendors have built a deep understanding of developing rApps that leverage the full capabilities of the underlying network infrastructure. Specifically, the ability to understand and implement RAN features gives RAN vendors a unique advantage over non-RAN vendors. Such knowledge allows them to optimize resource utilization, improve service quality, and enhance operational efficiency. Additionally, a thorough understanding of RAN features will be fundamental to anticipating potential challenges and devising appropriate solutions during development.

However, the effectiveness of RAN automation applications hinges on the capabilities of the SMO/RIC platform. This platform plays a critical role in collecting, monitoring, and analyzing RAN resource usage, as well as enabling control functions for configuration changes and conflict resolution. Therefore, a competitive SMO/RIC platform is essential for ensuring the efficiency and success of RAN automation operations.

Samsung provides a cohesive SMO/RIC platform for automating RAN operations, supporting various SMO functions and rApps, including MNO or 3rd Party rApps. This cohesive SMO/RIC platform, responsible for RAN E2E (RAN+Infra) management, comprises four component services: Topology and Inventory Management, Data Collection and Management, RAN NF OAM, and O-Cloud RMO. In addition, domain controllers—NFM, SDN, CIM, and NFO—are integrated to manage specific domains within the RAN. Through these components and controllers, the platform handles topological queries, synchronizes relationships, collects resource usage data, translates provisioning requests, and manages conflicts efficiently through provisioning workflows and a conflict manager on behalf of higher-layer SMO functions and rApps.

The services provided by the Samsung SMO/RIC platform are directly linked to Samsung's RAN expertise and specialty, which non-RAN vendors cannot replace. Additionally, Samsung's SMO/RIC solution already offers a rich suite of RAN applications on top of this integrated SMO/RIC platform, with plans to develop more innovative and intelligent RAN applications in the future. This comprehensive Samsung SMO/RIC solution will deliver substantial benefits to MNOs seeking to optimize spectrum utilization, energy efficiency, and operational effectiveness through SMO/RIC technology.

# Appendix: Key takeaways

## Why is a non-RAN vendor's SMO/RIC platform an undesirable choice?

Non-RAN vendor's SMO/RIC platform may be considered an undesirable choice for several reasons:

1. Limited RAN knowledge: Non-RAN vendors typically possess limited knowledge about RAN features and operations, which can impact the quality and effectiveness of their SMO/RIC platform solutions.

2. Integration challenges: Non-RAN vendors may struggle to achieve seamless interoperability with existing RAN vendor systems, leading to significant integration challenges and potential performance issues.

3. Reliable support issues: Non-RAN vendors may lack extensive experience in RAN automation processes and troubleshooting, making it difficult to provide reliable support over the long term.

4. Long-term viability: There may be concerns about the long-term viability of non-RAN vendors in the RAN automation market, raising uncertainties about their ability to support their solutions in the future.

5. Lack of continuous development: Unlike RAN vendors, non-RAN vendors may not invest heavily in research and development to continuously improve their solutions and incorporate the latest standard features and technological advancements.

Overall, the factors dealt with above contribute to the perception that non-RAN vendor SMO/RIC platforms may be an undesirable choice compared to solutions offered by established RAN vendors.

## Why is the Samsung SMO/RIC platform a preferred choice?

Samsung's SMO/RIC platform for automating RAN operations supports various SMO functions and rApps, supporting MNO or 3rd Party rApps with a unified interface. The platform consists of four component services: Topology and Inventory Management, Data Collection and Management, RAN NF OAM, and O-Cloud RMO, in conjunction with domain controllers NFM, SDN, CIM, and NFO.

1. Free of non-RAN vendor RIC concerns: Samsung's SMO/RIC platform is pre-integrated with Samsung RAN systems and supports the O-RAN O1 and O2 interfaces for other vendor RAN management. It will be continuously improved with the field-proven automation procedures and be with Samsung RAN business.

2. Cohesive SMO/RIC platform: Higher-layer SMO automation applications and rApps often seek similar information and require similar control capabilities. Upon application requests, the SMO/RIC platform efficiently handles topological queries, synchronizes topological relationships, collects resource usage data, translates provisioning requests, and manages conflicts through provisioning workflows and a conflict manager.

3. Abstraction and APIs exposure: The SMO/RIC platform exposes relevant RAN+Infra data abstractions and management services (MnS) APIs to both other SMO functions and rApps. Such APIs will give the benefits of abstracting RAN control complexities from automation applications, ensuring a streamlined and efficient provisioning workflow.

# Abbreviations

| | |
|---|---|
| AI | Artificial Intelligence |
| CIM | Cloud Infra Manager |
| COM | Coverage Optimization Manager |
| ESM | Energy Saving Manager |
| FCAPS | Fault, Configuration, Accounting, Performance, Security |
| KPI | Key Performance Indicator |
| LBM | Load Balancing Manager |
| MNO | Mobile Network Operator |
| NFM | Network Function Manager |
| NFO | Network Function Orchestrator |
| O-RAN | Open RAN |
| RAN | Radio Access Network |
| RIC | RAN Intelligent Controller |
| RMO | Resource Management and Orchestration |
| RT | Real Time |
| RU | Radio Unit |
| SDN | Software Defined Network |
| SMO | Service Management and Orchestration |
| TDD | Time Division Duplex |

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