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Executive Summary

New demands and new types of services are adding to the complexity and effort of network planning for mobile operators. In particular, 5G densification, new use cases like IoT and ultra-reliable low-latency (URLLC) services, and increasingly dynamic network sliced services require a fundamental rethink of the approach to radio planning. At the same time, scarcity of spectrum as established networks become more congested is an issue that requires network plans to be continuously adjusted.

Symworld RAN Commander is the solution to this changed radio planning and optimization need. Created to meet the challenges of limited spectral resources and aggressive rollout and densification schedules, RAN Commander has already proven its disruptive potential at Rakuten Mobile. It provides a single platform for both planning and optimization across multi-vendor networks, and extensive automation through in-built algorithms and full integration with live networks and crowdsourced data. It enables operators to plan and automate network-wide RAN investment decisions, flexibly, dynamically, and cost-effectively.

Traditionally, network planning involved addressing the concerns with signal strength, mobility support, and coverage for video channels, voice, and general data channels. However, network planning and optimization challenges are becoming more and more difficult as every new generation of wireless technology needs upscaling of the radio networks.

Besides the need for high-speed networks, the rising subscriber base is putting pressure on radio resources within a limited spectrum supply. Therefore, manual network design and tuning for enhancing the radio resource allocation in existing and future networks are most likely to fail. This necessitates developing automated tools and optimization algorithms that can handle challenging tasks. In addition, Telcos face significant challenges that legacy architectures are not designed to address, such as lack of automation, scaling infrastructure, etc.; the only way out is to opt for a cloud-native architecture.

Typically characterized as an activity carried out by a small number of highly skilled people supported by offline tools, network planning must increasingly be integrated part of the ongoing operation of the mobile network.

Legacy datasets and existing assurance and optimization workflows must keep up with the complexity, coverage, and capacity requirements. Therefore, there is a need for an on-demand radio network planning solution that allows network engineers to use advanced planning and optimization features to efficiently reduce the time and cost of planning and deployment.

Symworld RAN Commander delivers a holistic and customizable approach for business transformation, network growth, and 5G profitability. It bridges the gap for 5G RAN planning and optimization reducing operational risks and improving the end-user experience.

It is a comprehensive RAN optimization and automation solution enabling operators to maintain peak performance with precise insights into a subscriber and device connectivity, mobility and location, and radio coverage with analytics. Symworld RAN Commander comprises an integrated suite of applications to plan, troubleshoot and optimize networks using data-driven planning, crowdsourced data, GIS-map-based geo-spatial network data analysis, and visualization.

Challenges in RAN Planning and Optimization

The current radio frequency (RF) planning and optimization solutions are insufficient to support future wireless networks. To adapt to the changing needs of the network, RF planning and optimization solutions must be upgraded or replaced as networking standards and technologies change. The following challenges make end-to-end radio network design and optimization less effective and efficient:

- **Legacy desktop-based RF Planning tool**: Results in several potential problems such as compatibility issues with the operating system or hardware, not scalable, limited features due to system limitations, difficulty in
importing or exporting data from other systems, limited support, and documentation along with accessibility and performance issues.

- **Lack of a multifaceted solution to support Radio Network planning:** Over the years, telecom tools have advanced that can handle network planning, troubleshooting, and cell optimization of thousands of cells with integrated intelligence and automation. However, advancements have taken place, but they lack a complete solution, as each domain comprises separate tools for planning, troubleshooting, optimization, etc., to support radio network planning.

- **Static approach to RF Planning:** Conventionally, RF planning has been considered a static task wherein planning has always been done considering certain scenarios such as link budget, coverage, capacity, etc. It has been treated as a separate entity and not concerned with providing Quality of Service (QoS) in the traditional traffic-management-centric approach. Increasingly, planning cannot be confined to “Day 0” build-up, but is part of “Day N” – live network operations.

- **Siloed Data:** Planning data, Optimization data, subscriber movement, or network utilization insights remain segregated and siloed among different teams with zero end-to-end visibility across teams.

- **CAPEX conflicts:** Reconciling demands to expand today’s complex 4G/5G network through an accelerated network rollout while focusing investments for optimal returns and minimizing costs without sacrificing performance.

- **Inability to Scale:** The performance and responsiveness of an optimization tool with legacy planning is limited to the hardware on which they are deployed. Therefore, they cannot scale with an increase in demand and workload. Such monolithic architecture and standalone deployments limit businesses to use fixed resources and restrict the capability to process radio access networks and geographic data and perform large-scale optimization and complex calculations.

- **Low resolution of GIS Data:** As in 5G, network planning tasks are becoming complex due to the growing network densification. Small cell deployments increase the need for greater resolution of GIS data. Operators need a solution that must incorporate not only field measurements with less than one-meter accuracy but also sub-meter modeling data in high resolution with high accuracy so that CSPs can plan the deployment of 5G high-frequency sites.

- **Manual processes:** Planning and design tools are still manual to an extent, and there is a growing need for automation to help improve network deployment efficiency. In addition, the CSPs cannot handle large geospatial and diverse datasets, making predictive analysis of critical initiatives, like 5G rollout, time-consuming and prone to errors.

- **Failure to suggest optimization-related mitigation:** The current RF optimization processes and tools emphasize on human intelligence and experience to resolve issues in network like coverage holes, overshooting cells, coverage gaps, disoriented cells, etc. The dependence on human skill and the incapacity to use automated methods and find the right solution negatively impacts network quality, hampering the overall optimization process.

However, improving network planning, architecture, and optimization eventually aims to enhance customer satisfaction while maximizing revenue. Such a change requires a fundamentally new approach in the way CSPs plan and optimize networks, allowing them to meet the futuristic demands in real-time.

### An effective RAN Planning and Optimization solution

Maintaining network quality becomes difficult as subscribers increase, new technologies and services are implemented, and coverage is expanded. There is a need for intelligent solutions to address each stage of the network lifecycle. An effective RF Planning and Optimization solution supports:

- **Unified solution for planning and optimization:** An integrated solution that combines RF planning and optimization to give network operators comprehensive capabilities to plan and optimize networks effectively. The one that combines network measurements with advanced forecasts for highly accurate planning and optimization allows the field engineers to access an unprecedented level of geolocated insights into subscriber behavior and experience through vendors’ network performance data directly imported into the solution.
• Elastic horizontal scalability and multiple site prediction analyses: A solution that provides an innovative software development approach that is rapidly becoming the approach of choice when it comes to planning tools, one that is designed for the 5G era. One that offers elastic horizontal scalability and multiple site prediction analysis at any resolution with faster computation that is not possible with a traditional hardware system.

• Data-driven network planning: For effective planning, the solution must be capable of utilizing numerous input data sources comprising network performance metrics, drive test data, coverage issues, customer complaints, social media metrics, and crowdsourced data.

• Holistic RAN optimization and automation: An ideal RAN optimization and automation solution enables service providers to fix and fine-tune critical carrier capacity, quality, and coverage issues through mediated, correlated, and AI-digestible metadata sets. The benefits extend to performance issues mitigation. Optimizing network design through automation reduces the need for months of manual labor and results in observable CAPEX and OPEX reductions.

• Use of advanced analytics and machine learning: To handle and evaluate this data in real-time, RF planning and optimization for 5G networks require advanced analytics and machine learning techniques with efficient planning to match propagation reality. Thereby, resulting in a quicker time to market, fewer radio measurements, better QoS, and fewer optimization costs in the future.

• Predictive and measurement-based planning and optimization: Should enable the use of predictions and real-time network data simultaneously throughout the network planning and optimization process.

• Coverage analysis: There is a need for a comprehensive coverage analytics solution that provides insights across devices, locations, and subscribers. An ideal solution leverages innovative positioning practices using several precise map layers that include topography, transportation, and building data to improve accuracy. Coverage analysis evaluates the quality and reliability of the wireless signal in different locations.

• Integration: A standalone planning tool can no longer provide the anticipated benefits. The operational expenses are greatly reduced when network planning is integrated into other network lifecycle automation processes including testing, operations, and service assurance. For instance, when the network performance degrades and drive-test results can associate itself to a network issue or a configuration change, the ability to use such data to discover the underlying cause may shorten the time spent retrying the driving significantly.

• Increase efficiency through automation: An ideal solution must automate repetitive network design operations and allow the network engineers to complete both planning and optimization processes from a single platform which results in increased efficiency and eliminates the deployment of multiple tools working in silos.

• Efficient visualization of crowdsourced data: A solution that provides crowdsourced data visualization on the map and not just the drive test samples, giving CSPs a better understanding of the overall network performance, usage patterns, and subscriber movements. Advanced geo-analytics tools combined with visualization capabilities are needed to realize the entire value of the customer and network data.

In summary, this new approach to radio planning should make it easier for operators to make the best-informed decisions, combining rich experiential data from the live network as well as commercial constraints and future predictions. And without the need for custom integrations between end-of-life tools.

Symphony RAN Commander Planning and Optimization

The Symphony RAN Commander Planning and Optimization solution is a customizable and comprehensive approach for network expansion, 5G profitability, and business transformation. Using it, network operators can
ensure that their wireless network is designed and configured for maximum performance and reliability. Built on the Symworld Platform, the solution offers automation, data storage, integration, analytics, and ETL pipelines to extract and process data to democratize the flow of data between optimization and the RF planning platform from multiple sources (FCAPS, crowdsourced data, drive test logs, subscriber experience, etc.).

RAN Commander empowers RF engineers in RAN planning and optimization. It enables network operators to make data accessible wherever and whenever needed while eliminating excessive integration costs. Additionally, it provides the features required to manage the data through a common software layer powered by Symworld, such as security, workflow, storage, notifications, analytics, API management, and observability. Hence, there are no additional expenses or time-consuming integration tasks, removing dependency on third-party solutions.

![Network Planning](image)

**Figure 1: RAN Commander Planning & Optimization Suite**

With the right RAN planning and optimization solution, operators can maximize the projected business results of their 5G investments including churn, revenue, and quality of experience. Symphony RAN Commander is built with a microservice-based cloud-native architecture which makes it elastically scalable to any network size, accommodating nationwide deployments at the highest resolutions with high availability and disaster recovery features. With our solution, mobile operators have powerful capabilities to plan and optimize their networks correctly and effectively.

Network operators invest a large percentage of their revenue in their network infrastructure so that they can provide new services that are of high quality and at competitive prices. Symphony RAN Commander advances the use of cutting-edge algorithms on a virtualized, next-generation, and vendor-agnostic platform to predict the most effective layout for a new cell site. Symphony RAN Commander is fully automated and highly customizable with an on-demand planning workflow, covering every need of a RAN planner.

“RAN Commander Planning and Optimization Suite” is revolutionizing how engineers will plan their wireless networks in the future. It facilitates operators with extensive network expansion and densification planning capabilities, leveraging automated analysis and recommendations using AI/ML-enabled planning. As a result, radio engineering activities are becoming quicker and simpler by relying on ground-breaking machine learning innovations and real-world data to accurately predict wireless coverage, validate designs against live data, and eliminate manual complexities. In addition, the suite is integrated with the “Sympulse Network Performance Testing Suite,” through which operators can perform RF testing, and optimization within the same platform.
The solution ensures that the operator’s network is designed and optimized to handle the ever-increasing demands of the 5G services and applications and provide a better user experience. It is integrated with business intelligence tools allowing for real-time analysis of network performance. Leveraging geospatial analytics and coverage optimization, **Symphony RAN Commander** delivers a 5G network plan that meets the Quality of Experience expectations of the customers and the ROI expectations of the business. With purpose-built solutions to address the specific 5G priorities, operators can drive revenue growth with targeted and smart network investments, resulting in faster deployments, better control of radio infrastructure costs, and higher team productivity.

- **Lower total cost of ownership** with a scalable cloud-native platform providing insights on any network’s performance and supporting hybrid and fully cloud-based networks.
- **Data-driven approach** leveraging various input data sources, such as drive test, geolocated call trace, crowdsourced, and performance management data for informed business decisions.
- **Streamlined optimization processes** with a real-time view of the network, service-related issues, subscriber locations, root-cause analysis and built-in optimization analytics.
- **Automated network planning** removes complexities of how different applications integrate, thereby reducing the operator’s CAPEX by $2 billion over 10 years, as per statistics.
- **Cloud-native platform** allows operators to automatically scale the processing that needs to be implemented to perform network changes based on coverage and capacity data.
- **Integrated 5G solution** brings improved operational efficiency in the wireless planning and optimization activities, thereby providing enhanced visibility of the network so that operators can accordingly.

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**Symphony’s RAN Commander suite** is breaking down the barriers to rolling out and managing the next-gen networks. It comprises a suite of solutions that aim to lead the 5G and open RAN transformation, addressing the specific needs of the network operators. The solution facilitates operators to seamlessly manage various systems, vendors, and technologies, continuously configure and optimize the network, take closed-loop and automated actions, and gain a comprehensive understanding of the complete network landscape.
“Embrace Symphony’s Next-Gen RAN Planning and Optimization – a turnkey solution to cover all your network planning projects.”

Bringing Automation to RF Planning & Optimization

Symphony RAN Commander offers RF planning and optimization automation by providing tools and algorithms to design and optimize wireless networks. This includes predicting signal coverage, identifying potential interference issues, and selecting the most appropriate equipment and configurations for a given network. Automation helps to speed up the planning process, reduce the potential for human error, and improve the overall performance and efficiency of the network.

It comprises several benefits, including:

- **Data-driven approach**: Leverages various input data sources, such as drive test, geolocated call trace, crowdsourced, and performance management data for informed business decisions.

- **Informed Decision Making**: Real-time view of the network, service-related issues, and geospatial customer experience along with root-cause analysis and built-in optimization analytics enables faster and accurate decision making.

- **Cost savings**: Fully automated, highly customizable, dynamically scalable network planning and optimization workflows on cloud can help to reduce costs associated with manual planning and optimization, by streamlining the process and eliminating the need for specialized personnel.

- **Speed**: Automation significantly speeds up the planning and optimization process, allowing for faster deployment of wireless networks.

- **Accuracy**: Automated tools and algorithms reduces the potential for human error, ensuring that the network is designed and optimized correctly.

- **Efficiency**: Automation improves the overall performance and efficiency of the network, by identifying the most appropriate deployment scenarios and configurations for a given network.

- **Scalability**: Cloud-native automation helps to scale up the planning process for large-scale networks and can also be used to plan and optimize multiple sites simultaneously.
RAN Commander is engineered and purpose-built to provide a single platform for radio network planning, testing, analyzing and optimizing, while considering all standard capabilities and specifications for any network planning and optimization execution that an operator would anticipate for.

Symphony’s RAN Commander suite architecture is developed to support the following:

- **Cloud native, microservice-based architecture** that is agile to plan, build, and operate quickly and efficiently
- **Cloud agnostic with the use of Kubernetes** as underlying PaaS (Platform as Service) that helps to deploy the product in any cloud (Public/Private)
- **Cloud observability** support to collect real-time (streamed) data telemetry for applications and infrastructure monitoring
- **Highly scalable** to cater to the needs of an increasing number of users, transactions, and processing instances
- **High Availability** to ensure that the solution remains up and running and accessible to users in the face of unforeseen circumstances
- **Openness** to seamlessly integrate with third-party applications with the support of open API and event-based integration

**RAN Commander Planning Capabilities**

- **Analysis of RF signal strength and quality:** It helps to identify the poor signal strength areas or signal degradation, facilitating the users to fine-tune it to improve the overall RF system performance.
- **Live network data-driven planning:** It allows operators to utilize Sympulse and other public/private crowd-sourced network data sources to help comprehend the current network performance, highlight areas that need investment for coverage/capacity, and plan for network developments, thereby reducing operational costs and improving customer experience.
- **Geospatial Analytics:** It provides geolocated traffic and performance maps that enable RF teams to plan new networks and optimize existing ones using current, highly accurate geospatial data. It comprises high-resolution databases allowing it to quickly visualize terrain and clutter over large areas or across countries. The geo dataset includes clutter (DLU and DHM), DTM, vector, and population data.
- **Auto-suggestion for best candidate site:** It allows comparison of multiple candidate sites against nominal sites and suggests the most feasible candidate site. This feature saves a ton of time by doing away with the compulsion to compare each candidate site individually against the nominal.
Politically motivated actions have led to significant...
- **Performance KPI Analytics**: Enables one-click monitoring and investigation of network performance based on PM KPI counters.
- **Unified Coverage**: A Smart layer created by combining the crowdsourced network data with prediction data to provide a much more realistic network coverage and quality perspective.
- **Subscriber Experience**: It enables geospatial analysis, investigation, and troubleshooting of actual quality of experience reported by your customers.
- **Integrated Map Wizard Tools**: Host of smart tools for performing geospatial analysis on the map.
- **Automation Algorithms**: Comprises various in-built algorithms to auto-identify and mitigate coverage, quality and capacity issues by suggesting right solutions.

![Figure 5: Automated Identification of Service Gaps in network by using actual measurement data](image)

**Symworld Platform—Enabling Automation, Democratizing Data and Providing Seamless Integration**

Symworld Platform is the foundation of the RAN Commander Planning and Optimization Suite. It facilitates the RAN Commander to communicate with other Symworld applications to utilize the data for improved planning and optimization. It enables workflow-based automation, database support, AI/ML, data integrity, alert notifications, security, analytics, identity, and access management, reducing the dependency on third-party applications, while enabling accelerated time-to-market and resilience.

**Conclusion**

Symphony RAN Commander is the most cost-effective solution to enable the revolutionizing business use cases of the 5G era. It is a data-driven, cloudified, planning, and optimization platform that helps network operators to accelerate the deployment of 5G networks and fast-tracks time-to-market.

With this ground-breaking RF planning and optimization solution, network operators have automatic access to crowdsourced data, revolutionizing how engineers will design wireless networks in the future. By depending on real-world data and innovative machine learning advances to accurately predict wireless coverage, validate designs against live data, and remove manual complexities will make radio engineering tasks simpler and faster.

Symphony RAN Commander takes the operator through the entire RF planning, testing, and optimization lifecycle from indoor to outdoor, providing better control of their radio infrastructure costs with faster deployment and enhanced team productivity.