ericsson.com/
intelligentautomationplatform

Ericsson Intelligent Automation Platform

Solution brief

Bringing automation to RAN at scale

Ericsson Intelligent Automation Platform implements Service Management and Orchestration (SMO) for Open RAN, and extends those to take openness and automation forward with multi-vendor and multi-technology RAN support.

Automation is no longer optional

Telecommunication networks are becoming more powerful every day, but they are not getting any simpler. The evolution of technology over the last few decades has made it possible to provide mobile communications services at scale, performing in a way that may have seemed impossible a few years ago. As a result, the volume of traffic and diversity of use cases running on top of mobile networks has grown exponentially.

Moreover, the increased disaggregation of the Radio Access Network (RAN) nodes associated with adoption of cloud-native RAN architectures multiply the elements to manage.

As communications service providers around the globe take the next step in the evolution of mobile technology and start launching 5G services, the existing challenges related to opex efficiency and revenue growth are intensifying:

1. Managing network complexity created by legacy and 5G
2. Improving agility in managing legacy services and launching new services across existing physical 5G networks and the newer cloudified 5G network
3. Increasing productivity of resources and accelerating upskilling for the management of cloud-native telco networks
4. Securing new enterprise revenues requiring stringent service level agreement management and customization
5. Differentiating customer experience to reduce churn, improve net promoter score (NPS), as well as overall customer satisfaction

According to Ericsson's internal analysis and estimates, doing nothing is not an option as operational costs will more than double over the next five years. For communications service providers, the biggest part of this opex is related to RAN deployment, management and operations, so automation of these activities is key.

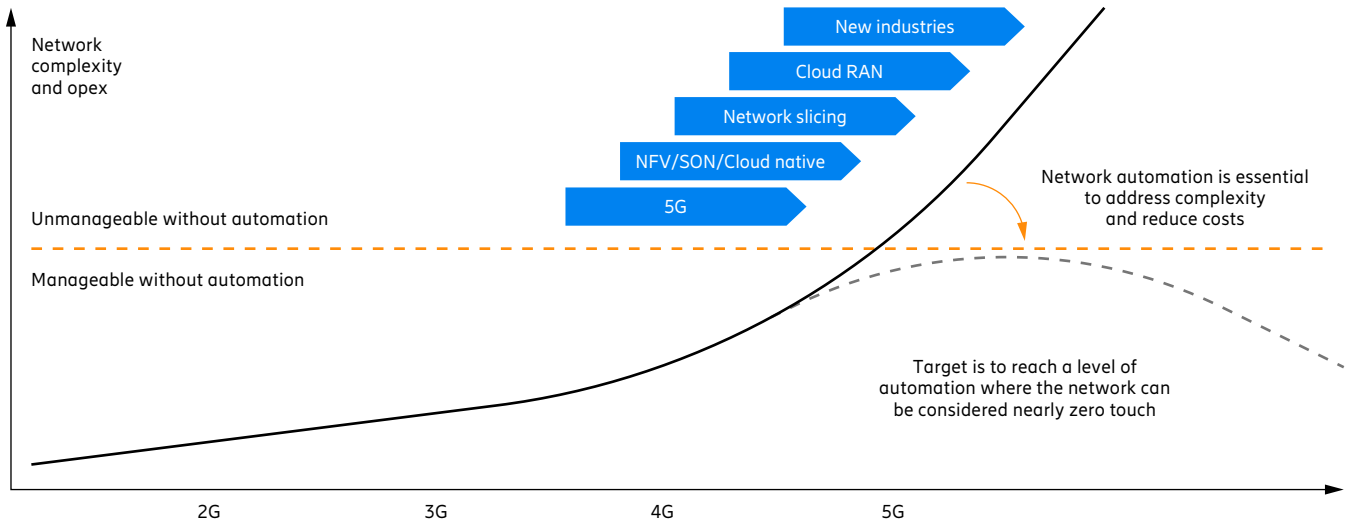
Bringing openness and disaggregation to RAN

Service providers are looking at reducing RAN opex, through Open RAN architecture and automation, with the following main drivers:

- openness and disaggregation to ensure supply chain security
- cloudification for leveraging commercial off-the-shelf (COTS) cloud infrastructure to improve return on capex and reduce RAN-related software operations and maintenance (OAM) costs
- accelerate innovation to drive new 5G revenues

This introduces additional complexity and costs from managing multiple vendors across different RAN components. Therefore, a common RAN automation platform is needed to efficiently manage and operate the radio network along with existing brownfield deployments. Open RAN service management and orchestration (SMO) platform defines the architecture and interfaces for Open RAN automation platform.

Figure 1: Opex will rise unless network and service automation is introduced



Enter Open RAN SMO

Open RAN SMO enables flexibility and agility when deploying RAN network functions. With the internal and external SMO interfaces, managing multi-vendor Open RAN networks is made possible.

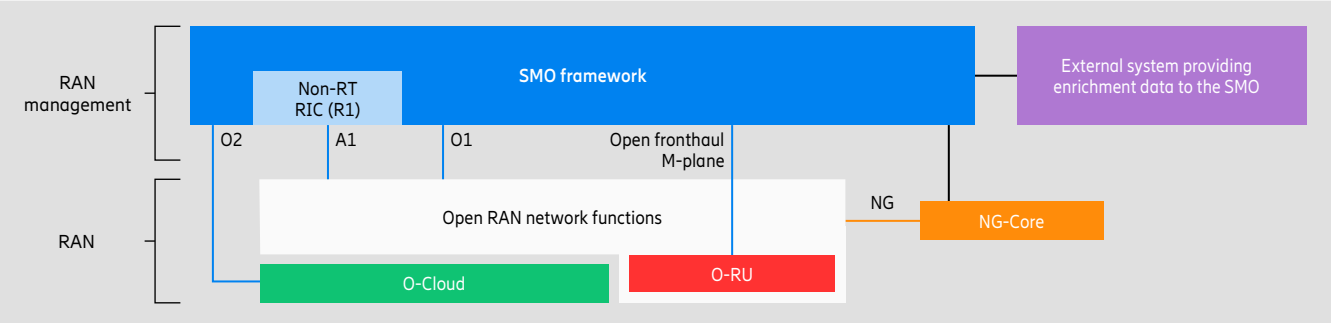
Open RAN defines network functions as central units (CU), distributed units (DU), near-real-time Radio Intelligent Controller (near-RT RIC) and non-real-time Radio Intelligent Controller (non-RT RIC), as cloud-native virtualized functions running on "O-Cloud" infrastructure.

SMO is the entity that is responsible for RAN domain management. SMO oversees life cycle management of network functions as well as the O-Cloud. SMO embraces the principles of openness in creating an automation platform based on cloud-native principles that enable agility in deploying RAN network functions and applications through standardized and open interfaces.

There are various internal and external SMO interfaces – R1, A1, O1, and O2 – that allow SMO to manage multi-vendor Open RAN network.

- **R1 interface**, internal to SMO, is motivated by the need for portability of multi-vendor rApps and providing value-added services to rApp developers and solution providers. It is a collection of services including, but not limited to, service registration and discovery services, authentication and authorization services, artificial intelligence/machine learning (AI/ML) workflow services, and A1, O1 and O2-related services. In addition, the interface enables new open APIs to be integrated into the SMO framework.
- **A1 interface**, between the near-RT and the non-RT RIC, provides fine-grained policy guidance and other data enrichments to RAN functions.
- **O1 interface,** between SMO and the Open RAN network functions, is the OAM interface towards Open RAN functions to achieve FCAPS management, software management and file management capabilities.
- **O2 interface** is the O-Cloud Management and deployment interface between SMO and O-Cloud. It supports orchestration of O-Cloud infrastructure resource management (such as inventory, monitoring, provisioning, software management and life cycle management) and deployment of the Open RAN network functions.

Figure 2: High-level architecture of Open RAN



O1 and M-plane – SMO FCAPS interfaces to RAN
O2 – SMO cloud-native deployment interface
A1 – Non-RT-RIC to near-RT-RIC interface
R1 – rApps interface to Non-RT-RIC and/or SMO services

Legend
- Open RAN defined interface
- 3GPP defined interface
- Interface out of scope

Source: O-RAN Alliance architecture

Going beyond SMO

Realizing the benefits of openness and automation in the RAN domain requires a multi-technology and multi-vendor approach.

Ericsson Intelligent Automation Platform comprises the implementation of Open RAN's SMO function and takes this forward by extending it with the capabilities to manage not only Open RAN and Ericsson's Cloud RAN technology, but purpose-built RAN networks like Ericsson Radio System.

Also, the platform provides both design and runtime environments for RAN automation use cases across physical and Cloud RAN.

The runtime environment enables multi-vendor applications to run on the platform, access data, and control network elements.

Additionally, the design environment allows for rapid application development and life cycle management of applications. It is supported by a software development kit (SDK) that is launched together with the platform.

Ericsson Intelligent Automation Platform supports all the interfaces in line with Open RAN principles – R1, A1, O1, and O2 – and provides a safe and feature-rich execution environment for rApps that implement diverse use cases in the area of RAN automation.

A comprehensive offering
To provide value to service providers from day one, Ericsson Intelligent Automation Platform is launching in conjunction with other components and products.

Software development kit
Much bigger than a set of APIs for development and integration, an SDK provides developers with everything they need to build and take the application through the different stages from development to production in the most effective way:

- tutorials and how-tos
- example applications
- API examples and full documentation
- build utilities
- verification environment
- integration with CI/CD toolchain
- helper libraries and modules

rApps
Aligned to Open RAN principles and implementing use cases in all areas of RAN automation:

- network evolution, such as capacity planning
- network deployment, such as the rApps Ericsson Sector Carrier Orchestration and Ericsson Canary Upgrade
- network optimization, such as Ericsson Performance Diagnostics rApp
- network healing, such as AI-powered advanced cell supervision

Services
A complete set of capabilities to accompany the service provider in the RAN automation journey:

- transformation and implementation plan – based on "as-is" and "to-be" scenarios, a detailed plan and design of how to realize the to-be scenario
- consulting – Ericsson services offer business qualification on the possible efficiency gains
- training – all courses required to kickstart platform operations, development and customization
- deployment and life cycle management – initial installation as well as upgrades of the automation platform
- multi-vendor customizations – customer-specific multi-vendor and multi-technology implementations
- design and build automation use cases – to extend provided rApps and create new rApps when required

Key benefits

Handles multi-vendor RAN complexity and scalability

- Provides management and orchestration of multi-vendor RAN networks over open interfaces
- Automates third-party purpose-built RAN via EMS integration leveraging OSSii
- Ericsson has deployed Network Design and Optimization (NDO) applications in 9 million cells worldwide, with half in multi-vendor RAN environments

Multi-technology, enabling adoption of Open RAN

- Supports automation of purpose-built and Cloud RAN/Open RAN networks
- Ericsson is launching rApps to maximize network ROI across purpose-built and Cloud RAN/Open RAN

Open SDK empowers rApp developers to maximize ROI

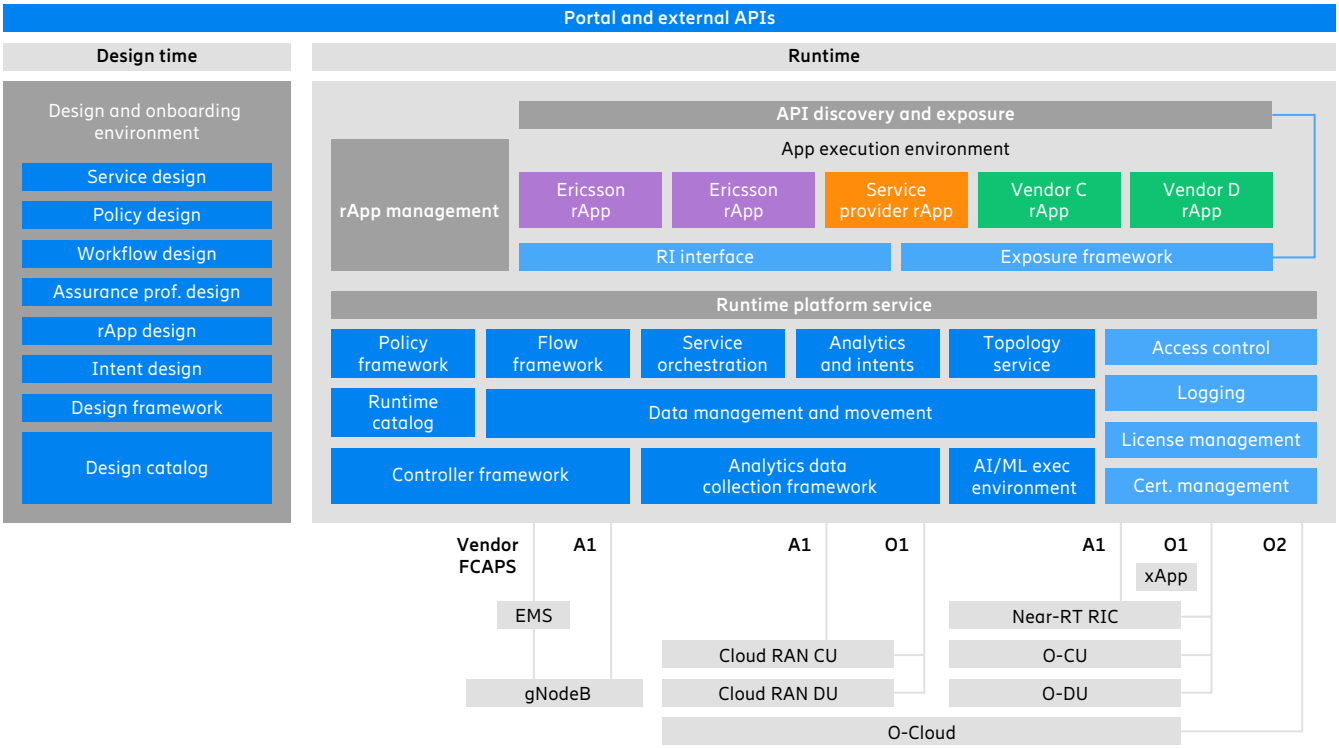
- Enables development and deployment of rApps from service providers and third-party vendors
- The platform's SDK has been used to create rApps on a common platform
- Ericsson strongly supports openness and innovation as a major contributor to Open RAN working groups, multiple global standards and industry bodies including 3GPP, ONAP and TMF, as well as being a founding member of OSSii

Connects RAN to network slicing, management, assurance and orchestration

- Supports RAN and OSS evolution strategy
- Handles disaggregated RAN complexity
- Supports rapid innovation, agility and fast time-to-market, decoupling development and life cycle management

Any mobile network. Intelligently automated

Figure 3: Ericsson Intelligent Automation Platform components and interfaces



Platform components

The main functional components of the platform are as follows:

Application manager
Life cycle management and monitoring of applications hosted within and by the platform.

Service orchestrator
Manages network service life cycles using a TOSCA-based orchestration engine.

Policy framework
Enables the model-driven life cycle management (deployment and execution) of policies and supports the addition of new policy engines and formats.

Data management and movement
Infrastructure supporting the transit or sharing of data in the platform, as well as various persistence technologies.

Analytics and intents
Components and services providing analytic insights such as event-based counters and KPI calculation, as well as expression and management of intents.

Analytics data collection
Set of all file and stream-based data for fault, performance and log data. It will initially support the O1 interface.

Controller framework
Supporting control access towards multiple external entities, including networks and other systems, through individual controllers.

Topology service
Provides access towards and management of a near real-time standardized topology and inventory model.

OSS portal
Web-based single point of entry to connect to the rest of the operational support systems (OSS), supporting integration and discovery of OSS capabilities.

ML execution environment
Supports ML model training, execution of ML algorithms and life cycle management of models.

Runtime catalog
Supports all verified artifacts and software that is accepted and validated for deployment in production and execution.

Workflow execution environment
Enables users to execute and monitor pre-defined or user-defined workflows and supports the definition of new tasks.

RAN automation use cases and rApps

rApps provide realization of RAN automation use cases, and the need for sharing resources and capabilities among rApps demands the best from the supporting platform.

The rApp concept is defined as an application designed to run on the non-RT RIC to realize different RAN automation and management use cases, with control loops on a time scale of one second and longer. rApps will be using an open and standardized R1 interface on the Ericsson Intelligent Automation Platform. For the interaction with RAN, the A1 interface can be used. The A1 open interface will interact with the non-RT-RIC for intent-based RAN optimization and automation.

As rApps are running on top of Ericsson Intelligent Automation Platform, external data sources can be integrated for the rApps to add additional data to its use cases. More precisely, these data enrichment capabilities are one of the foundations for the differential value the rApp concept will enable.

rApps are modular applications that leverage the functionality exposed by the non-RT RIC/SMO framework to perform multi-vendor RAN optimization and assurance capabilities via the R1, A1, O1 and O2 interfaces. rApps can be developed and delivered by the multi-vendor community and are standards-based and application platform agnostic, meaning they can run on any vendor's non-RT-RIC.

rApps share common services

Each rApp can also interwork with other rApps by means of standardized interfaces to build a more complex automation function, in which the insights from one rApp serve as input to another rApp to take more complex decisions. We can say that "small" rApps compose "large" use cases.

For example, Ericsson Frequency Layer Manager rApp optimizes the automated load balancing features of the radio network between different frequency layers. This rApp is composed of several smaller functions to provide the load balance recommendations, and some of these functions are also shared with other centralized SON algorithms such as Ericsson 5G Centralized Neighbor Relations rApp, cell type classifier, physical topology builder.

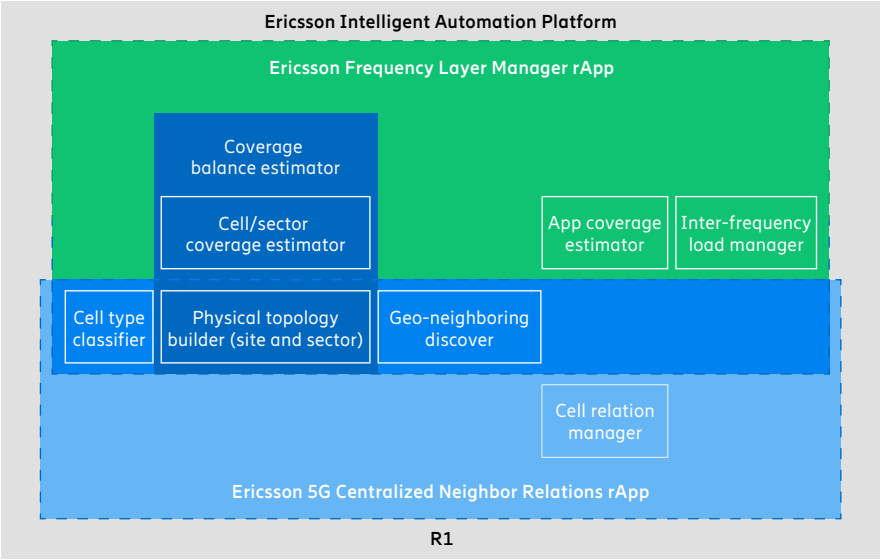
Some more examples of the capabilities enabled by these software building blocks are:

- cell type classification
- site and sector identification
- geographical neighbors
- mobility scoring
- coverage balance and contiguity
- device slicing

This sharing of services among the rApps has a number of benefits:

- "platform value" from reuse by enabling even more rapid application development
- reduces overall complexity, as the size of the rApps can be smaller
- data and insights can be shared among rApps
- standard life cycle management procedures across the rApp ecosystem

Figure 4: Ericsson Frequency Layer Manager rApp example: sharing a number of common services with other rApps via the platform



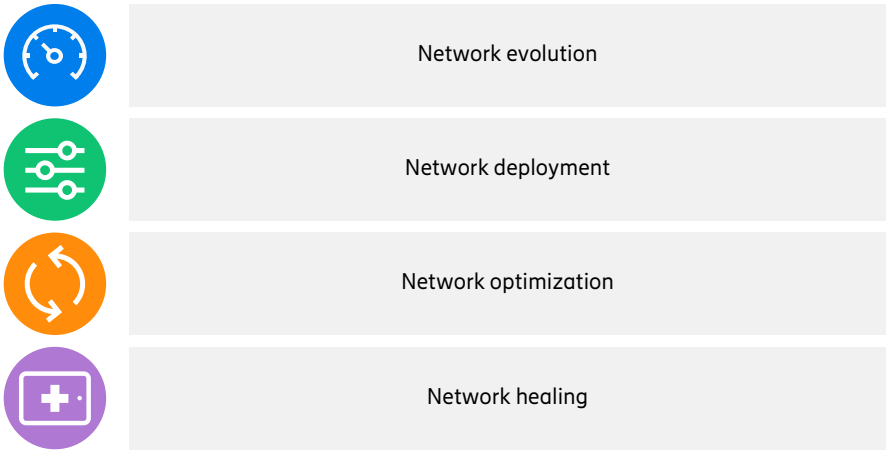
rApps work together to fulfill use cases

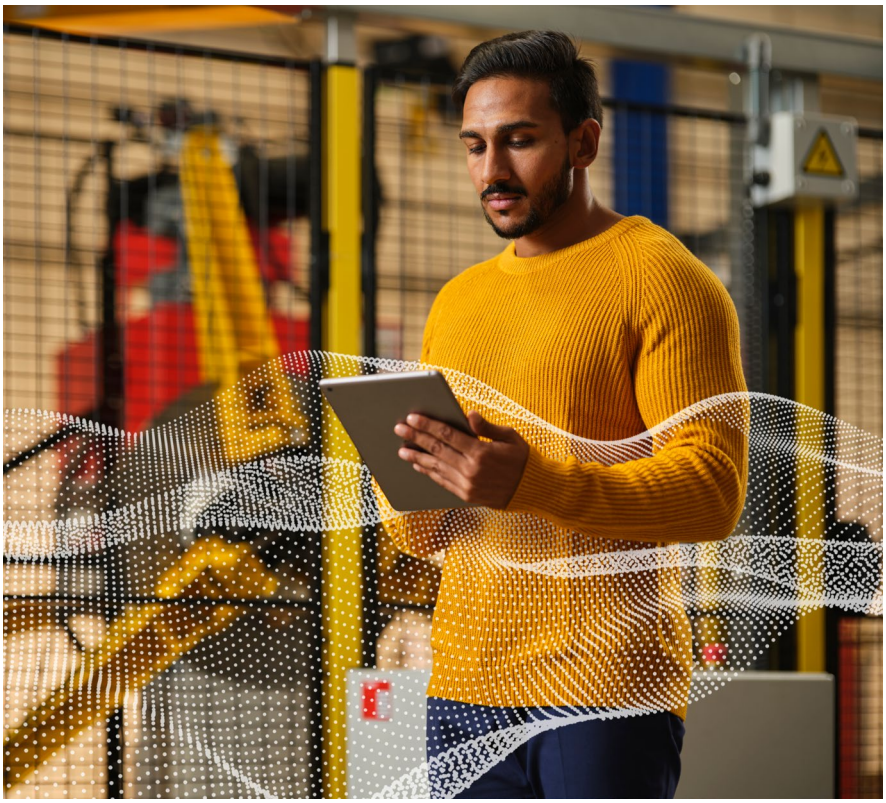
In many cases, rApps are composed to provide the functionality that more complex use cases require.

The different use cases in the wide area of RAN automation, with some examples, can be presented as follows:

- **Network evolution:** Secures network investments aligned with business strategy, improving energy and service performance, as well as enabling new revenues through evolution of network assets by data-driven and intent-based insights and recommendations. Example: Capacity planning.
- **Network deployment:** Handles provisioning and life cycle management of complex networks with optimal costs and speed to market. Examples: the rApps Ericsson Canary Upgrade, Ericsson Sector Carrier Orchestration, Ericsson 5G Centralized Neighbor Relations, Advanced Radio Coordination (E-RAN management).
- **Network optimization:** Offers intelligent autonomous functions to optimize customer experiences and return on investments. Examples: Ericsson Frequency Layer Manager rApp, user equipment prioritization for service assurance (Ericsson QoS Nudging rApp), Ericsson Performance Diagnostics rApp.
- **Network healing:** Ensures service continuity and resolution of basic and complex incidents, delivering high availability while keeping the opex at a minimum.

Figure 5: Different areas of RAN automation empowered by the Ericsson Intelligent Automation Platform and the rApps





Empower the rApp ecosystem with the best SDK

Ericsson Intelligent Automation Platform provides rApp developers with an SDK, which has unique capabilities to streamline the development and life cycle management process.

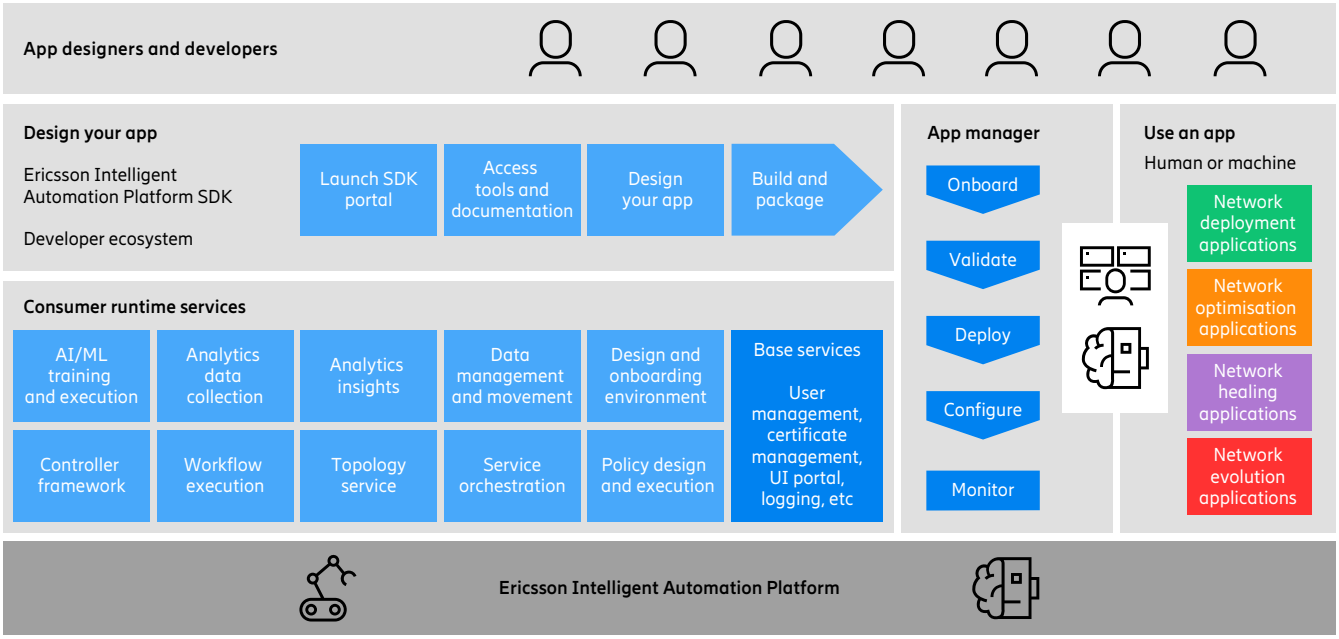
The platform SDK is much bigger than a set of development and integration APIs. It offers everything needed to efficiently see the application through each stage.

Built on a strong foundation of services, the platform is cloud native (deployed on Kubernetes) and provides a defined architecture for ease of application structuring. Standard interfaces to integrate with logging, authentication, certificate management and data movement allow developers to focus on the business logic and deliver the key value of the use case.

The automation platform offers developers a suite of APIs and capabilities:

- **Data management and movement:** Includes access to key data bus of the system.
- **Topology service:** Near-RT source of truth for inventory and topology.
- **AI/ML training and execution:** Provides AI/ML model life cycle management, execution and a training environment.
- **Analytics data collection:** Offers raw analytical data in a file or stream-based data format. Standard collection interfaces for fault management (FM), performance management (PM) and others will be provided and supported out of the box.
- **Analytics insights:** Analytics processing capabilities enable valuable insights into network behavior and performance.
- **Base services:** Offer everything an application needs such as logging, user management, certificate management and UI portal.
- **Design and onboarding environment:** DevOps pipelines enable the automated onboarding, verification, promotion and publication of software and models.
- **Controller framework:** Enables parameter configuration on managed elements and uses an events-based API to provide notifications of application changes to allow near real-time action. Abstracts complex details of the underlying system to allow developers to focus on their use case.
- **Policy design and execution:** Design and execution for policy handling using multiple engines.
- **Service orchestration:** TOSCA-based orchestration engine supporting declarative orchestration, through ETSI's open source management and orchestration (ETSI-MANO) resource orchestrators, of end-to-end services.
- **Workflow execution:** Realization of flows of activities that flexibly orchestrate system functions and capabilities, supporting new use cases.

Figure 6: Ericsson Intelligent Automation Platform SDK example workflow and platform services



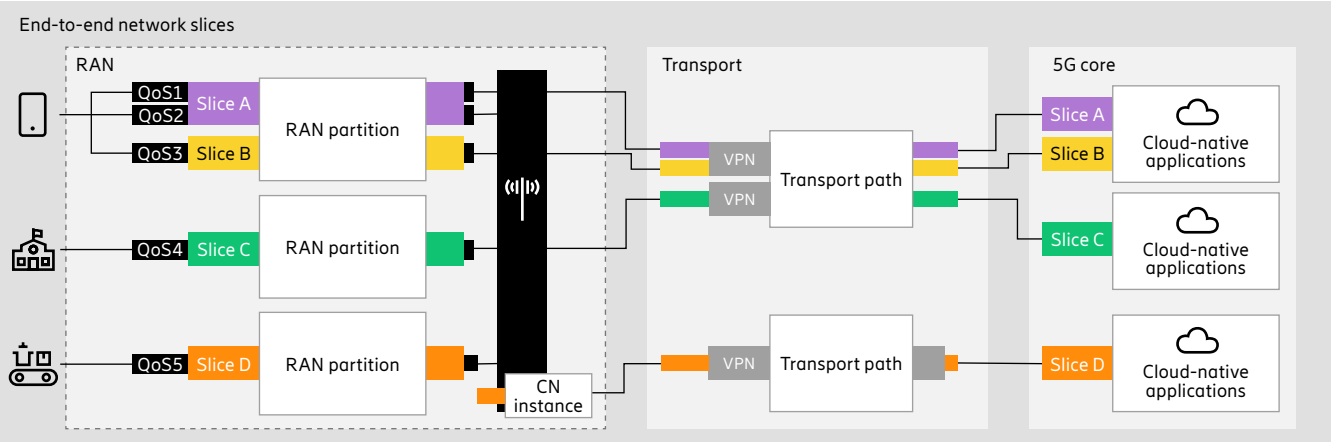
Connecting the dots of end-to-end automation

Ericsson brings its end-to-end experience on network slicing to ensure that the Open RAN functions are integrated with the rest of the network domains for the best customer experience.

High network performance and enhanced customer experiences are as important in the evolution to Cloud RAN as opex improvements. Ericsson understands end-to-end services and how the overall customer experience is dependent on the coordination and performance of the different network domains, where RAN is a fundamental part, but not isolated (see Figure 7 for example).

Ericsson also understands how to connect the RAN technologies to the rest of network domains to enable real end-to-end-service management in all areas, from fulfillment and assurance to monetization.

Figure 7: Network slices require the coordination of different network domains



Cases where this multi-domain understanding of the service architecture is required include the ability to:

- create and manage end-to-end network slicing, which is critical for 5G enterprise services
- implement AI/ML driven closed-loop assurance for multi-domain services where RAN is an integral part, to maintain service integrity and availability
- orchestrate consumer and enterprise services and scale them up and down in response to demand

These capabilities will fuel the adoption of Open RAN. Better overall performance and customer experience for lower cost is a true driver for RAN evolution.

Ericsson is deploying these capabilities today in purpose-built and Cloud RAN networks, and the platform makes it possible to connect these capabilities to the Open RAN domain.

An ecosystem of benefits

Ericsson Intelligent Automation Platform enables RAN automation to be realized and unlocks significant journey benefits:

- faster time-to-market with RAN capability alignment and management across the multi-vendor radio network
- operational flexibility with automated RAN deployment, operation, optimization and energy savings
- end-to-end integration of operations and service experience aspects that increase satisfaction and higher lifetime value for enterprise and residential customers

An estimation of the benefits produced by these drivers is reflected in the three most important areas for the service provider:

- revenue increase linked, for instance, to 5G enterprise services and driven from improved time-to-market
- opex savings – specifically RAN opex – with considerations of benefits coming from improved RAN operations, planning and optimization
- customer satisfaction and metrics such as the NPS. Improvement here results from reduction of network detractors by improving RAN network experience, and this can drive revenues itself, as well from new customers and reduced churn

By realizing these benefits, the Ericsson Intelligent Automation Platform becomes a platform of growth for the service provider.

About Ericsson

Ericsson enables communications service providers to capture the full value of connectivity. The company's portfolio spans Networks, Digital Services, Managed Services, and Emerging Business and is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's investments in innovation have delivered the benefits of telephony and mobile broadband to billions of people around the world. The Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York.

www.ericsson.com

Ericsson
SE-164 80 Stockholm, Sweden
Telephone +46 10 719 0000
www.ericsson.com

1/22112-FGM 101 030