ZERO TOUCH NETWORKS WITH CLOUD-OPTIMIZED NETWORK APPLICATIONS

Why Zero Touch networks?

Operators have high expectations on 5G networks. They want to create and offer new services with short time to market, delivered from a cost-efficient cloud infrastructure. The telecom market is highly competitive with challenges from over-the-top players. This puts pressure on costs for building and operating networks. The total cost of ownership of operators' networks is negatively impacted by an increasing technical complexity driven by new service paradigms and the need to support legacy services.

Today, telecom networks have management and monetization systems with limited support for automation. Due to legacy deployment and operational models, they require extensive manual support. This results in high operating costs and limited support for flexible and quick service creation.

Going forward, networks will be based on a distributed cloud infrastructure. The functional architecture has horizontal layers, with separate domains for administration and responsibility. The separation between infrastructure and network applications requires the management layer to correlate operating information from different network domains. Operation and maintenance functions like alarms, fault, performance, and life-cycle management are coordinated on the customer service level.

Operating costs are minimized by networks that do not require human intervention for life-cycle management and service offerings. A Zero Touch network has end-to-end network programmability for service creation

Marian Darula
Head of NFV & Application Architecture
marian.darula@ericsson.com

Ignacio Más
Senior Expert in Programmable Network Architecture
ignacio.mas@ericsson.com

and full automation of life-cycle processes. It is built using cloud and software-defined networking (SDN) technologies with cloud-optimized network applications and network slices to address the needs of different consumer, enterprise, and industry segments.

Zero Touch networks in 5G

5G networks are built for advanced use cases, including enhanced mobile broadband, and massive and critical machine type communications. These use cases have high demands on real-time management and automation of the 5G RAN, 5G core and distributed cloud infrastructure. Services are provided from a network infrastructure that is not necessarily dedicated to 5G but which also supports legacy services. For networks of this type, a management system with a high degree of automation is crucial for cost-efficient operation.

Automation is a prerequisite for network slices. A network slice consists of network resources that serve a certain business purpose or a customer/tenant. A network slice is created, configured, modified, and removed by management functions. New types of services are created and configured using templates and abstract components/building blocks. The user of a network slice expects fast service delivery, i.e. the time from an order on a customer portal to the instantiation of a network slice in a service provider network. This process, which takes weeks using traditional operation and maintenance approaches, is reduced to minutes or seconds.

The distributed cloud infrastructure and cloud-optimized network applications expose application interfaces (API) to higher management layers. Network resources and services are abstracted to enable automation on a network slice level. The network slice life-cycle management is model driven and supports multi-tenant operations.

Zero Touch network building blocks

Ericsson's cloud-optimized network applications, based on cloud native principles, support automated deployment and operation in a distributed cloud environment. Applications are decomposed into microservices that interact through application interfaces. Different components are managed together to minimize the operational complexity of cloud-optimized network applications. Fast service creation and adaptation to customer needs are achieved, while keeping the management of applications and services simple and cost-efficient.

Ericsson networks are based on a set of architectural paradigms referred to as COMPA (Control, Orchestration, Management, Policy, and Analytics). COMPA offers robust and reusable design patterns for open- and closed-loop automation. The COMPA architecture assumes that a network is divided into administration and responsibility domains, such as access, network applications, cloud infrastructure, transport, and business support. Each of these domains has full operational responsibility for its resources and exposes services to other domains or cross-domain functions. Domain and service orchestration enables automation across different types of resources and uses workflows to provide the desired network behavior. A policy framework uses advanced analytics to provide consistent and non-conflicting closed-loop automation. COMPA is configured and deployed depending on business objectives and the maturity of automation capabilities. In the initial stage, it enhances the existing domain managers for applications, cloud services and transport. In a second stage, COMPA functions use a common set of components for analytics, policy, orchestration, inventory and catalogue management. These components are flexible, extendable, and programmable in order to accommodate to the specific needs and business objectives of each operator. Domain adaptations are implemented as analytics applications, policies, orchestration scripts and mediation, inventory models and catalogue artifacts. Finally, COMPA patterns are implemented in network applications, which are enhanced with application analytics and policies. The industry also recognizes this need and this is reflected in the creation of the Open Network Automation Platform (ONAP).

"To further increase the degree of automation, machine learning is applied to harvest knowledge from the vast amount of data generated in the network."

"COMPA offers robust and reusable design patterns for open- and closed-loop automation."

To further increase the degree of automation, machine learning is applied to harvest knowledge from the vast amount of data generated in the network. These methods enable the transformation from automatic functions, relying on handcrafted rules and hard coded logic, into autonomic functions that constantly and automatically learn from, and adapt to, rapidly evolving network behavior. These data-driven functions are used to eliminate the need for tuning the network and to detect and resolve network incidents at much higher precision and significantly faster—in many cases even before they happen.

Software-defined networking (SDN) enables network programmability and abstraction through policy-based and centralized control. An SDN overlay network provides dynamic behavior in a data center environment. Ericsson's cloud SDN controller acts as the networking management engine that complements the compute

> "Dynamic Service Orchestration is used for automated management of network slices."

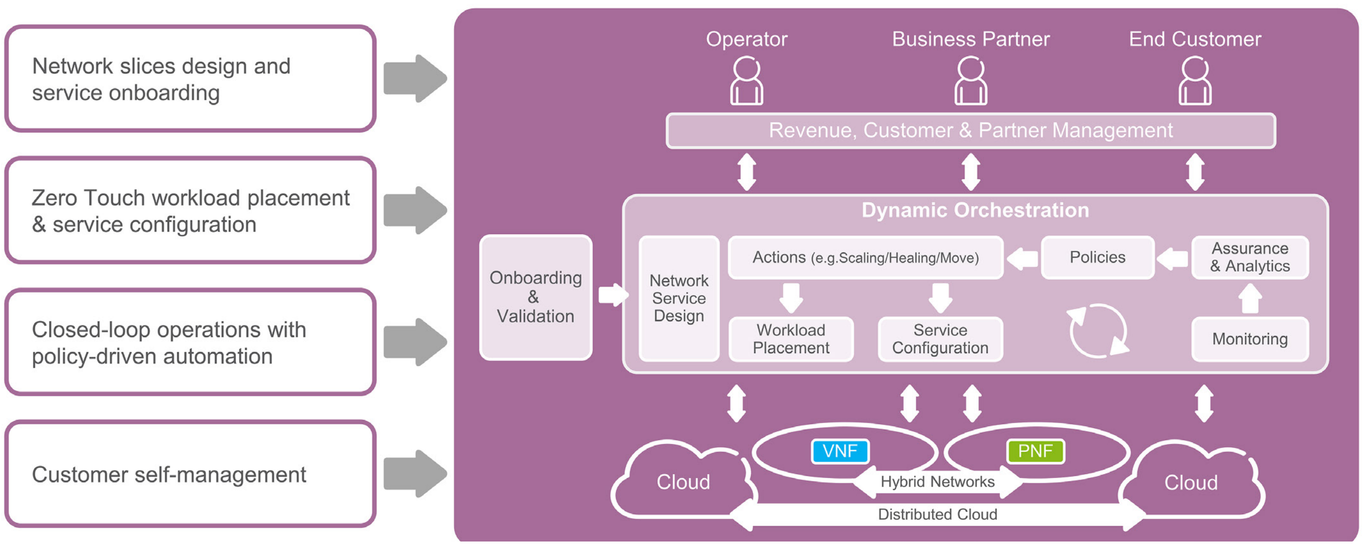
and storage virtualization layers. It provides tenant network isolation for automated management of network slices. SDN orchestration of transport allows the creation of an IP/MPLS forwarding plane abstraction layer. Transport SDN offers a unified transport orchestration layer that interacts with the multi-vendor and multi-domain transport environments of operator networks. It also enables tenants to define service graphs (a desired set of network services) that are created in a distributed cloud environment without manual reconfiguration.

Network function virtualization (NFV) enables automated life-cycle management of cloud-optimized network applications and network functions. This includes onboarding, deployment, instantiation, and management operations. Ericsson's NFV solution has multiple layers with open interfaces and follows the principles and interfaces specified by ETSI. It provides an environment where functions running in virtual machines, containers or as bare metal deployments are life-cycle managed in the same way.

Ericsson's dynamic service orchestration provides life-cycle management of customer facing network services. It combines the capabilities of distributed cloud infrastructure, cloud-optimized network applications, NFV, SDN and COMPA to create programmable networks. Service orchestration uses customer service-level agreements (SLA), including monetization, and links these to resource facing SLAs per domain. Each domain management can then deploy, enforce, and monitor them using domain COMPA. The chart below illustrates Ericsson's service orchestration concept, from design and validation to deployment, monitoring, automated service exposure, monetization and decommissioning.

Dynamic Service Orchestration is used for automated management of network slices. A network slice instance consists of resources and functions that are specified by a slice blueprint, e.g. expressed in the modeling language TOSCA. The slice blueprint describes the application structure, relationships, configuration, and the required resources. Pre-defined and pre-packaged solutions are deployed using standardized slice templates. These can be tailored to the needs of enterprises, customers and large-scale operators. Slice templates include workflows for automated operations and will be provided by both network suppliers and service providers. The same network can serve multiple customers and tenants, each served by a dedicated network slice, while providing optimal resource utilization through orchestrated infrastructure sharing. Built-in elasticity guarantees that the network quickly reacts to changing resource demands in real time, thus also ensuring optimal performance in a dynamic environment.

The management and monetization layer provides functionality for service assurance. Performance is optimized for each use case and incidents impacting service quality are quickly and automatically detected and resolved. The management and monetization layer has built-in support for reactive and proactive assurance, based on a health check, performance analysis, root-cause analysis, troubleshooting and fast resolution functions.



SUMMARY

5G networks enable new use cases and business opportunities for many industry segments. Network services and applications are offered in a flexible and dynamic way, in a distributed cloud environment, serving multiple customers. New technologies and service models can increase complexity and new management solutions are used to control and reduce operating costs. This is Zero Touch networks.

The new operational model relies on dynamic service orchestration that combines the characteristics of distributed cloud infrastructure, cloud-optimized network applications, NFV, SDN and COMPA. Automated network slice management is implemented in steps, minimizing the risks associated with new architecture. The functionality grows step-by-step in each network domain and is combined across domains in a service orchestration layer.

Ericsson's dynamic service orchestration has template-based deployment of network slices and supports multi-tenancy, service elasticity and performance optimization. This enables 5G services for consumers, enterprises, and industries.

Ericsson AB
SE-126 25 Stockholm, Sweden
Telephone +46 10 719 00 00
Fax +46 8 18 40 85
www.ericsson.com

4/287 01-FGB 101 0325

© Ericsson AB 2017