프라이빗 네트워크 솔루션

강지훈 시니어 컨설턴트

Industrial opportunity

For service providers, there's a lucrative opportunity to provide cellular connectivity to industries

4.3 billion

Number of wireless connections in smart factories by 2030

For industries, the ROI for moving to cellular-enabled Industry 4.0 is strong

1 yr vs. 2 mo

Time to reconfigure an automotive factory – wired vs wireless

Reliable wireless connectivity enables more automation to increase efficiency, productivity, accuracy.

5-25%

Efficiency gains from AR-enabled vision picking or guided product assembly

Dedicated cellular connectivity provides greater reliability and device density, predictable latency and robust security.

$30K per minute

Cost of downtime in an automotive factory

Source: ABI Research

Use case examples in a smart factory

Real-time automation

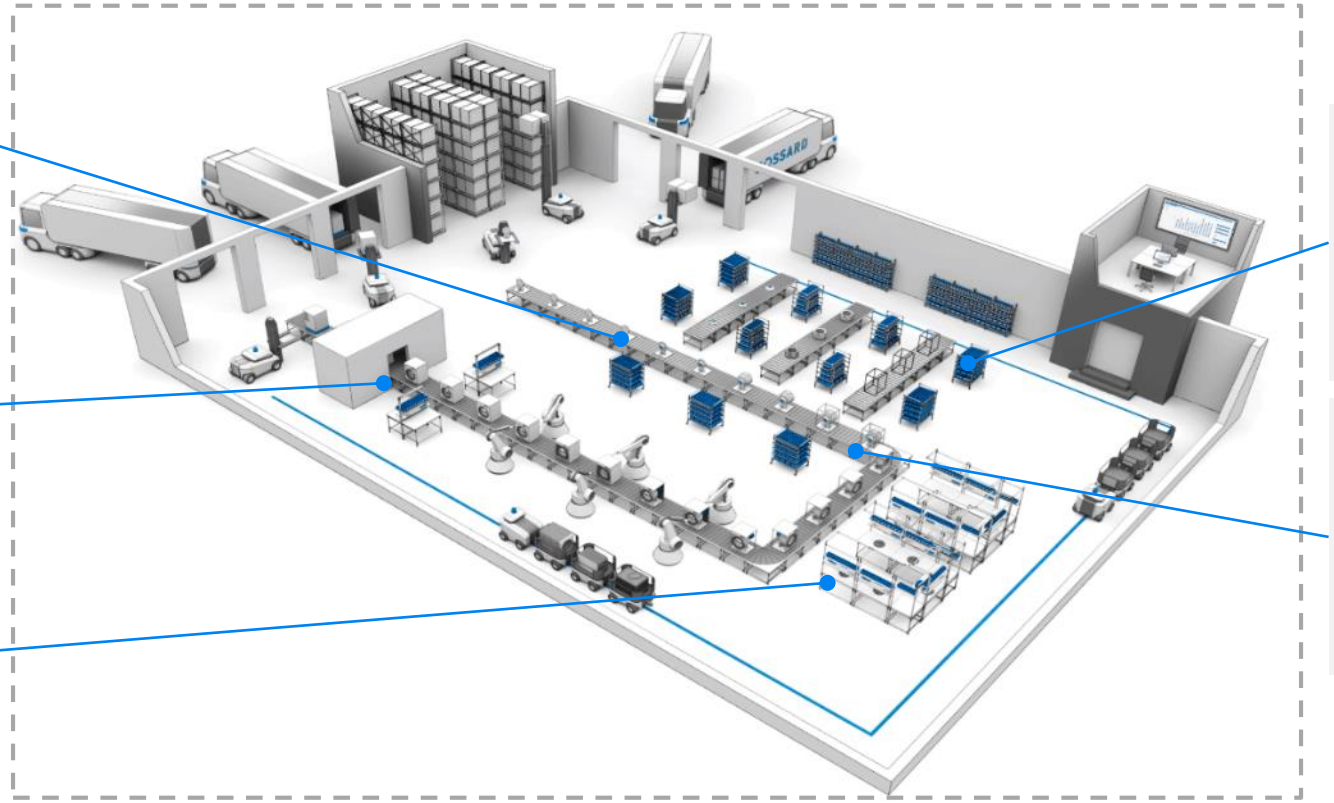
Real-time production chain automation with autonomous mobile robots

Autonomous robotics

Collaborative robots

Augmented reality

AR asset diagnostics



Monitoring and tracking

Asset condition monitoring

Enhanced video services

Digital twin for remote operations

Multiple use cases and benefits – Scaling up initial investment of cellular network deployment

Deployment types to address private networks

Ericsson approach

Reuse of MNO network assets

Isolated

T1	T2	T3	T4	T5	T6
Total slicing	Local RAN + Core slicing	T2 + Local data breakout	T3 + PTT	T4 + Unified Communications	Full network on premise (isolated)
	RAN outdoor/indoor	RAN outdoor/ indoor	RAN outdoor/ indoor	RAN outdoor/indoor	RAN outdoor/ indoor
		EPC	EPC	EPC	EPC
			Push to Talk	Push to Talk + IMS	Push to Talk + IMS
				HSS	HSS
					Only local management

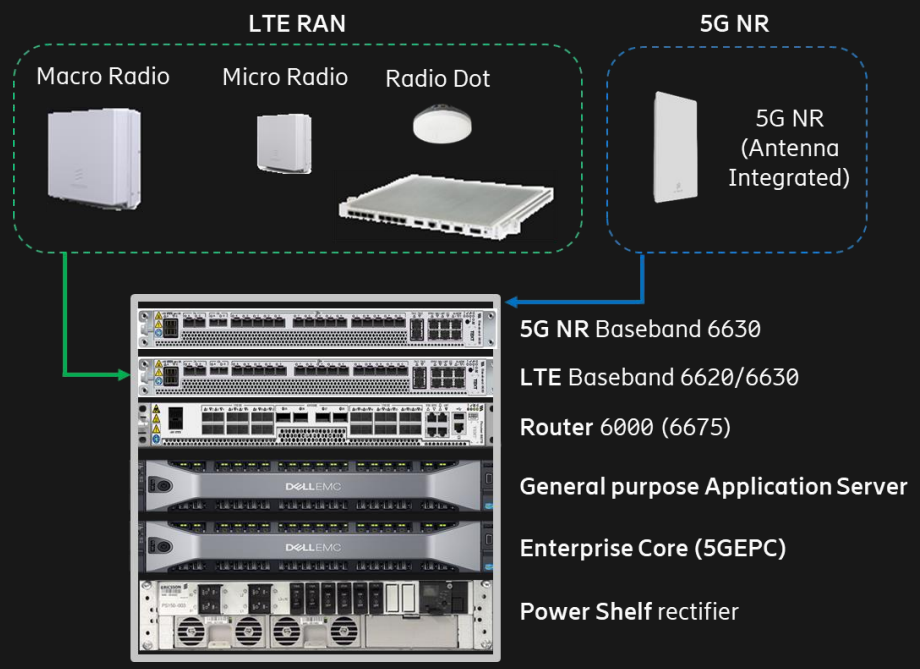
On Enterprise premise Ericsson components

Operator Integrated

Two solutions to address on-premise connectivity

Private Networks

(4G & 5G stand-alone example)



Both stand alone and integrated with operator to scale and re-use of assets
Flexible configurations including critical communications features

Industry connect

Network management portal
IC Sim writer & watchdog

RD2243 (for LTE B7)
RD4442 (for US CBRS)

Network Controller on
2x Dell VEP 4600
in active / hot-standby
configuration

Chassis: RBS 6601
Baseband: IDU 5209 (LTE)
Distribution: IRU2242

Rectifier (Vertiv Netsure 2100)

Controlled environment/indoor solution for
factories and warehouses industry 4.0 applications

Easy to order, easy to install and easy to mange for enterprise IT
Channel ready, CSPs as Value added reseller – designed for GTM scale

Mercedes-Benz cars significantly increases efficiency and flexibility

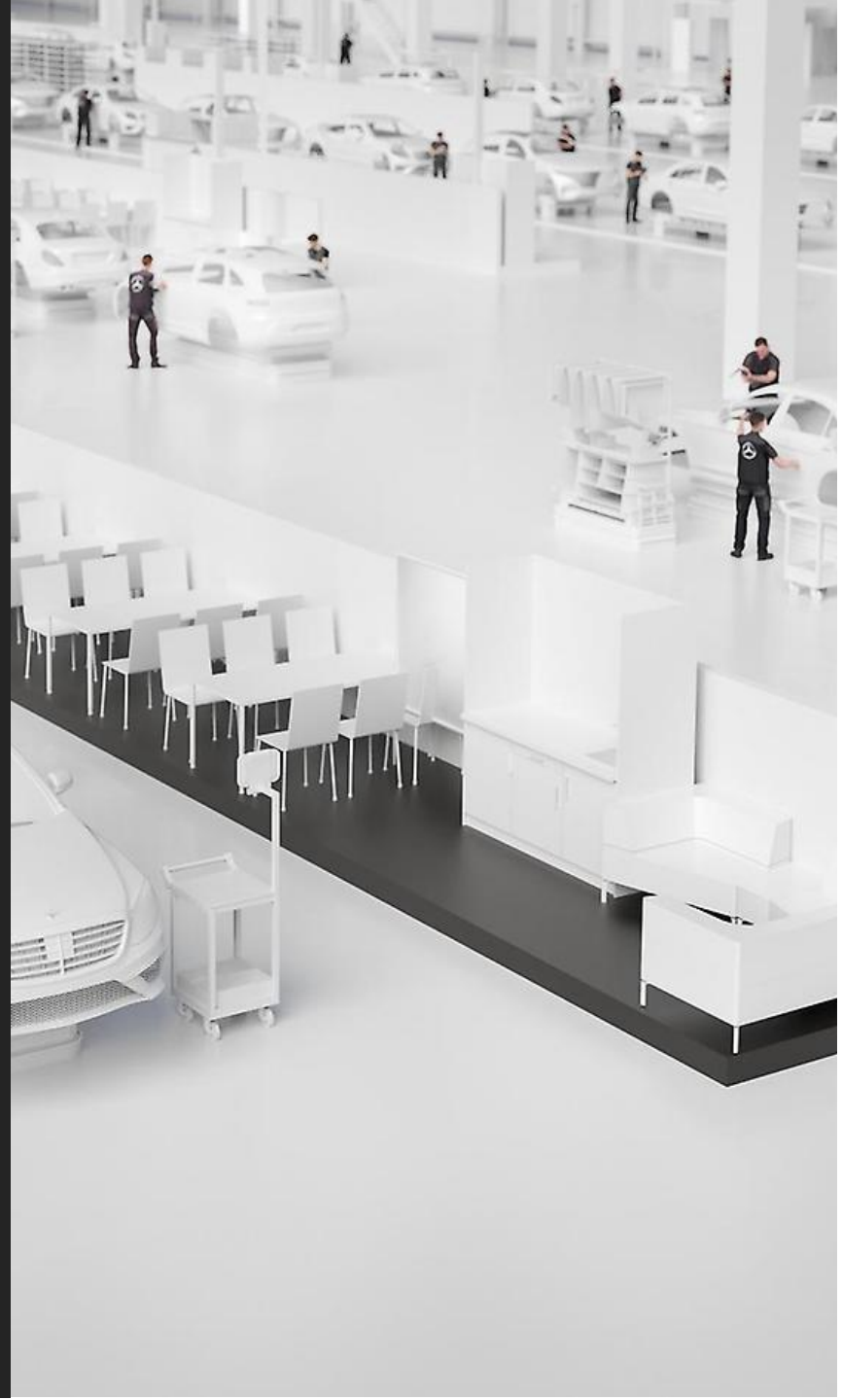
Case: Factory 56

The Challenge

Need of a flexible and connected infrastructure to replace traditional assembly line with driverless transport systems to significantly gain efficiency and flexibility to produce large quantities of very different vehicles

"As the inventor of the car, we are taking digitalisation in production to a whole new level. With the installation of a local 5G network, the networking of all production systems and machines in the Mercedes-Benz Cars factories will become even smarter and more efficient in the future. This opens up completely new production opportunities."

Jörg Burzer, Member of the Divisional Board of Management of Mercedes-Benz Cars



ERICSSON | LG

The Solution

Commercial 5G Network:

- Ericsson Private Network Solution
- Ericsson 5G Radio Dot for high performance indoor
- First phase covers 20.000 of the 220.000 m² of Factory 56

The expected results

- Optimize existing production processes through data linking or product tracking on the assembly line
- Process optimization, which can be adapted on short notice
- Intelligently linking production systems and machines to support the efficiency and precision of the production process
- Sensitive production data stays on premise

Partners

- Telefónica Germany
- Mercedes-Benz

5G for Vehicle Production

Customer: Audi

The Challenge

Current WiFi solutions do not fulfil requirements regarding reliability, device handling and handover. Ethernet cables are inflexible and need regular maintenance to avoid service interruption.

The Solution

Private 5G deployment in Band n78 (3.4-3.8GHz), AIR 6488, RDS 4479, eOSS and integration into factory mission critical ICT infrastructure and Manufacturing Execution System (MES).

The expected results

5G non-public network for industries implemented at a shop floor, will enable controlling of robots, steering of AGVs, firmware download to vehicles and connecting a large amount of devices with pervasive connectivity and low latency

Partners

- Audi

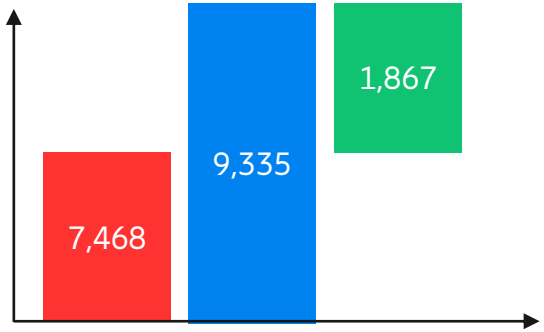
Smart Manufacturing ROI and COI analysis
– Automotive manufacturing in Germany 2021-2025

Status Quo factory

Factory size: 500,000 m²

Legend ($ million)

ROI Analysis



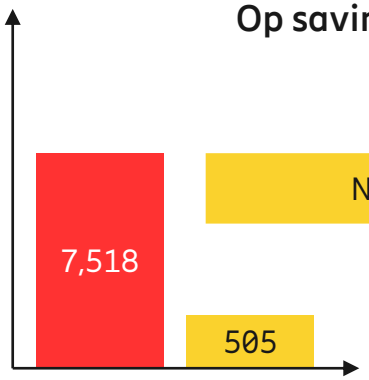
COI Analysis

Lack of investment in connected cellular Industry 4.0 by Status Quo factory **incurs operational inefficiency**

COI: 17.5K Vehicles or US$495 million

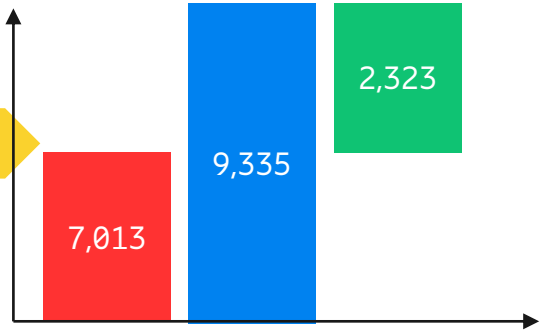
Upgraded factory

Cellular 4.0 investment leads to Op savings



Net result

ROI Analysis



COI Analysis

Gross profit increase: 4.9%
Operational cost savings
ROI: 9.2x

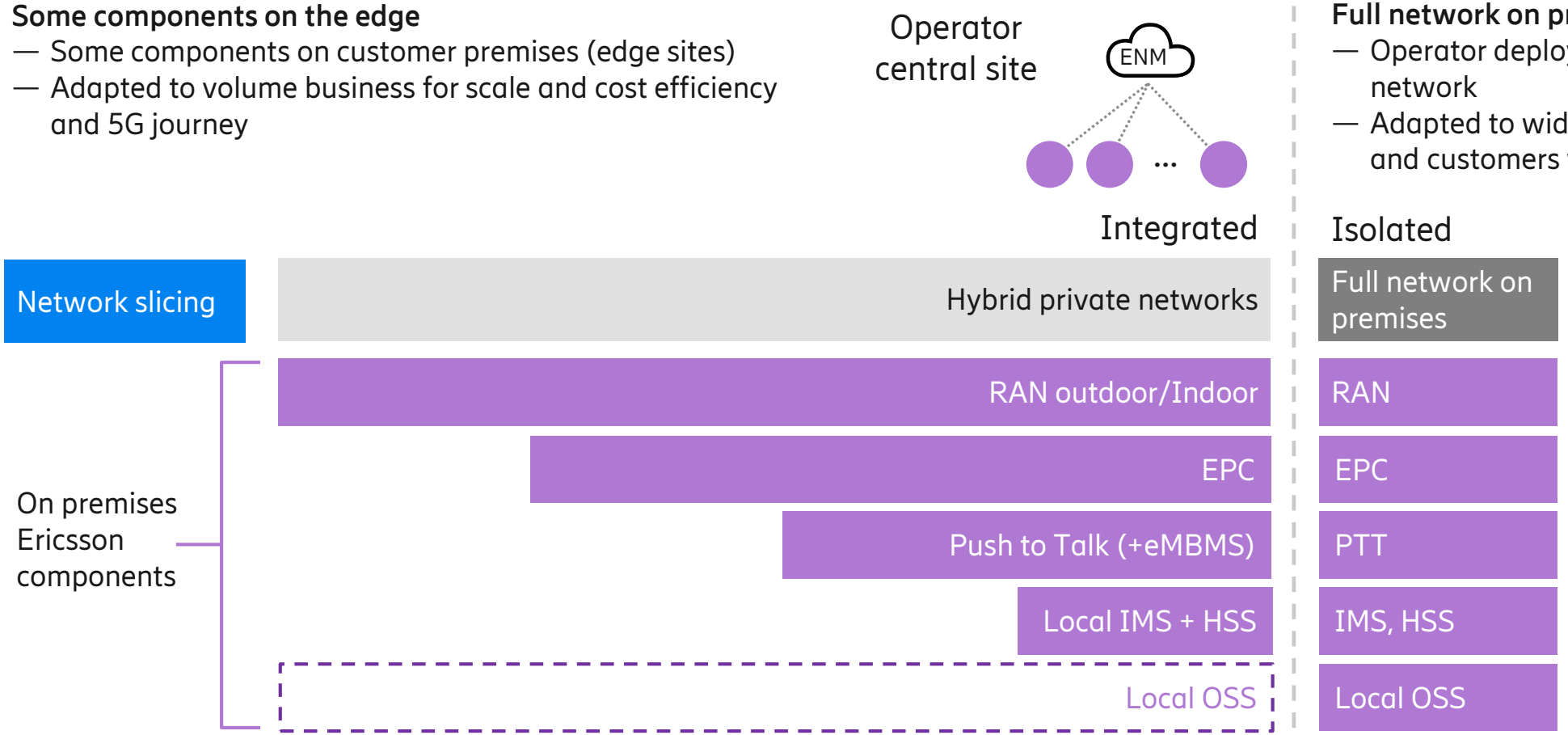
Note: Revenue was kept constant to highlight operational savings impact

Source: ABI Research

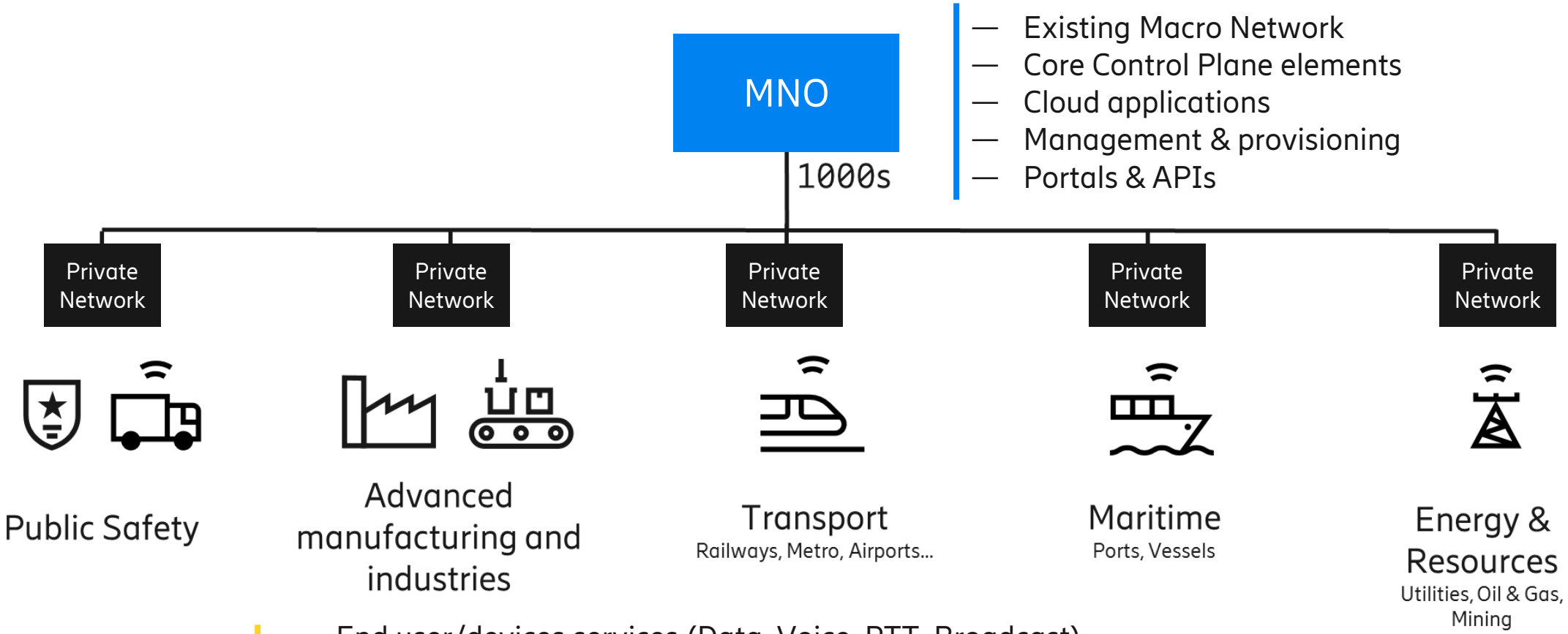
Local networks – Flexible deployments for private networks enabling business scalability

Some components on the edge
- Some components on customer premises (edge sites)
- Adapted to volume business for scale and cost efficiency and 5G journey

Full network on premises
- Operator deploys full dedicated network
- Adapted to wide area networks and customers with critical needs



Private networks in thousands



— End user/devices services (Data, Voice, PTT, Broadcast)
— Local high availability & services survivability
— Quality of service, security, throughput, latency

Private Network - Operations scope
– standardized base & flexible scope

Service scope / Objects of Service	Design & planning	Testing & validation	Release & deployment	Transfer-to-operations	Change mgmt	Dynamic Event mgmt	Incident mgmt	Smart problem mgmt	Preventive maintenance	Asset & config. mgmt	Perf. mgmt & optimization	Capacity mgmt	Security mgmt.	Field services
NE infrastructure														
Nodes / VNF:s														
SW updates & upgrades														
HW replacements & upgrades														

In scope of ops.

Optional scope

Core network management for private networks

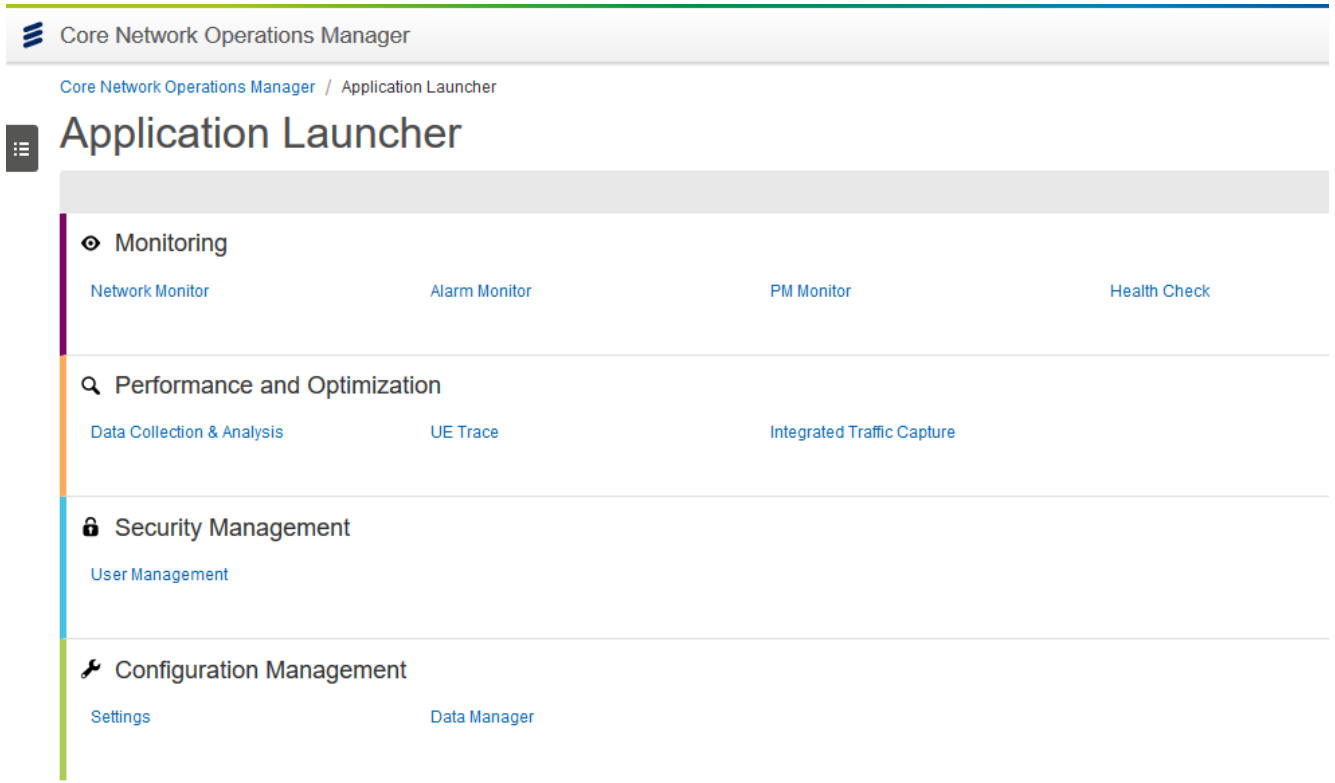
CNOM

- Core Network Operations Manager (CNOM) comprises a set of GUI-based applications to facilitate operations use cases in the Core Network domain (EPC and IMS)

- Main applications:
  - Network Monitor
  - Health Check
  - Data Collection & Analysis
  - UE Trace
  - Integrated Traffic Capture

- The main target group is operations personnel

- CNOM is sold as part of the
  - Core Network Base Package in ENM
  - Ericsson Network Director (END)



Network Monitor

Create Health Check Report | Health Check | Traffic Analysis

mme087

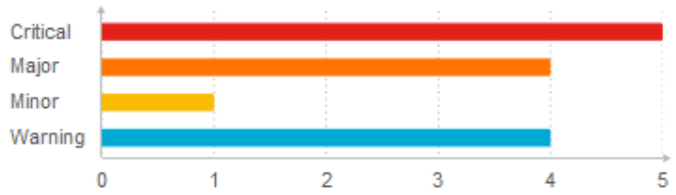
Summary View | Detail View | Timeline View

Node Status

Monitoring Status	Started
Node Type	SGSN-MME(LWG)
HW	VIRTUAL
SW	CXS101289_R71F07(001-00-10)
OS Uptime	102 DAYS
UTC Time Offset	UTC+0200

Timestamp: Mon Apr 30 2018 19:50:28 GMT+0800 (China Standard Time)

Alarm Summary



Timestamp: Mon Apr 30 2018 19:50:29 GMT+0800 (China Standard Time)

Throughput

Throughput | 3 Selected

Subscribers

3 Selected | Reference: Average last hour

Name	Current	Reference
AttachedUsers.L	38	42
AttachedUsersSGs.L	0	0
PdnConnections.L	38	43
Bearers.L	38	43
AttachedUsers.W	2378	1054
PdpContexts.W	0	0
AttachedUsers.G	2350	1052
PdpContexts.G	0	0

Timestamp: Mon Apr 30 2018 19:49:00 GMT+0800 (China Standard Time)

CPU Load

Reference: Average last hour

2.1(AP/DP/LC/SS7_SCTP_DP)	Current:	21%
	Referen...	17.7%
2.2(AP/DP/LC/SS7_SCTP_DP)	Current:	21%
	Referen...	17.8%

Failure Ratio KPI

Accessibility

5 Selected | Reference: Average last hour

AttachFR.L	Current:	100%
	Referen...	51.7%
AttachFR.W	Current:	0%
	Referen...	0%
PdpCtxActFR.W	Current:	100%
	Referen...	51.7%
AttachFR.G	Current:	0%
	Referen...	0%
PdpCtxActFR.G	Current:	100%
	Referen...	51.7%

Retainability

3 Selected | Reference: Average last hour

PagingFR.L	Current:	0%
	Referen...	0%
PagingFR.W	Current:	0%
	Referen...	0%
PagingFR.G	Current:	0%
	Referen...	0%

Network management for MNO/CSP managed private networks

Comparison of capabilities

Network Management for MNO/CSP managed Private Networks

ENM – Focus for MNO/CSP

- VNF/CNF/PNF Software Management
- Scale 1000s/10000s VNF/CNF/PNF
- Bulk Network Provisioning
- Full Network Performance Management
- Radio Network nodes Auto- Provisioning
- Full Network Fault Management
- MNO/CSP User Management
- Full Network Configuration Management

Network Runner – Focus for Enterprise

- Scale 10s/100s VNF/CNF/PNF
- Key Performance Indicators for Private Networks
- Fault Identification for Private Network Operations Issues
- Private Networks simplified NW Provisioning
- Simplified Day to Day Private Network Operations Tasks
- Private Networks Subscriber Provisioning
- Private Network User Management
- Private Networks Subscriber Services Provisioning

Summary of 2 key functional capabilities

EMS
(ENM)

The heavy lifting Telecoms FCAPS tool set that the MNO/CSP (or in some scenarios the Enterprise) use to do the detailed Network & Element management of the private network. In all scenarios this role is fulfilled by ENM.

Unique in that this is available for the MNO/CSP to be offered to the Enterprise to give a more tailored perspective of the same network managed by the EMS

Enterprise Portal
(Network Runner)

An abstracted (as in fit for purpose) monitor and dashboard for the Enterprise to view PN availability & status as well as a front end for Enterprise Subscriber provisioning. Very simple network O&M use cases. Role fulfilled by Ericsson Network Runner.

Values: Evolved solution

Network Management for MNO/CSP managed Private Networks

Optimal OPEX: MNO/CSP

ENM Grouping & Separation of Private Networks

Optimal OPEX: Enterprise

Network Runner Portal

Minimal Provisioning Effort & Time To service

Automated NW & Subs rollout

Flexibility

MNO/CSP Mix & Match Scenarios to suit individual Enterprise

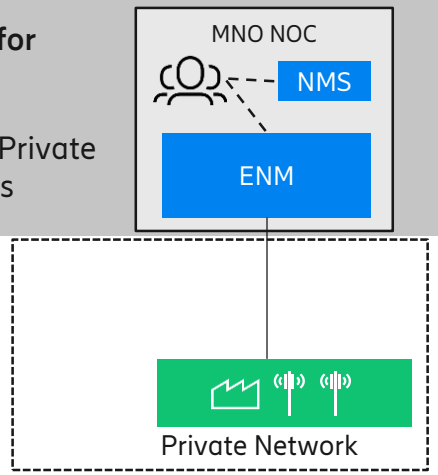
Scenarios – Network management for MNO/CSP managed private networks

Efficient central management for multiple Private NW

ENM Separation & Grouping of Private networks for network operations

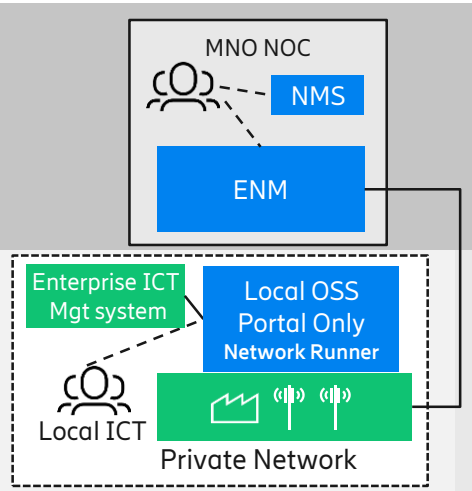
Integrated Scenario:

Full Central Management



Integrated Scenario:

Local Normal Operations with survivability

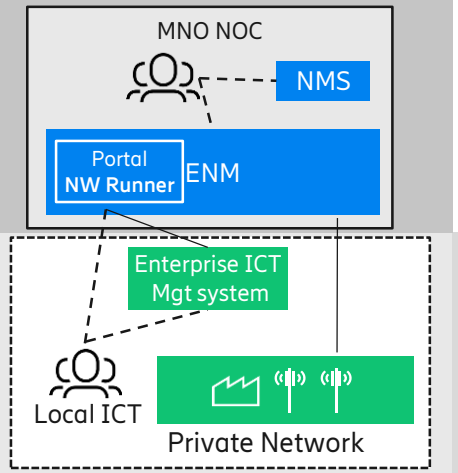


Simplified Local Status Views

Normal Operations Local management with survivability

Integrated Scenario:

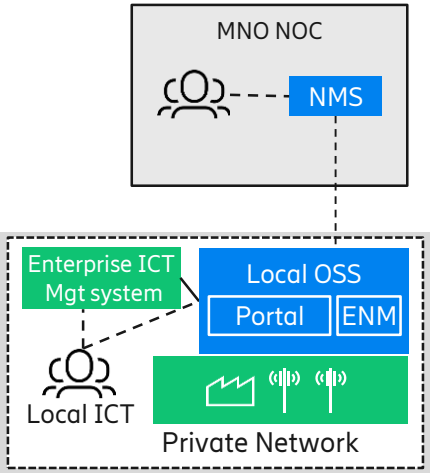
Local Status Views



Simplified Local Status Views

Isolated Scenario:

Full Local Management



Simplified Local Status Views

Full Operations Local management with survivability

Ericsson Network Runner

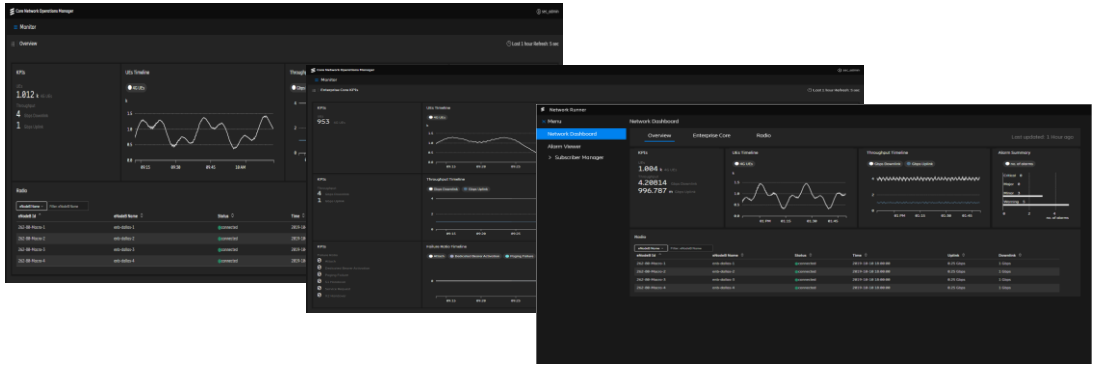
Network Runner management for Private Networks (First Release)

Monitor Network Performance – contextual dashboard view. ✓

Immediate notification of serious issu es or faults related to the network. ✓

Capability to identify locally remedial network corrective work required. ✓

Capability to observe & monitor subsc ribers. ✓

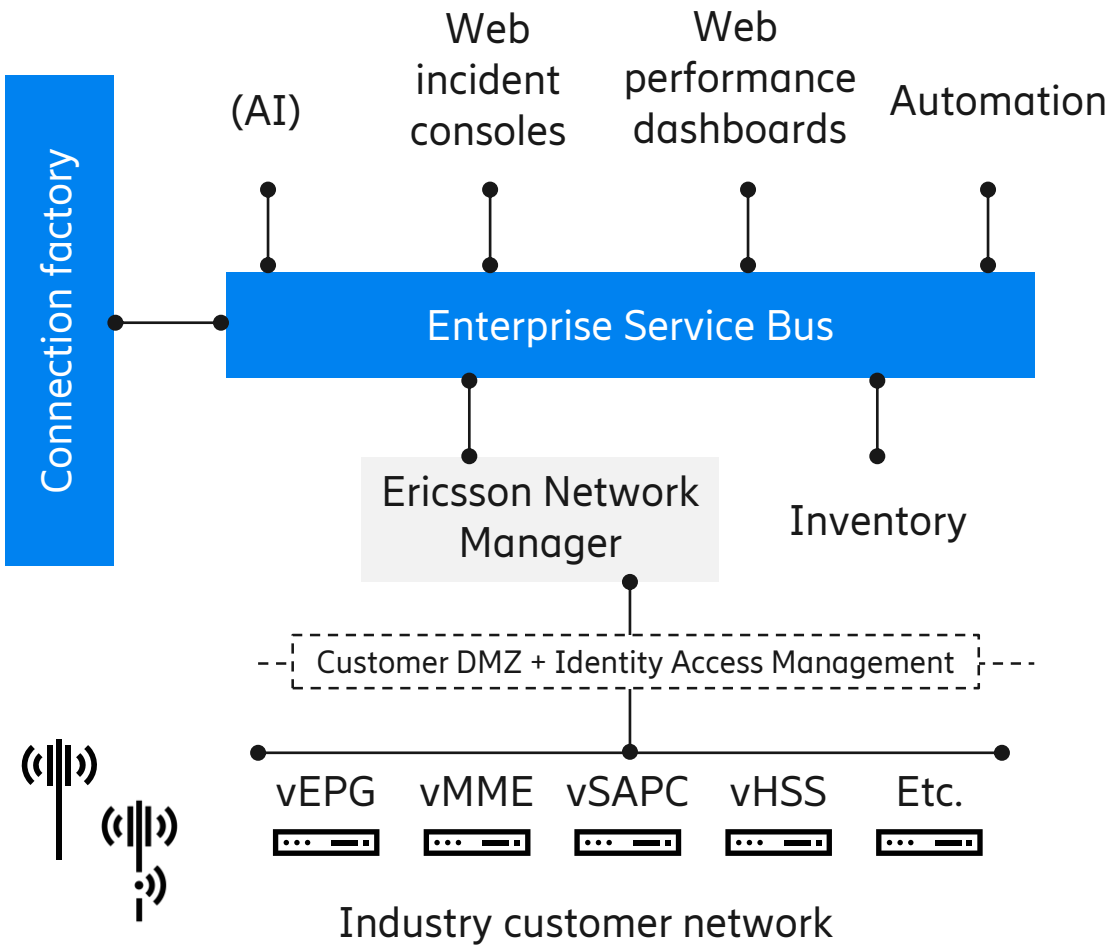


- Targeted at Enterprise staff who are not Telecoms prof essionals
  (contextual monitoring of network performance and cri tical system functions)
- Built as Cloud Native
  (minimal footprint & future-proof deployment environ ments and connectivity)

Private Networks Operations

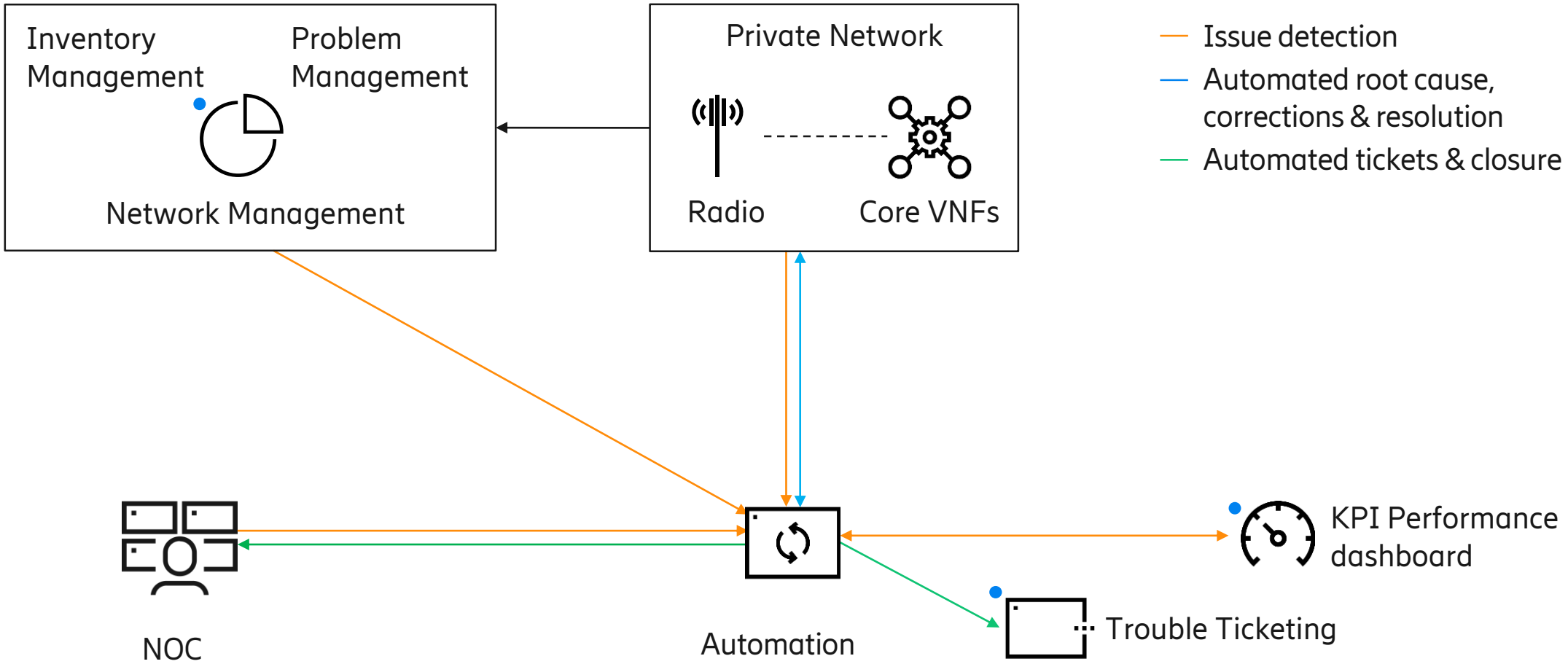
A “light-weight” Operations Engine for Private Networks that leverages automation, AI and Machine Learning capabilities and enables quick time-to-market.

Managed Services "light-weight" Operations Engine for private networks



- Cover full scope - radio, VNFs and applications
- Based on high-levels of automation
- Web-based access to performance & status
- Secure user access management & zone based conn ections
- Low touch integration through Connection factory

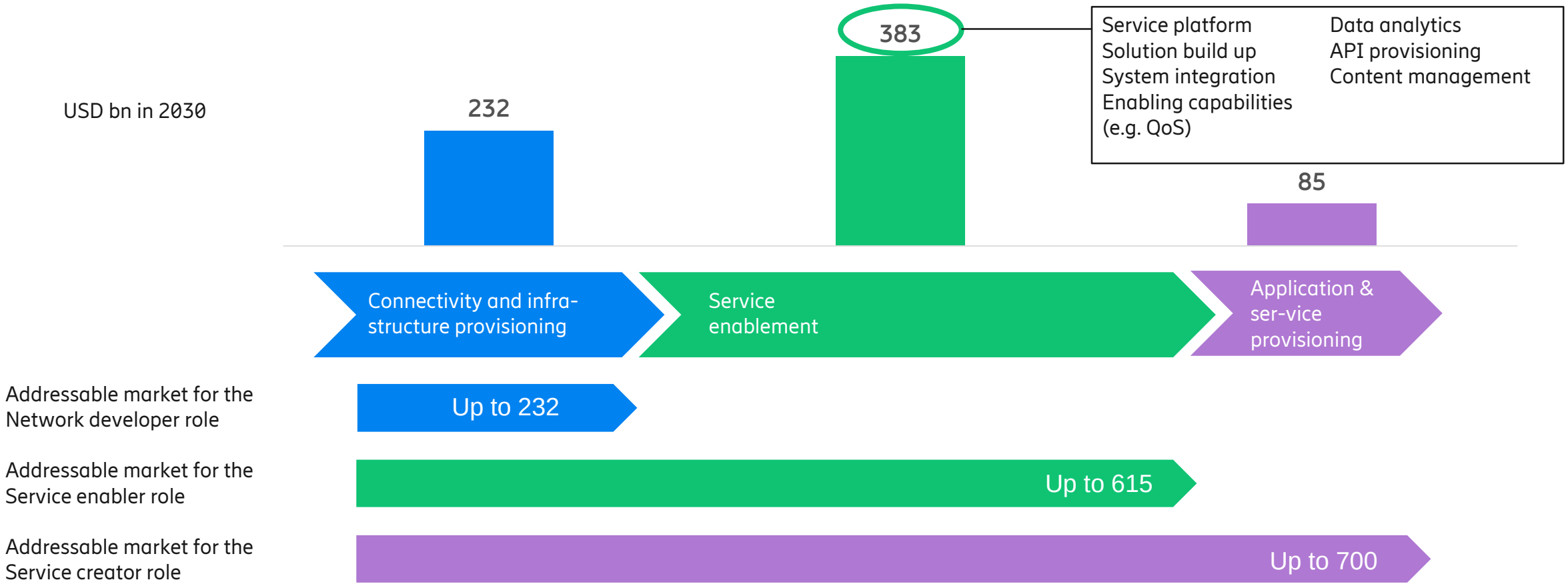
Self-healing automation architecture for private networks



Core network exposure (SCEF and NEF)

Opens mobile network capabilities allowing network operators to collaborate with partners by creating an ecosystem for innovation and new service creation

Network exposure business potential for service providers



Service enablement opportunity includes network & data exposure solutions and connected services revenue

Source: Ericsson and Arthur D. Little

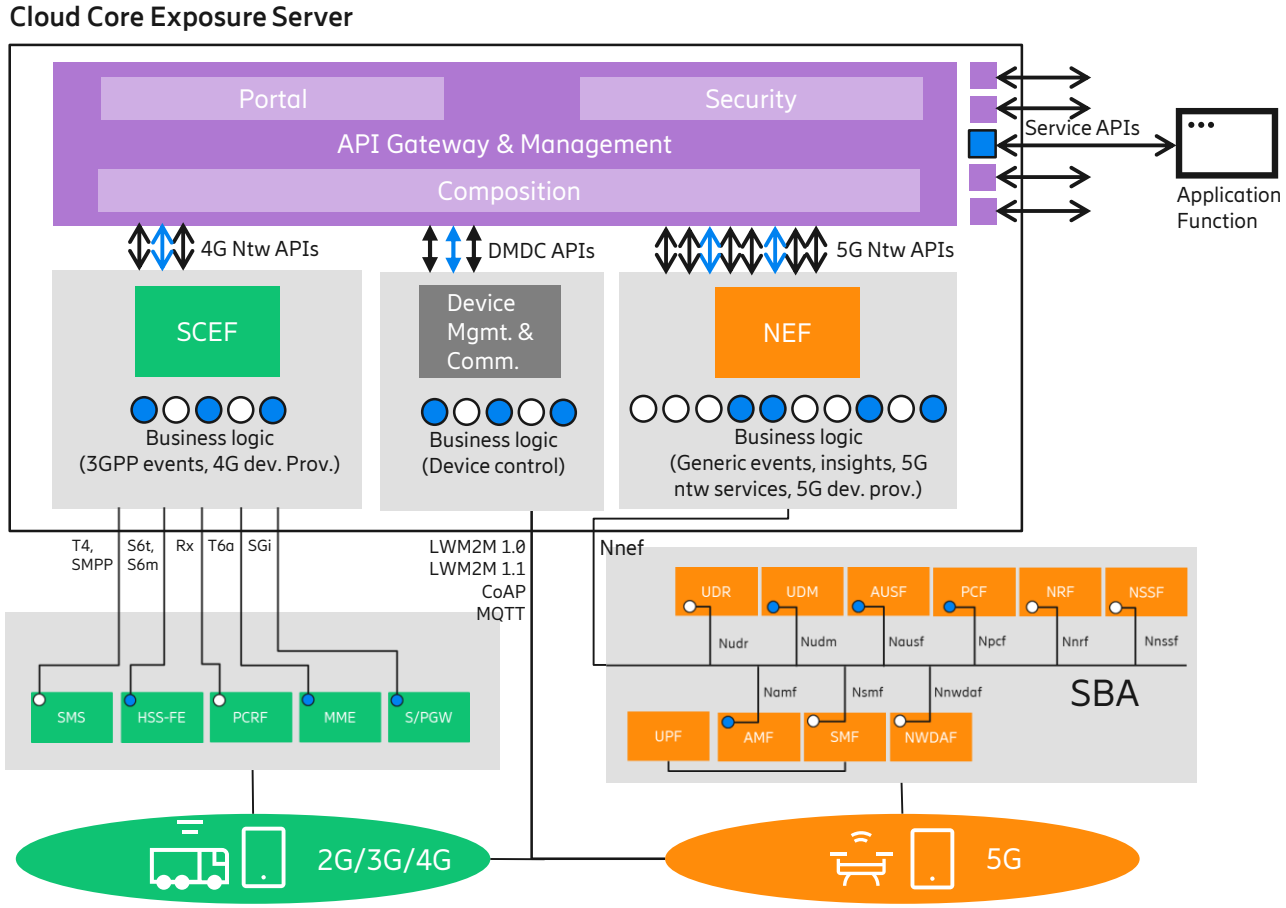
Foster business innovation
– With core network exposure capabilities

Centralized API management, embedded API gateway and exposure capabilities, enabling:

- Standard and tailored APIs per applications and use cases
- The ability to open 4G and 5G Core network capabilities to third parties.
- Increased network automation for operational efficiency.

New revenue	Network programmability

Read the Ericsson report: [Programmability in 5G Core networks]

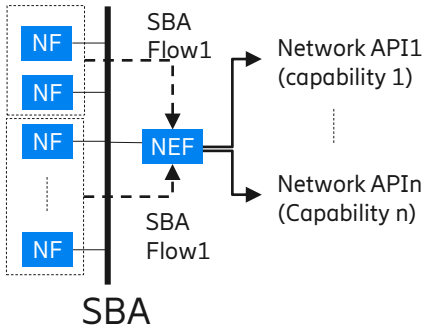


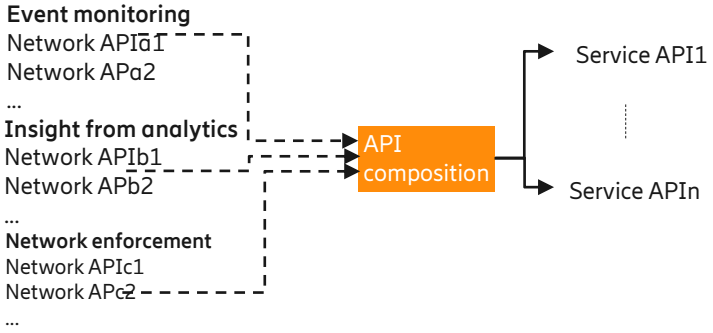
Ericsson API Exposure Process
– Creating developer experience

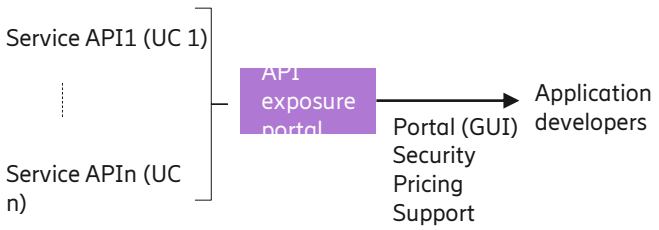
Activate Core Network Capabilities

Compose capabilities to create Service API tailored around specific Use Cases

Expose Service API towards Application developers securing pricing, LCM and security mechanisms





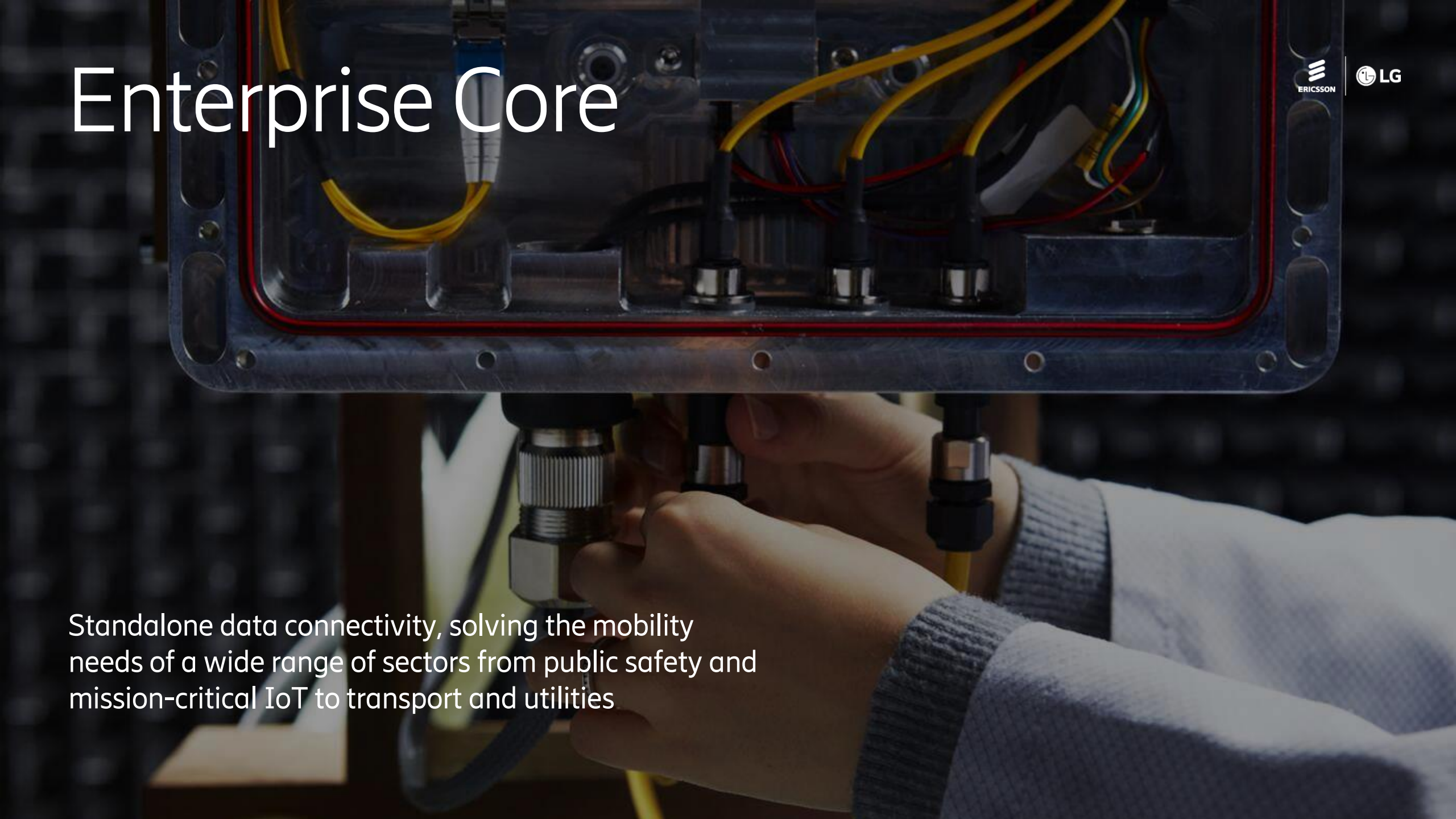


SBA enables the creation of specific communication flow between NF and NEF (based on standard i/f), focused to expose Network Capabilities through standard Network API

The composition of Network APIs enables the creation of Service APIs designed around specific Use Cases. A Service API is typically a combination of the following API categories: monitoring (detect something), insight (analyze and deduct) and enforcement (take action in the network)

Service APIs can be sold to the market of application developers offering an API management system able to secure registration, payment, life-cycle management, support, etc.

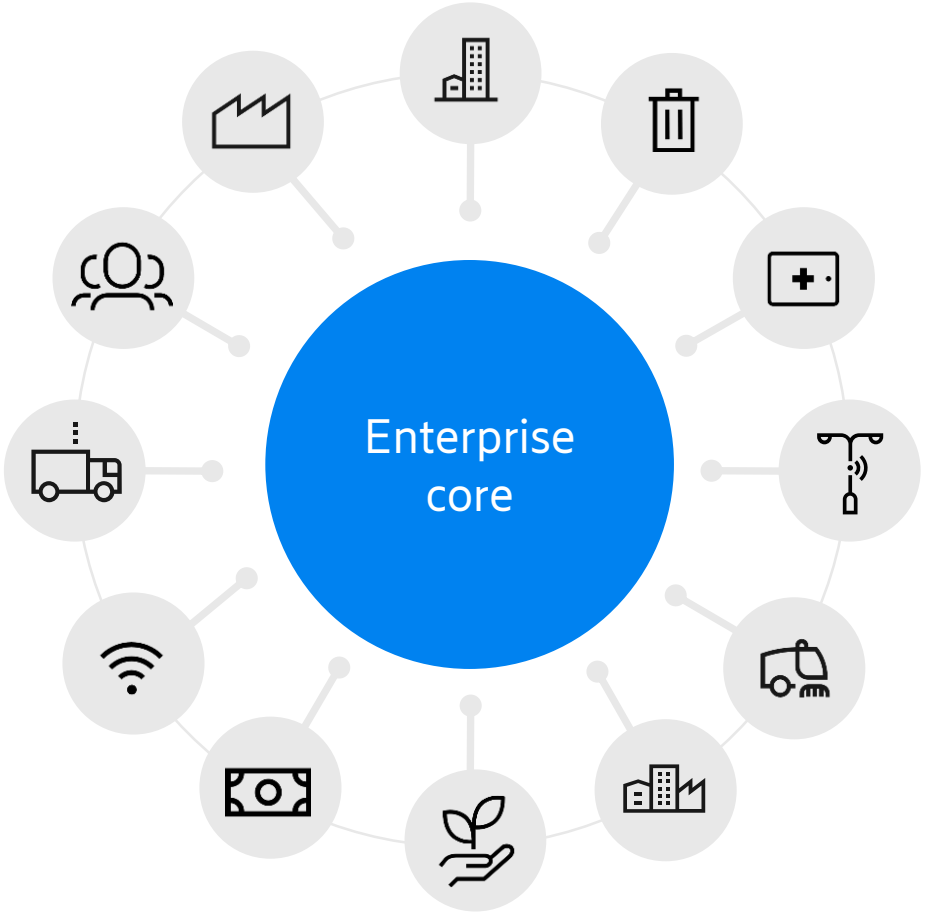
Enterprise Core



Standalone data connectivity, solving the mobility needs of a wide range of sectors from public safety and mission-critical IoT to transport and utilities

Enterprise Core

- Single/dual server deployment
- Full set of market-leading EPC, Policy and UDM network functions
- Carrier grade KPIs and characteristics
- Automation and pre-configuration to decrease complexity
- Fast and simple deployment



Enterprise Core base package and value packages

Value Package — Requires the SW Base package, with same capacity

Price Parameter: Per system size (500, 1k, 5k, 10k, 20k and 50k users)

EPC	UDM	EDA	NWD
	Communication	Communication	
High Availability & Pooling	Advanced Network Protection	Advanced Network Protection	
5G EPC	5G EPC	5G EPC	Network Runner
Enterprise Core EPC Base Package	Enterprise Core UDM Base Package	Enterprise Core EDA Base Package	Enterprise Core NWD Base Package

Cloud Eco-System Support

SW Subscription and Product Support

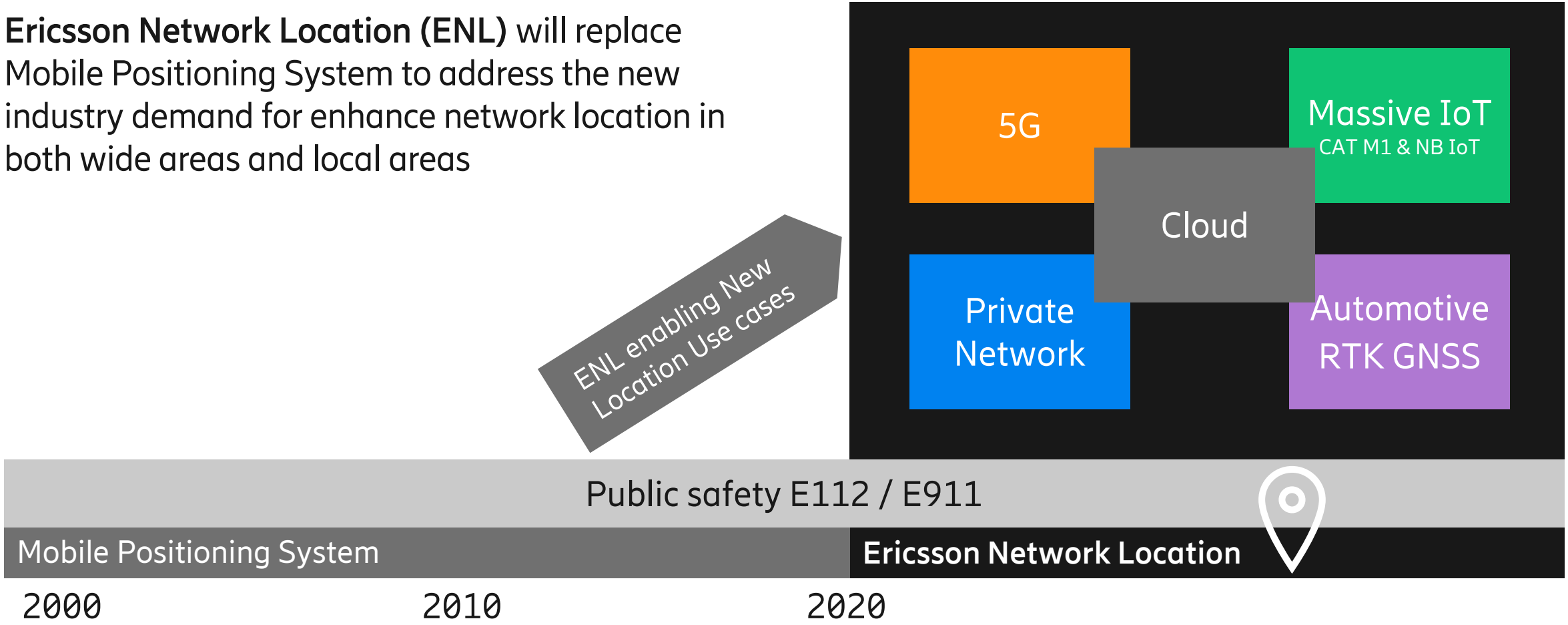
Cloud Execution Environment

Ericsson Network Location

Location everywhere

Network location evolution

Ericsson Network Location (ENL) will replace Mobile Positioning System to address the new industry demand for enhance network location in both wide areas and local areas



Full stack 3GPP Network Location technology – Ericsson Network Location

RDS positioning key enabler for industry verticals

RD 2242/
RD 2243/
RD 4442

Ericsson Radio Dot System

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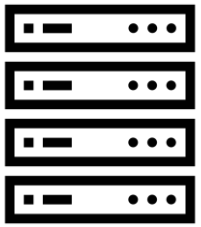
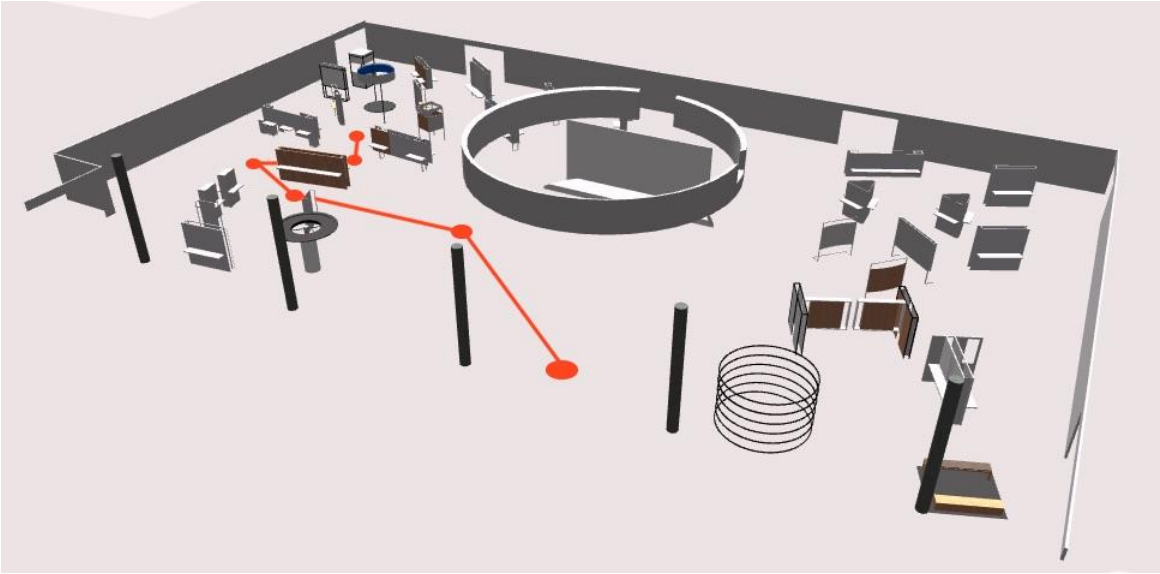


Locate connected devices indoor with high accuracy while providing superior connectivity and capacity



Ericsson Network Location

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