

■ ENTERPRISE · INDUSTRY · M2M/IOT

Private LTE / 5G Networks

Turn-key 4G and 5G Standalone cores and a dedicated core for M2M/IoT — secure, high-performance connectivity for every enterprise site.



Rel. 17

3GPP-compliant 5G SA core

4G + 5G

NSA and Standalone cores

20

Live private LTE/5G networks

MCPTT

Plus VoLTE and VoNR voice

■ WHY PRIVATE LTE / 5G

Enterprise connectivity: the next growth frontier

Industrial automation and M2M/IoT are the fastest-growing segments in telecom. Automated, non-human connections are on track to outnumber traditional subscribers — and they need connectivity that public networks were never designed to deliver.

Industrial traffic must be processed as close to its source as possible. Many sites — mines, ports, plants and remote facilities — lie outside commercial coverage, where building traditional telecom

infrastructure makes no business sense. And every IoT vertical demands its own mix of bandwidth, latency, reliability and security.

Private LTE/5G meets all of these needs on one dedicated, carrier-grade network — a mobile network built and operated for a single enterprise or campus.

■ The enterprise advantage over public networks

Dedicated performance

Capacity engineered for the customer's own traffic model — free from public congestion, with consistent ultra-low latency and optimised traffic paths.

Security & data sovereignty

Data stays on premises. The enterprise decides which devices may connect, and operational networks can be physically separated from corporate IT.

Complete control

Full authority over network policies, QoS prioritisation, upgrade cycles and device access rights.

Coverage where it matters

Purpose-placed small cells eliminate dead zones in mines, factories, warehouses and metal-heavy plants where public signals and Wi-Fi fail.

■ A fast-growing global market

\$4.4–5.9 bn

Global private LTE/5G market value in 2026

\$24–150 bn

Projected by the early 2030s, depending on the scope of infrastructure included

Hundreds

Of private networks already launched worldwide

Source: Grand View Research. Leading network vendors have launched dedicated private-network product lines, and industry leaders in mining, logistics, energy and the public sector — including Rio Tinto, Newcrest, Ocado and Enel — already run their operations on private LTE/5G.

Where private networks are launched

Site type	Networks	Industry	LTE	5G
Factory	92	Manufacturing	28	80
Mine	45	Transport & logistics	44	29
Port	39	Mining, oil & gas	43	13
Research centre	26	Utilities	25	6
Industrial plant	21	Public sector	17	8
Smart city	16	Education	10	10

Source: Analysys Mason. Leading applications: industrial equipment (65 networks), AGVs and autonomous vehicles (37), asset tracking (36) and mobile broadband (32).

INDUSTRY USE CASES

Use cases that transform operations

From Industry 4.0 and smart cities to mines, ports and utilities, private LTE/5G connects people, machines and data with the reliability that business-critical operations demand.

Secure telemetry

Reliable, encrypted collection of machine and sensor data.

CCTV & video analytics

High-uplink video over LTE/5G with AI-based analytics.

Group communications

Push-to-talk, voice and video for every team on site.

100% call recording

Full recording of operational voice for compliance.

Network access control

A local EIR ensures only approved devices connect.

Automated vehicles

Remote-controlled and autonomous machinery at scale.

Asset & staff tracking

Real-time location of people, vehicles and equipment.

Device management

Central control of SIMs and devices across all sites.

MCPTT: the broadband successor to professional radio

Mission Critical Push-to-Talk (MCPTT) is the 3GPP standard for broadband group communications over LTE and 5G — the natural replacement for ageing professional mobile radio such as TETRA and P25.

Fast radio-resource allocation and dedicated QCI/5QI classes give critical traffic absolute priority, while teams gain individual, group and broadcast calls, HD voice and video, file transfer and messaging.

TARGET VERTICALS

Where private networks create value

Industry 4.0

Wireless robots, AGVs and connected production lines.

Mining, oil & gas

Autonomous haulage, remote operation and worker safety.

Transport & logistics

Warehouses, rail and fleet operations with real-time tracking.

Ports & airports

High-density sites with cranes, vehicles and ground crews.

Utilities & energy

Smart grid, substations, pipelines and power plants.

Smart & safe cities

CCTV, critical infrastructure and mission-critical voice.

Spotlight: the connected mine



Automation of mining and transport

- Real-time telemetry from every machine, including moving trucks
- Predictive maintenance for trucks, excavators and drills
- Unmanned trucks and excavators, with remote control when needed
- Predictive mine analytics: soil and slope sensors detect dangerous shifts
- Intelligent equipment monitoring with vibration and temperature analysis
- Automated ore loading and fleet geolocation

Industrial safety and personnel monitoring

- HD video and computer vision to detect violations and people in hazardous zones

- MCPTT replaces legacy PMR, adding video and multimedia
- Cell Broadcast warnings, smart wearables with SOS and fall detection
- Missing-helmet detection and behaviour analytics
- Real-time positioning of personnel and equipment

End-to-end digital mine

- All quarry data in a single cloud system
- Cloud dispatching and load forecasting
- Digital twins of production processes
- Real-time warehouse and inventory tracking
- Automatic detection of breakdowns and leaks
- Integration with ERP systems

BUSINESS MODELS

Flexible business and deployment models

Private networks can be owned by the enterprise or delivered by the operator as a service — on operator spectrum, dedicated industrial spectrum or shared bands.

Spectrum and licensing options

Model	How it works
Operator spectrum (MVNO-style)	Frequencies belong to the mobile operator; the enterprise builds the full core except the radio access.
Dedicated industrial spectrum	Government allocates spectrum for industry-related projects — for example, 700 MHz in South Korea.
Shared and unlicensed bands	3.5 GHz CBRS in the US, 5 GHz in Europe; LTE Bands 87/88 under discussion.

Who does what

Private LTE / MEC

Business communications (IMS/VoLTE, with MCPTT as an option), enterprise data services and data feeds to automation and industry-specific platforms.

Mobile operator

Internet access, external communications beyond the industrial sites, national and international roaming, and connectivity between sites and to the operator core.

Two proven commercial models

Option 1 • Build & Operate

The enterprise funds and owns the private core, provides sites, power and intra-site connectivity, and integrates with ERP and automation systems. The operator procures radio and core to specification, transfers ownership, allocates spectrum, maintains the core as a managed service and provides Internet, roaming and interconnect.

Option 2 • Network-as-a-Service

The enterprise defines services, coverage and SLA, provides sites and power, and pays a recurring fee. The operator procures and rolls out radio and core, allocates spectrum, maintains the network and delivers a turn-key service against the enterprise's RFP and SLA.

Private network services

Voice services

VoLTE/VoNR point-to-point calls, MCPTT multipoint and broadcast group calls, and dispatcher voice.

Data services

CCTV over LTE/5G, telemetry and monitoring, autonomous vehicles, staff, vehicle and asset tracking, AR/VR, digital twins and assisted driving.

PROTEI PORTFOLIO

PROTEI Private LTE / 5G NSA: a turn-key 4G core

A complete, fully virtualised 4G core — with services and BSS functions — from one vendor, integrated and tested together and compatible with eNodeB equipment from multiple vendors.

Core

HLR/HSS · EPC · DPI

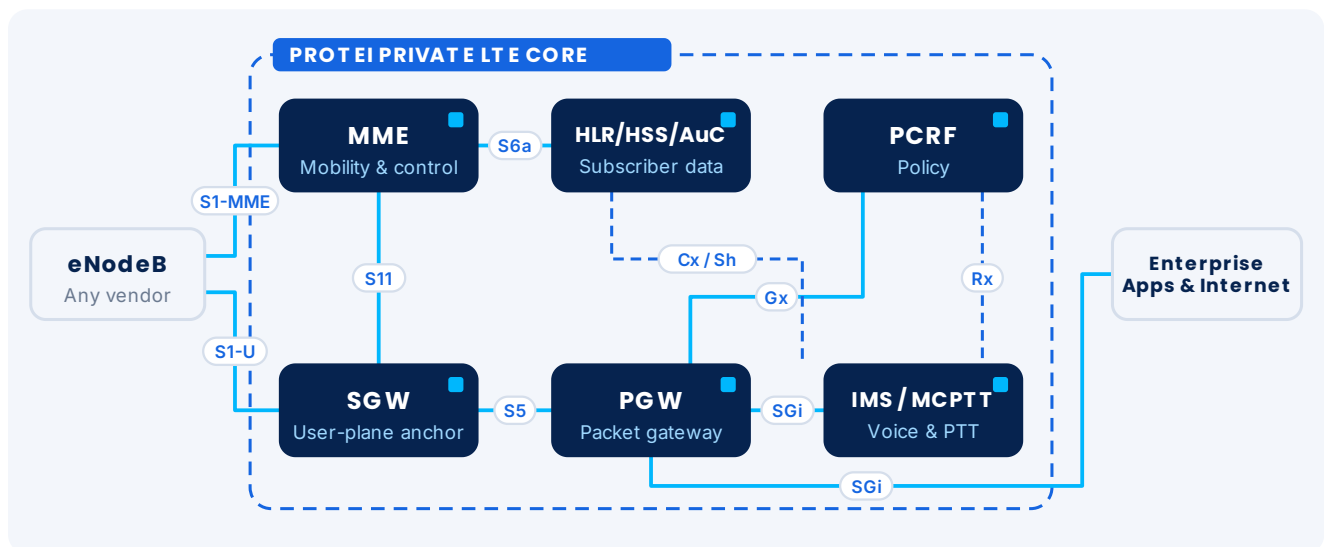
Services

IMS/VoLTE · MCPTT · Messaging (UC)

BSS domain

PCRF · M2M connectivity management

- ✓ 3GPP Release 16 compliant
- ✓ Fully standardised 3GPP interfaces
- ✓ QCI support for GBR and MCPTT services
- ✓ Up to 30 Gbps per EPC and up to 100,000 subscribers
- ✓ Dedicated core networks (DCN/DECOR)
- ✓ 5G NSA (Option 3) ready



PROTEI Private LTE/5G NSA core: all core elements from one vendor, integrated and tested together

PDN-GW / GGSN

The gateway to external networks: GTP tunnel termination, RADIUS authentication, inter-RAT handover, IP address allocation and optional built-in PCEF.

SGW

The user-plane anchor: routes and forwards user packets, anchors mobility during handovers, terminates downlink data and triggers paging for idle devices, and manages UE contexts.

MME

The key control node: idle-mode tracking and paging, bearer activation and deactivation, SGW selection at attach and intra-LTE handover, and subscriber authentication.

DPI

Traffic intelligence for the private network: prioritisation, bandwidth management, service differentiation and service delivery based on PCRF policy.

CHOOSING THE RIGHT TECHNOLOGY

LTE, 5G NSA or 5G SA?

	LTE (4G)	5G NSA	5G SA
Architecture	EPC core	5G RAN + 4G core	Full 5G Core (5GC)
Latency	30–50 ms	20–30 ms	3–10 ms (URLLC)
Peak throughput	~1 Gbps	~2 Gbps	10 Gbps+
Network slicing	No	No	Native (S-NSSAI)
Local breakout	Via CUPS	Via CUPS	Distributed UPF
Positioning	Lowest entry barrier	Reuses 4G investment	Full 5G value

LTE offers the lowest total cost of ownership for basic data, voice and IoT with relaxed latency. **5G NSA** is the fastest path to higher speeds on the existing 4G core. **5G SA** is required for network slicing, ultra-low

latency, distributed local breakout and full independence from 4G — the only option for mission-critical and sovereign private networks.

PROTEI PORTFOLIO

PROTEI Private 5G SA: a cloud-native core for industry

A cloud-native, service-based 5G Core built to 3GPP Release 17 — with network slicing, local breakout and mission-critical services.

Core

UDM/UDR · AUSF · AMF · SMF ·
UPF · NRF

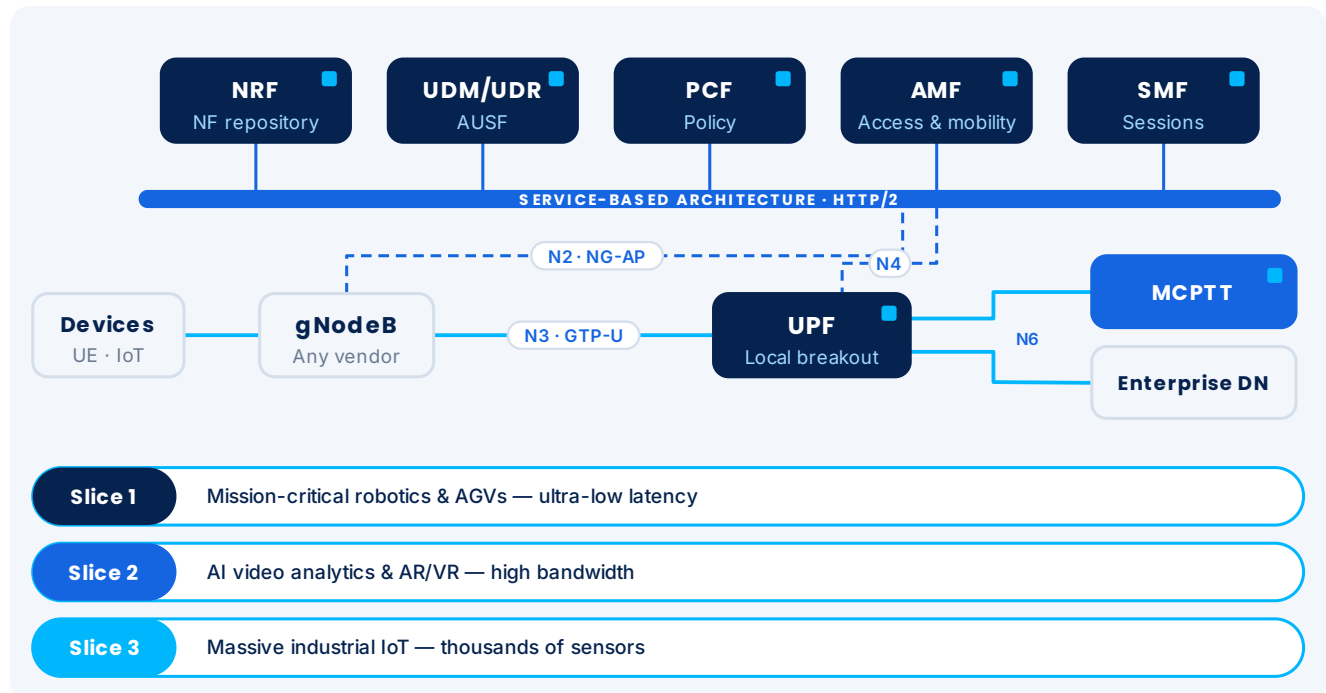
Services

IMS/VoNR · MCPTT · Messaging
(UC)

BSS domain

PCRF/PCF · M2M connectivity
management

- ✓ 3GPP Release 17+ compliant
- ✓ Static or dynamic network slicing
- ✓ Fully standardised 3GPP interfaces
- ✓ Up to 30 Gbps per instance and 10,000 subscribers
- ✓ MCPTT services and VoNR
- ✓ 5G SA (Option 2)



■ PROTEI Private 5G SA core with network slicing: one physical network, multiple isolated virtual networks

Function	Role in the network
AMF	Device registration, connection and mobility management; NAS signalling
SMF	PDU sessions, IP allocation, UPF selection and QoS enforcement
UPF	User-plane routing and anchoring; connection to the data network
UDR	Subscriptions, device profiles, policy rules and slice data
UDM	Subscriber identities, credentials and service subscriptions
AUSF	5G-AKA and EAP authentication; SUPI/SUCI protection
NRF	NF registration, discovery and health monitoring

■ 5G SA IN OPERATION

Resilient, scalable and easy to size

■ Resilience by design

Redundancy is built on the NRF as defined in 3GPP TS 23.501: every network function registers its endpoint, capabilities and status; the NRF monitors their health;

requesting functions receive only available instances; and on failure, traffic switches automatically to a redundant instance. The AMF runs as a load-balanced pool, while UPF redundancy is handled at the control-plane (N4) level.

■ 5G SA IN OPERATION

Core capabilities, sizing and subscriber data

■ Core capabilities

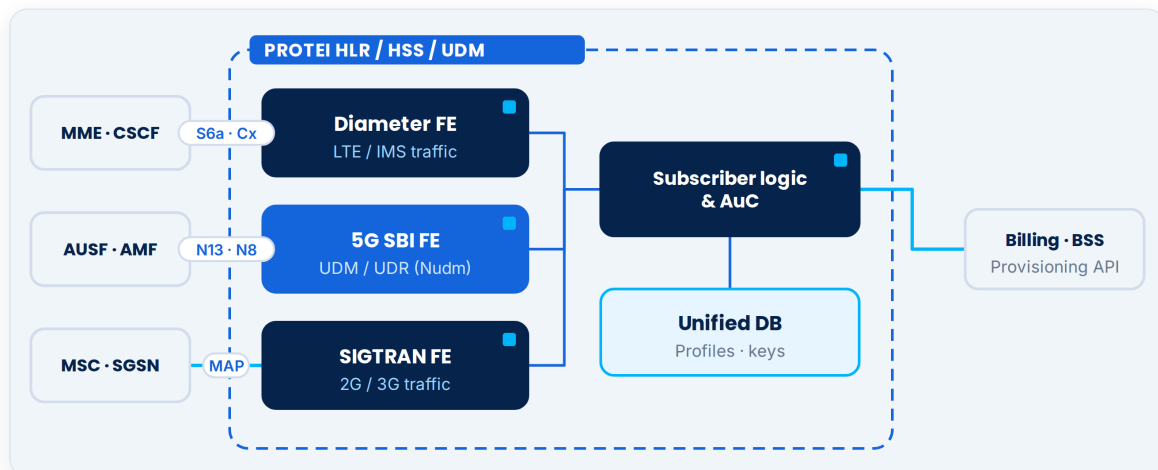
- Registration and authentication (5G-AKA/EAP) via AUSF and UDM
- PDU session establishment, modification and release
- High-performance packet forwarding in the UPF

- Local breakout — traffic stays within the customer perimeter
- A dedicated 5GC domain, isolated from the public network
- Session-level QoS by 5QI (3GPP TS 23.501 §5.7)

■ Sizing: start small, scale fast

	Entry configuration	Scaled configuration
Capacity	1,000 subscribers · 5 Gbps	10,000 subscribers · 30 Gbps
Control plane	2 VMs · 6 pCPU · 16 GB RAM each	On a single server:
User plane	1 UPF VM · 8 pCPU · 24 GB RAM · Intel E810 NIC	24 pCPU · 128 GB RAM

■ HLR / HSS / UDM / UDR: one subscriber brain



- Converged subscriber data for 2G, 3G, 4G, 5G and IMS in one node

- ✓ Tailored for MVNO/MVNE, private LTE/5G and M2M
- ✓ Embedded authentication centre (AuC)
- ✓ UDM/UDR with Nhss interface for seamless HLR/HSS integration
- ✓ M2M-friendly licensing by throughput, not by subscriber
- ✓ HLR, HSS and IMS-HSS in one node
- ✓ Scalable and highly reliable

PROTEI PORTFOLIO

Traffic intelligence and policy control

PROTEI DPI

A software platform for deep analysis of IP traffic, with QoS optimisation that makes the most of network resources and enables new value-added services. It runs on standard x86 servers for fixed and mobile broadband, scales without a single point of failure, recognises OTT content using statistical methods and launches new services quickly from a regularly updated signature database — with standard Gx and Gy interfaces.

- Detection by packet direction, IP addresses and ports, transport protocols and protocol parameters
- Traffic signatures, DNS caching, session correlation and session behaviour
- Statistical identification of obfuscated traffic
- Drag-and-drop reporting with an SQL-like query language on a high-performance ClickHouse database
- Online KPI monitoring for every IP flow



- PROTEI DPI analytics: real-time traffic insight by protocol and service

Policy Controller (PCRF/PCF)

Flexible policy control, data-traffic charging and QoS management, convenient subscriber management and statistics, and integration through Gx, Gy, Rx, N7,

N15 and other interfaces — one policy platform for LTE and 5G SA, with granular access control.

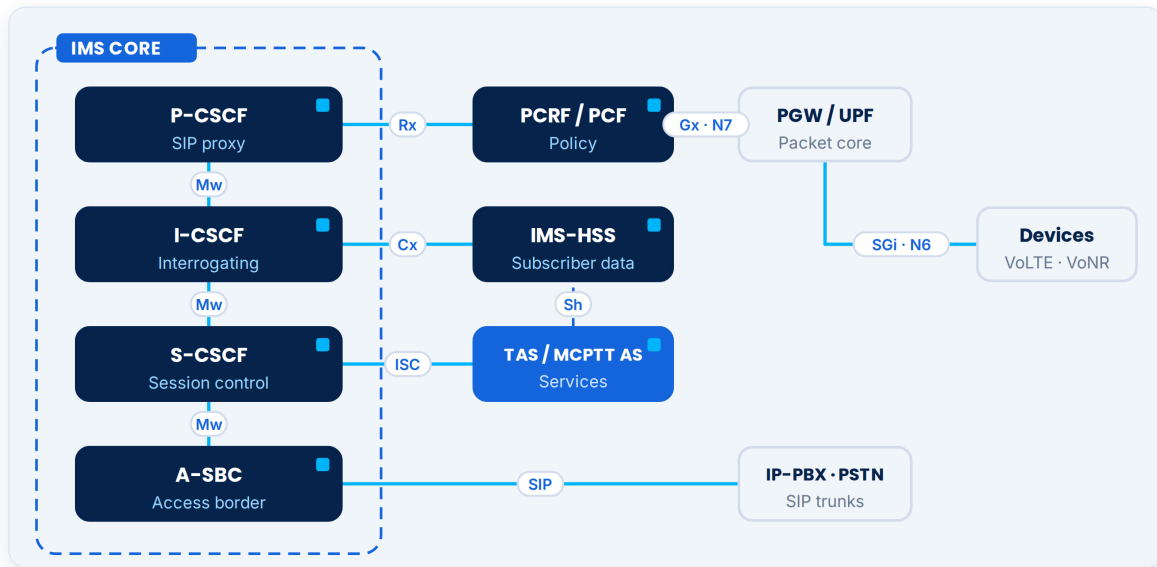
SERVICES

Voice and mission-critical communications

IMS voice core

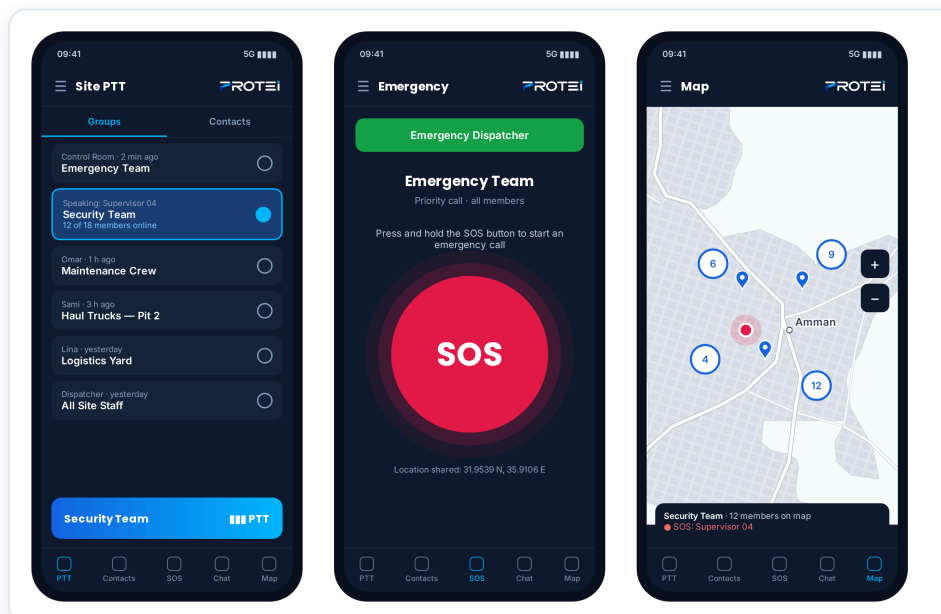
A fully virtualised IMS core for public and private deployments, delivering VoLTE and VoNR with full 3GPP interfaces. It connects SIP devices outside the

IMS such as IP-PBXs, and supports call forwarding and SIP forking, IMS-AKA authentication and encryption, transcoding, multiple IMPUs, iFC parameters, call-duration and re-registration timers, a built-in ENUM/DNS server and DNS-based load balancing.



PROTEI IMS core for private LTE/5G voice

PROTEI MCPTT platform



PROTEI MCPTT client: group calls, emergency SOS and live team map

- ✓ Complete MCPTT solution, 3GPP Release 15
- ✓ Standard application server on top of IMS, or standalone
- ✓ MCDATA (Release 15), file transfer and messaging
- ✓ Any 3GPP-compliant terminal, including MCOP

SERVICES

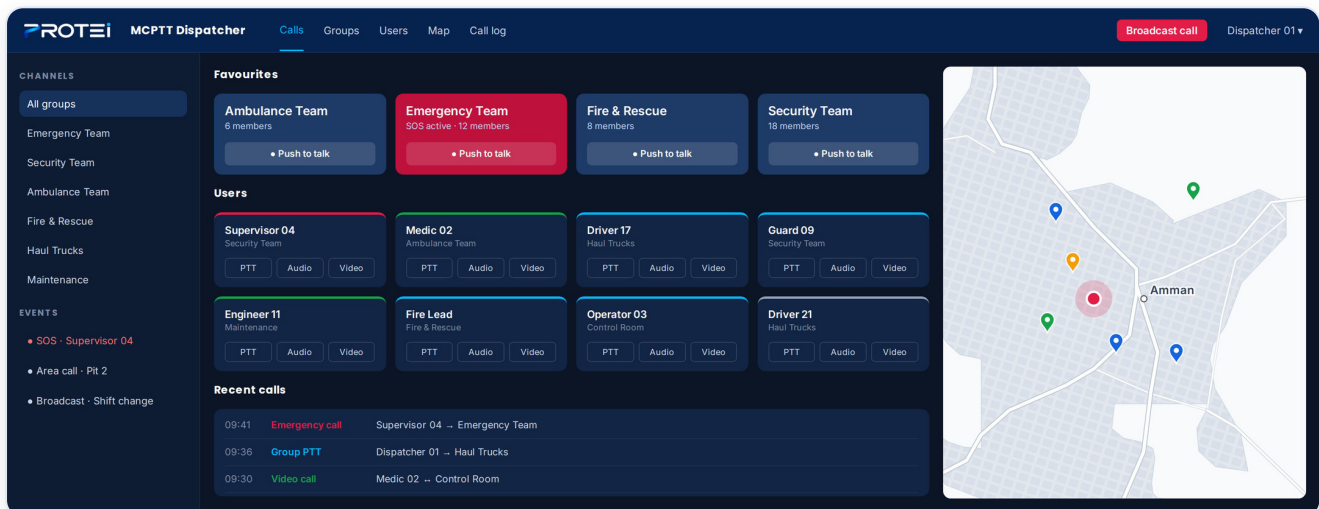
MCPTT client, dispatcher and terminals

Client application

Emergency calls; private full-duplex audio and video calls; group PTT calls; messaging and media transfer; geolocation; hardware PTT and SOS buttons; calls to corporate and public telephone networks; remote updates and call history.

Dispatcher console

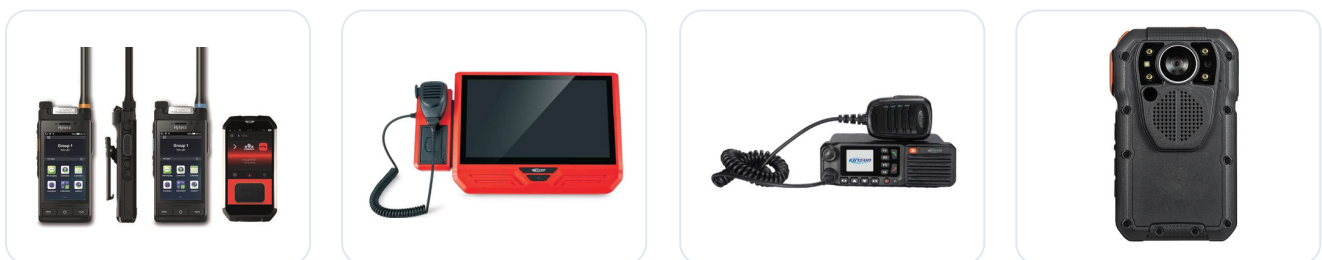
A cross-browser web workstation whose functions adapt to each user's role: group, private, emergency and broadcast PTT calls; full-duplex audio and video; user, profile and workgroup administration; muting; live terminal status and location; area group calls; ambient listening and video monitoring; and call logging.



PROTEI MCPTT dispatcher console

Rugged user terminals

Explosion-proof Android 7+ (64-bit) smartphones with removable battery, large PTT button, SOS button and loud speaker. Recommended devices include the Telo TE620P (P version) and Rugear RG760 — complemented by dispatcher tablets, vehicle-mounted terminals and body-worn cameras.



SERVICES · IOT

M2M connectivity management

A connectivity-management platform tailored for M2M devices and IoT projects — managing SIM cards and devices at scale through a web portal or API.



M2M Connectivity Management dashboard

SIM & device control

Lock, block and manage SIM cards and devices at scale.

Consumption limits

Per enterprise, client, account or device.

Location control

Alerts when a device leaves its permitted area.

Fraud monitoring

Detects suspicious usage and IMEI changes.

Open API

Integration with external IoT and business platforms.

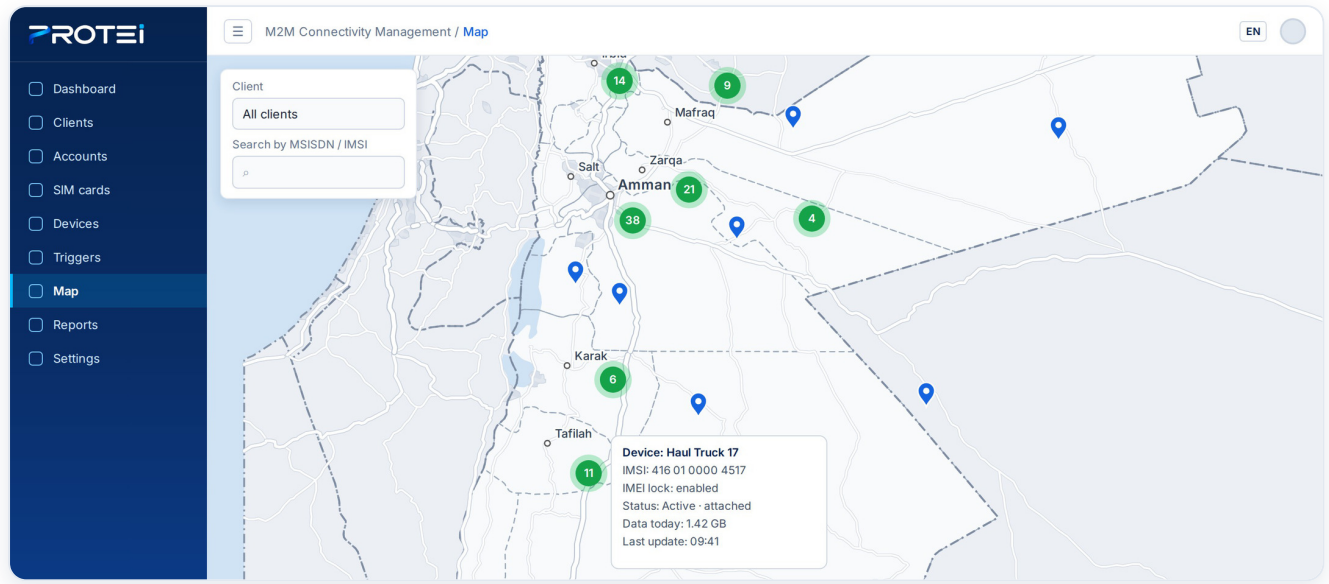
Notifications

Flexible email, SMS and portal alerts.

- Monitor device activity: attach/detach, active data sessions and more
- SIM lock — bind each SIM card to a specific device (IMEI)
- Trigger points and thresholds with automated actions
- Embedded GIS module with location control
- Provisioning integration with HLR/HSS: services, static IPs and IP pools
- Fraud monitoring and flexible email and SMS notifications

SERVICES · IOT

Integrated GIS and automation



■ Integrated GIS: live device map with location control

Device lifecycle

Awaiting activation, active, suspended, blocked and deactivated — with full history.

Client hierarchy

Macro-client (corporation or MVNO) → clients → accounts → devices.

Triggers

Data, SMS or charges above or below a threshold, per enterprise, client, account or device.

Actions

Notifications by portal, email or SMS; SIM blocking in the HLR; service blocking in the OCS.

Client and device administration

Client details

Name, tax and contract information, custom fields.

SIM parameters

ICCID, MSISDN and IMSI.

Device parameters

Device name, TAC (IMEI), vendor, model and IMSI-IMEI lock.

Device configuration

APN list, VIP and administrative status, thresholds, SMS and roaming flags, rating plan, home region and static IP.

■ DEPLOYMENT

Built on open, standard platforms



■ Platform hardware and software

Hardware

Standard x86 COTS servers or blades, ready for virtualisation.

Operating systems

Red Hat Enterprise Linux, Ubuntu or Oracle Linux.

Virtualisation

KVM, VMware or Hyper-V; telco or private cloud; or bare metal.

■ Why PROTEI for private networks

17 years

Of expertise in carrier-grade telecom software

20

Live private LTE/5G deployments

50+

Systems covering every key core element

45

Countries with delivered projects

Full MVNOs

And dozens of DPI deployments in commercial operation

Multi-vendor

Proven with leading core and RAN equipment

One partner for the whole private network

From the core and policy to voice, MCPTT and IoT connectivity, PROTEI delivers an integrated, tested private network stack — with the engineering support to deploy it on your site and the 24/7 support to keep it running.



■ ABOUT PROTEI

Carrier-grade telecom solutions since 2009

Founded in 2009 and headquartered in Amman, Jordan, Professional Telecommunication Incorporation (PROTEI) designs and delivers carrier-grade software for mobile and fixed network operators, MVNOs, enterprises and governments. Our portfolio of 50+ systems and solutions spans core network, roaming, messaging, value-added services, data management, public safety and customer care.

With development centres in Jordan, Europe and the CIS, live deployments across the Middle East, Europe, Africa, Latin America, Central Asia and the CIS, and regional offices in the UAE and Central Asia, PROTEI serves more than 400 clients. Every platform is designed in-house under ISO 9001:2015 and ISO 14001:2015 certified quality management.

17

Years in telecom

400+

Clients worldwide

45

Countries

50+

Systems & solutions

Turn your network into your next growth engine.

Talk to our experts about private LTE and 5G networks for your enterprise customers — and see how PROTEI can help you grow revenue, cut costs and protect every subscriber.

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