Tecore networks

Product Catalog

Scalable Mobile Networks

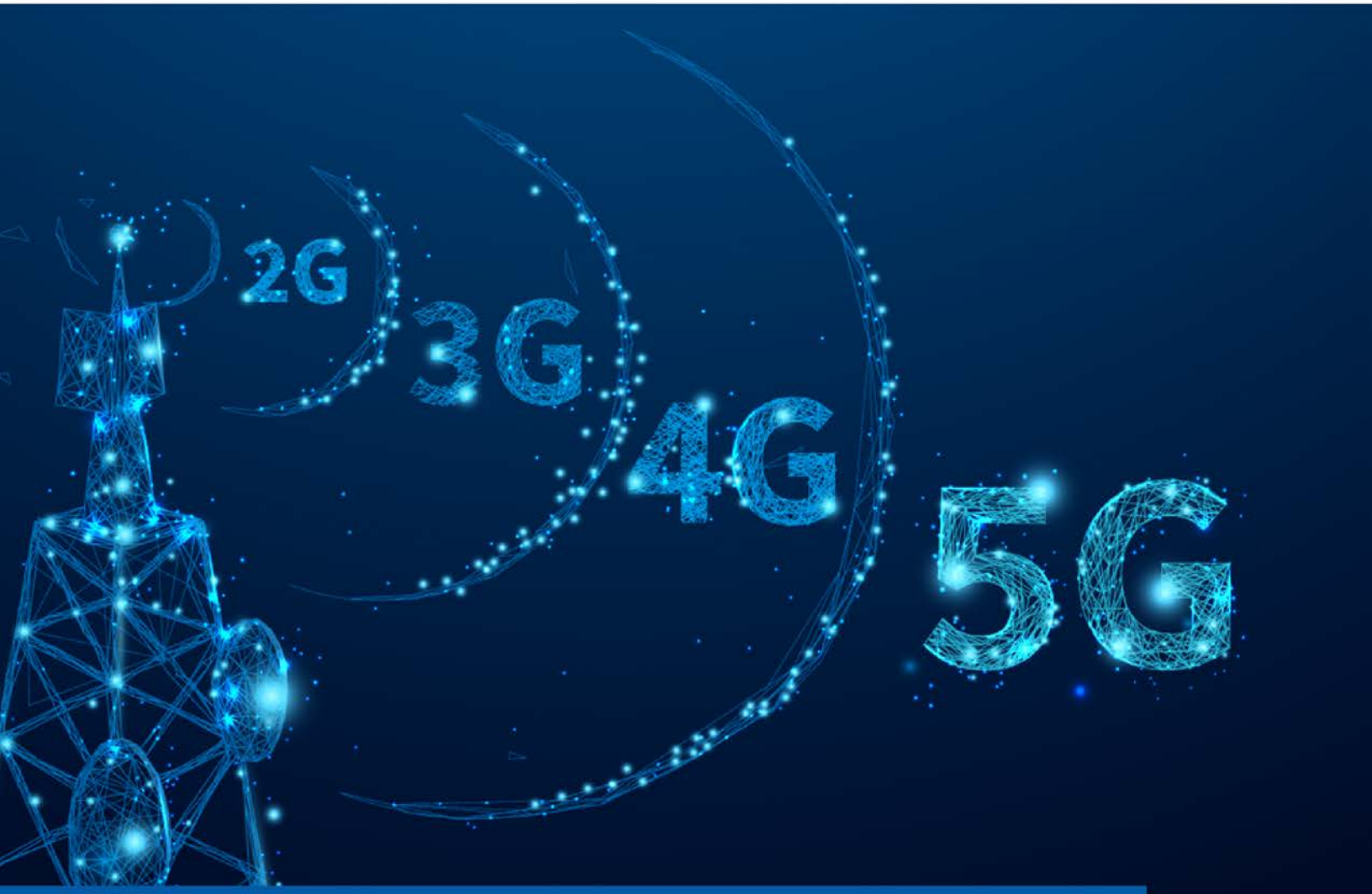
410-872-6000
www.Tecore.com

About Tecore

Tecore has been committed to providing innovative, reliable, and scalable wireless infrastructure solutions since 1991. We have become a trusted provider to the commercial, government, and military markets, and have established a proven track record of performance and evolution driven by our innovative software-defined approach.

Tecore's technology foundation is our iCore®, a software-defined all-IP core network that incorporates the key components of scalability and industry compliance in an x86 design. The effectiveness of the architecture and design has allowed the product to evolve across multiple generations of wireless from 2G to 5G. In addition, Tecore also offers a CoreCell product line of Software Defined Radio (SDR) base stations. Following the standard architectural split of Base Band Unit (BBU) and Remote Radio Head (RRH) connected over a fiber infrastructure, the CoreCell product line leverages X86 based SDR processing and fiber connectivity to a comprehensive set of Radio Heads across all standard commercial bands in scalable power and configuration.

With 5G networks supplanting legacy technology, Tecore Networks provides solutions that evolve forward as technology advances while continuing the support of legacy generations from a common baseline of software.



Technology Vision

As the wireless world moves toward greater throughput and higher bandwidth services, Tecore's technology vision is to deliver the conduit for communications. Focusing on software-defined capabilities and standard hardware technology that can evolve across the generations of wireless technologies, Tecore's technology baseline is the foundation for wireless communications.

Our solutions deliver an unprecedented level of functionality, such as:

- Supporting multiple technologies including 5G, 4G LTE, HSPA+, WCDMA, and GSM, in a single network;
- Integrating multiple network components on a feature-rich platform in a single system solution;
- Evolving capabilities and policies that implement the targeted security enclave to mitigate the ever-growing threats of cyber-attacks;
- Delivering innovative new services that facilitate market differentiation and targeted functionality to meet the requirements;
- Scalability from single-site all-in-one networks to global deployments leveraging cloud-based infrastructure

Tecore Highlights

Legacy Core

As operators sunset legacy networks in 2G & 3G, Tecore remains committed to providing carrier-grade support for those legacy technologies in areas where the service is still supported

Rip & Replace

The Rip and Replace service completely removes the old software and installs Tecore's optimized core technology while minimally impacting the end-users

5G

With significantly more capacity for moving data, ultra-low latency, and the added ability to connect to a multitude of different devices at once, 5G has fundamentally changed the way we live, work and communicate

Smart Cities

Tecore's iCore® multi-technology Core Network platform offers an efficient path to convergent wireless technologies and applications and provides a reliable base for Smart City operations.

Public Safety

The key to effective public safety and security communications is flexibility, control, and the ability to provide consistent communications capabilities – regardless of the situation. While larger macro-based systems deliver these communications on a day-to-day basis, there are many public safety situations that require a compact portable and agile solution.

sDAS

As cellular networks evolve to the next generation and technology users demand superior coverage with low latency, high throughput and superior user experience, Distributed Antenna Systems (DAS) once considered the de facto standard to provide in-building coverage has over time increased in footprint, infrastructure, costs and time to deploy.

MAS-E

Tecore's Managed Access (MAS) is a combination of our patented Intelligent Network access Control (iNAC) technology, coupled with a Distributed Antenna System (DAS) to provide a secure umbrella within which commercial cellular spectrum is managed.

Network in a Box (NIB)

Tecore's Network in a Box® (NIB) is a multi-generational 2G/3G/4G/5G all-in-one, rapidly deployable hardware and software solution integrated with a core network, IMS, Remote Radio Head (RRH) and Baseband Unit (BBU).

Our Value Proposition

Reputation

With over 30 years in the business, our team and technology have supported the industry across multiple generations of wireless technology. We've earned a reputation for quality and performance across all of our solutions and services.

Technology

While our current road map is focused on 5G, Tecore's iCore® and CoreCell product lines provide a common baseline to integrate past, present, and future generations of technology.

Certified

We have a range of certifications and approvals from the FCC, CE, governmental agencies, and industry partners. We take pride in our ISO-9001 certification, ensuring our customers are provided the best quality in the business.

Flexibility

While the core technology remains the same, the infrastructure necessary is configured based on each customer's requirements.

Patents

Technology leadership is not only measured by the innovative products and solutions a company brings to the market but also by the foundational patents that set them apart.

Trusted

With the growing risk coming to light from questionable providers, Tecore remains the trusted source for reliable, secure, and scalable wireless infrastructure globally.

Core Network

The iCore® Software-Defined Core Network

The iCore software-defined core network is the baseline for a family of solutions that deliver cost-effective carrier-grade options to a wide range of markets worldwide. The iCore can be deployed supporting the latest 4G LTE technology, as well as provide a bridge to previous generations of technology, including 3G WCDMA, 2G GSM, and CDMA, from a common baseline. The iCore is also 5G-ready compliant with the latest 3GPP standards to meet today's 5G deployments and beyond.

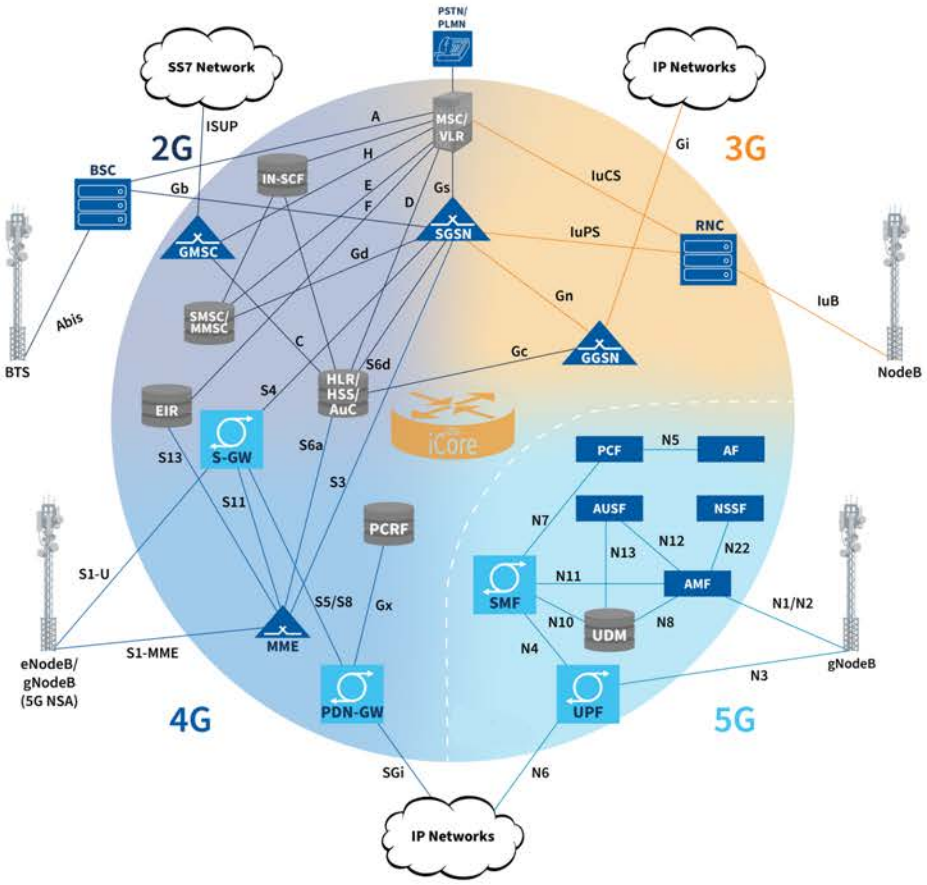
5G, LTE, UMTS, GSM, Multi-Technology Core Network

iCore is the world's first complete, multi-technology mobile core network available in three distinct implementations targeted at commercial, private, government, military, and OEM market segments.

This platform delivers one or multiple core network subsystems for 5G, 4G LTE, UMTS, and GSM enabling support for the most widely deployed mobile technologies in a broad range of applications and deployment scenarios. The common set of object code implements support for all protocols from a single converged platform. Utilizing a carrier-grade, high-availability Linux platform, the next-generation iCore provides a solution for million-subscriber markets as well as distributed scalability across any-sized market.

With integrated media gateway capabilities and a choice of standalone or distributed architectures, the system offers an efficient path to convergent wireless technologies and a competitive technology road map for tomorrow's markets. The optional integrated RNC enables operators to manage RAN from multiple technologies or vendors simultaneously.

iCore leverages Tecore's track record of deploying GSM, CDMA, 3G, and multi-protocol networks around the globe, as well as its patented software-defined architecture guided by 3GPP/3GPP2 industry standards, to deliver a comprehensive, converged mobile platform.



Legacy Support

As part of a comprehensive package, Tecore continues to support 2G and 3G wireless networks and provide legacy support for networks in transition. The iCore® platform provides a trusted foundation that bridges the gap from previous generations of technology with 4G LTE and 5G.

Network evolution is an ongoing process that demands continuing support for existing technologies while preparing for the future. Next-generation technology deployments must be carefully managed to optimize time and investment while maintaining continuity of operations. To assist in this process, Tecore's product line enables operators to future-proof their networks through incremental upgrades. This stepwise approach supports continuity of operations for both backward and forward capability through the deployment process.

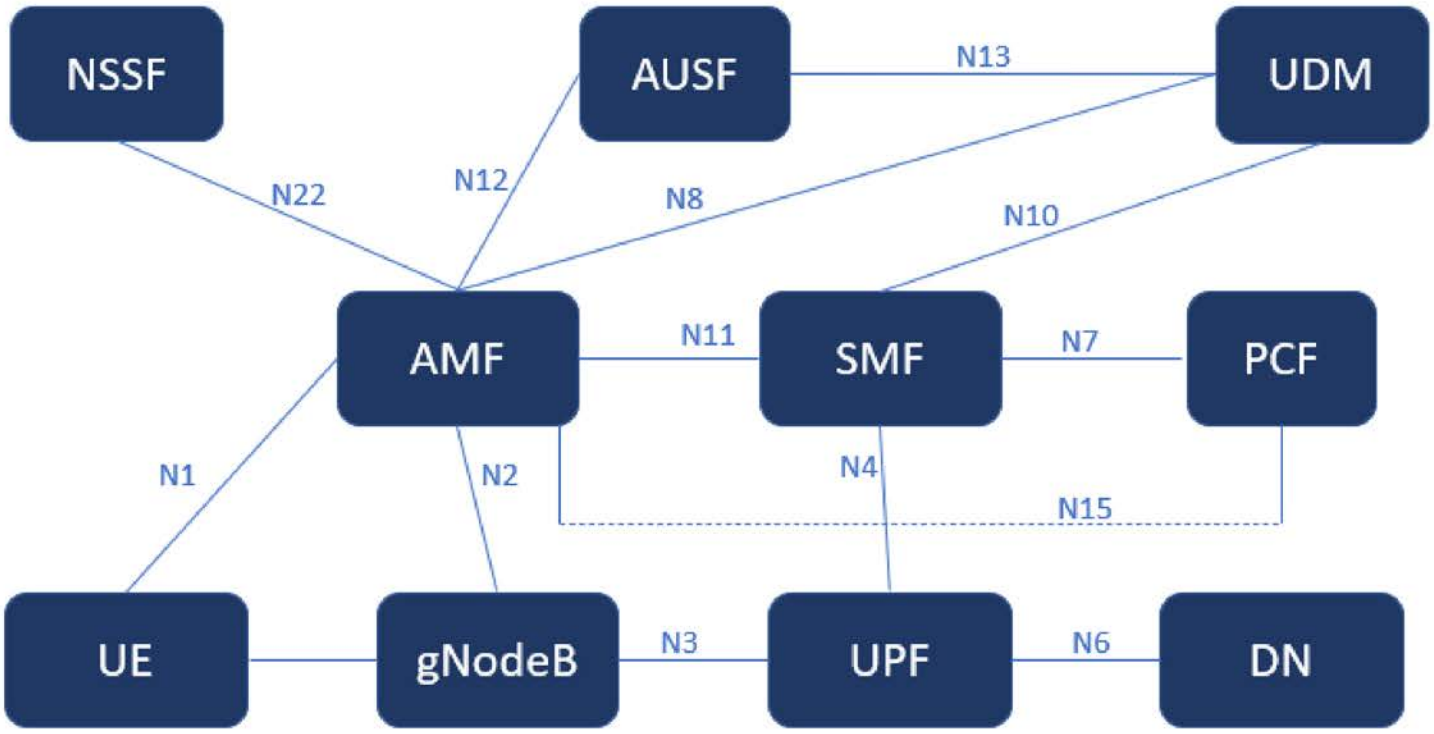
5G Network

As the number of connected devices grows and the connectivity needs of Communications Service Providers (CSPs) and business networks shift towards higher throughput, security, and reliability, the evolution from Evolved Packet Core (EPC) to 5G Core (5GC) and RAN will be central in meeting the needs of new services and applications. 5G Non-Standalone (5G NSA) and Standalone (5G SA) will open up a new universe of possibilities for differentiation and business.

The evolution to 5G will rely on multiple steps, including:

- Virtualization of core network functions for Packet Core, IMS, and subscription management
- Separation of control and user plane functions
- Introduction of network slicing, enabling multiple logical networks to be supported over one network platform
- Distribution of cloud infrastructure closer to users
- Consolidation of user plane functions for mobile, fixed wireless, and fixed access

These architecture changes will be critical to achieving the targeted 5G network that meets the business' and CSP's needs.



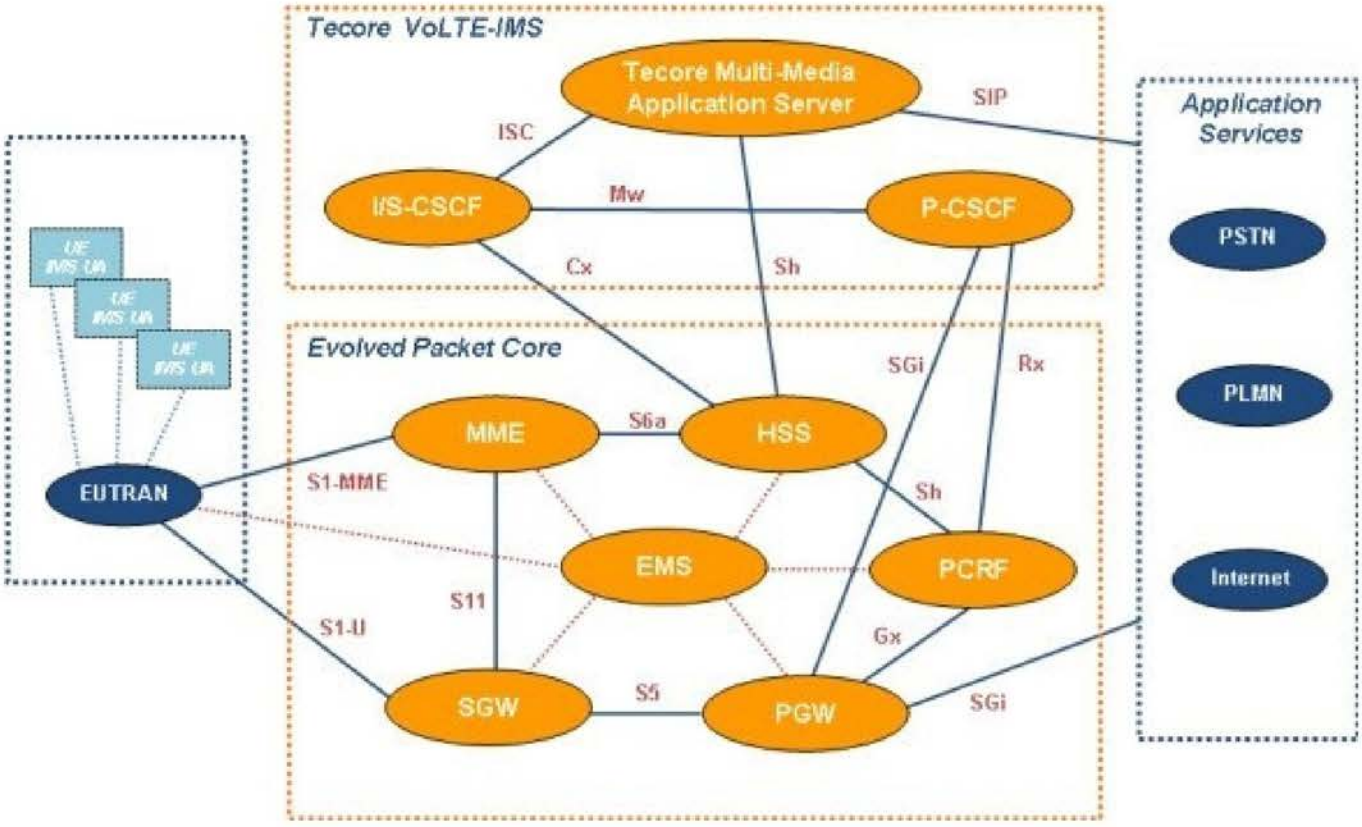
iCore Product Evolution

The software strategy of the iCore is centered on software-defined multi-generation industry compliant components providing upgrade paths to augment existing systems with new technology and/or capability. When the introductions of the next generation of technology are required, the iCore provides the requisite upgrade path to augment the network.

IP Multimedia Systems (IMS)

Tecore's IP Multimedia Subsystem (IMS) architecture offers a standardized framework for delivering secure and reliable multimedia service across networks. The IMS Core is a subsystem of multiple functions that are linked together by a standardized interface. Though SMS and data have complimented voice calls in proliferating avenues of communication, Voice has still maintained a favored position in allowing mobile subscribers to communicate swiftly and clearly over a cellular network. As voice services are migrated from legacy circuit-switched (CS) networks to data networks in 4G and 5G, IMS has played an integral role in providing the quality, scalability and flexibility for users to communicate.

Leveraging Session Initiated Protocol (SIP) to initiate, maintain, modify and terminate real-time communication sessions, the IMS core provides the necessary foundation for enabling quality voice calls in LTE (VoLTE) and 5G (VoNR) while integrating with Tecore's All-G Core network to enable converged services in Voice and SMS.



With Tecore IMS, operators can leverage next-generation technology benefits including:

- Common platform to support multimedia services
- Enhanced QoS management
- Multiple Charging Options
- Consistent delivery of services across networks and technologies
- Tecore's IMS is available on all of the iCore hardware platforms including Network-in-a-Box and the MVP series

iCore Attributes and Advantages

2G, 3G, 4G, 5G

The iCore includes all of the Core Network components in a single compact solution delivering value-added features and services for smaller operators.

Key Attributes

- Patented processing of multiple technologies and protocols including:
  - 5G, LTE, WCDMA, GSM, and CDMA on a single platform
- Integration of multiple network elements and value-added features in a single chassis with scalability to cloud-based virtualized architectures
- IP-based, software-driven x86 architecture built on a carrier-grade Linux platform
- Built to be profitable for as few as 100 subscribers, and scalable to a million subscribers

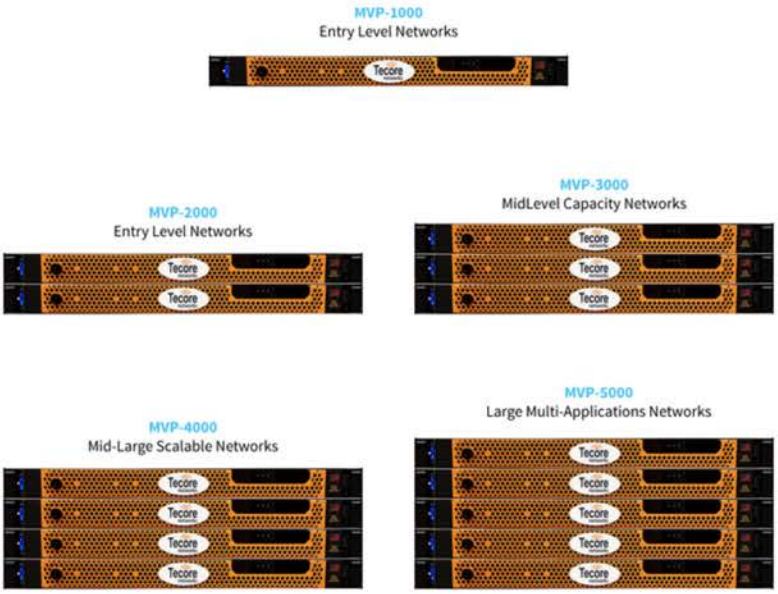
Advantages

- Dramatically reduced space and power requirements, installation time, operational complexity, and cost of ownership
- Increased functionality and revenue opportunities through a software-driven feature set
- Product line evolution enables operators to future-proof networks through incremental upgrades

Mobility Virtualized Platform (MVP)®

iCore® In The Cloud

Tecore's Mobility Virtualized Platform (MVP)® delivers scalability and Cloud capability to the iCore family of products. With the MVP platform providing the consolidation of resources across multiple servers into a common pool, the virtualization package is able to partition resources into multiple virtual machines (VM) and provide the CPU, memory, and storage required in an encapsulated VM environment. The MVP provides a highly reliable platform that is expandable in processing capabilities and resource pools that can adjust as the network grows. This provides upward scalability for the iCore suite of Core Network elements that were not possible on previous hardware platforms. The MVP platform leverages commercial off-the-shelf hardware and virtualization technology to create a flexible environment for the iCore Applications Suite. Ultimately, this translates into the most flexible Cloud-based Core Network in the industry and future protection of CAPEX investment as the network grows.

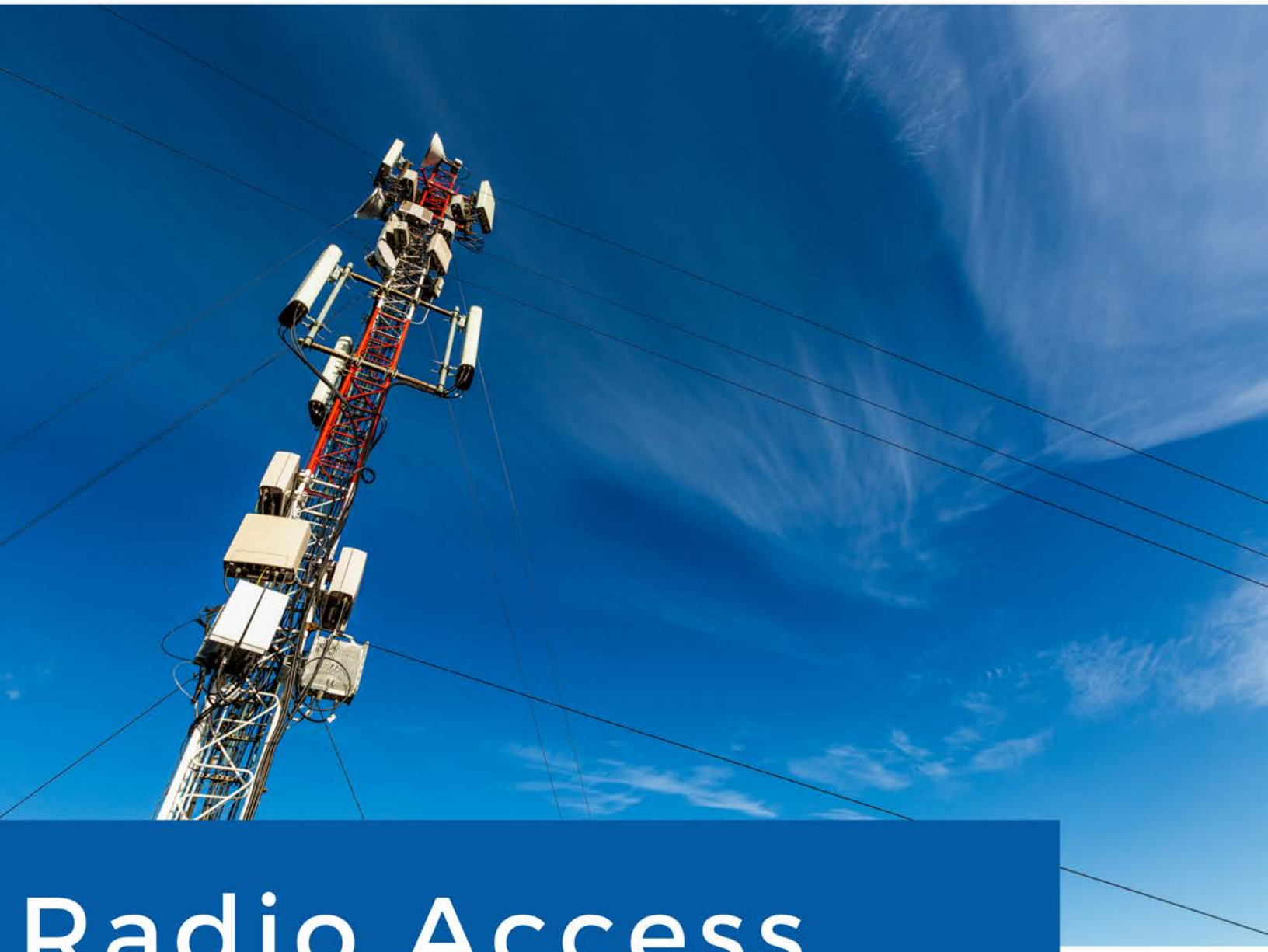


Benefits & Features

- Full support for the iCore software-defined core network product suite
- Processing scalability supporting 1,000 to 1,000,000 subscribers
- Scalable from 500 to 50,000 sessions
- Third-party application support
- Multi-server architecture
- Geo-redundancy options

Tecore's MVP architecture provides the customer with the following attributes:

- **Hardware Independence**—Virtual machines are completely independent of their underlying physical hardware, which increases the availability of hardware and applications for improved business continuity
- **Compatibility**—Virtual machines are completely compatible with all standard next-generation Intel processors, applications, and device drivers, so you can use a virtual machine to run all applications that you would run on a server-based computing platform
- **Isolation**—While virtual machines can share the physical resources of a single computer, they remain completely isolated from each other as if they were separate physical machines
- **Encapsulation**—A virtual machine is essentially a software container that bundles or "encapsulates" a complete set of virtual hardware resources, as well as an operating system and all its applications, inside a software package. Encapsulation makes virtual machines incredibly portable and easy to manage.



Radio Access Network

Radio Access Network

CORECELL- gNodeB/eNodeB

With greater speed for moving more data, lower latency for greater responsiveness, and the added ability to connect to a multitude of different devices at once, 5G may fundamentally change the way we live, work and communicate. To address the market's needs, Tecore's 5G Standalone (SA) and Non-Standalone (NSA) solution offers a full range of gNodeB and eNodeB base stations ranging from high capacity macro to a full suite of small cell configurations that deliver 4G/5G capability in size, weight, and power required for the application. Tecore's gNodeB and eNodeB's integrate seamlessly with Tecore's Packet Core network (EPC & 5GC) over an All-IP packet data network providing a complete 4G/5G network solution for commercial, government, and military applications.

Legacy RAN

As part of a comprehensive package, Tecore continues to support 2G and 3G wireless networks and provide legacy support for networks in transition. With the software stack developed in-house to support legacy networks, Tecore can provide the Base Station Controller (BSC) and the Base Transceiver Station (BTS) functionality for communication in GSM networks and similarly the Radio Network System (RNC) and the NodeB for UMTS network communication.

Macro iDU

Tecore's Macro iDU platform provides a highly scalable and modular platform that allows customers to build their networks up from one to hundreds of thousands of sites with a robust LTE feature set including 2x2 MIMO, 256DL/64UL QAM modulation, and flexible radio-head options to meet a wide variety of cellular coverage scenarios.

Compact Design

With an impressive footprint, the iDU's weight ranges from 11 to 26.4 pounds, including the uncompromising support of a rugged IP67 shell. The iDU is capable of delivering high-speed network access to provide vital information and extensive support for a variety of network requirements. By maximizing performance, Tecore has minimized tower loads and deployment time to meet strict operational requirements.

Frequency Support & Compliance

The iDU provides support for all 3GPP specified bands in both TDD and FDD technologies, including Band 14 for Emergency Response. If required for the scope of the network, additional bands can be customized into the end-to-end solution. This wide range of frequency capabilities includes custom and unlicensed bands, allowing for easy deployments worldwide for a variety of applications.

Benefits & Features

- Macro version includes high power configuration for outdoor networks
- Macro design leverages separate Base Band Unit and Remote Radio Head providing flexibility in deployment options
- Scalable small cell includes low power configuration for in-building applications and is for ultra-compact, rapidly deployable, or ad hoc communication systems
- Integrated design delivers a small footprint optimized for ease of installation and integration
- Complete end-to-end management solution with a total lower cost of ownership
- Enhanced modulation techniques and scalable bandwidth options

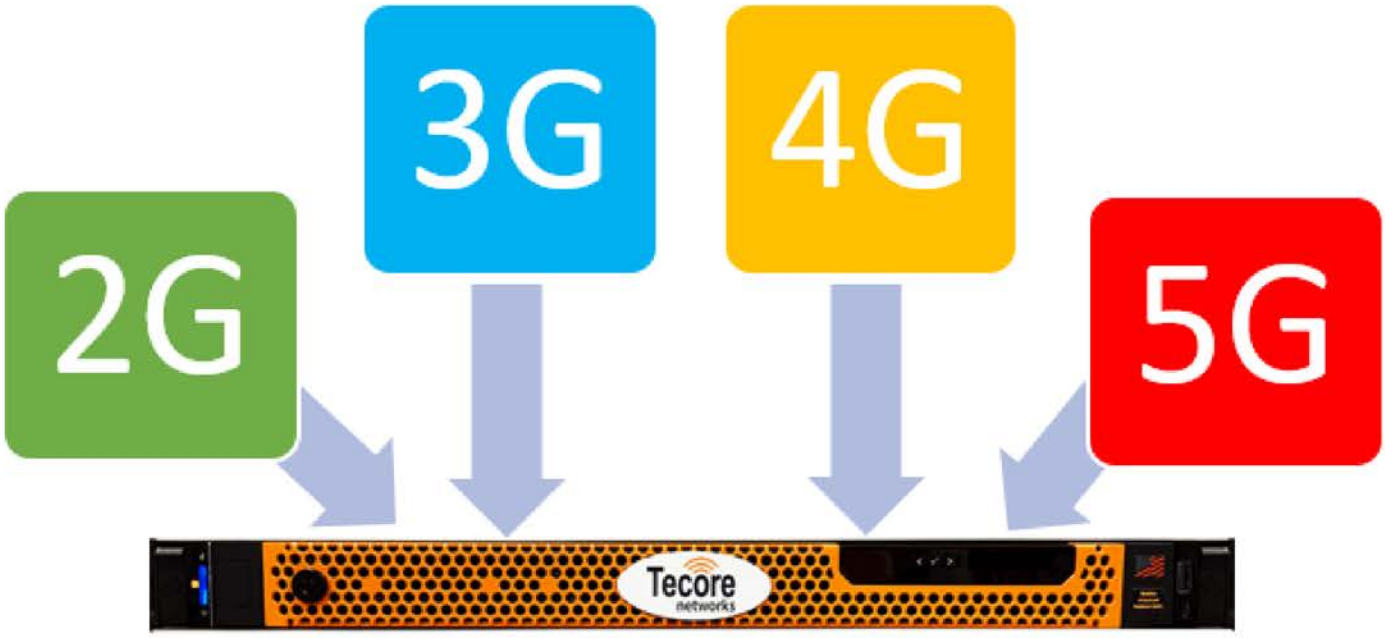
Compact Design

The iDU is offered in three different power variants ranging from 250mW to 40W. The number of sites and overall system size typically required for similar networks is vastly due to the high power output and extremely small form factor. In turn, this reduces overall system cost (CAPEX), as well as site acquisition, installation and maintenance costs, and network efficiency, which help maximize return on investment for operators.

Baseband Unit

Typical wireless telecom stations include a baseband processing unit, an RF processing unit (remote radio unit), and a baseband unit (BBU).

The baseband unit (BBU) processes the baseband in a telecom system. BBUs are responsible for all communication through the physical interface. They are small, have low power consumption, and are easily deployable.



All Gs BBU

- x86 Based Architecture
- Scalable up to 1,000 Simultaneous Active Users per Baseband unit
- 2G, 3G, 4G & 5G stack available

- For 4x4 NR 78 (5 -100Mhz) @ 256 QAM
  L1 DL = ~82Mbps to ~1.8 Gbps

- For 2x2 NR 78 (5 – 50Mhz) @ 64 QAM
  L1 DL = ~42Mbps to ~440 Mbps

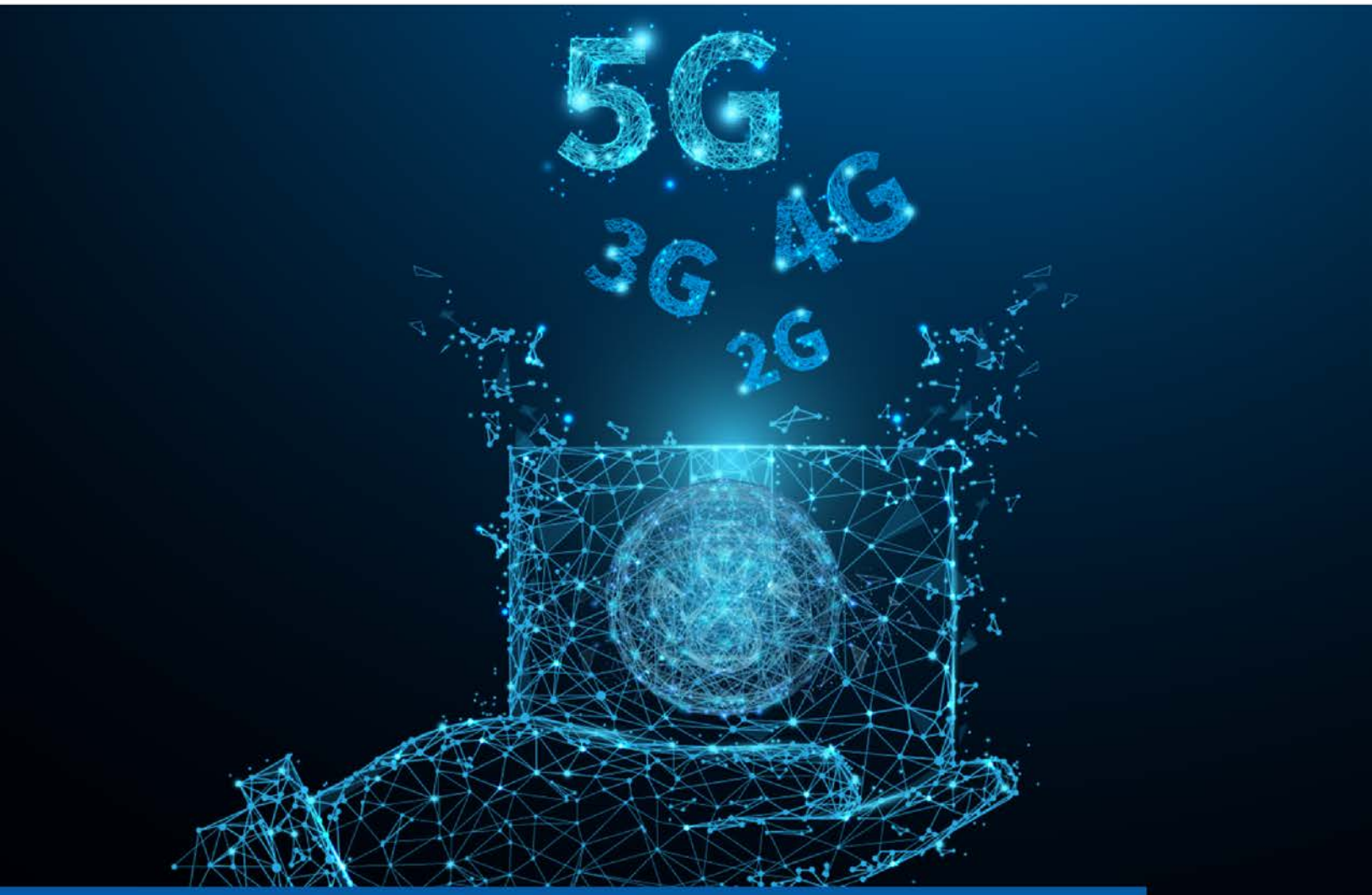
Remote Radio Head Corecell-RH

SPECIFICATIONS & FEATURES

Wireless operators are demanding greater packet data throughput to service data-hungry subscribers on their mobile devices and applications.

The full line of CoreCell-RH (Radio Heads) is built to support scalability in power and capability that meets the deployment requirements of today's networks. Available in a high-powered 40W 4×4 MIMO configuration as well as 250mW systems designed for in-building and localized coverage applications, the CoreCell-RH family of Radio Heads supports the right configuration for the site.

Specifications	Meta Cell	Macro Cell	4x4	Macro iDU
Dimensions	14.6" H x 14.6" W x 6.09" D 37.08 x 37.08 x 15.47 cm	11.6" H x 7.9" W x 6.0" D 29.46 x 20.07 x 15.24 cm	14.57" H x 14.54 "W x 3.59" D 37.01 x 36.93 x 9.12 cm	16.91" H x 7.87" W x 6.16" D 42.95 x 19.98 x 15.65 cm
Weight	45.0lbs / 20.4kg	20.86lbs / 9.46kg	<11.02lbs / <4.99kg	32.0lbs / 14.5kg
Power Consumption	500W typical	200W typical	180W max	<400W typical
Tx/Rx	4T4R	2T2R	4T4R	2T2R
RF Output Power	160W (40W per port)	40W (20W per port)	8W (2W per port)	40W (20W per port)
Radio Access Technology	2G/3G/4G/5G	2G/3G/4G/5G	4G/5G	2G/3G/4G/5G
Multi-Radio Access Technology	Yes	Yes	Yes	Yes
i/Q Connectivity	CPRI or 10 GbE	CPRI or 10 GbE	2 CPRI up to rate 8	CPRI or 10 GbE
Management Interface	Local Gigabit Ethernet	Local Gigabit Ethernet	Local Gigabit Ethernet	Local Gigabit Ethernet
RET Control AISG V2.0	Yes	No	Yes	Yes



Network In A Box® NIB

Network In A Box®NIB

All-In-One Portable Network

Network in a Box® (NIB) solutions provide easy-to-use, rapidly deployable communications, addressing the need for mission-critical, network coverage in the field.

The benefit of using Tecore's NIB is the capability to have an all-in-one transportable network solution that provides a wireless cellular network for private and secure communication within CONUS and OCONUS regions. The NIB is capable of supporting Voice, SMS, data similar to a commercial carrier network, and it also offers the added advantage of operating in specific 3GPP bands. Our family of products is designed to deliver wireless communication capability in the most demanding environments, including BLOS, ship-to-ship, ship-to-shore, ground communication, network on the move, unified communication at the edge of the battlefield, etc. These NIBs check the box in supporting federal agencies' mission objectives by providing the necessary mobile infrastructure and high bandwidth for mission-critical communication. Most importantly these NIBs can operate in 2G, 3G, 4G or 5G (SA/NSA).

Aerial Relay Network

Ship to Ship/Ship to Shore

Fixed/Mobile Base

Cell on Wheels

Network on the Move

iCore® NIB

Network in a Box®

Size: 16.91" H x 7.87" W x 6.16" D
42.95 x 19.98 x 15.64 cm

Weight: 32.0 lbs / 14.5 kg

Power: 250W typical, 300W max

Technology: 2G, 3G, 4G and 5G (SA/NSA)

IOPS NIB

Network in a Box®

Size: 16.91" H x 7.87" W x 8.00" D
42.95 x 19.98 x 20.32 cm

Weight: 39.5lbs / 17.9kg

Power: 300W typical, 350W max

Technology: 2G, 3G, 4G and 5G (SA/NSA)

LYNX™

Network in a Box®

Size: 12.0" H x 5.50" W x 5.75" D
30.48 x 13.97 x 14.61 cm

Weight: 14.0 lbs / 6.4 kg

Power: 150 Watts

Technology: 4G

iCore®
Network In A Box®

Rapidly Deployable

Tecore's iCore® Network in a Box® (NIB) is an all-in-one portable integrated hardware and software box capable of supporting a Core Network, IMS-Core in addition to an eNodeB/gNodeB and Remote Radio Head (RRH).

The iCore NIB provides highly operational availability supporting 2G/3G/4G/5G in a small, compact, portable form factor to meet commercial or critical public safety needs when a backhaul connection to the Macro EPC or core network is lost. A number of broad deployment scenarios include extreme disaster, special rescue missions, emergency management, armed forces, peace-keeping missions, and mobile communications networks in transit. The iCore NIB leverages the patented iCore portfolio of 3GPP-compliant software-defined core network elements and E-UTRAN 3GPP compliant access portion of the network. The iCore NIB provides voice, text, video, and packet data services through network elements that are developed to relevant 3GPP standards.

Residing in the iCore NIB are Virtual Machines (VM) that include Network Core, IMS-Core, Base Band Unit (BBU), and Remote Radio Head (RRH) elements. Capable of supporting the BTS/TRX, RNC, NodeB, eNodeB and gNodeB, the NIB provides a network for the desired technology , while offering better quality of service and higher bit rates for packet data-intensive applications.

With this flexible architecture supporting network functions virtualization, the iCore NIB can be deployed quickly to meet the operator's requirements in broad deployment scenarios. The iCore NIB is a robust all-in-one integrated solution enabling comprehensive management and operations of networks and has been successfully deployed in commercial, government, and private networks on a global basis.

Benefits & Features

- Self-contained, secure, LTE/5G Network-in-a-Box (NIB)
- Supports up to 1000 Simultaneous Active Users
- Requires no existing infrastructure
- Operates as Secure Standalone or Integrated
- Integrate 4G LTE/5G capabilities into existing networks
- Operates in several 3GPP bands
- Scalable to meet customer requirements
- Adaptable for Air, Ground, Maritime, Dismounted, and Network-On-The-Move Operations

IOPS
Network In A Box®

Rapidly Deployable

Tecore's IOPS Network in a Box ®(NIB) is an all-in-one portable integrated hardware and software box capable of supporting a Core Network, IMS-Core in addition to an eNodeB/gNodeB and Remote Radio Head (RRH).

Tecore's Isolated Operation for Public Safety (IOPS) Network in a Box ® (NIB), is theindustry's first all-in-one, transportable and ready-in-minutes network solutioncapable of supporting an LTE Core Network, IMS-Core in addition to an eNodeB and2x20 Watt integrated Remote Radio Head (RRH). Tecore has incorporated 30 years ofindustry leadership in scalable wireless systems into the design of the IOPSarchitecture. The IOPS NIB leverages the patented iCore® portfolio of 3GPP-compliant software-defined core network elements and E-UTRAN 3GPP compliantradio access portion of the network. The standard package contains an HSS, LTEEvolved Packet Core (EPC), IMS-Core, 4G LTE eNodeB, and a Remote Radio Head(RRH) providing the relevant voice, text, and packet data services.

The IOPS offers a valuable hardware addition to the NIB that allows operators to install a myriad of applications that utilize the network technology. Optionally, the IOPS NIB has the capability to support legacy technologies in 2G and3G. Furthermore, to support the global rollout of 5G, the IOPS NIB also has the capability of supporting 5G Networks in NSA mode. this single platform has the capability to provide a complete network solution in 2G, 3G, 4G, and 5G. This functionality is unmatched in today'sindustry.

With this flexible architecture supporting network functions virtualization, the IOPS NIB can be deployed quickly to meet the operator's requirements in broad deployment scenarios including operator network expansion, disaster and rescue missions, emergency management, armed forces, peace-keeping missions, and mobile communications networks in transit.

Benefits & Features

- Self-contained, secure, LTE/5G Network-in-a-Box (NIB)
- Supports up to 1000 Simultaneous Active Users
- Requires no existing infrastructure
- Operates as Secure Standalone or Integrated
- Integrate 4G LTE/5G capabilities into existing networks
- Operates in several 3GPP bands
- Scalable to meet customer requirements
- Adaptable for Air, Ground, Maritime, Dismounted, and Network-On-The-Move Operations

LYNX
Network In A Box®

Rapidly Deployable

Adaptable, Rapidly Deployable 4G LTE Networks Delivering Mission-Critical Communications to the Tactical Edge.

Tecore's LYNX™ provides a rapidly deployable, high speed, 4G LTE communications network to support Defense, Public Safety, and Security Force Operations. A fully integrated, self-contained, LTE Network-in-a-box, the LYNX is an all-IP solution delivering a compact, adaptable, and cost-effective end-to-end 4G LTE network.

Leveraging Tecore's almost 30 years of experience in engineering scalable wireless networks, the LYNX is designed to meet strict size, weight, and power (SWaP) requirements making it as flexible as it is capable. The LYNX platform includes an integrated EPC, eNodeB, radio, and processor capable of delivering high speed voice, messaging, and data to users operating anywhere in the world. As a standalone network, the LYNX can provide network coverage in rural and remote areas without any existing infrastructure. The LYNX can also integrate into existing customer networks, bringing secured, high speed 4G LTE network extension capability to tactical operations centers, forward operating bases, mobile and emergency response units. The LYNX with its robust capability set, compact form factor, and cost effectiveness addresses a broad range of application requirements for military, security, and public safety communications.

Capabilities

The LYNX provides commercial 4G LTE voice, messaging, internet, and multi-broadcast services for users as a standalone private network or while integrated as part of a larger communications network. The LYNX's compact size, all-IP architecture, and fully integrated EPC and eNodeB make it adaptable to air, ground, or maritime operations. Its full feature capabilities, intuitive interface, and portable form factor are ideal for tactical, rapidly deployable, and first responder communication networks.

sDAS

Tecore's sDAS (Smart Distributed Antenna Systems) solution is the next evolution of DAS that leverages a cost-effective and compact solution to provide excellent in-building coverage.

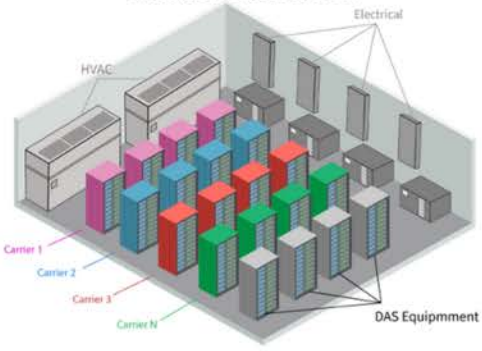
This technology incorporates the mRU (Multi-RAT Radio Unit) radio, a high-powered multiband radio supporting 2G, 3G, 4G, and 5G simultaneously on a single radio and the mDU (Multi-RAT Digital Unit) that is a multi-carrier digital baseband signal processing unit.

Tecore's sDAS enables Simplified deployment with only 2 pieces of active equipment

Multi-RAT Digital Unit (mDU)

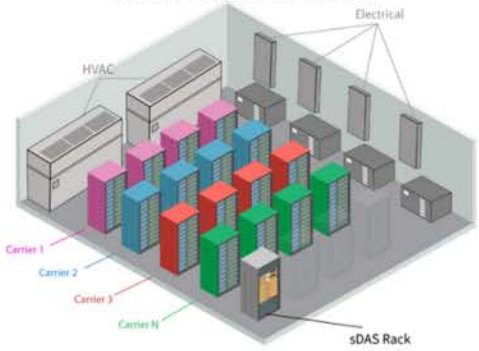
Multi-RAT Radio Unit (mRU)

Existing DAS Headend Room



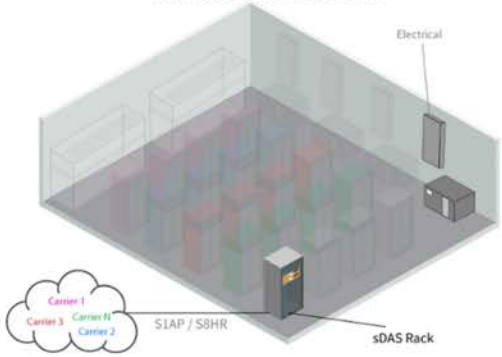
- Large headend footprint
- Extensive power and cooling

Transitional DAS Headend Room



- mPOI – Bridge to existing carrier RAN equipment
- Reduction in DAS headend footprint
- Future proof solution

NexGen DAS Headend Room



- Minimal headend footprint
- Eliminate Carrier RAN equipment
- Eliminate excess HVAC and electrical services
- Simplifies maintenance

Tecore's sDAS (Smart Distributed Antenna Systems) solution is the next evolution of DAS that leverages a cost-effective and compact solution to provide excellent in-building coverage.

This technology incorporates the mRU (Multi-RAT Radio Unit) radio, a high-powered multiband radio supporting 2G, 3G, 4G, and 5G simultaneously on a single radio and the mDU (Multi-RAT Digital Unit) that is a multi-carrier digital baseband signal processing unit.

Tecore's sDAS enables Simplified deployment with only 2 pieces of active equipment

Multi-RAT Digital Unit (mDU)

Multi-RAT Radio Unit (mRU)

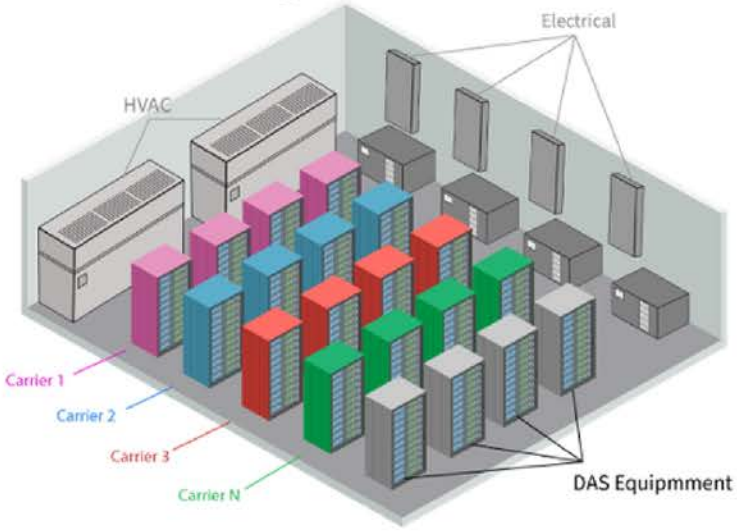
sDAS Features

The sDAS platform delivers a flexible solution for any type of venue by covering 14 licensed radio frequency bands with a single pair of smart radios based on the mRU (multi-RAT Radio Unit). The mRU smart radio supports the following features:

- One Low-Band Radio supports seven (7) LTE/NR bands (2/25, 4/10/66, 30, 41)
- One Mid-Band Radio supports seven (7) LTE/NR bands (5/26, 12/17, 13/14, 71)
- **FCC Certified** in each band
- Operates four (4) bands concurrently at 20 Watts of RF power per band
- Support for All-Gs (GSM, UMTS, LTE, NR)
- NMS tailored for Neutral Host and BYOC
- Support for joint operator DAS power-sharing
- Daisy-chaining for simplified installation
- BUS or Ring topology supported
- Integrated BBU with S1/N2 Interface to Core
- Compact form factor (14.5"x14.5"x4.5")
- DL/UL Carrier Aggregation
- Outdoor Rated – IP67
- AC Powered

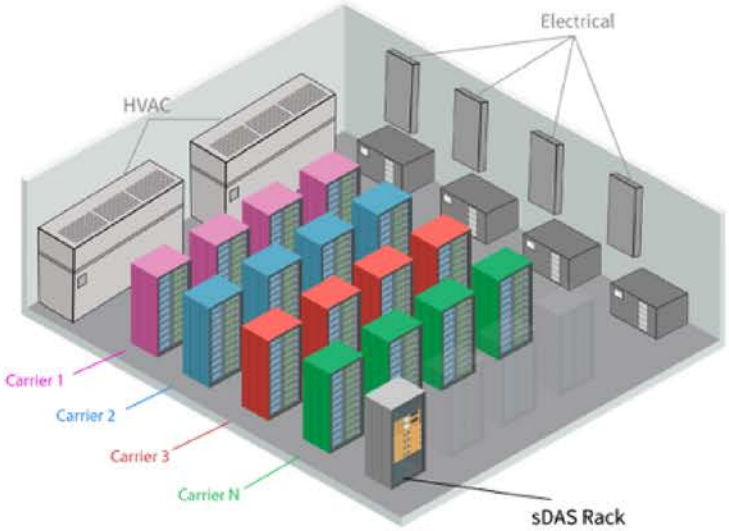
DAS Head End Rooms

Existing DAS Headend Room



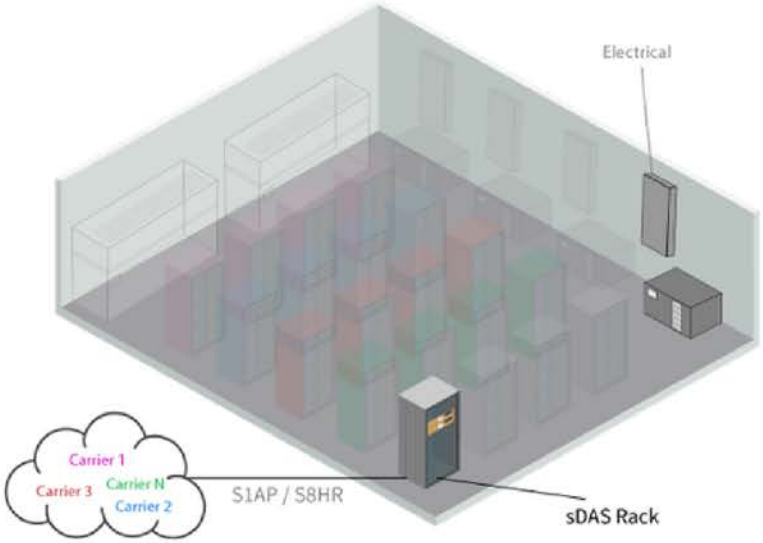
- Large headend footprint
- Extensive power and cooling

Transitional DAS Headend Room



- mPOI – Bridge to existing carrier RAN equipment
- Reduction in DAS headend footprint
- Future proof solution

NexGen DAS Headend Room



- Minimal headend footprint
- Eliminate Carrier RAN equipment
- Eliminate excess HVAC and electrical services
- Simplifies maintenance

Smart DAS leverages the **mDU (Multi-RAT Digital Unit)** for signal generation to eliminate the costly headend equipment and valuable building space that it would typically occupy, saving money, time and space. Tecore's **mRUs (Multi-RAT Radio Unit)** are not amplifiers, but proprietary radios that intelligently distribute the multi-carrier signals to the site simultaneously, with daisy chaining capability to minimize fiber home runs, infrastructure costs, and electrical power needs.

This technology incorporates the mRU (Multi-RAT Radio Unit) radio, a high-powered multiband radio supporting 2G, 3G, 4G, and 5G simultaneously on a single radio and the mDU (Multi-RAT Digital Unit) that is a multi-carrier digital baseband signal processing unit.

- Up to a 90% reduction in equipment footprint due to lack of required carrier radio equipment and current DAS equipment.
- Up to a 90% reduction in required electrical and HVAC equipment and service due to the reduced amount of hardware.
- Significant CAPEX and OPEX reduction realized by the minimalization of electrical/HVAC equipment and the elimination of carriers' radio equipment.

Simplifying the DAS Solution

Tecore's sDAS platform is a next-generation, cost-effective, and hardware-efficient DAS solution flexible enough to meet the coverage and capacity requirements for in-building or campus wireless needs. Its architecture allows for a cost & infrastructure-effective solution, that allows all business owners and venues to consider a DAS deployment where current DAS is economically prohibitive.

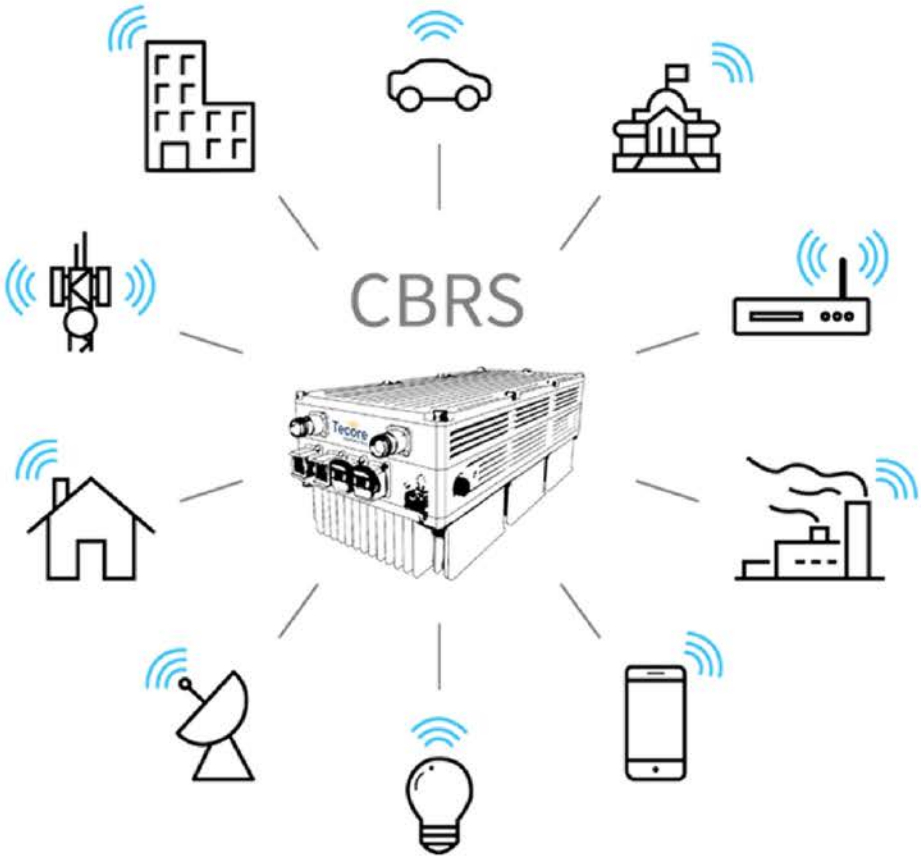
CBRS

Citizens Broadband Radio Service (CBRS) is enabling a new way to approach radio spectrum sharing with its efficiency, low-cost, rapid access, capacity, and security/reliability. For both small and large indoor or outdoor deployments, CBRS allows operators and enterprises to expand their existing services, or new entrants to go to market with unique and innovative solutions.

As a Priority Access License (PAL) winner, Tecore is aware of the challenges that accompany a CBRS deployment. Tecore CBSD's are OnGo certified and Part-96 compliant, and our 29 years of experience providing Core to Edge support allows customers to leverage Tecore's All-G patented iCore technology that provides the EPC functionality for a comprehensive CBRS solution.

CBRS Use Cases

- College Campuses/Higher Education
- Hospitals & Healthcare Clinics
- Mines
- Industrial Internet of Things and Manufacturing
- Warehouses
- Skyscrapers and Large Complexes
- Sports Stadiums
- Event Venues
- Hotels and Hospitality
- Airports and Public Transportation



CBRS for Enterprises and Smart Cities

For enterprises and smart cities looking to deploy a private carrier-grade cellular network, CBRS offers lower barriers of entry by reducing the cost to deploy and making spectrum accessible without a license. Currently, major mobile operators hold a total of 130 MHz of licensed spectrum on average, so the newly available 150 MHz of CBRS spectrum will have large implications for enterprises and smart cities.

CBRS allows users, cities, and enterprises to have access to secure LTE-ready spectrum that can meet their voice/data needs without any data/information being exposed to an outside network. For organizations in locations without reliable commercial wireless service, CBRS can be a path to providing high-quality reliable wireless services.

CBRS Technology Benefits

While Wi-Fi offers a lower cost indoor solution for general data connectivity use cases, the CBRS may be worthwhile for enterprise applications that require additional advantages inherent to LTE, including:

- **Reliability** - from interference-free wireless operation;
- **Security** - proven LTE security framework;
- **Mobility** – network coordinated "make before break" handover; and,
- **Quality of Service performance** – as a result of coordinated wireless access.

Wireless with service levels

- service level objective (SLO) metrics for minimum throughput, maximum latency, and jitter, and/or maximum packet error rate – per standard

Performance at range

- high-power levels – 1W (30dBm) indoors and 50W (47dBm) outdoors, maintaining connections at -120 dBm

Unnoticeable mobility

- CBRS based LTE network considers the coverage and capacity resources available across the entire network footprint to allow fast roaming with an unnoticeable delay to the end-users

Clean spectrum

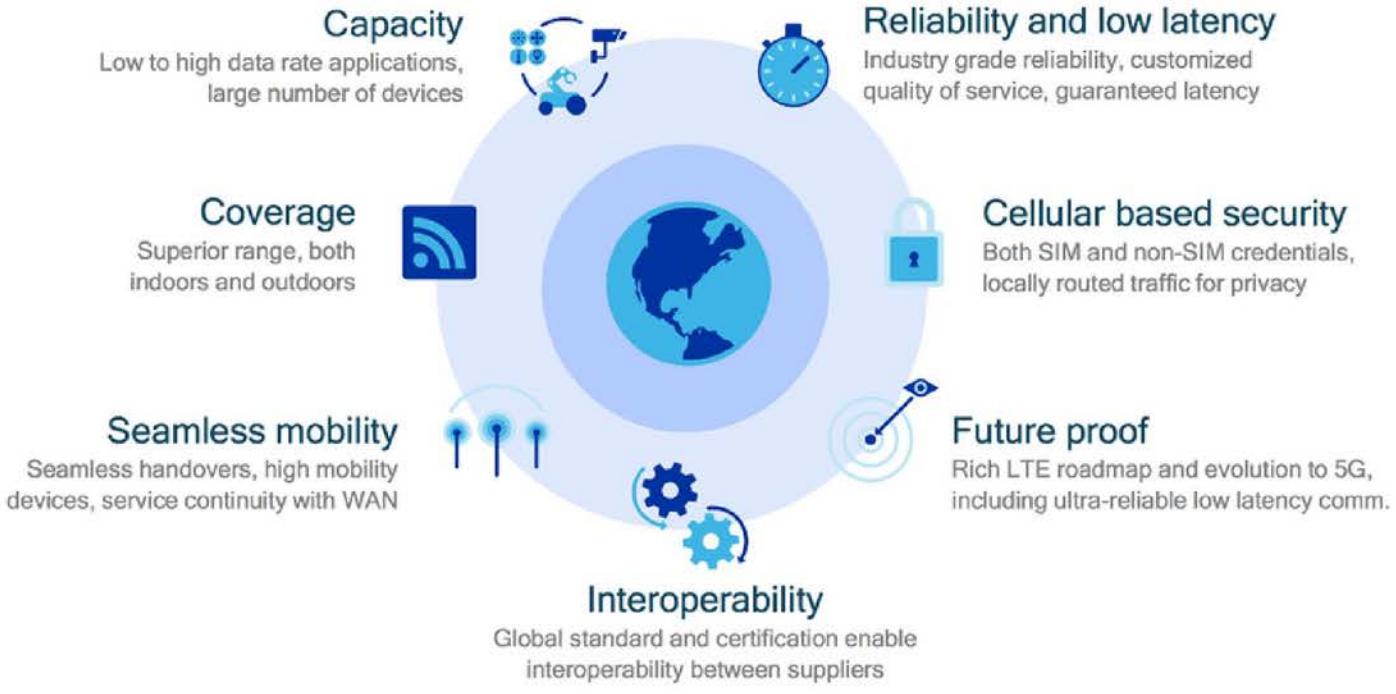
- Use of CBRS spectrum by enterprises will be coordinated via certified Spectrum Access Systems (SAS) certified by FCC in the United States

IoT ready coverage

- CBRS based network extend minimum performance requirements down to 50-100Kbps, delivering "cell edge performance"

CBRS for Industrial Internet of Things

Tecore's CBRS solution offers best-in-class flexibility, scalability, and custom feature development in the market today. Let us help you build for your needs today and continue to leverage the solution for your needs for tomorrow.



Smart City

Using technology to enhance the quality of life for the general public and increase the efficiency of public safety responders is the goal of the Safe City Solutions Movement. There are many moving parts associated with building a technology layer over a metropolitan area. Today the public and private sectors are inundated with applications. However, to be effective, they must have a strong communications backbone from which to operate.

Tecore's iCore® multi-technology Core Network platform delivers one or many-core network subsystems for LTE, HSPA+, and GSM. The system offers an efficient path to convergent wireless technologies and applications and provides a reliable base for Smart City operations. This adaptable communications infrastructure supports the collection, aggregation, and analyses of real-time data for First Responders, City Officials, and associated agencies.

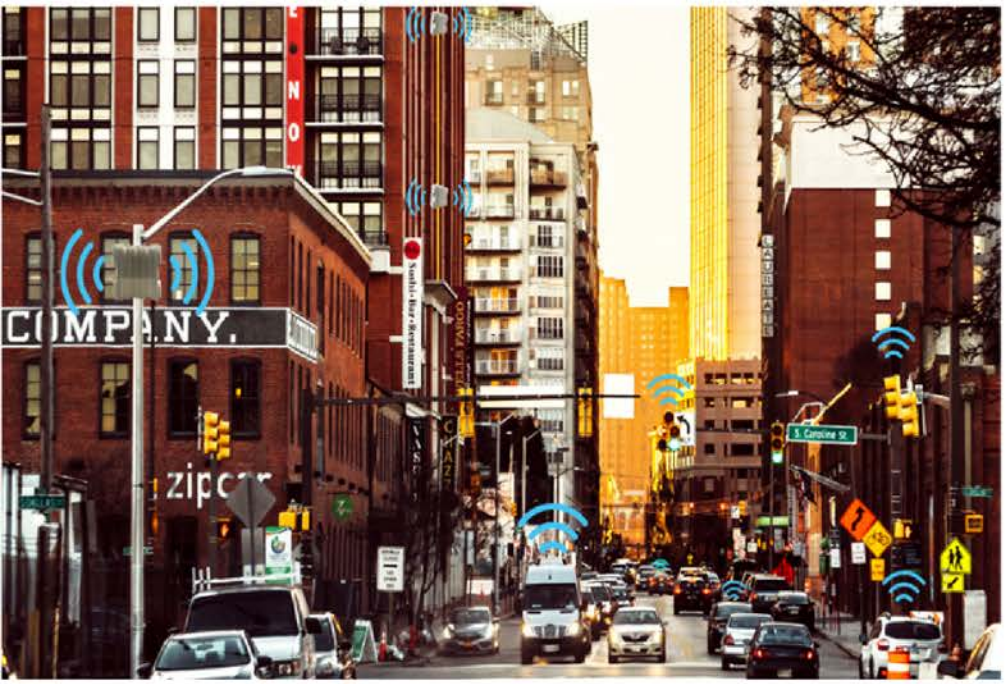
As an information and communications technology (ICT) solutions provider, Tecore's platform provides the consolidation of resources across multiple servers into a common pool. By enabling this integrated and cohesive network platform, interagency communications and collaboration are significantly improved; directing first responders and key operations agents to gather, review and respond in real-time.

A Smart City is a Framework that Provides:

- Intelligently connected infrastructure
- On-demand situational awareness
- Direct engagement with citizens
- Real-time metrics of city infrastructure and environment
- Proactive interaction across city departments to dynamically improve efficiency
- Benefits aimed to improve city life increasing commercial and residential interests

Smart Cities and CBRS:

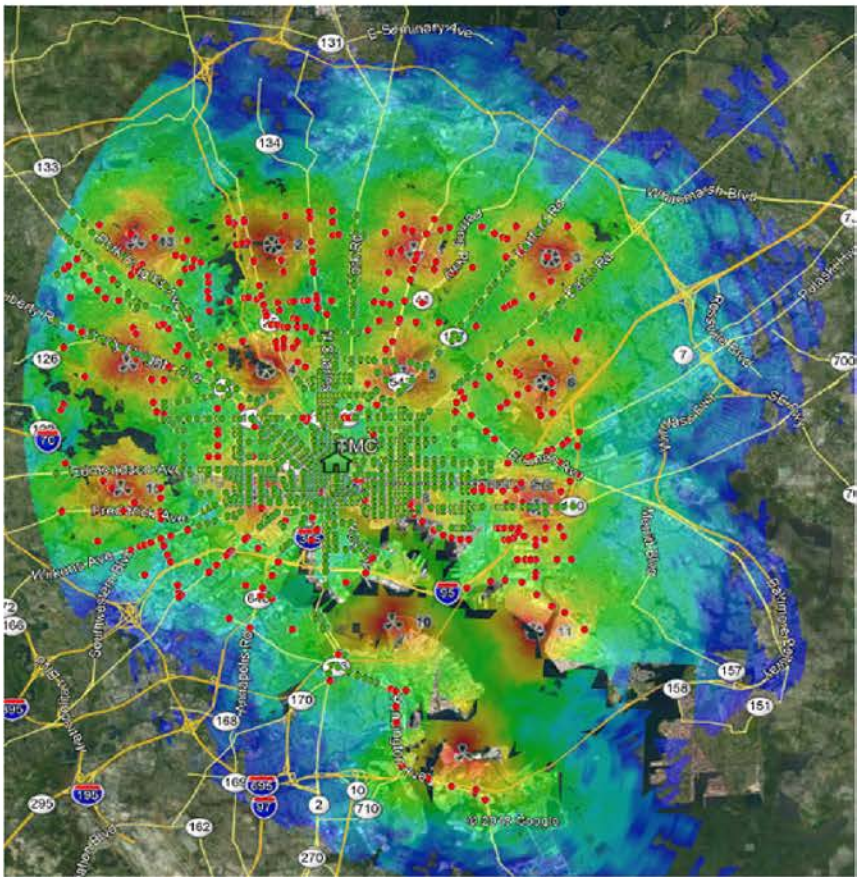
Smart Cities can use CBRS to enable the use of information and communication technologies to improve the quality and efficiency of city operations and services, meeting the needs of present and future generations. CBRS can also provide public internet services on dedicated frequencies, or implement charges for individual sectors. Similarly, the city can leverage CBRS to provide public internet services on dedicated frequencies or implement charges for individual sectors.



- Department of Transportation
- Private Communications
- Internet of Things (IoT) Applications
- Public Works
- BCPD and BCFD
- Internet Access for residents and visitors

Smart City Network Heat Map:

- Adaptable network architecture to cover large urban cities to suburban communities
- Flexible to provide densification, coverage, or both

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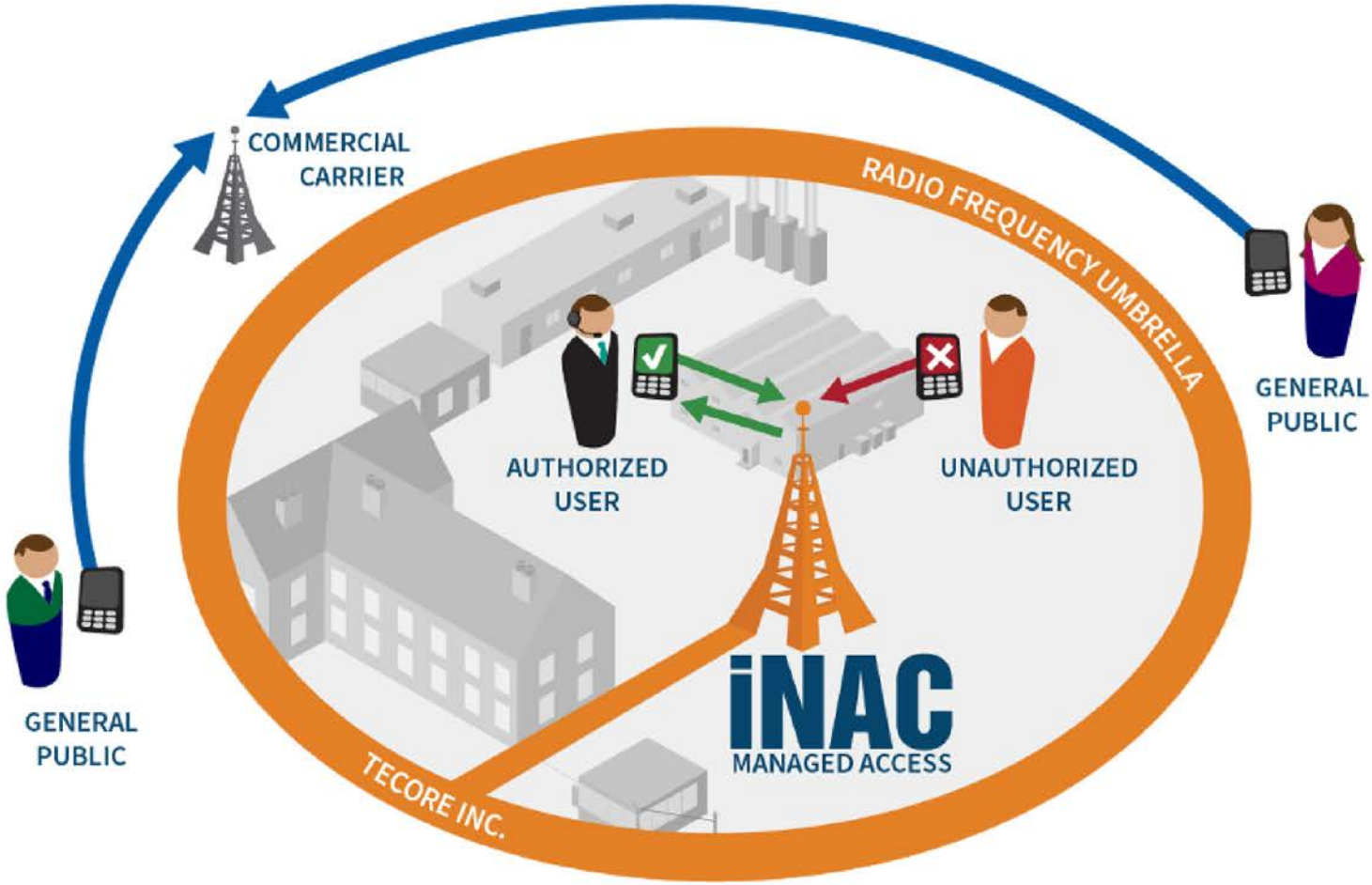
MAS-E

Managed Access Systems - Evolved (MAS-E)

MAS-E is a solution that manages communications from authorized and contraband devices that are attempting to access a commercial wireless service within the correctional facility. It is a complete end-to-end wireless solution that goes beyond the ability to just control contraband devices but also includes private LTE services, IoT, Push-To-Talk, and customized feature development.

Tecore Patented Technology

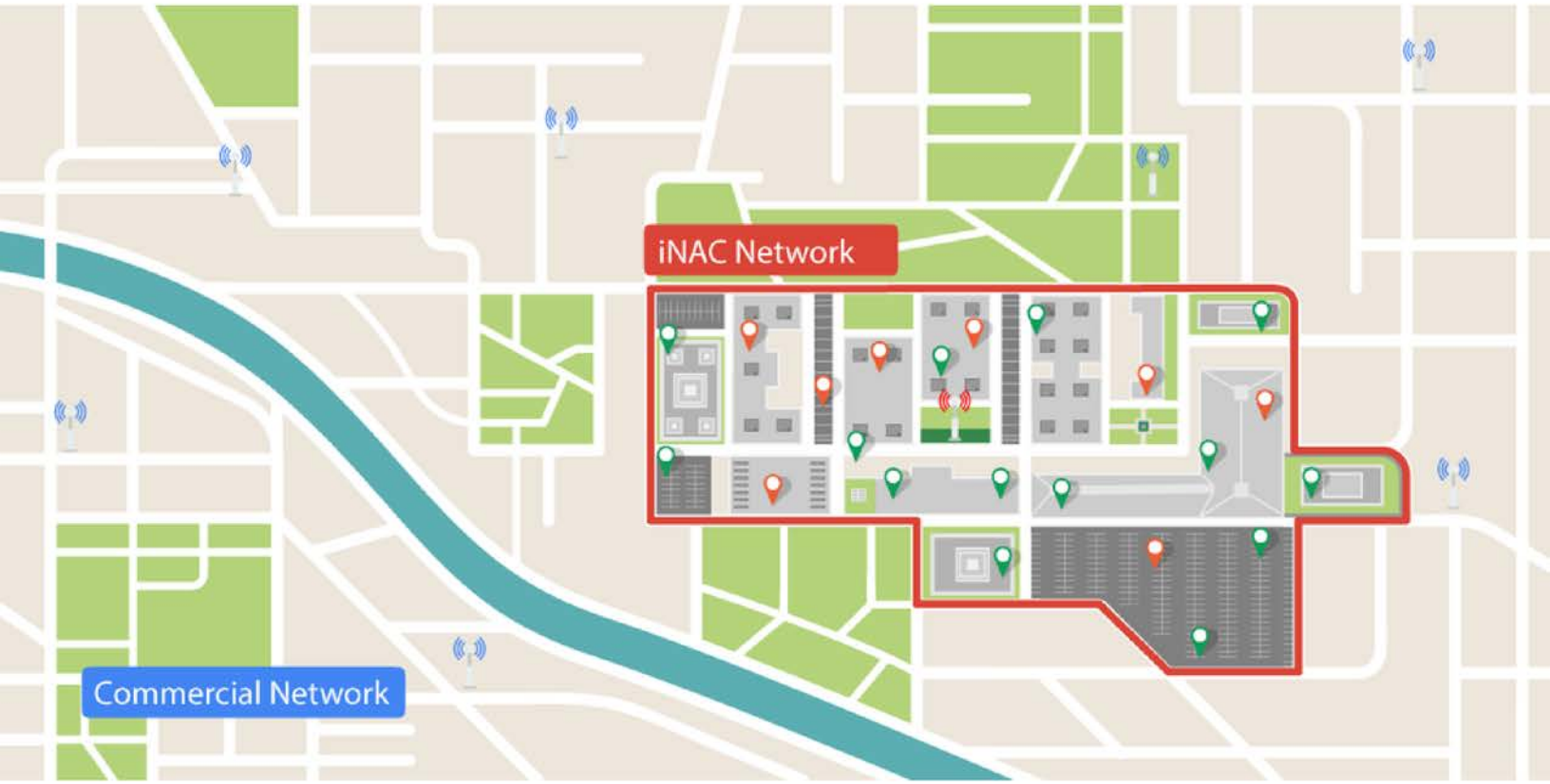
- Patented processing of multiple technologies and protocols including:
  - 5G, LTE, WCDMA, GSM, and CDMA on a single platform
- Integration of multiple network elements and value-added features in a single chassis with scalability to cloud-based virtualized architectures
- IP-based, software-driven x86 architecture built on a carrier-grade Linux platform
- Built to be profitable for as few as 100 subscribers, and scalable to a million subscribers



Intelligent Network Access Controller (iNAC)

The iNAC Managed Access system has revolutionized the industry with a patented solution for controlling contraband cell phones. The epidemic of contraband cell phones in correctional facilities today presents not just a local security risk but a threat to national security. It was not until Tecore delivered iNAC as an effective countermeasure that the corrections community had a solution that delivered the comprehensive operational capability to address the problem. Proven in both urban and rural installations, a contraband device is rendered useless from its first attempt when iNAC is installed. The end result is effective control of the communications environment within the facility.

As an end-to-end solution, the iNAC removes all the previously required carrier radios from the telecom room and replaces them with a smart radio and the iNAC cloud service platforms. The iNAC cloud services platform provides a rapid and simplistic solution for the MAS-E core services while the smart radio platform reduces the amount of hardware that is required. Combined, this architecture greatly reduces the CAPEX as well as the OPEX from the ongoing reduction of facility services and infrastructure.



Tecore's iNAC solution provides a more cost-effective, simple, and rapid deployment of a MAS-E solution to manage the entire wireless communication environment within a correctional facility.

The patented iNAC provides an end-to-end solution for selective communications restriction across the spectrum of technology, frequency, and portability in a single platform. Users are classified into categories and either allowed to access the commercial network or prohibited access on a device-by-device basis. The iNAC automatically sends authorized communication attempts to the intended commercial carrier, while capturing and blocking unauthorized communication attempts from contraband devices. This meets the requirements of service restriction while continuing to allow access to select individuals. Further, this approach eliminates the need to overlay additional systems to provide localized communications.

Rural Broadband

Tecore's solutions focus on technology that is built to fit the unique coverage, capability, and backhaul requirements of rural deployments coupled with scalable pricing that meets the economic challenges of the Rural Broadband initiatives.

Tecore's product line evolution enables operators to future-proof their networks through incremental upgrades with support for as few as 100 subscribers, to robust scalability into the millions.

Mobile Broadband (MBB)/Fixed Wireless Access (FWA)

- Carrier-grade Core network support for LTE/5G MBB/FWA
- Centralized Core network/Distributed Edge network
- Faster, reliable, and more secure than traditional broadband

Legacy Network Support

- Support for 2G/3G Core and RAN network

Reduced CAPEX and OPEX

- Future proof network with single hardware supporting All-Gs
- All-Gs support on Core and RAN
- Maximize ARPU with Tecore's Solution

Private Enterprise

Today numerous vertical markets are leveraging the opportunity to deploy their own network, enhancing business operations and functionality while reducing costs.

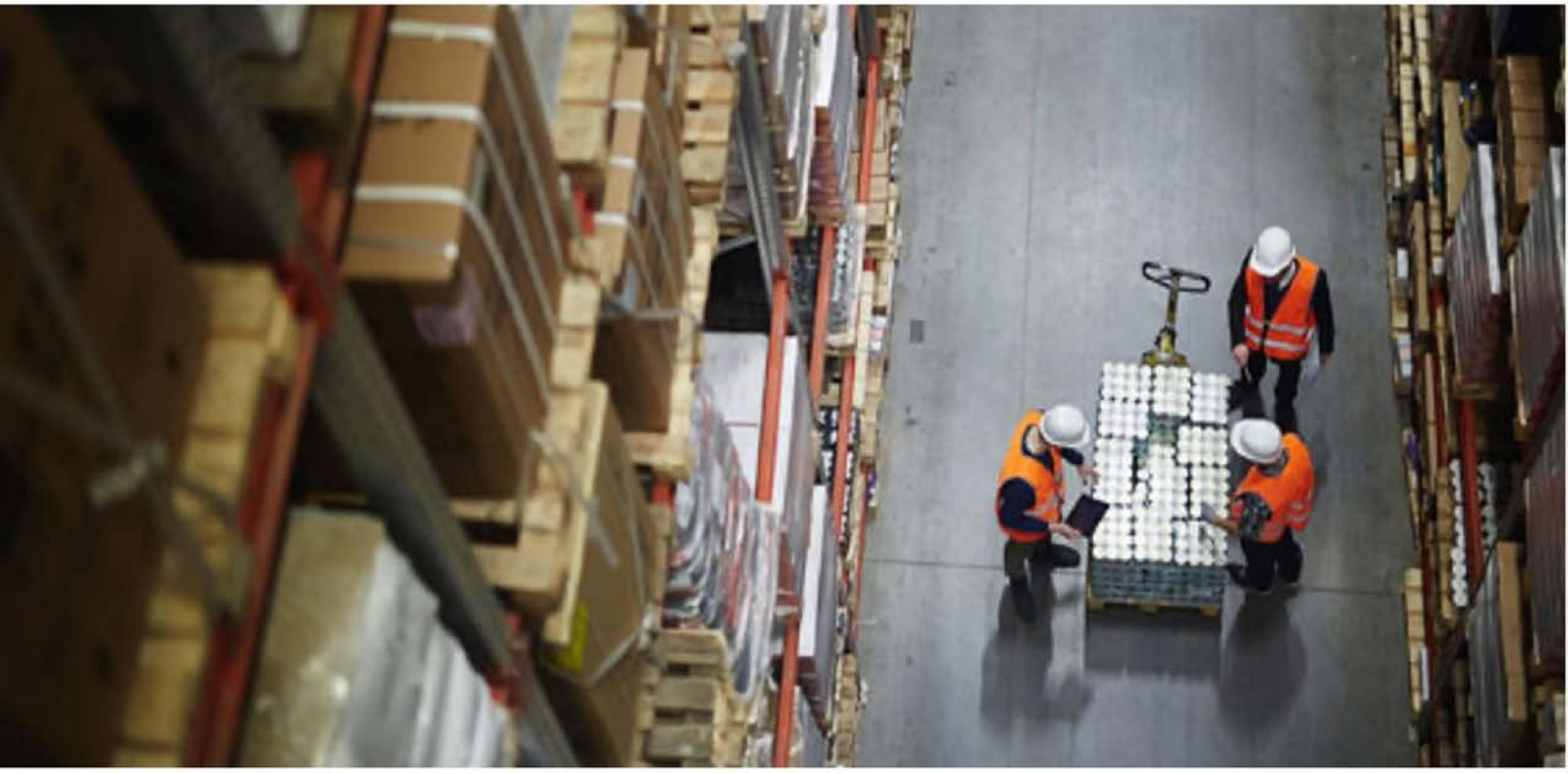
A key component to achieving these operational gains is the ability to access real-time data and analytics as part of a fully integrated view of operations. Tecore's customized multi-technology cellular infrastructure provides local control and customization through a common platform allowing private entities to capitalize on future opportunities.

In-Building Wireless Solutions

- Minimal Headend equipment footprint
- 14 cellular bands covered between 2 RRH
- Mobile local calling
- Custom ring groups/custom dial-plans
- Secure calling
- On-Prem IT infrastructure (PBX)

Neutral Host Network

- Single hardware supporting multiple carriers
- All-G's support on Core and RAN
- Single hardware supporting All-G's
- Support S1-AP interface from eNB to Carrier Core Network
- Support S8-HR connection for roaming interconnect



Bring Your Own Network - BYON

With the deployment of 5G and the opportunities it brings for a connected world, private operators can easily enhance standard operational efficiencies through connected automation and augmented applications to evolve their business. When implementing a private network enterprises have complete control over the device and its outside network interaction. The Bring Your Own Network (BYON) platform, provided by Tecore's products and solutions, allows for complete control of network access.

Rip & Replace

Tecore's Infrastructure Solution for Carriers

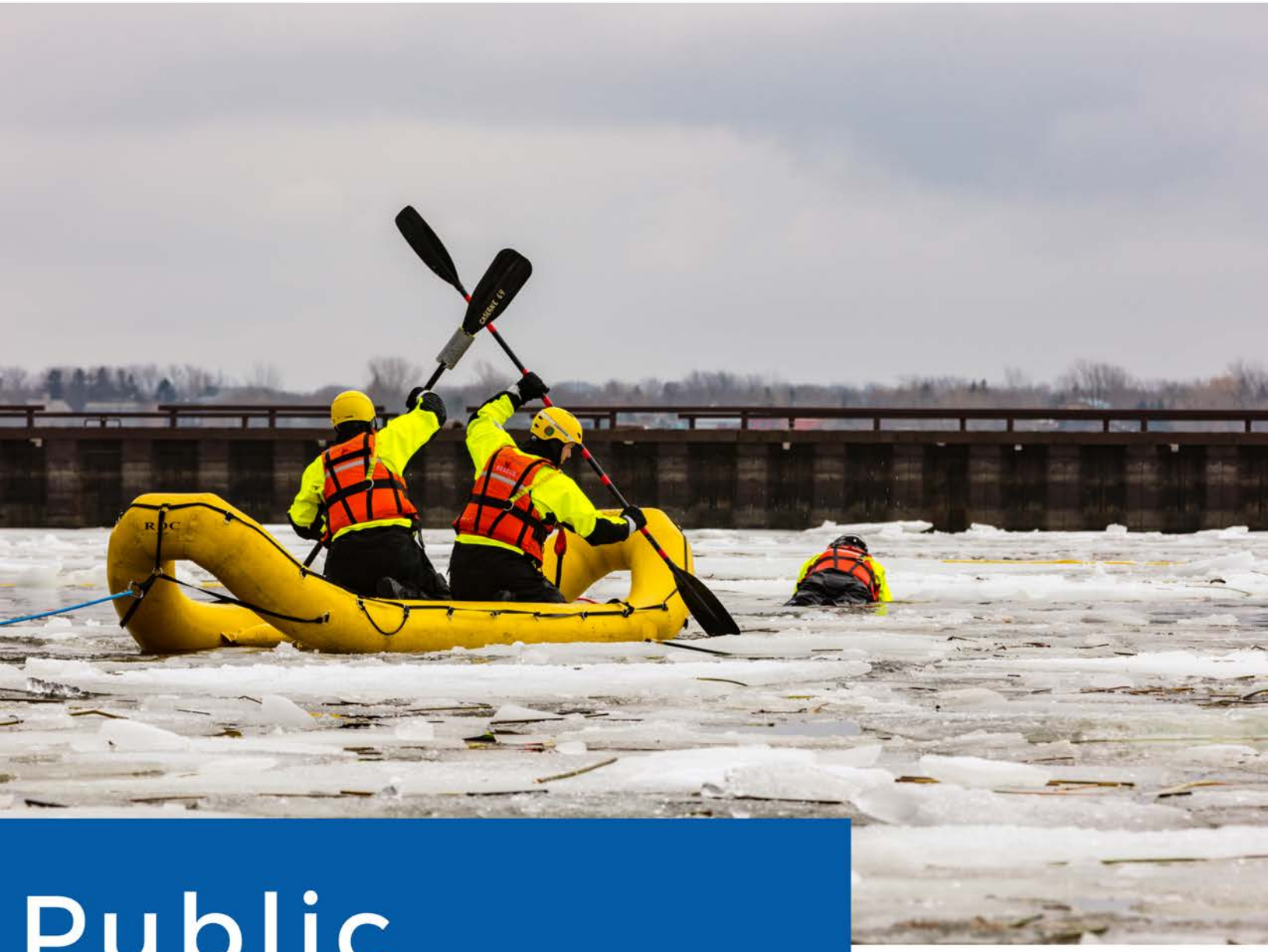
- All-G Carrier-grade Core Network
- Built on x86 platform
- Supports modular and flexible design
- Integrates into existing networks or support installation of new network
- Future proof network on single hardware supporting All-Gs
- Supports following Core components;

- MSC/VLR
- UMSC
- MME
- SAE-GW
- CSCF
- HLR/HSS
- AuC/AC
- SGSN/GGSN
- IMS for VoLTE
- AMF/SMF
- Tandem
- PDSN
- GLR/SIP Register
- SMSC/MMSC/ESME
- USSD Services
- Prepaid SCF App. Server
- Media Gateway
- SGW/PGW
- Network Slicing
- UDM/AUSF

Core Layer Equipment
4G/5G-NSA Evolved Packet Core - Small/Medium/Large, SGW, PGW, MME (10k to greater than 200k subs
HSS Subscriber Data - Small/Medium/Large, HSS (1k to greater than 500k subs, includes deployment)
PCRF Server
2G/3G HLR added to HSS - Small/Medium/Large (1k to greater than 500k subs, includes deployment)
Cloud – Virtual EPC (SAE-GW, Firewall, Carrier Grade NAT, MME, PCRF)
AAA Server (Small/Medium/Large)
IMS Core - Supporting Volte

Radio Access Network Equipment
3G/UMTS RNC (Radio Network Controller) Small - Medium (50 - 1000 nodes)
3G/UMTS NodeB HW/SW addition to eNodeB
BTS/BSC Small – Medium (50 – 1000 nodes)
2T2R eNodeB with 3 sectors, single spectrum band of up to 20 MHz/sector.
Cloud – Virtual EPC (SAE-GW, Firewall, Carrier Grade NAT, MME, PCRF)
AAA Server (Small/Medium/Large)
IMS Core - Supporting Volte

FCC Certified Radios
B2 (1900Mhz), B5 (850Mhz), B7 (2600Mhz), B41 (2500Mhz), NB-IoT dedicated band support for B86 (757-758Mhz)



Public Safety

The key to effective public safety and security communications is flexibility, control, and the ability to provide consistent communications capabilities, regardless of the situation.

While larger macro-based systems deliver these communications on a day-to-day basis, there are many public safety situations that require a team essentially “Bring Your Own Network ™”. In many cases, the prioritization of devices and users is essential to the level of support necessary to effectively manage an emergency or a high-security situation. In response, Tecore delivers proven technology solutions including secured access and requisite countermeasures that meet the requirements for the most critical communications challenges.

Emergency Services

The reality is that permanent FirstNet infrastructure will NOT be immune to the impact of natural disasters and other significant events that disrupt the commercial wireless networks deployed on the very same towers. To ensure continuity of vital services for first responders and emergency support personnel, a recovery mechanism during these interruptions which enables portable and rapidly deployable LTE communications are needed. Tecore's IOPS-capable Network in a Box® (NIB) platforms can be deployed in a matter of moments, supporting standalone operations as well as integrated connectivity as part of the larger FirstNet infrastructure.

PRODUCTS AT A GLANCE

Core

- 5G Core
- 4G LTE EPC
- LTE MicroCore
- 3G - Universal Mobile Telecommunication system (UMTS) Packet Core
- IMS Core for VoLTE/VoNR and SMS
- Intelligent Network - Service Control Function (IN-SCF)
- iCore UMSC/MSC/VLR Switching platform
- iCore HLR/HSS
- iCore SMSC/MMSC
- iCore Radio Network Controller
- 2G/3G - General Packet Radio Service (GRPS) Support Node
- Scalable Mobility Virtualized Platform

Radio Access

- Meta Cell - 4x40W RRH
- Macro Cell - 2x20W RRH
- CoreCell-RH - 4x2W RRH
- mRU Low-Band
- mRU Mid-Band

Network in a Box (NIB)

- iCore Network in a Box
- IOPS Network in a Box
- LYNX Network in a Box

Solutions

- iNAC Managed Access Solution
- Smart and Shared DAS (sDAS)
- Private LTE and 5G (CBRS)
- Public Safety
- Cloud Based Systems
- Legacy Network Support