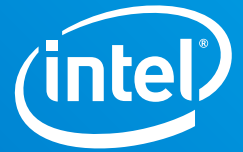
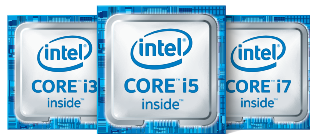


SOLUTION BRIEF

Communications Service Providers
Private LTE



NetNumber* Private LTE Offers New Enterprise WLAN Option



The combination of powerful mobile devices and the use of cloud computing has opened up a growing number of new wireless enterprise requirements that are creating a need for private LTE networks which facilitate high-speed access to distributed enterprise compute resources.

These enterprise applications are growing in multiple verticals that include manufacturing, mining, vehicle automation, rural broadband, defense, public safety, energy, and maritime. This new, distributed compute-mobile networking model provides lower latency, increased bandwidth, and other benefits that enable new applications which require a more dynamic mobile environment.

NetNumber,* a member of the Intel® Network Builders Edge Ecosystem, meets these market demands with its TITAN* private LTE solution running on servers powered by a wide range of Intel® processors.

The Challenge

Traditional technologies used for edge wireless networks and devices have included land mobile radio (LMR) and Wi-Fi, each with their respective benefits and limitations. While highly reliable, LMR is typically a low-bandwidth, voice-only, push-to-talk (PTT) solution that can't address the higher bandwidth requirements of video and imaging. PTT solutions are configured to support one-to-many, multi-cast communications for everything from first responders to retail.

In comparison, Wi-Fi provides improved wireless data speeds, but its challenges include limited range, weak tolerance to interference, high maintenance costs, and poor security.

Private LTE is an emerging technology that overcomes the challenges of LMR and Wi-Fi by delivering dramatic improvements in range, data rates over a wide area, and security. Enterprises own their private LTE networks, which operate separately from the existing public-facing LTE infrastructure. It's an ideal alternative for situations where coverage is compromised and/or not available or where interference and range are factors (e.g., manufacturing, mining, and rural broadband).

Spectrum Considerations

Building a private LTE or 5G network starts with identifying a frequency spectrum that can be used. A common way to acquire the necessary spectrum is to lease it from the mobile network operator (MNO) that owns that spectrum in the geography under consideration. Alternative solutions include Citizens Broadband Radio Service (CBRS),* a licensed/shared spectrum solution in the USA, and the MulteFire* unlicensed/shared spectrum solution that is used globally. Intel is a sponsor member of the CBRS Alliance and is actively involved as a chair of the technical working group. NetNumber is also a member of the CBRS alliance as an advisor with particular focus on the private LTE market. Intel and NetNumber, along with other member companies, are addressing the challenges that exist in the United States for enterprises to obtain spectrum via the CBRS alliance. More information can be obtained at cbrsalliance.org.

Benefits of Private LTE

- **Capacity:** With the evolution of 4G, Private LTE provides support for almost all enterprise applications.
- **Coverage:** Private LTE delivers a superior coverage range and interference mitigation compared to Wi-Fi, increasing the reach of indoor and outdoor coverage.
- **Reliability:** Private LTE provides telecom-grade reliability and low latency, with the ability to customize quality of service (QoS) levels.
- **Security:** Private LTE networks are self-contained and require both SIM and non-SIM credentials to access the network. Traffic is locally routed for privacy.
- **Interoperability:** Private LTE networks are based on global 3GPP* standards, enabling interoperability between suppliers.
- **Future Proof:** Adopting 3GPP standards today provides a roadmap and path to 5G, including mission-critical push-to-talk support.
- **Seamless Mobility:** Private LTE supports seamless handover between networks, enabling mobile devices and service continuity.
- **Consolidation:** Private LTE can enable the consolidation of multiple networks into a single managed network infrastructure (IoT, push-to-talk, and enterprise communications).

Use Cases

Some of the key use cases for private LTE networks include the following:

- **Mining:** Private LTE provides far-reaching coverage for machine-to-machine (M2M) and personnel communications in mines. Private LTE in mining consolidates IoT, communications, and push-to-talk silo networks into one common network infrastructure.
- **Defense:** Private LTE solutions can be transported in a backpack and easily set up, providing armed forces operating in remote locations fast, security-enabled reliable communications to support their mission.
- **Public Safety and Disaster Relief:** Private LTE can provide mission-critical connectivity in times of natural disasters and other crises when public cellular networks become congested and unavailable.
- **Maritime:** Private LTE networks enable maritime vessels with the ability to offer reliable broadband services while at sea for crew and passengers.
- **Industrial:** The manufacturing environment (robotics, machinery) benefits with a high level of wireless connectivity with improved interference tolerance and capacity benefits of private LTE.
- **Energy:** Power generation facilities can leverage private LTE in high interference environments and consolidate multiple networks including PTT (push-to-talk) and enterprise communications.

Foundation Platform for Private LTE: Combining Intel® Architecture with NetNumber TITAN Edge

NetNumber's private LTE solution is based on its award-winning TITAN platform and is made possible through partnerships with industry leaders such as Intel. Specifically, the Intel® NUC compute platforms based on Intel® Core™ i3 processors, Intel Core i5 processors, and Intel Core i7 processors are commonly used in private LTE network remote edge locations.

Multi-Access Edge Computing (MEC): The MEC specification that is gathering momentum under direction of the European Telecommunications Standards Institute (ETSI)* and its members is expected to be an important part of private LTE network architectures in the future. There are specific benefits to a private LTE deployment that the ETSI MEC specification helps to provide in terms of reducing operational and capital expenditures. Some examples are in simplifying subscriber management, backhaul bandwidth reduction, video content caching-streaming, IoT collection-processing, and the ability for a critical edge to continue services when isolated from the rest of the world. Intel's leadership role in the ETSI MEC specification is helping to establish a more open and standards-based solution that will enhance the future of private LTE networks.

An example of how a private LTE edge node is constructed on the Intel compute platform and the applications that are supported is described in Figure 1. The NetNumber TITAN edge is combined with NetNumber Ecosystem partners' components to enable the complete private LTE edge node solution that is virtualized or containerized.

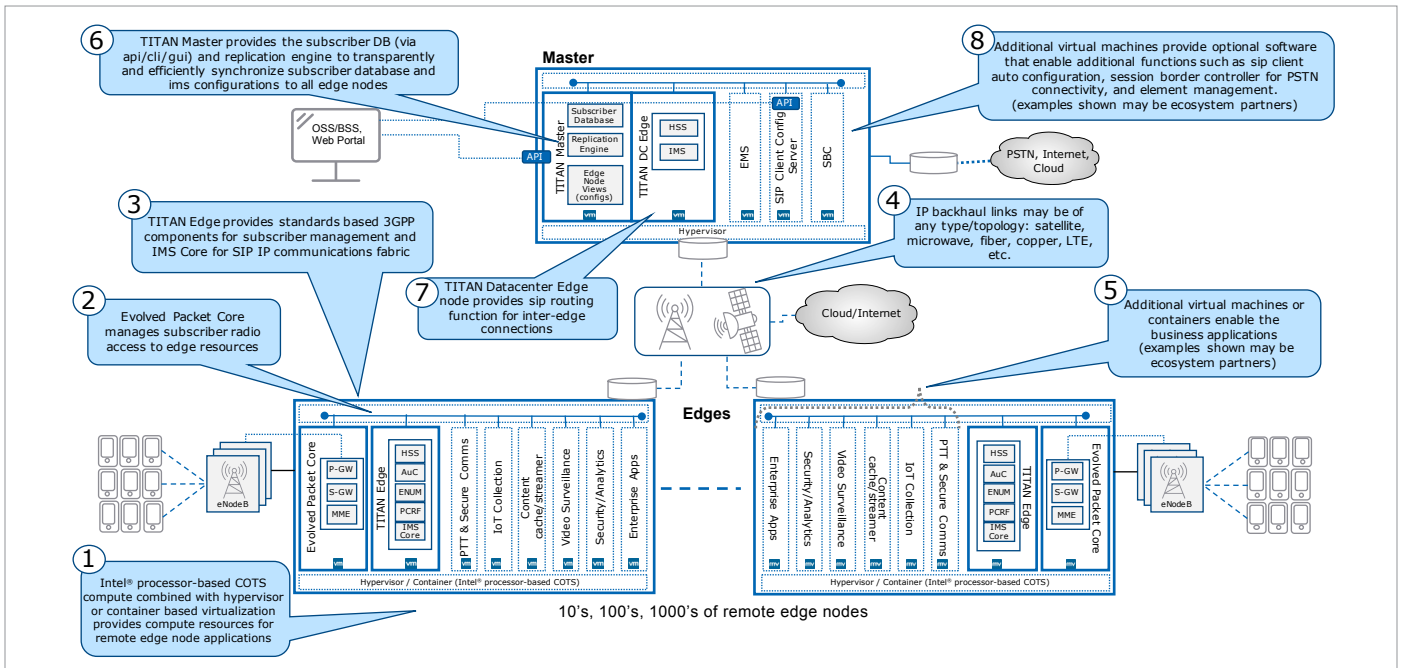


Figure 1. Foundation platform for NetNumber Private LTE¹

The NetNumber Private LTE Solution Utilizing Intel® Technology

Intel platforms provide a robust and efficient foundation for the scalable TITAN solution—from the data center to the field. NetNumber’s distributed subscriber database architecture, shown in Figure 2, is optimized for provisioning and managing subscribers at the edge. Subscriber configurations provisioned on the master node

are automatically replicated to the edge nodes, and that replication is optimized and minimized for efficient WAN utilization. In addition, edge nodes can run independently of the master when an IP connection is unavailable, a requirement for public safety, maritime, and military applications. Each TITAN edge node is designed to support thousands of subscribers, while each TITAN master database can support from tens to thousands of edge nodes.

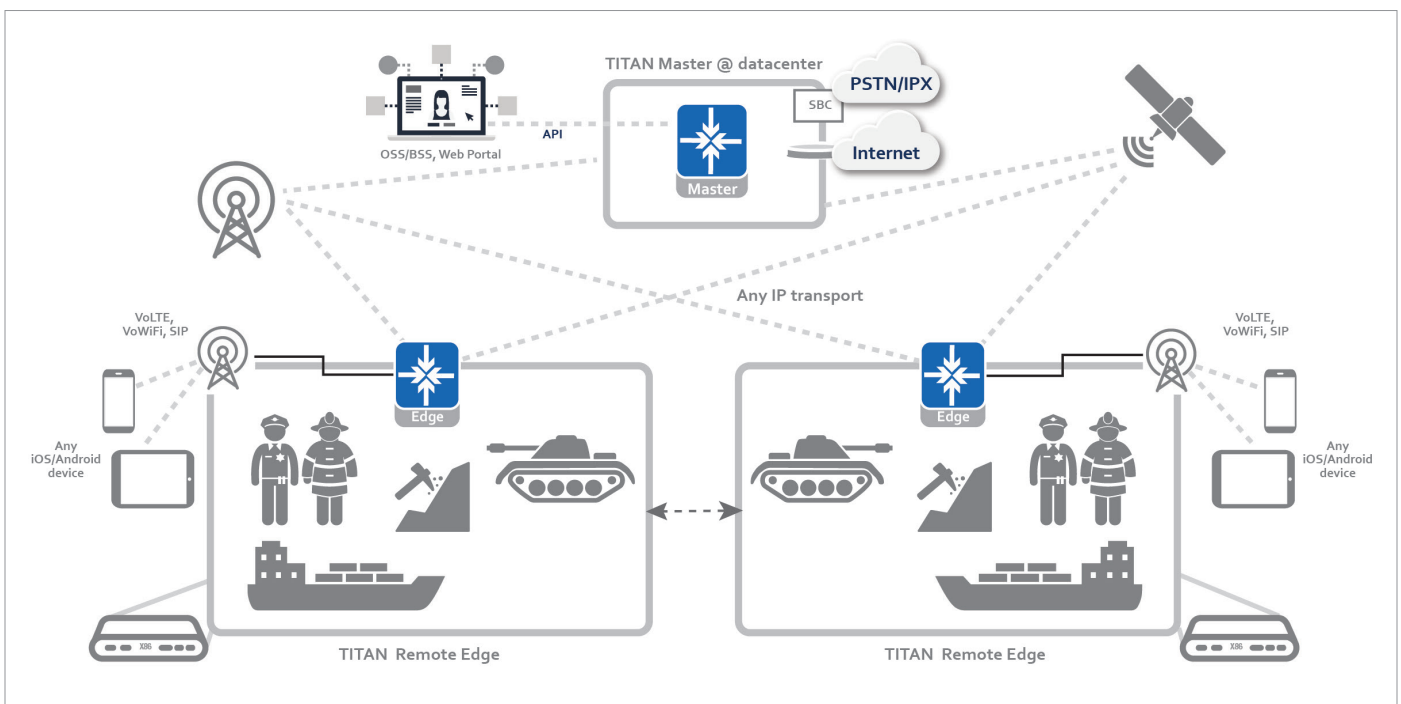


Figure 2. NetNumber’s distributed subscriber database architecture

The NetNumber TITAN private LTE edge node uses the Intel compute architecture based on the Intel Core i processor family. Many private LTE edge nodes take advantage of the Intel NUC kits or Intel NUC boards, which are ready to build or integrate into the private LTE edge node design. The configurable features and small form factor options provide the ideal compute platform for integration into disaster relief kits, drones, and vehicle edge nodes for example.

Key Features

- Virtualized or containerized, hosted in a very small footprint
- Intel Core i processor family—scalable, configurable, compact compute features
- Distributed subscriber database providing efficient, automated replication from the master, located in the data center to the edge
- Satellite friendly options for replication, optimized for WAN efficiency
- Autonomous edge operation
- Scalable options—start small and expand subscriber count as needed
- Redundancy options—both at the data center and the edge, drones, and vehicle edge nodes for example.

About NetNumber

NetNumber, Inc. brings nearly two decades of experience delivering innovative signaling control solutions that enable carriers to accelerate implementation of new services across multiple generations of networks, while dramatically simplifying the core network and reducing operating costs. NetNumber is a global provider of Centralized Signaling and Routing Control (CSRC) solutions to the communications industry.

About Intel® Network Builders

Intel Network Builders is an ecosystem of infrastructure, software, and technology vendors coming together with communications service providers and end users to accelerate the adoption of solutions based on network functions virtualization (NFV) and software defined networking (SDN) in telecommunications and data center networks. The Intel Network Builders Edge Ecosystem is a new initiative gathering ecosystem partners with a focus on accelerating network edge solutions. As an integral part of the broader Intel Network Builders program, this initiative aims to facilitate partners' access to tested and optimized solutions for network edge and cloud environments. Learn more at networkbuilders.intel.com.

Learn More

NetNumber's Private LTE Solution: www.netnumber.com/solutions/#lte

Intel NUC Boards and Kits: www.intel.com/nuc

Intel® Network Builders Edge Ecosystem: networkbuilders.intel.com/networkedgeecosystem



¹ Figures provided courtesy of NetNumber.

Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration. No computer system can be absolutely secure. Check with your system manufacturer or retailer or learn more at intel.com.

Cost reduction scenarios described are intended as examples of how a given Intel-based product, in the specified circumstances and configurations, may affect future costs and provide cost savings. Circumstances will vary. Intel does not guarantee any costs or cost reduction.

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