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By: Raj Radjassamy, 5G/wireless segment leader, OmniOn Power

The speed, security, bandwidth, and near-instantaneous communications of new 5G wireless networks are driving market-changing innovation across both business and consumer wireless applications. And close behind the initial consumer-focused deployment will be a host of new 5G-enabled enterprise and industrial applications. According to our report, that transition might be right around the corner. The report – based on a survey of 204 CIOs and CTOs from global Fortune 1000 companies[1] – found that 83% of respondents have either transitioned to 5G or anticipate doing so within the next two years.

These next-generation industrial and commercial applications will rely on high-bandwidth enterprise, or private, 5G wireless networks to carry hundreds of "condition" data points every second. These 5G private networks could be found in smart factories, cargo ports and warehouses of the future, as well as across hospitals and even in the depths of mines. In these applications, it's essential for data to move at near-real-time, low-latency speeds (1-5 milliseconds) to inform always-on, fully automated intelligent monitoring and control systems.

At the center of these 5G private networks are intertwined networks of small cell radios or distributed antenna systems (DAS) deployed for indoor or outdoor applications. And enabling this network equipment requires robust, yet dense, power solutions capable of providing the precise power needed in ever-shrinking footprints. Let's take a look at a few potential candidates for 5G private networks, and what makes this technology a good fit for each.

APPLICATIONS OF 5G PRIVATE NETWORKS

Industry 4.0

Advanced manufacturing can employ hundreds of connected smart devices, from motors and relays to computer-controlled laser cutters, all networked via indoor communication radios, hub controllers, and local computer servers. With private 5G networks, they would be able to take advantage of the high bandwidth and low latency promised by 5G to stream gigabytes of near-real-time data to monitoring and control systems and best optimize facilities and operations.

Warehousing, Logistics, and Shipping Ports

From autonomous robots roaming warehouses to managing fleets of trucks or guiding shipping containers from ports to trucks and rail cars, 5G private networks create a near-instant view of the global supply chain. This real-time view is increasingly significant as supply chains become more complex and digitized.

1. The survey conducted for the report included respondents in the U.S., the U.K., France, Germany, and Italy.

Mining

5G is driving digital transformation of mining operations with real-time connected systems and "digital twin" simulations. This not only can help optimize the operation of mining and processing equipment, but also can help keep equipment online and connected for real-time monitoring and diagnostics in very challenging environments.

Connected Campuses

In research centers, universities, and metropolitan hospitals, 5G private networks can connect all parts of the "learning ecosystem" to provide a better user experience and improve real-time collaboration. This could also include connecting building systems and security as well as channeling terabytes of data for new super computing, artificial intelligence and augmented reality applications – such as for virtual learning, research, and advanced simulation tools.

Driving these new high-speed, data-intensive, low-latency communication applications are a new set of 5G use cases, specifically, enhanced machine-to-machine total communications (MMTC), and ultrareliable low-latency communications (URLLC) standards. URLLC operates in a relatively narrow radius, usually less than a mile, but at multi-gigabyte speeds – making it ideal for industrial applications.

MEETING PRIVATE NETWORK POWER CHALLENGES

Energizing the many iterations of 5G private networks demands power conversion systems be efficient, compact, and versatile enough to be located across often challenging settings – from factory ceiling hub controllers and small cell remote radio units (RRU) attached to light poles to remote 5G DAS installations that work around congested clusters of buildings. Meeting these challenges requires a range of power innovations.

Power Source Flexibility

Private network small cell or DAS deployments, depending on the application setting and area to be covered, may need a power conversion platform that offers flexibility for different power input options.

These could be local AC input power from power/lighting poles or DC power distributed from a centralized DC power plant with battery backup.

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OmniOn Power's products can achieve 5G efficiency levels of up to 96%, meeting the 80-PLUS industry-standard.

The DC power could be distributed either as high-voltage remote line power (+/- 190 volts DC) or boosted DC voltages (54V to 58V) to account for the distance to be covered and the number of radios to be powered.

Power Density

The RRUs used in most small cell settings are often located in compact, indoor or outdoor locations, from factory ceilings to pole-mounted units across a shipping port, where both small size and high-density power output is critical. Consolidating external power management into a single, smaller, integrated power module can help achieve this.

Power Conversion Efficiency and Thermal Management

"True" 5G is expected to operate at higher frequency bands (in the GHz range) and is expected to consume more energy than 4G. Central to powering any 5G private network is managing both the efficiency levels and thermal output of power conversion.

OmniOn's power supplies, for example, can achieve efficiency levels of up to 96%, meeting industry-standard 80-PLUS® levels.

Excessive thermal output affects overall performance and longevity and can derate the output of a power conversion module. Employing a range of thermal management techniques, including fanless conductive cooling can help mitigate this. Also, moving heat-intensive power modules under the printed circuit board, near or on a chassis, can create an effective heat sink to wick away excess heat.

Robustness

Given the range of harsh settings these private networks can be deployed in – from indoor heavy manufacturing facilities to 5G radio units outside on power poles or on the exterior of buildings, exposed to heat, cold, humidity and rain – power supplies and systems need to be robust and reliable in any condition.

OmniOn Power offers a range of power supplies and systems that provide the compact footprint, high power density, and efficient thermal operation required for private 5G networks. It also offers conformal-coated and sealed power supply variations to help further protect systems from harsh outdoor conditions.

For more information on OmniOn Power's 5G solutions, please visit omnionpower.com/end-to-end-solutions/5g.

And to download its recent 5G data report. "Destination 5G: How Global Fortune 1000 CIOs and CTOs are Charting Their Course," click here.