UPDATES ON 5G WIRELESS

>> By Marc Cram, BSEE, CDCD
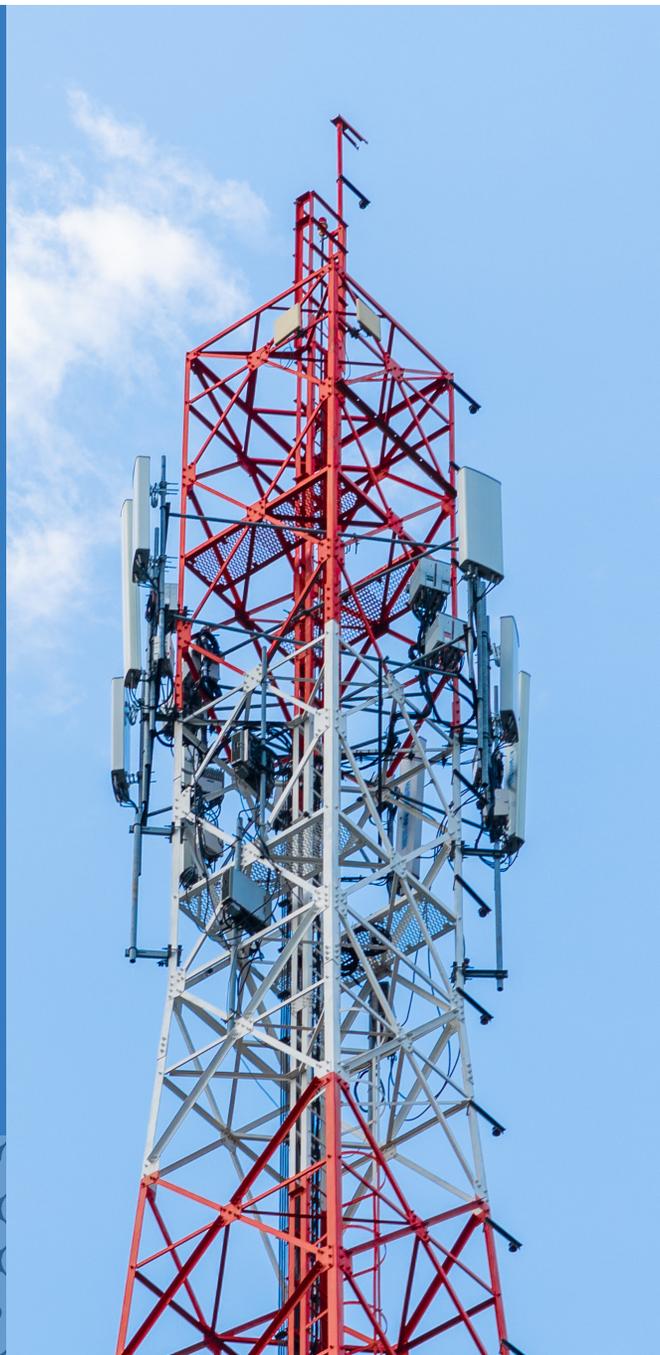
EXECUTIVE SUMMARY

This industry brief discusses the state of 5G rollouts, the interdependency of IoT, smart cities, edge computing and 5G wireless, and the changes to the power landscape that will be driven by 5G deployments.

INTRODUCTION

In 2019, some aspect of the looming launch of 5G wireless services makes the headlines on a daily basis. Around the globe, carriers are battling for mindshare and share of wallet from potential consumers of the soon to be unleashed bandwidth with announcements of the latest cities to have their networks turned on and the latest services to be offered. Fixed wireless to the home, anyone? Promises of a forthcoming revolution in the way that we connect to the internet, the IoT, the environment, and to one another are escalated at the same time as warnings are given regarding potential security, privacy and health risks of the new technology wunderkind.

# THE 5G ROLLOUT
A 2019 PERSPECTIVE

At the mid-point of 2019, South Korea and China are leading the way globally with deploying hardware to support 5G. Published statements from both have the number of sites already running in the tens of thousands, with the promise of many more to come. Very few handsets are available yet to take advantage of these sites. North American and European Union countries are still working through standards and holding spectrum auctions. Huawei, Samsung, Nokia, and Ericsson are announcing new agreements with carriers on a daily basis, while handset maker Apple only recently settled their patent and licensing dispute with Qualcomm over 5G modem technology, and silicon vendor Intel has dropped out of the 5G modem race altogether. Verizon launched a non-standard version of 5G fixed wireless internet service that has seen little uptake. Questions abound about how much money consumers will be willing to pay for 5G service above and beyond that offered by 4G. So, the market is likely to see an extended period of adoption before the carriers see a return on their capital investment.

A MATCH
MADE IN HEAVEN

Communities that are embracing the "Smart Cities" moniker and philosophy are deploying large fleets of sensors (IoT) in the hopes of delivering a smooth-running, efficient, sustainable and livable environment and improving the customer service levels of government. Cameras, gunshot detectors, parking space monitors, air quality, water quality, and numerous other sensors that are near, on, (or even in!) the citizenry are generating volumes of data that are being delivered across networks both wired and unwired. Over time, the flexibility that comes from 5G wireless connectivity will allow more sensors generating more data to operate in more places, greatly expanding the need for local processing and storage (edge computing).

Edge computing will also be the enabler for the promised latency and functionality of 5G wireless, forever putting to rest the question of "the last mile, or the only mile." Open software stacks in the form of network function virtualization (NFV) will allow white box servers to act as both the control plane and user plane of the wireless networks, supplanting many baseband units (BBUs) in today's topology with Open Radio Access Networks (O-RAN) and Cloud RAN. Working together, open software, open hardware, IoT, and edge computing will both enable and simultaneously rely upon 5G technology. Smart Cities will depend on services built upon the 5G networks. There will be "virtuous synergies" as the IoT, edge computing, and 5G wireless all grow together.
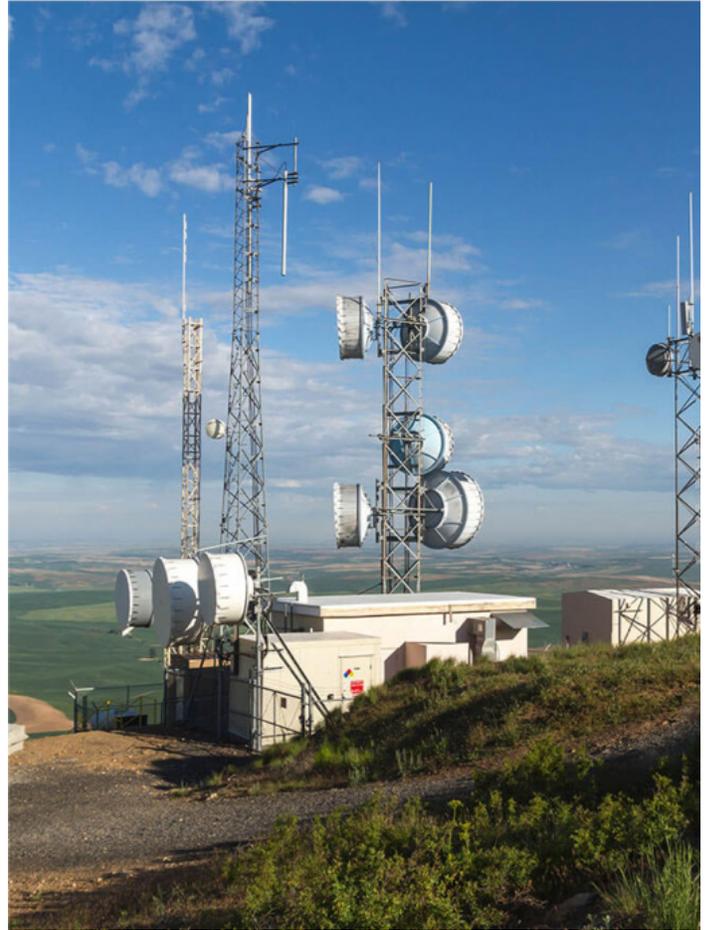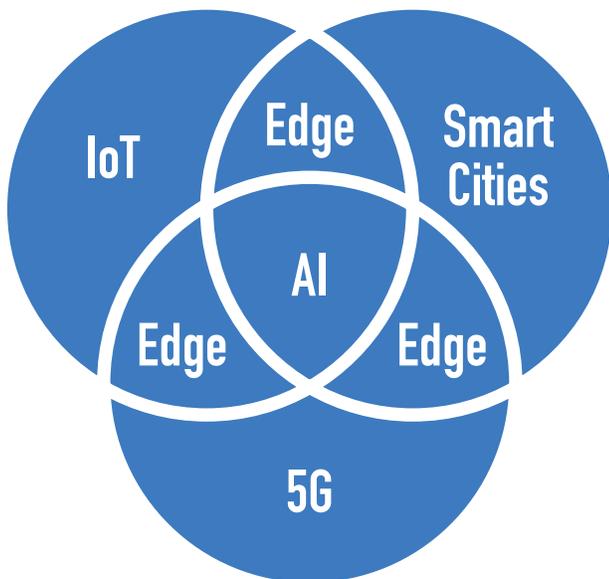
ADDRESSING
LATENCY FOR 5G

5G wireless technology is expected to deliver multigigabit throughputs and vastly reduced latency times. Prevailing thought within the industry is that meeting these goals will require new hardware in the form of edge computing infrastructure be deployed around the globe, particularly in dense subscriber environments like most major cities.

CHALLENGES FOR 5G

One firm hoping to address this edge computing need is Edgemicro of Denver, Colorado. Edgemicro's business model is to provide colocation facilities for IT customers to deploy their hardware 'at the edge.' They are building small modular data centers for deployment in small to mid-sized urban environments that may be under-served by legacy telecom or colocation infrastructure. Their typical data center employs eight conventional IT racks equipped with PDUs from Server Technology to provide power for their customer tenants.

By situating their data centers near available fiber and power capacity locations, Edgemicro expects to be able to help content delivery networks, video streaming services, autonomous vehicles, and other time-critical applications benefit from the bandwidth boost afforded by 5G wireless service. Artificial intelligence (AI) and some distributed cloud applications are also likely to benefit from running in Edgemicro facilities.

All of the touted benefits of 5G wireless come at a price. Greater amounts of radio spectrum are required to deliver the hoped for bandwidth. The new frequencies assigned for 5G do not penetrate buildings and homes as easily as the existing 4G allocations do, so new techniques such as dynamic spectrum-sharing and directional beamforming are required to maximize throughput and ensure quality of service expectations are met. The effective distance for new frequency 5G cells on a watt-by-watt comparison to 4G is significantly reduced, rivaling today's Wi-Fi access points for usable coverage. This could require an order of magnitude more hardware and site locations to have 5G coverage that rivals 4G. Buildings will have to either be fitted with distributed antenna systems and 5G picocells, or rely on handoff of traffic to new Wi-Fi 6 infrastructure, or revert back to 4G spectrum when handsets are operating indoors.

Recent statements from Cisco claim that over 80% of mobile usage happens by handsets operating indoors, meaning smartphone users will either be sorely disappointed when their phones transition from 5G to 4G when going inside or the carriers (and building owners?) will have to invest heavily in new infrastructure to meet the rising data demands. Finding the right business models to support this buildout will prove challenging for all involved, and that is without the added impediments of local government restrictions on antenna placements, RF radiation levels, and power consumption. By one estimate, 5G will require an incremental power increase of over 2% of worldwide capacity.

"80% of wireless use takes place indoors"
- Cisco

CHALLENGES

- New technology
- Complexity and automation
- Available spectrum
- Propagation vs. frequency
- Regulatory – Federal, state, and local
- Capital expense on the part of carriers
- Cost to consumer versus benefits
- Power consumption of the network
- Reliability and uptime
- Aesthetics
- Perceived health risks

POWERING 5G

Initial deployments of 5G infrastructure will be an overlay to existing 4G hardware, causing growth in the total power consumed by the networks. As the coverage area of the 5G hardware is smaller, said hardware will need to be spaced more closely together and will require new solutions for delivering electrical power. Carriers may opt for a variety of solutions based on the circumstances at each cell. Wherever they can, carriers will opt for sourcing renewable energy in the form of solar, wind, or hydroelectric power. Some of it will be delivered through the utility grid and some will be generated locally at the point of consumption.

The vast majority of the power will need to be remotely monitored and managed through automation to ensure uptime while maintaining efficiency and avoiding truck rolls. Solutions for indoor installations will be different from outdoors in both size and functionality. Some sites will utilize DC power, while others will require AC power. Having the ability to see and manage both AC and DC through a common interface is critical to enabling AI software to work its magic and ensuring the networks operate reliably.

Server Technology HDOT Cx PDUs

Raritan PX3-5000 family PDUs

legrand® IS POWER, LIGHT, AND DATA

Legrand's Raritan and Server Technology are the leading brands of intelligent power distribution products worldwide, available in more form factors and power densities than any other manufacturer provides. With solutions for both AC and DC power ranging from one kilowatt (1 kW) through one hundred kilowatts (100kW), no installation is too small or too large for our products. Legrand also offers a variety of Power Over Ethernet (POE) products that meet the needs of indoor installations.

Beyond power, Legrand also manufactures two-post and four-post racks and IT cabinets, containment, cooling, connectivity, and cable management products that are used in data centers and 5G sites worldwide. Contact your authorized Legrand partner today to see what we can do for you and your most demanding applications.

WHY SERVER TECHNOLOGY

Server Technology's power strategy experts are trusted to provide rack PDU solutions for demanding data centers worldwide ranging from small technology startups to Fortune 100 powerhouses. Because power is all we do, you will find us in the best cloud and colocation providers, forward thinking labs and telecommunications operations. Server Technology customers consistently rank us as providing the highest quality PDUs, the best customer support, and most valuable innovation. Let us show you – we have over 12,000 PDU configurations to fit every need, and over 80% of our PDUs are shipped within 10 days.

Only with Server Technology will customers Stay Powered, Be Supported, and Get Ahead.

Interested in learning more about how Server Technology can help you manage and distribute power in your application?

Visit us online at www.servertech.com

WHY RARITAN

Raritan, a brand of Legrand, is a global leader in intelligent rack PDUs, KVM switches, and other data center infrastructure monitoring and management solutions. Raritan's innovations improve the reliability, efficiency, and intelligence of data centers and server rooms around the globe — including those of the top Fortune 500 companies, such as Cisco, Dell, Google, HP, IBM, Intel, and Microsoft.

To learn more, visit Raritan.com

WHY LEGRAND

At Legrand, we build sustainability into everything we do. We are committed to developing solutions that enable high performance buildings (such as data centers), reducing the environmental impact of our own operations and transforming how people live and work -- more safely, more comfortably, more efficiently. We were ranked 51st among the Global 100 World's Most Sustainable Corporations in 2018. In addition, Legrand North and Central America was recognized by the Department of Energy (DOE) in 2018 for achieving a 20.3 percent reduction in energy intensity. We are committed to optimizing the way we manage energy, water and waste because these practices are good for the environment and good for business.

www.legrand.us

Server Technology — A brand of legrand®

Server Technology Inc.	(775) 284-2000 Tel
1040 Sandhill Road	(800) 835-1515 Toll Free
Reno, Nevada 89521	(775) 284-2065 Fax
	sales@servertech.com

Raritan — A brand of legrand®

Raritan Americas, Inc.	(732) 764-8886 Tel
400 Cottontail Lane	(800) 724-8090 Toll Free
Somerset, NJ 08873	(732) 764-8887 Fax
	sales@raritan.com