How Connectivity at the Edge Streamlines Operational Agility

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Today's businesses need to be more agile than ever before. Under pressure from rising costs, increasing competition, and global supply chain constraints, a business's profitability hinges on the ability to quickly adapt and innovate. In today's hyper-connected digital world, achieving operational agility requires the capability for employees, devices, and safety personnel to stay connected at all times — everywhere — throughout buildings and across campuses.

This always-on, in-building voice and data connectivity is critical for businesses and public institutions to maximize efficiency and productivity, as well as optimize the guest experience. Unfortunately, modern buildings and energy-efficient Leadership in Energy and Environmental Design (LEED) certified materials tend to block 5G and LTE radio frequency (RF) signals from outside, while also restricting signal propagation indoors. As a result, organizations frequently experience dropped calls, lost data connections, and poor quality of experience (QoE), ultimately leading to lost business.

Intelligent Operations

Increasingly, enterprises are leveraging the efficiencies that 5G and 4G bring to their business operations. In addition to providing mobile coverage for employees, customers, and guests, network managers also need to consider device connectivity requirements when making strategic investments. For example, a growing number of industries are adopting Internet of Things (IoT) and artificial intelligence (AI)-powered applications to achieve peak efficiency, from Industry 5.0 automation and real-time inventory tracking to streamlining guest services in hospitality operations, such as mobile keys and ordering room service.

Beyond just offering basic voice and data connectivity, many businesses are increasing reliance on cloud-based applications at the edge of the network as well. Bringing the cloud closer to devices and users in this way helps reduce latency and improve responsiveness, particularly for applications that benefit from real-time processing. Likewise, property managers are

increasingly relying on digital automation to optimize property operations, such as controlling security cameras, lighting, smart thermostats, and other building systems.

Regardless of the specific use case, in-building networking plans should ensure plenty of bandwidth for smart devices and operational teams. Yet, the ability to maximize operational agility doesn't necessarily require deployment of the latest and greatest 5G technology. For many smaller enterprises, the performance, speed, and latency of 4G in-building coverage are sufficient.

The Power of Connectivity

To ensure reliable coverage everywhere, building owners and network operators typically install in-building communications technology to deliver mobile connectivity directly to users indoors, where up to [80 percent](#) of all mobile data traffic occurs, according to Ericsson. In some cases, such as in retail shops or cafes, business owners may offer Wi-Fi service to their customers. However, despite promises of improved performance with the latest standards, such as Wi-Fi 6 and 7, this technology still faces issues, including painful registration and login, security risks, and network congestion, particularly during large traffic surges at peak times. In addition to being inconvenient, this can also present safety concerns, particularly during emergency situations.

Alternatively, many commercial building owners opt to deploy a dedicated distributed antenna system (DAS) platform, which carries voice and data signals all the way to the edge of the network, thereby eliminating coverage dead zones and improving service quality with fewer dropped calls. For nearly any type of business, this on-demand coverage and bandwidth is critical for maximum productivity, agility, and employee morale. Moreover, the ability to deliver seamless connectivity also provides an optimized visitor experience, from hotels and convention centers to hospitals and universities.

Upgrade Options

While these advanced applications provide considerable ease of use and efficiency, making the transition to the latest mobile technology may require some DAS changes with certain legacy neutral-host platforms. With global 5G connections predicted to reach 8 billion by 2029, mobile network operators are adopting new 5G RF spectrum whenever possible to keep pace with demand for coverage and capacity. But legacy DAS architecture is often unable to support new frequencies without equipment

updates or changes. When upgrading non-modular systems to 5G, for example, an expensive overlay of new infrastructure or a complete rip-and-replace project may be required to support new 5G spectrum using time division duplexing (TDD) timing sequence. However, modular systems offer an upgrade capability, allowing additional amplifiers or add-on remote units to be installed to support new 5G bands or sectors. This enables a more cost-efficient and sustainable approach to technology migration.

Yet even after upgrading DAS equipment to support new frequency bands, additional modifications may be required to enable seamless in-building coverage. This is due to a shorter signal propagation range of new 5G mid-band frequencies, such as the C-Band spectrum, versus legacy mobile spectrum. These new bands are more easily blocked by interior walls, furniture, and energy-efficient glass, resulting in a smaller in-building coverage footprint.

As a result, when upgrading legacy DAS installations to utilize mid-band spectrum, antenna replacements, additional amplifiers, or other modifications may be necessary to match the existing in-building coverage footprint. Of course, every in-building deployment is unique. The

size, materials, and layout of a specific building or campus all require careful evaluation to determine the most appropriate type of DAS platform and how it should be deployed.

Advancing Technology

Yet, some small to mid-sized enterprises, hospitals, schools, or hotels may not need or be able to afford a dedicated in-building DAS system with dedicated capacity. These small and medium-sized enterprises require an alternative solution to meet the mobile connectivity needs of their employees, tenants, students, patients, and guests. This need is especially crucial for businesses that allow a bring-your-own-device (BYOD) policy, where connectivity can be mission-critical, such as hospitals and data centers.

As wireless communications technology has advanced, recent developments now enable alternative DAS system offerings to meet the needs of small and medium-sized enterprises as quickly, simply, and affordably as possible. By employing "off-air" signals from the nearest public cell site, these Federal Communications Commission (FCC) Part 20 consumer signal boosters enable a shared-capacity DAS solution that can deliver reliable mobile coverage inside small to mid-size buildings, such as those measuring around 150,000 square feet or smaller, or those with less population density.

Shades of DAS Differences

It is worth taking a moment to understand the differences among off-air DAS solutions. Legacy off-air repeater systems (FCC Part 20 industrial signal boosters) require retransmission agreements from each mobile network operator, due to the risk of destructive interference to the outdoor macro network. Obtaining this approval can be very challenging, leading to uncertain outcomes and project delays.

Other solutions that fall under the FCC Part 20 consumer signal booster rules comprise two general types. The first of these is a wideband signal booster, whereas the second, more advanced type is a channel-selective signal booster. The wideband signal boosters amplify both intended and unintended signals within the supported frequency bands, which limits performance. On the other hand, channel-selective signal boosters amplify only the best channel available within a frequency band, providing higher quality signals and an enhanced user experience.

Because this latter type of channel-selective solution is authorized by the FCC and is carefully designed to prevent interference with macro networks, building owners, businesses, and third-party operators do not require retransmission agreements from mobile network operators. In this way, small and medium-sized enterprises can quickly access in-building connectivity that works with all major network service providers, supported by nearby cell sites, and enjoy multi-operator coverage that can be expanded without disrupting service.

Some of these Part 20 DAS channel-selective consumer signal booster systems utilize standard structured cabling infrastructure to distribute mobile communications throughout small to mid-size buildings, which is quicker and easier to install and maintain than coaxial cabling. Unobtrusive remote units are then installed in areas of the building that need enhancement to ensure seamless in-building coverage.

Agile at the Edge

With pervasive connectivity available for users and devices, any business or public institution can enhance operational agility, resulting in optimized efficiency, productivity, and profitability regardless of building size or configuration. Today, various technology options are

available, enabling building owners and network operators to select the neutral-host solution that delivers the best balance of performance, scalability, and cost-effectiveness to satisfy the mobile connectivity needs of their employees, tenants, and guests.