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# Addressing the FTTA/FTTN challenge

Fiber deployment evolving to help operators meet 4G/5G demand

Worldwide deployment of 4G LTE service is just starting to ramp up for markets outside of the U.S. Meanwhile, the first true 5G commercial networks are tantalizingly close to being ready in select regions. Software is being tested, hardware is in the works, and carriers are readying their plans to flip the switch on their 5G network in the first half of 2019[1].

For network operators, globally, the pressure to deliver on these expectations is intensifying. Perhaps the biggest challenge is bringing enough macro and small cell capacity on line to support the immediate need for more 4G and the imminent launch of 5G.

## Infrastructure challenges of 4G expansion and 5G implementation

4G uses the traditional macro site with antennas and remote radio units (RRUs) at the top of the tower. In some cases, such as high-density urban areas that are difficult to cover, the macro layer is augmented by a layer of metro cells or outdoor small cells for more targeted capacity and coverage.

On the other hand, 5G enhanced mobile broadband will rely on a dense network of small cells and upgrades to macro cells designed to support the higher frequency bandwidths and deliver the increased capacity that will be required.

Despite their topological differences, 4G and 5G deployment share an important challenge. They will require a huge number of new macro cell and/or small cell nodes. As 4G capacity demand continues to grow, operators are implementing higher order sectorization and MIMO, increasing the amount of fiber connectivity required on the tower top. 5G will feature outdoor small cell densification on the order of one cell every 200 meters or so.

## Discrete FTTA/FTTN deployment

The amount of traffic, increased speeds, and lower latency requirements are quickly outstripping the capabilities of traditional coaxial cabling. To keep pace with the demand, trends show networks are replacing coaxial-based trunks and feeders with optical fiber.

- By **2023,** worldwide monthly mobile data traffic is expected to reach **107 exabytes.**
- By **2022,** the average connection speed is expected to surpass **40 Mbps.**

Source: Cisco VNI Global Mobile Data Traffic Forecast (2015 to 2020)

The traditional solution for bringing fiber and power to macro and outdoor small cells involves discrete fiber-to-the-antenna (FTTA) and fiber-to-the-node (FTTN) solutions. This economical model, most familiar to wireless operators and installers, includes two individual cables—power and fiber—running from the baseband units (BBUs) directly to the RRUs. Alternatively, cables from the BBUs may be routed to a fiber enclosure that is connected to the RRUs with flexible fiber jumpers. This latter configuration enables future changes to the RRU without having to replace the trunk. The discrete approach provides good design flexibility. For example, separate fiber and power can be run either individually to each RRU or by fiber trunk and power trunk to connect multiple RRUs.

**Pre-assembled fiber enclosure with plug-and-play capability**

For connecting to multiple RRUs, operators also have the advantage of deploying discrete plug-and-play technology. This recently introduced solution incorporates all fiber components in a pre-assembled enclosure and is compatible with most radio types. Installers attach the fiber trunk and pre-assembled fiber jumpers to the BBU and RRUs, respectively, saving time and costs on installation and subsequent upgrades.

In burgeoning smart cities, where much of the IT and power infrastructure is being routed beneath the streets, operators are starting to connect urban outdoor small cells using fiber drop cable solutions. Hardened, preterminated fiber connectivity provides easy plug-and-play installation of fiber between the RRU and a wireline demarcation device to facilitate the increasing need for wireless/wireline convergence.

At the same time, the recent introduction of 5G in standalone/non-standalone architectures has intensified the fronthaul requirements for small cell radio nodes, emphasizing the need for more efficient and economical FTTA/FTTN solutions. These architectures are being deployed as overlays atop existing 4G networks. In many cases, a common radio may operate in both 4G and 5G modes simultaneously with each mode generally requiring a discrete fiber fronthaul connection. In other words, the required fiber fronthaul is doubled. Additionally, when 5G is deployed using mmWave spectrum, the sheer volume of bandwidths needing to be supported requires multiple fiber connections per node to provide enough backhaul capacity.

## Emergence of the hybrid FTTA/FTTN solution

As the number of required antennas and nodes increases, installation time, cost and tower loading become bigger concerns. Many networks are now turning to hybrid FTTA/FTTN solutions in which one or more power conductors and multiple fibers are bundled within the same outer jacket, creating both hybrid trunks and hybrid jumpers. In a macro site environment, one FTTA trunk cable can typically support up to 12 RRUs. Power options can range from 10 to 6 AWG, with fiber counts of up to 48 strands and growing.

**Hybrid trunk with 48-fiber count and power**

In nearly all cases, these hybrid solutions are able to save the network owner on the labor cost and installation time required to deploy their sites. More specifically, the ability to deliver power and fiber to the RRUs with a single run typically creates the following benefits:

- Significant time savings that translate into faster turn-up of services
- Reduced tower loading and potentially lower leasing costs
- Ability to deploy fiber with built-in future capacity
- A more scalable cabling infrastructure
- Simplified RF path

Hybrid FTTA/FTTN solutions have been in use for a number of years. Some of the earliest configurations featured a single run of hybrid cable from the baseband units to each sectorized RRU.

This simplified approach, which continues to be used, enables network operators to feed and power the RRUs with a reduced amount of equipment and tower loading. Time studies[2] have shown that running a single hybrid feeder from the base station to the RRU cuts installation time nearly in half compared to using separate power and fiber cables. Today, this approach is popular where an accelerated solution is desired and space is limited.

As the number of RRUs being deployed has increased, different hybrid FTTA solutions have emerged. Today, operators have a range of hybrid configurations available to meet specific deployment requirements. These include solutions to support individual sector runs, as well as a variety of breakout systems that provide options for accelerating installation and reducing tower loads. For example, some distribution boxes require manually connected fiber jumpers while others provide different styles of plug-and-play convenience. These include designs with factory-terminated and attached cable legs, and ones using a small terminal with factory-fitted connector ports and a 50 percent slimmer trunk.

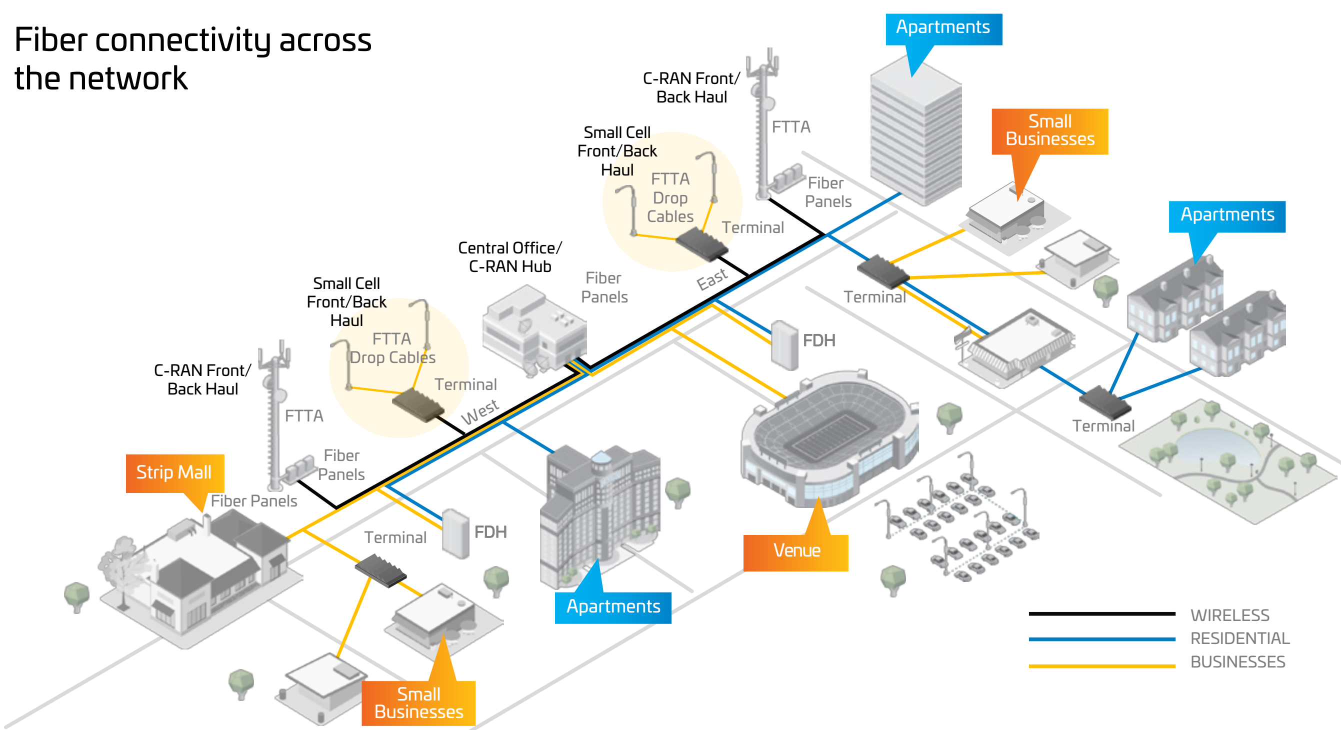
## Fiber to the node for C-RAN outdoor small cells

The various FTTA/FTTN solutions may also have a unique role to play in the growing deployment of centralized RAN (C-RAN) fronthaul architectures involving outdoor small cells. This approach can take different forms: Fronthaul for outdoor small cells may be fed directly using dark fiber from the central office or headend; an alternate architecture uses shared fiber resources to connect small cells. Either scenario will require several fibers running directly from the small cell to the central facility, as well as low-voltage power. In metro areas, lots of fiber and power will be needed, and much of it will have to be installed.

In many cases, environmentally hardened multifiber connectors will be needed to connect the small cell node to an adjacent fiber demarcation point; for example, a wireline terminal in a hand hole. As a result, fiber-optic splice closures (FOSCs) and multiservice terminals (MST and similarly MHT) will play a role, in addition to FTTN cabling.

Once installed, the fiber connectivity to outdoor small cells can be used to support additional services. This can help facilitate support for fiber-to-the-home, security systems, environmental sensors and traffic systems, as well as vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications. All this adds to the demand for a solution that can combine fiber-optic communication and power and feed the growing development of smart cities.

**Fiber connectivity across the network**



## Conclusion

If industry projections regarding 4G growth are anywhere close to accurate, the vast majority of deployments will occur during the next four years. During that time, operators will potentially need to install hundreds of thousands of small cells, as well as begin to deploy overlays in support of 5G. The amount of new fiber needed is expected to be significant.

At the same time, specific site requirements—such as installation speed, tower loads and minimal visual impact—suggest network owners and operators will likely need to expand their FTTA/FTTN toolbox if they are to continue to meet installation schedules and budgets. This means becoming familiar with the available discrete and hybrid solutions and understanding the unique value proposition of each.

CommScope has been a leader in the development of FTTA/FTTN solutions, with an extensive portfolio that features all the configurations discussed in this paper. Network operators interested in learning more are encouraged to visit the **FTTA section** on the CommScope website.

## References


1. The Truth About 5G: What's Coming (and What's Not) in 2019; Tom's Guide; February 25, 2019
2. Scott-Grant Ltd. Time study, commissioned by CommScope; December 2015





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