Rethinking the Fourth Utility Connectivity Conundrum

Broadband networking is rapidly becoming the fourth utility alongside water, gas and electricity. Lessons learned from the COVID-19 pandemic highlight the challenges of relying on current broadband networks with sub-gigabit speeds for working, learning and accessing essential services. It gets even more complicated in dense metro areas where wireless network congestion and inherently slower-than-gigabit network data rates often go hand in hand in MDUs and affordable housing complexes.

Recently clarified FCC rules allow tenants in apartments and office buildings more transparency, competition and choice for broadband services, including 5G in-home services with backhaul through a wired (coaxial cable) network and in-unit distribution using a wireless router.

The goal of gigabit and multi-gigabit networking for all is equally aided in the U.S., with approximately $42 billion of the infrastructure bill allocated for low-cost broadband internet infrastructure in multifamily residential buildings. However, the challenges of deploying low-cost, high-bandwidth total fiber or 5G network services in dense, metro-area, single-family homes, affordable housing units and MDUs still is up against significant economic and technical barriers.

MDU Fiber Challenges

Understanding fiber network evolution helps explain why total fiber, though the ideal, is challenging to deploy in existing metro-area MDUs and affordable housing complexes.

The telecommunications access family tree evolved to connect most premises to a local exchange via twisted-pair telephone wires. Copper or aluminum wires are band-limited by their construction and are typically not designed to deliver high-speed gigabit and multi-gigabit digital data.

DSL technology from the mid-1980s using existing twisted-pair copper wires is still the basis of current broadband networks. Various iterations from basic rate ISDN to HDSL, ADSL and VDSL allowed a capacity extension, which got fiber closer to premises' interiors. However, an entire fiber network comes at a cost. On average, fiber optic cable installation costs $1 to $6 per foot based on the fiber count. Though the exact price to wire an entire building varies, the average cost for 100 to 200 individual drops is $15,000 to $30,000.

Repurposing Existing MDU Coax

The primary objective of the Broadband Forum's recently published technical report, TR-419, is to allow fiber ISPs and operators to use and repurpose existing coax infrastructure to extend fiber gigabit services with minimal on-site construction work. Called fiber to the extension point (FTTep), the standard features no quality-of-experience (QoE) degradation, and an FTTep connection can be located outside or inside a building.

Locating a new, high-speed access node at the extension point and reusing existing coax passive networks has several advantages. First, it avoids installing new infrastructure into and around the home. There is no need to install new fiber-to-the-home cable or drill a hole in an external wall to take the fiber into a single-family unit (SFU) or install fiber within an MDU's hallways and drill holes in each apartment to connect the optical network unit (ONU).

The coax broadband access point (antenna outlet) is located at the heart of the premises or the media hub for seamless smart TV and IPTV services access, ensuring there is no need for additional internal wiring.

Reusing coax infrastructure inside or outside a building provides greater flexibility and reduces the lead time between receiving and fulfilling a customer order. It can provide multi-gigabit services for both residential and business customers. It allows customers to self-install and removes the need for additional visits to customer premises, saving money and time.

For gigabit and future-proofed multi-gigabit fiber connectivity to each unit in an MDU or affordable housing complex, this is where another industry standard kicks in: MoCA Access. MoCA Access and FTTep provide operators, MDUs, and building managers, owners and tenants with architecture to deploy fiber services for 30 percent less than traditional, full-fiber installations cost.

The Multimedia over Coax Alliance (MoCA) developed a point-to-multipoint (P2MP) connectivity access standard with 2.5 Gbps capability in which each subscriber has an encrypted link to the primary node. The MoCA Access 2.5 standard for operation on coaxial cable meets the integration requirements of GPON, XG-PON and XGS-PON and uses 500MHz-wide tunable frequency bands in the 400–1675 MHz spectrum. MoCA Access also provides close to symmetrical services with low latency for seamless streaming, gaming and learning.

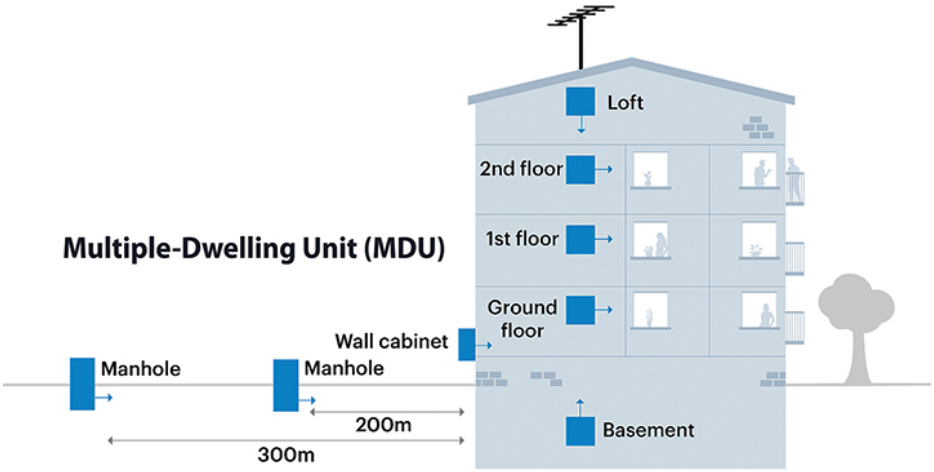

Figure 1: Typical fiber-to-the-extension point (FTTep) deployment scenarios (figure courtesy of InCoax Networks AB).

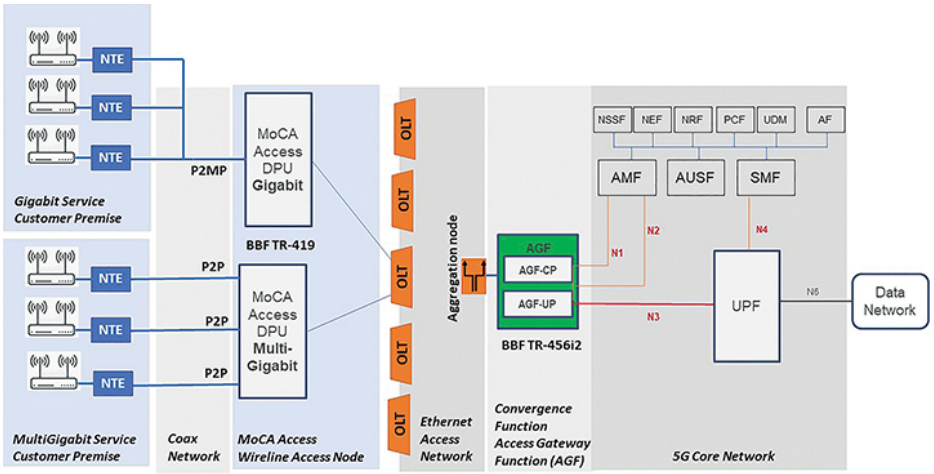

Figure 2 – Typical 5G network applying MoCA Access and Broadband Forum TR-419 in Wireline Common Carrier context with TR-456i2 (figure courtesy of InCoax Networks, Inc.).

Addressing 5G Service Gaps

Building 5G coverage in urban metro areas that reaches all homes, MDUs and affordable housing complexes is challening. 5G services in dense urban

or metro areas typically need a high base-station density within 60 meters from a subscriber's living unit, which
is often not practical or cost-effective to build.

5G fiber deployments in brownfield MDU buildings are costly and require permission from both building owners and tenants. Reusing existing phone wires does not meet the 5G gigabit broadband networking objective.

In conjunction with 5G service operator objectives for a 1 Gbps seamless broadband network experience in urban environments, Broadband Forum's recently approved new standards, TR-456i2 and TR470i2, the convergence of wireless and wired networks will help expand 5G services by using fiber networks.

Reusing the coaxial network with a point-to-point (aka home-run) connection from a basement or an outdoor cabinet to each living unit provides multi-gigabit capacity. Fiber access extension technology TR-419 and MoCA Access, combined with TR-456i2, lets 5G service operators, building owners, and customers obtain 5G coverage in buildings with existing coax cabling.

Likewise, industry standards MoCA Access and TR-456i2 converge to provide multisession and enhanced authentication support for legacy wireless routers with no 5G capability. Multisession enables users to connect to multiple service networks; previously, users were limited to a single data network.

Global networking connectivity standards make fiber connectivity in MDUs and affordable housing complexes more accessible and affordable.

How can a metro-area MDU or an affordable housing complex ensure the fourth utility, broadband networking, is fast, secure and affordable? The

answer lies in the vital work of global standards organizations to ensure interoperability and economies of scale.

Industry-standard organizations, such as MoCA, ITU-T, ETSI and the Broadband Forum, play pivotal roles in downstreaming innovation from industry and academia into standards underpinning fiber broadband network connectivity products with worldwide applications. This allows metro-area affordable housing complexes and MDUs equitable access to high-speed, gigabit and multi-gigabit fiber and 5G broadband networking.

Helge Tiainen is the head of sales and marketing, product management, and business development at InCoax Networks AB. Roberta Silverstein is the managing director for MoCA.