Carrier-Class Wi-Fi in the Home

Is the end of in-home wiring in sight?

By Masha Zager / *Broadband Communities*

From the beginning of the FTTH era, distributing fiber bandwidth inside homes has challenged service providers. After terminating a fiber at a resident's doorway, a provider must still deliver bandwidth to computers, televisions, phones and an ever-growing number of connected gadgets. In new buildings, FTTH providers encourage builders to install structured Ethernet cabling, a robust and reliable technology; serving existing homes poses more problems.

Because telephone, coaxial and power lines already run through most residents' homes, service providers try to use those wires whenever possible. Equipment vendors and large operators collaborated to create an alphabet soup of protocols for sending high bandwidth over existing wires; HPNA, MoCA, HomePlug and G.hn are among those that have generated the most support. These approaches work well in homes whose wiring is in good condition and suitably configured.

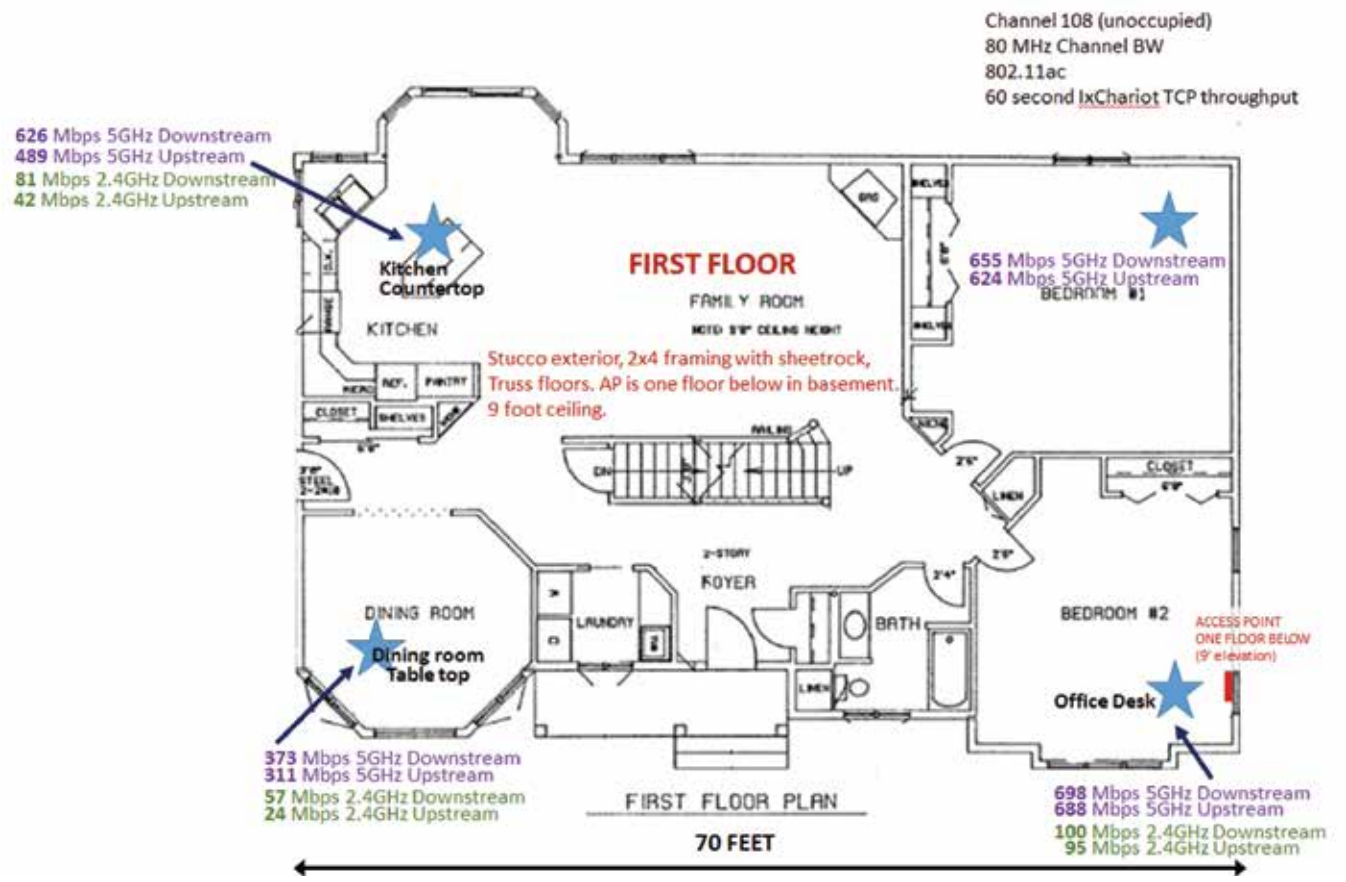
However, engineers have struggled to increase home-networking speeds as fast as Internet speeds, which keep leapfrogging ahead. For example, the current version of MoCA, a protocol for delivering bandwidth over in-home coaxial cables, supports a maximum sustained throughput of 800 Mbps – which is a bottleneck for gigabit Internet access. In addition, installing and maintaining wired in-home networks can be a major expense and headache for service providers.

In older homes, existing wiring may not even support high bandwidth. Wiring that was installed long before the Internet existed obviously wasn't designed with broadband service in mind; even if the configuration is appropriate, the wires themselves may be in poor condition. Additionally, in apartment buildings, especially when power lines are used for broadband, there may be interference between home networks in adjacent apartments.

When they can't deliver broadband over existing home wiring, service providers must usually install structured Ethernet cabling – a very expensive and disruptive retrofit. Some homeowners forgo ordering FTTH service because they don't want service providers to drill into their walls.

The holy grail of in-home networking has always been wireless, which is flexible, inexpensive and nondisruptive. The Wi-Fi standard is immensely popular for short-range wireless communications, and the majority of broadband households use Wi-Fi in the home to support mobile devices. Most broadband home gateways now have built-in Wi-Fi routers. Yet until now, Wi-Fi routers have not been up to the task, in terms of coverage, capacity or reliability, of supporting a complete home networking system.

> The holy grail of in-home networking has always been wireless, but until now, Wi-Fi has not been robust enough to serve as a complete solution.



Anticipated wireless coverage in a typical house equipped with a Calix GigaCenter gateway

That may be about to change. The newest Wi-Fi standards support high bandwidth, new antenna designs improve coverage, the use of the 5 GHz wavelength (in addition to the 2.4 GHz used in most Wi-Fi applications today) reduces interference, and software has been developed to manage multiple Wi-Fi streams and devices intelligently. Incorporating all these technologies – collectively called carrier-class Wi-Fi – into chipsets makes whole-home solutions feasible and affordable.

FIBER TO THE HOME, WI-FI INSIDE

First to announce a carrier-class Wi-Fi solution built into a fiber-to-the-home ONT was Calix, which in September 2014 unveiled two new gateways, the 844G and 854G GigaCenters. (The 844G is IPTV-enabled and the 854G is RF-enabled.) Calix expects these products to deliver unprecedented in-home wireless broadband coverage, quality of service and speed.

The GigaCenters, which support GPON technology on the upstream side, have wired connections for POTS, Ethernet and (for the RF version) RF services. Calix expects to introduce additional models that will support active Ethernet on the FTTH side, as well as models that will support HPNA and MoCA technologies on the home networking side.

Though the GigaCenters' Ethernet ports support symmetrical 1 Gbps speeds, they may not always be needed because the Wi-Fi ports are expected to provide enough speed and coverage for most users. (Wired connections are still recommended for whole-home DVRs.) Using Wi-Fi, along with the software bundled by Calix, should reduce installation and maintenance costs for service providers and enable the introduction of new services.

Speed. The GigaCenters' wireless capabilities are based on the Quantenna QSR1000 chipset, which includes 802.11ac Wave 2, 5 GHz band Wi-Fi technology with 4x4 multiuser multiple-input, multiple-output (MU-MIMO) antennas and universal beamforming. Even though the Quantenna chipset supports almost 2 Gbps of throughput, Calix is advertising only "100 Mbps+" for wireless Internet access. (As the diagram shows, higher speeds are likely.)

There are many reasons to be cautious about promising high speeds: First, most of today's mobile devices operate on the 802.11n standard in the 2.4 GHz spectrum and cannot achieve wireless gigabit speeds. Second, multiple Internet-connected devices may be in use in a home at any one time. Third, the GigaCenters prioritize IPTV and VoIP traffic over Internet traffic to ensure high reliability and low latency for these services. (They can support up to eight simultaneous

"Devices that used to be wireline, like high-definition TVs, can now be fed wirelessly. You can move that TV whenever you want."

high-definition video streams and *still* have enough bandwidth for 100 Mbps Internet access.) In addition, Internet speeds will be lower in harder-to-reach corners of a house.

Coverage. Testing by Calix and Quantenna shows that the GigaCenters are likely to reach nearly ubiquitous coverage of even traditionally challenging home environments.

"This represents the convergence of wireless and wireline," explains Geoff Burke, senior director of corporate marketing at Calix. "Devices that used to be wireline, like high-definition TVs, can now be fed wirelessly. You [the subscriber] can move that TV whenever you want. You can walk all over with the iPad." Burke adds that even large homes with rebar-reinforced walls and other barriers to Wi-Fi are likely to experience Wi-Fi coverage in more than 95 percent of their space. "We're pretty confident that, in any environment, this is going to work really well," he says.

Wi-Fi installations in multifamily housing have been known to cause interference problems, but the GigaCenters use 22 separate channels in the 5 GHz spectrum – enough for apartment dwellers to successfully tune out their neighbors' networks.

Installation and maintenance. Randy Olsen, assistant general manager of Venture Communications Cooperative in Highmore, S.D., one of the first service providers to run trials of this device, says, "The advanced carrier-class Wi-Fi capabilities of the Calix GigaCenter will be a game changer for us – dramatically reducing our subscriber installation times in our IPTV service areas."

According to Calix, service providers such as Venture can double their average number of new video subscriber installations each day, lower their labor costs, increase subscriber satisfaction and reduce time to revenue – all of which significantly improve the business case for FTTH deployment.

Maintenance is also easier with the GigaCenter gateways. If televisions are unwired, a truck roll is no longer needed when a user wants to move a TV from one room to another. And when problems occur, the Calix Consumer Connect software built into the gateways can interface with subscriber devices for advanced Wi-Fi diagnostics and troubleshooting. By enabling technicians to see past the gateways into Wi-Fi networks, service providers should be able to eliminate many more truck rolls.

New services. An embedded service creation engine in the GigaCenters serves as a launch pad for new resident and cloud-based applications and network management tools (for example, prioritizing and managing services by device), as well as for third-party applications. According to Calix, this creates an agile, highly scalable environment for new revenue-generating service modules.

As Burke says, "If you're a service provider and you *don't* go this route, establishing yourself at the heart of the gigabit home with visibility from devices to the network – you're going to say, 'Shoot, I missed it.'" ❖

Masha Zager is the editor of ***Broadband Communities****. You can reach her at masha@bbcmag.com.*