Cable and the Gigabit

Competition from fiber to the home is pushing cable companies toward providing gigabit service – and, in some cases, toward providing fiber to the home.

By Masha Zager / Broadband Communities

In the vast areas of the United States that lack access to fiber to the home, cable companies have easily maintained their positions as broadband speed leaders. Moderate investment over two decades kept them well ahead of DSL and wireless competition – and, in many cases, ahead of residential bandwidth demand. Unless developers mandated fiber in new construction or coaxial infrastructure was in a condition too poor to upgrade, few cable companies saw any need for FTTH.

All that changed with the Game of Gigs. Once Google demonstrated it could provide gigabit speed at a moderate cost and consumers responded with enthusiasm, the strategy of gradual evolution was no longer good enough. Large and mid-sized telcos began building gigabit networks. New providers suddenly appeared on the scene. Hundreds of municipalities started to review their options, develop broadband plans and issue RFPs. Areas that once had seemed safe for cable were no longer so safe. The gigabit genie wasn’t about to go back into the bottle.

In the last year, cable companies have launched ambitious plans to meet the gigabit challenge wherever it appears – or to stave off competition where they think it might appear. They have a wide variety of technologies to choose from, and where they will deploy each of these is still unclear.

What does seem clear is that providers will use their capital unevenly, based on demographics and competitive threats, and that cable infrastructures will become more rather than less diverse. “MSOs are more comfortable than telcos in having a diversity of networks,” says Erik Gronvall, senior manager of product management, fiber innovation, for CommScope, which makes a variety of equipment for cable providers. “They’re already doing wave-division multiplexing and other things that are complicated to manage, so it’s not a big challenge to manage multiple networks.”

Communities need to be aware of this growing diversity and make sure they are not left behind. Mike Coco, president of Choice Property Resources and a keen observer of the multifamily broadband industry, comments, “It’s possible we’ll have an increasing broadband gap. Not just rural areas but also suburban and metropolitan areas will have gaps.” In addition to financial considerations, he says, political factors may influence providers’ decisions about where to invest. Cities that are loud and clear about their residents’ need for better broadband are more likely to get better broadband, other things being equal.

GIGABIT STRATEGIES

Here are some strategies for cable providers to approach and ultimately achieve gigabit service. Most require significant effort and investment.

Channel bonding. Most cable providers today use a hybrid fiber-coaxial (HFC) architecture, running fiber to a neighborhood node and serving the neighborhood with coaxial cable from that node. With DOCSIS 3.0, that configuration can provide up to 40 Mbps per channel. Bonding multiple channels allows higher speeds. “That’s the type of activity happening now,” says Tom Cloonan, CTO of
equipment vendor Arris, “but it will eventually become inadequate because bandwidth growth goes up every year.”

**Switched IP video.** This technology – essentially the same method most telcos use to deliver video services – transmits video to a user only upon request. (Today, only long-tail TV channels are typically delivered on request; popular channels are usually broadcast to every customer.) By not sending video that users aren’t watching, cable providers can reclaim additional channels for internet service – which allows them to do more channel bonding.

**DOCSIS 3.1,** which has just become commercially available, allows cable companies to increase the total available bandwidth from 1 GHz (today, most use only 750 MHz) to 1.7 GHz. The extra bandwidth can be used for any purpose, including video service, but most providers intend to use it for data. How much data a DOCSIS 3.1 network can carry depends on the network’s condition and configuration, but Cloonan says 10 Gbps downstream and 1 Gbps upstream might be typical. That’s the amount of bandwidth for an entire service group, which currently includes 150 to 500 customers.

**Node splits.** The fact that users share the available bandwidth on a node is the reason for the complaint that cable slows down when the kids come home from school. So cable providers can increase bandwidth per customer by adding more nodes and reducing the number of customers that share each node. The number of customers per node has fallen steadily over the last decade, and, Cloonan says, it will continue to fall. “We’ll see 50 to 100 subscribers per service group – that’s quite a large chunk of bandwidth per subscriber,” he notes.

**Fiber deep.** Splitting a node can mean putting two small nodes into the same enclosure that housed one large node. Often, however, it involves running fiber deeper into neighborhoods and placing the new nodes closer to subscribers’ homes. Shortening the length of coaxial cable reduces or even eliminates the need for amplifiers in the field and further increases available bandwidth.

At some point, however, node splitting reaches a natural conclusion. “There’s a tipping point," says Gronvall. “When you go to Node Plus Zero [fiber to the last amplifier], the next split does not make economic sense. It could be as small as 32 customers – similar to the size of a single PON – and, depending on what the infrastructure looks like in that area, it could make more sense to do RFOG or PON.”

**Remote PHY and Remote MAC+PHY.** Newer DOCSIS versions give cable operators the option of moving some or all headend functionality – for example, subscriber management and provisioning – to fiber nodes. In this scheme, transmission from headend to node is via Ethernet rather than RF and can even make use of passive optical network (PON) architectures. This solution reduces the need for power and rack space in headends and improves signal-to-noise ratio, increasing spectral efficiency – which again increases throughput speed.

**Fiber to the building.** Increasingly, cable operators are placing fiber nodes in the communications rooms of multiple-dwelling-unit (MDU) properties. Once an operator delivers fiber to a property, it has a number of options (other than FTTH) for distributing bandwidth within the property, including DOCSIS, MoCA, HPNA, G.hn, VDSL, and G.fast. Though DOCSIS and MoCA are the most likely choices, “no one choice is the right one,” Cloonan says. “It depends on the constraints of each building. You don’t want to rewrite the building.”

**Fiber to the home.** Finally, cable providers can future-proof their networks by migrating to true FTTH – using either RFOG, which is essentially just an RF fiber node placed at a home, or the PON technologies favored by telcos and fiber overbuilders (including the next generation of PON technologies, NG-PON2 and 10G-EPON, which will be needed to deliver services to businesses and cell sites). Using PON involves more than running fiber; operators must also prepare the headend and IT infrastructure (network management, provisioning, and so forth) for FTTH, Gronvall says.

HFC and PON coexist well in networks, according to Cloonan; cable operators can build FTTH where appropriate (primarily in new builds) without having to replace coax that still provides adequate service. The migration to all-fiber networks is an “evolution rather than a revolution,” Cloonan says, adding that cable operators “will still have deep fiber and coax in 20 years.”

**MAKING DECISIONS:**

**A SMALL OPERATOR**

Cory Heigl, general manager of Packerland Broadband, a small MSO that provides triple-play services in Michigan and Wisconsin, spoke in a recent Light Reading webinar about how these issues play out in real-life decision making. Packerland faces a challenging situation: Its 3,900 broadband customers, spread out across 51 small towns, are below average in terms of income and above average in terms of age. Younger subscribers are moving to nearby cities such as Green Bay, and everyone who can go elsewhere for the winter does. Yet bandwidth consumption is growing by 11 percent per month, and 30 percent
of customers subscribe to higher broadband tiers (Packerland offers speeds up to 100 Mbps).

Packerland had already made efforts to increase available internet bandwidth, including migrating to ClearQAM (digital video), doubling the upstream channel from 5–42 MHz to 5–85 MHz and splitting nodes to create smaller service groups. However, when bandwidth demand continued to grow, the company realized it was headed for DOCSIS 3.1, at least in areas with high demand. In addition, it decided to test FTTH deployment, which Heigl calls a “long shot,” in certain areas to compare the return on investment with DOCSIS 3.1.

Factors that would make a community a good candidate for FTTH rather than DOCSIS 3.1, Heigl said, include the following:

• Greenfield development
• Coax plant in poor condition

• Ease of construction (agricultural land that’s easy to trench or available utility poles and accommodating power companies)
• Distance from the headend (DOCSIS 3.1 doesn’t have as long a reach as DOCSIS 3.0 does).

Packerland’s experiments are still ongoing, but Heigl said he expected FTTH to have advantages in terms of plant maintenance and operation, compared with coaxial cable.

**MAKING DECISIONS: A LARGE OPERATOR**

Comcast, the largest U.S. cable company, is engaged in a massive, multiyear project to upgrade to gigabit service. It is already offering 2 Gbps service via several FTTH technologies in more than 100 markets (though not at competitive prices and only within a third of a mile of its existing fiber backbone), and it has begun to implement DOCSIS 3.1 in several markets.

Hossam Salib, vice president of access technology strategy for XFINITY Communities, Comcast’s multiframe family division, spoke at the 2016 Broadband Communities Summit about Comcast’s strategy to make gigabit service available to every unit in every MDU that it serves. Salib noted that much of the residential growth in the United States is in MDUs and that MDU residents generally have high bandwidth demand. In fact, Comcast’s roadmap for upgrading MDUs extends for 20 years and goes well beyond the gigabit.

XFINITY Communities runs fiber to the unit in greenfield MDUs—which Salib said was comparable in cost to HFC—and it also rewires existing MDUs with fiber if owners agree. Its fiber-to-the-unit solution, which uses PON for data and RFoG or coax for video, depends on the distance of the building from the headend; the PON optical line terminal may be in the headend or in a remote node.

“‘A lot of owners don’t really want to be rewired,’” Salib commented. “‘It takes cost, time and work.’” However, any brownfield MDU can be upgraded to fiber to the building and DOCSIS 3.1 to provide downstream gigabit service today and symmetrical gigabit service in the future. Within these buildings, XFINITY provides service over existing wiring.

If a building has both coax and Ethernet cable, XFINITY uses an “Ethernet switch” solution, distributing video over coax and data via fiber to the floor and Cat 5e or Cat 6 cable to the unit. A more typical fiber-to-the-building solution distributes both video and data over coax.

Eventually, Salib said, all the solutions XFINITY Communities is implementing will support 10 gigabit service, using 10G-EPON, future versions of DOCSIS 3.1 and Ethernet.

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