# Dark Fiber Versus Lit Fiber

San Francisco is considering two options for a citywide open-access network. Both are good, but one option offers significant advantages.

By Greg Whelan / *Greywale Advisors*

I n October 2017, the city of San Francisco released a feasibility study for a ubiquitous, open, fiber-to-the-premises network – ubiquitous as in 100 percent citywide and open as in open-access broadband. There will be tremendous benefits to the San Francisco community if this network is built. Yet there are also challenges that range from utility pole attachments to the reaction of the incumbent service providers.

The study, conducted by CTC Technology & Energy and IMG Rebel, proposed two public-private partnership models, a dark fiber model and a dual model that includes both lit and dark fiber. Both models are orders of magnitude better than broadband today. If either model were widely deployed throughout the United States, it would unleash a wave of innovation and economic growth for decades.

Why would a city as large and vibrant as San Francisco want to undertake a massive $1.5 billion civil construction project, becoming the owner and potentially even the operator of an open-access fiber network? For the same reason many other cities do. The San Francisco report stated, "Broadband networks rank among the most important infrastructure assets of our time – for purposes of economic development and competitiveness, innovation, workforce preparedness, health care, education, democratic discourse and environmental sustainability."

Modern broadband *is* critical community infrastructure, and yet there are digital divides on a neighborhood-by-neighborhood basis. The economics for private entities to serve entire communities are challenging. Hence, the city figured that someone else should build the infrastructure, and that someone is the city itself.

## A SIMPLE BROADBAND MODEL

A simple model can help people understand the ecosystem impacts of large-scale, open-access broadband deployment. A simple broadband ecosystem, shown in Figure 1, includes three types of entities. On one side are consumers and businesses. On the other side are cloud companies that offer the applications, services and content the first side wants. In the middle are broadband access providers, which in the United States include traditional telephone companies, cable TV companies and mobile network operators. In an ideal ecosystem, the entity in the middle provides the two sides, as well as different entities on the same side, with access to one another.

The broadband ecosystem is not really that simple. In the U.S. market, most broadband access providers also provide applications, services and content (see Figure 2). In addition, cloud companies have numerous initiatives to accelerate the deployment of both fixed and wireless broadband networks. For example, two projects led by Facebook, the Open Compute Project and the Telecom Infra Project, are trying to accelerate the incumbent providers to move faster. Alphabet/Google took an alternative approach and created Google Fiber to overbuild select cities with its own fiber-to-the-premises networks. Even with net neutrality regulations, the playing field is not level because some players have more power than others.
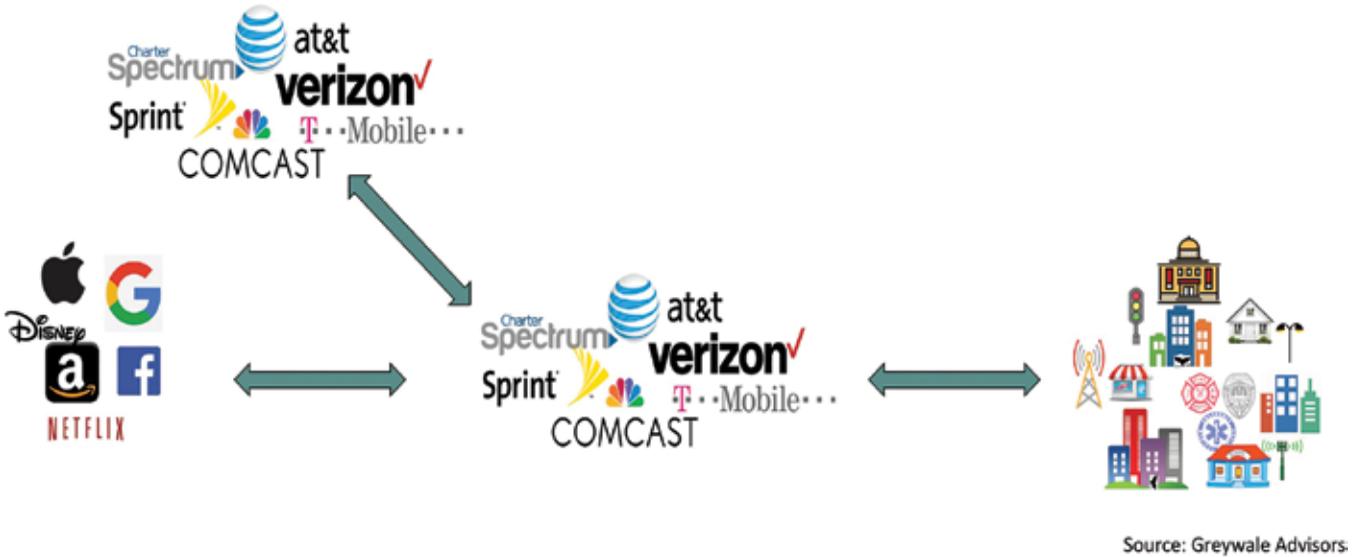
Figure 1: Simplified broadband ecosystem



Figure 2: Real broadband ecosystem

## OPEN ACCESS TO DARK FIBER

The basic concept of open access is to separate services from the network. (See Figure 3.) This can be done at the dark fiber (passive) layer or at the lit (active) layer. In the open-access dark fiber model, the city or other network owner funds the buildout of fiber strands to every premises and then leases individual fibers, address by address, to service providers. The lease payments cover the bond payments, and all is well.

The dark fiber model is much better than today's broadband market, but it poses a barrier to entry to smaller companies. The lessee of any fiber must light both ends. The broadband data center (central office) needs optical equipment to light each fiber. Doing this at scale requires a budget and skills beyond the reach of most entrepreneurial broadband service innovators.

The same is true on the premises side – the lessee must deploy some device to terminate the fiber and hand off traffic to the in-home or in-building network. Yes, it can be done, but to do it even once, not to mention at scale, a company must buy equipment and trucks and hire installers.

Thus, a dark fiber model could lead to a faster version of today's broadband ecosystem (Figure 2), in which national, regional and local service providers compete to offer triple-play and internet-only connections.

The lack of service providers is often cited as a problem with open access. But how many triple-play or internet-only providers does anyone really need? If a community had two companies that competed to lease dark fiber and
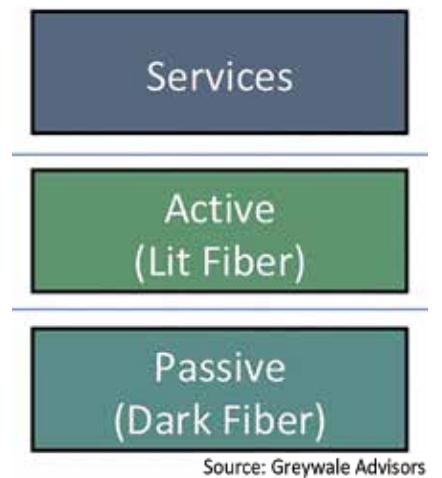


Figure 3: Open-access model

offer today's services at gigabit speeds, it would be an elite global community. This alone does not solve the power
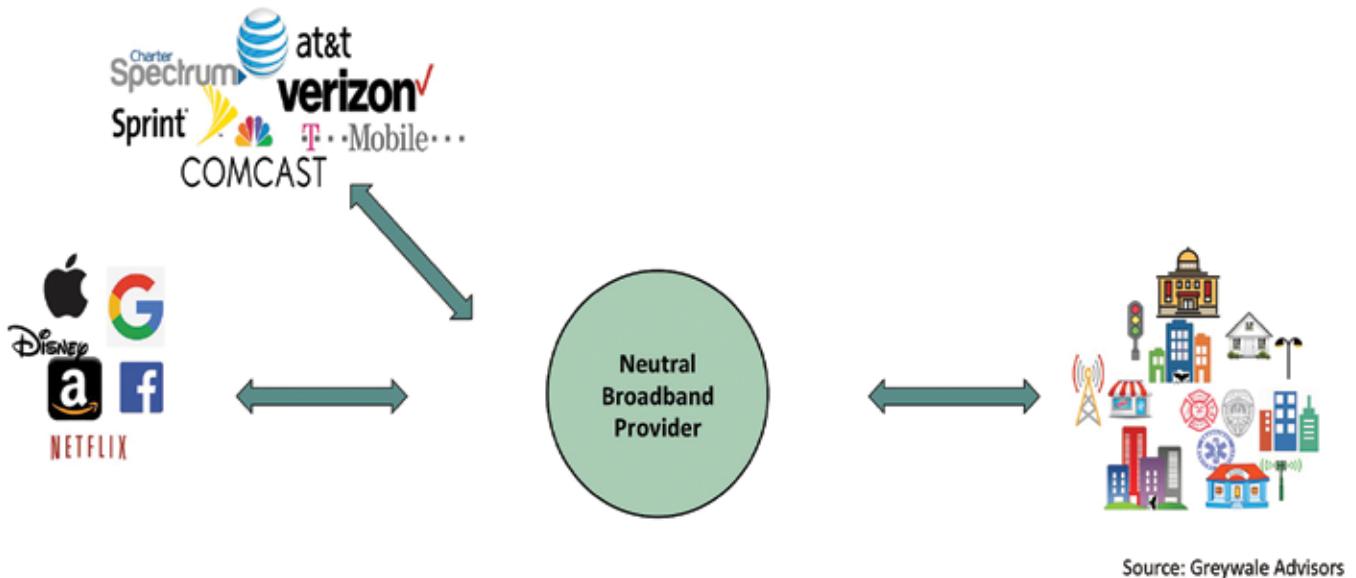
Figure 4: Lit-model broadband ecosystem

Source: Greywale Advisors

imbalance in the ecosystem; it just makes the whole ecosystem faster.

Large cloud companies could also lease dark fiber and serve individual homes. Google Fiber could lease the entire network, as it did with the open dark fiber network in Huntsville, Alabama. Large cloud companies should see the strategic advantage of being the gateway for all their customers' communications needs. The big cloud companies certainly have the resources to light open fiber networks. If the future of broadband is just high-speed, best-effort internet access, does it matter whether a telco, a cable company or a cloud company provides that access? The only differences among them are price and brand strength.

Given the current challenges of lighting a network at this scale, the dark fiber model is likely to be limited to a few large providers. Thus, the dark fiber model could lead either to a faster version of today's broken broadband market or to a market dominated by large national brands that have the wherewithal to light the fiber at scale. Still, there's nothing *too* dark about this model; it's a lot better than today's.

## OPEN ACCESS TO LIT FIBER

The key benefit of the lit model is that it eliminates the barrier of obtaining the skills and resources to light the fiber. Rather, the network operator (the city's private partner, in the case of San Francisco) lights the fiber and offers lit connections to service providers. In this model, a service provider just needs to peer or interconnect with the city. It doesn't have to purchase and operate the last-mile optical equipment.

The lit model (Figure 4) enables multiple service providers to serve the same home or business over the same fiber at the same time with guaranteed quality of service and security. By contrast, in the dark fiber model, only one service provider at a time can use a fiber and serves as the gateway to all other service providers, as shown in Figure 1. Switching service providers requires physically disconnecting the fiber from one service provider and reconnecting it to another.

The lit model creates a level playing field in which all service providers have equal access to all customers. It eliminates the disadvantage cloud companies face in today's ecosystem – namely, that their success is determined by broadband providers' willingness to upgrade and those providers' interpretations of net neutrality. This disadvantage is increasing as broadband providers offer more content and cloud services.

## INNOVATION CITIES

Many cities claim to be or want to be "innovation cities." A big benefit of the lit open-access model is that it is an innovation platform. With the lighting barrier removed, anyone can become a broadband service provider. Figure 5 shows several possible future service providers.

Public cloud companies, such as Microsoft and Amazon, can offer secure, very high-speed and low-latency connections to customers attached to the network. They and IoT companies will have a platform for edge computing as well, as the broadband data center should be locally situated. Colleges and universities can offer 4K video lectures and immersive learning experiences directly to all residents of the community. Gaming companies can become service providers and offer their customers a new level of experience with ultra-low latencies and gigabit speeds.

City governments can become service providers, offering every resident e-government services securely and at high speed and keeping all local data local. They can also utilize the ubiquitous fiber network as a platform for smart-city and public-safety
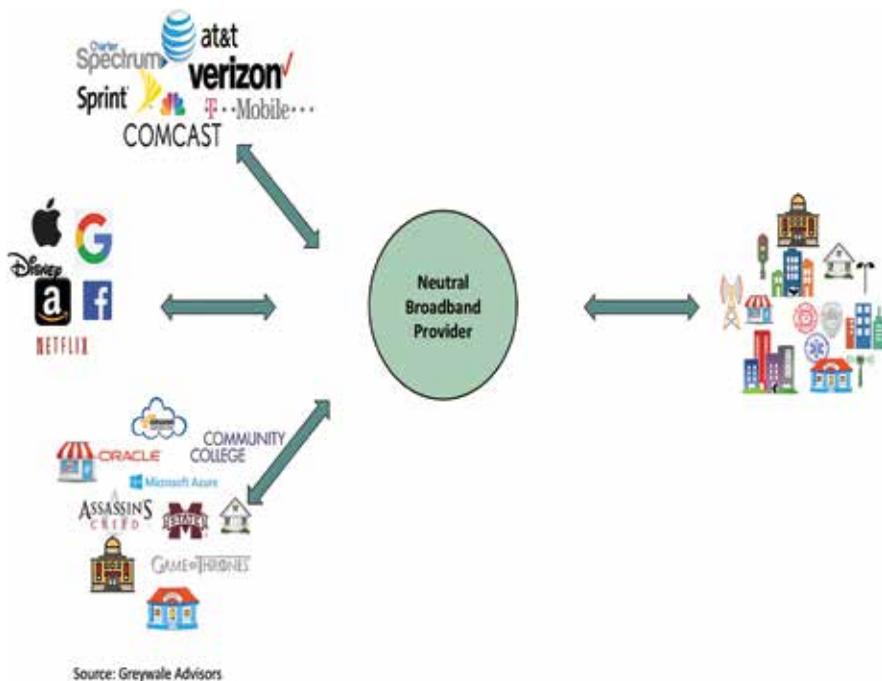
Figure 5: Lit-model broadband ecosystem in an "innovation city"

applications. Local businesses can become service providers, too, serving local customers locally and securely at gigabit speeds. All these services can be delivered to the same home at the same time over the same glass strand.

These are the easy examples. Once lit, open-access networks are widely available, new broadband applications will arise that people can't even think of today. That's the power of having an innovation platform driving a community.

Open-access broadband, dark or lit, does not have to be a threat to incumbent service providers. It's not a zero-sum game, as it is when Google Fiber comes to town and builds its own network. A forward-looking incumbent would welcome someone else doing the heavy lifting of constructing a citywide fiber network. Dark or lit, a citywide network will turn the incumbent's access network into a variable cost that scales linearly, instead of today's huge, front-loaded, fixed-cost model.

Incumbents could reallocate the $1.5 billion saved in San Francisco, for example, toward developing new, innovative services and content. They could become nimble, like cloud companies. They would also enjoy the

same playing field when they serve the 75 percent or more of U.S. customers

that don't live within their fixed broadband network footprints. These forward-looking incumbents would see a city-funded and -operated open-access network as a big win.

The city of San Francisco should be lauded for showing how a major metropolitan area can implement two models of a ubiquitous, open, fiber-to-the premises network. The dark fiber model has limitations but is far preferable to today's model. The lit fiber model eliminates a barrier to entry and opens the broadband network to a wide array of new services. Yes, there are challenges, but the outcome for the community would be epic. ❖

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