
# The New Zealand Ultrafast Broadband Network: Flexible, Cost-Effective Open Access

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# Introduction

The Government of New Zealand's nationwide fiber-to-the-home (FTTH) project—the Ultra-Fast Broadband (UFB) initiative—demonstrates how off-the-shelf passive optical network (PON) technology can cost-effectively provide a wide range of open access broadband services.

The UFB project, which intends to connect 75 percent of New Zealanders over 10 years, is managed by a government-founded crown company, Crown Fibre Holdings (CFH). CFH's functional requirement is to create a reliable and scalable broadband network to connect homes and businesses at speeds significantly greater than those available over the incumbent digital subscriber line network. From a business perspective, the network must fit within the project budget, enable public-private partners to operate a non-discriminatory open access platform, and be operable by the public-private partner with an acceptable amount of training and operational investment.

CFH initially considered a wide range of point-to-point fiber and PON technologies. Through its engineering process, and lessons learned from the experiences of similar networks, CFH selected the following elements and approach:

1. A fiber-to-the-premises (FTTP) architecture, designed to serve most homes and businesses with a PON but capable of providing point-to-point and diversely routed services to high-volume and critical users;
2. A mixture of aerial and underground construction, with air-blown fiber technology where appropriate;
3. Electronics centered on widely deployed, standards-based Gigabit PON (GPON) optical technology, designed to provide Metro Ethernet services with a committed information rate (CIR) and guaranteed quality of service (QoS)—and with multiple service providers serving each premises; and
4. A scalable operational support system/business support system (OSS/BSS) solution that supports provisioning, billing, management, and SLA enforcement in an open access framework.

Notably, the UFB's open access requirements did not require CFH to take a significantly more expensive approach to the network design and equipment. For example, the design did not require dedicated fiber for multiple service providers to each home. It also did not require CFH to abandon a PON architecture for a point-to-point architecture, which could have more than doubled the outside plant cost for the network. Finally, it did not require a customized optical solution—it uses standard off-the-shelf hardware, for which the UFB obtained competitive bids from several manufacturers.

As a result of its ability to cost-effectively provide open access, the UFB will be able to deliver not only a nationwide FTTH network, but also ultra-fast broadband competition (in the form of multiple service providers offering services to customers), all at the cost of a single network build. And, it will be able to do so without risky or unproven hardware.

# The Composition of the Open-Access Model

Structurally, the UFB model is a public-private partnership. CFH oversees the government's NZ$1.5 billion investment; it will distribute the funds to private partners that will construct or upgrade central offices (COs), build fiber between the COs, build fiber from the COs to 75 percent of the homes and businesses in New Zealand, construct the subscriber drops, install the customer premises equipment, and operate and maintain the fiber and the Layer 2 electronics.

CFH selected four private partners:

- Telecom New Zealand (the incumbent local exchange carrier, now required to spin off its service provider component),
- Enable (a service provider owned by the City of Christchurch),
- WEL (a publicly-owned power company), and
- Northpower (a publicly owned power company)

The private partners are required to complete construction over a period of 10 years, comply with a service level agreement with CFH, and provide non-discriminatory access to retail service providers (RSPs) offering data, voice, and video services. The private partners will also pay back the government's investment at the end of the project.

Customers will contract directly with RSPs, which will include legacy companies (e.g., the retail portion of Telecom New Zealand, TelstraClear, Vodafone, Sky) and new entrants. RSPs will connect with the private partners at a regional point of interconnection (POI) for each metropolitan area. RSPs will obtain wholesale Metro Ethernet services or dark fiber from the private partners and in turn will provide retail services to homes and businesses. The RSPs will initially sell standard data, video, and voice services, but those services are expected to evolve as RSPs and customers become aware of the possibilities of the UFB. Potential future services may include customized telemedicine, telework, educational, energy management and other solutions.

## *Layer 1 Model*

The inter-CO aggregation network will be diversely routed with sufficient fiber for current and future needs. The access network will provide fiber from the COs to neighborhood cabinets. There will be sufficient fiber count to provide a 1:24 split for PON technology and sufficient spare capacity to provide point-to-point services to power users or users requiring special security. There will also be the capability to provide full path redundancy for the most critical users, with fiber connecting the user to separate cabinets, or even separate COs.

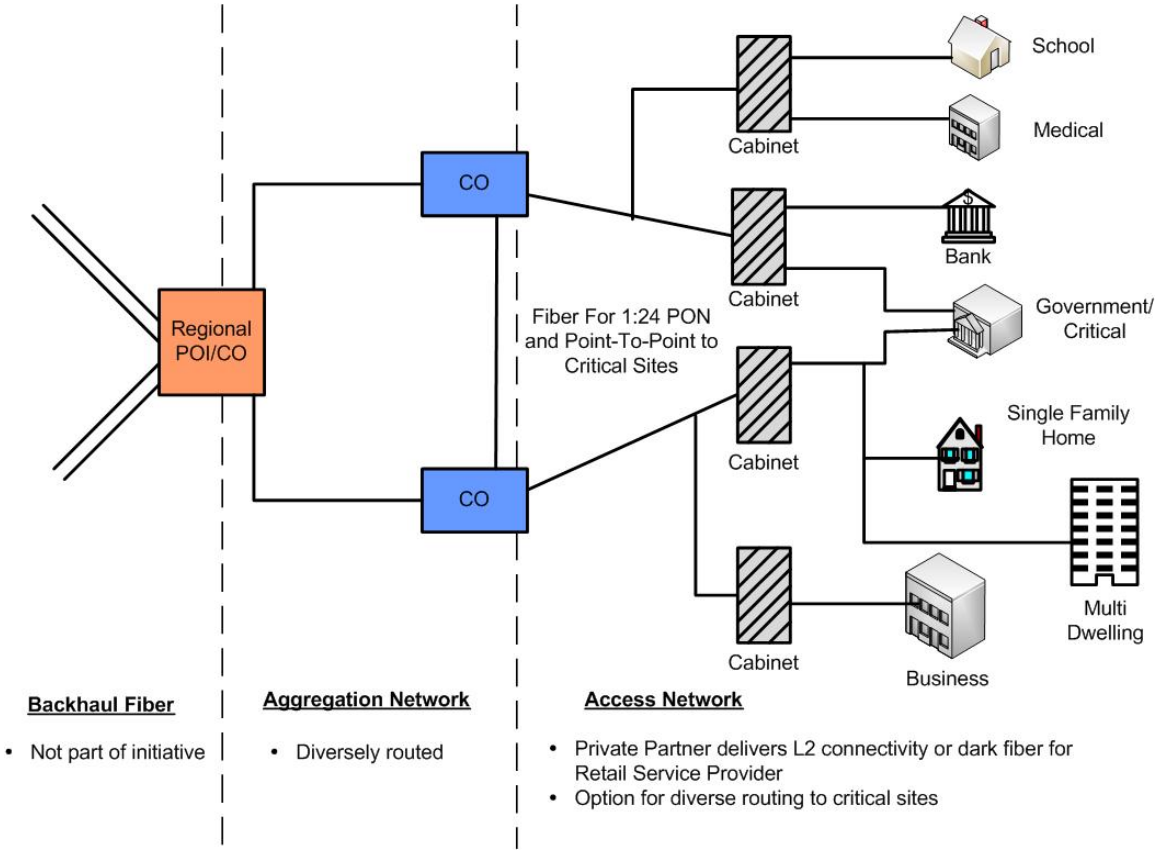
The private partners will construct fiber optics to the property boundary of each premises (Figure 1), and will be responsible for installing the subscriber drop upon request from the RSP. (The private partner will be bound by an SLA to complete the installation on time.) Each drop will contain two fibers, one of which will be spliced to the cabinet.

Fiber will be installed aerially or underground at the discretion of the private partner, which will choose a cost-effective approach that will enable compliance with the SLA.

The private partners are opting to use air-blown fiber in many places, including most of the underground build, to cost-effectively facilitate future growth.

In 2020, the private partners will be required to unbundle the fiber, and RSPs will be able to locate their own cabinets and create their own PONs.

**Figure 1: Layer 1 Model**




## *Layer 2 Model*

In the UFB, private partners will provide Layer 2 services to RSPs using PON or point-to-point technologies (Figure 2). The majority of Layer 2 services will be Ethernet services provided over a GPON platform. The GPON platform will also make available an RF video overlay (for one RSP per customer—most video is expected to be IP) and WiFi. Most RSPs will also provide a residential gateway (RG) at each customer premises, configured with the ports and media of its choice.

Each GPON premises can be served by multiple service providers. Individual RSPs will be provisioned over separate virtual local area networks (VLANs); each RSP will also have the capability of provisioning its own VLANs within its VLAN.

Private partners are subject to SLAs on activation of new service, addition or change of service provider, packet delivery, and committed information rate. The standard

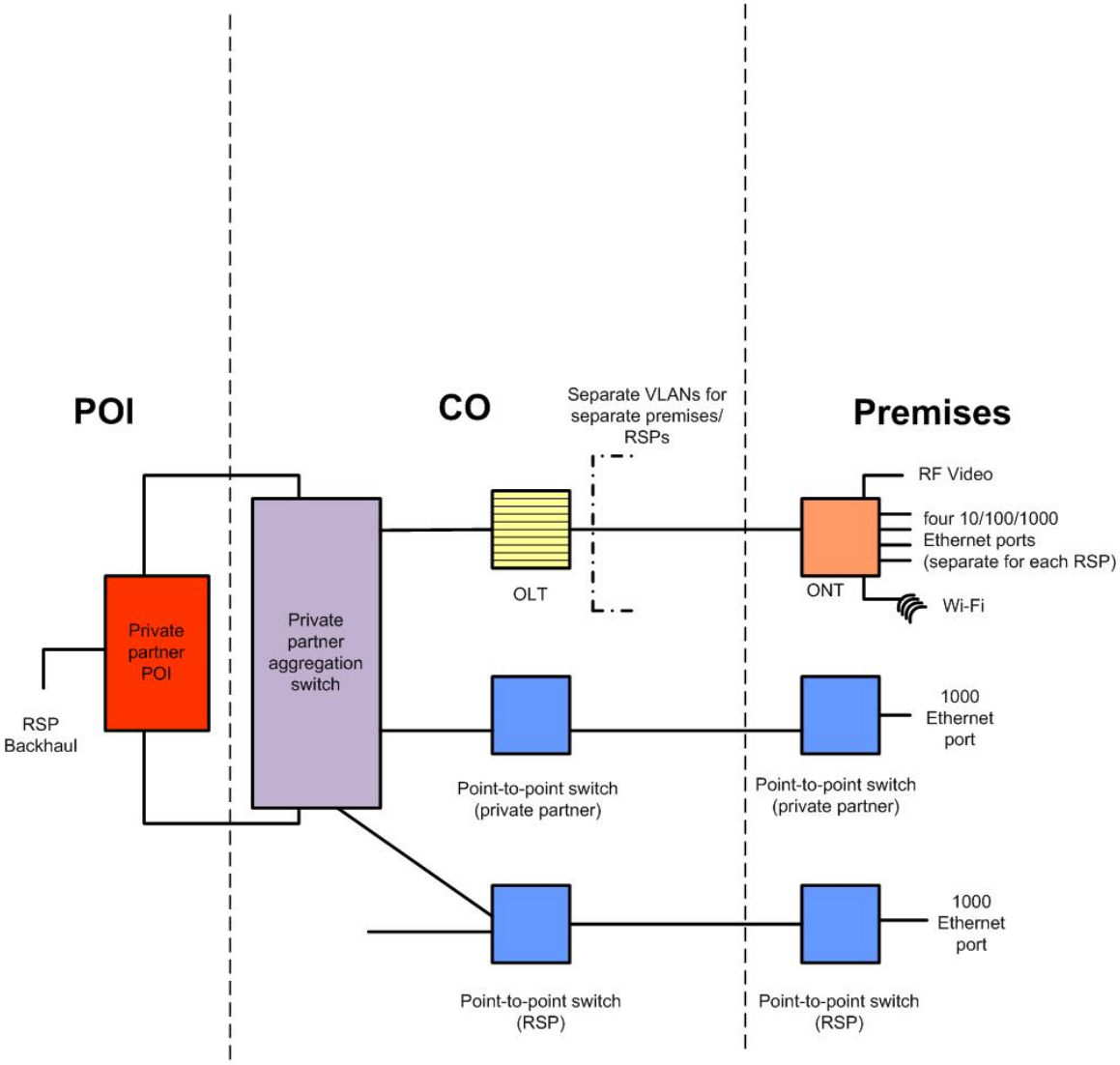
wholesale offering is 100 Mbps downstream/50 Mbps upstream with 30 Mbps/10 Mbps available as an introductory offering. Services are available as best-effort or with a committed information rate (CIR) of 2.5 Mbps.

The private partners will be required to upgrade to higher-speed PON technologies when CFH determines, based on demand and the prevailing state of the art, that an upgrade is needed. Because of this requirement, a robust technological roadmap was a key consideration in selecting the equipment.

The RSP may also obtain dark fiber from the private partner and connect its own terminal equipment at the CO and the premises, providing its own specialized services, such as dense wavelength division multiplexing (DWDM).

RSPs will connect to the private partners at one or more of the 20 regional POIs across New Zealand (with diverse connection available). RSPs are responsible for obtaining backhaul connections to the POI; backhaul is not part of the UFB initiative. However, RSPs can reach the majority of the UFB customers by connecting to the POIs in the cities of Auckland, Christchurch, and Wellington.

**Figure 2: Layer 2 Model**




In the initial implementation the private partners will use existing processes for billing, managing workflow, and performing moves, additions, changes, and deletions. The private partners are in the process of specifying an operational support system/business support system (OSS/BSS) to increase automation and include business-to-business interfaces, which will enable the RSPs to have greater transparency and interactivity with the authorized parts of the private partner network. Another goal is to have a common storefront for RSPs to interact with all private partners, enabling RSPs to buy a common set of services and use the same processes and interfaces to reach a national market.

## *Other Open-Access Models*

New Zealand's UFB initiative is just one model for cost-effectively delivering open access services over standard PON architecture.

A different open-access model has been adopted and implemented in Singapore. Singapore's Next Generation Broadband Network was initiated by the government to make fiber networking available nationwide. The model is similar to New Zealand's in that RSPs manage the customer relationship and obtain Layer 2 services from a wholesale provider. It is different from New Zealand's in that Layer 1 and Layer 2 are controlled by separate entities. It is also different because Singtel, the ILEC, opted to construct its own fiber network and provide facilities-based competition to the Next Generation network.

In Australia, the NBN Co broadband network is structurally similar to New Zealand's. The main differences are that the network is national rather than regional, and the Layer 1 and Layer 2 networks will be funded and operated directly by the government, rather than through a public-private partnership.

In the U.S., Google is beginning construction of Gigabit-speed FTTP networks in Kansas City, Kansas and Kansas City, Missouri, and on the Stanford University campus. Google's approach is different than New Zealand's in that Google sets 1 Gbps as the baseline speed. Google has not provided details of its open access model, which may include Google operating both as an infrastructure provider and RSP.

British Telecom (BT) will be operating its fiber network in a virtual unbundled local access (VULA) model where competing RSPs and ISPs will be able to obtain access to the fiber access network in a given local area and be provided a "raw" service from the aggregation point to the premises equipment. This approach is different than New Zealand's in that the build is being performed by the ILEC, and BT is permitted to operate as an RSP on the network.

## Transforming a Closed Model into an Open-Access Model

Clearly there are many technical approaches to providing open access within a fiber network. However, the New Zealand UFB model of open access is an approach that would have a relatively low impact on a closed system that was evolving to open access for commercial reasons (e.g., a company is seeking to outsource its RSP functions) or in response to regulators.

The lower impact is because most of the Layer 1 and Layer 2 infrastructures could remain the same through the evolution. The open access UFB network will provide most of its customers with GPON services and operate over GPON infrastructure. This means that there is no need for greatly enhanced fiber count, as would be required if the fiber were unbundled at Layer 1 (i.e., for RSPs to have their own individual fibers from the central office to the premises).

Secondly, the GPON infrastructure of a closed network could be kept as-is if the network were to transition to an open access model. Most GPON equipment operates according to industry standards that facilitate the separation of communications on VLANs through the network from the network-to-network interface (at the POI) to the user premises. Each premises can simultaneously be served by multiple RSPs on separate VLANs. Each RSP's customers can be provisioned with well-characterized services with SLAs. Finally, the OSS/BSS system can facilitate automated

provisioning, monitoring and billing transactions between the RSPs and the open access provider.