FTTP System Architecture

End-to-End Architecture

Figure 1 shows the architecture topology for supporting service across multiple market areas. A brief summary of the end-to-end architecture follows. Subsequent sections provide more information on each major component within the planned Verizon FTTP overlay architecture.

Figure 2 shows full build and overlay architecture. FTTP will be built instead of copper facilities in new communities. In existing communities, the existing copper network will continue to serve those customers who have not migrated to the FTTP network. The fiber is deployed from a Central Office location within a wire center area.

Figure 1-High Level End to End Architecture

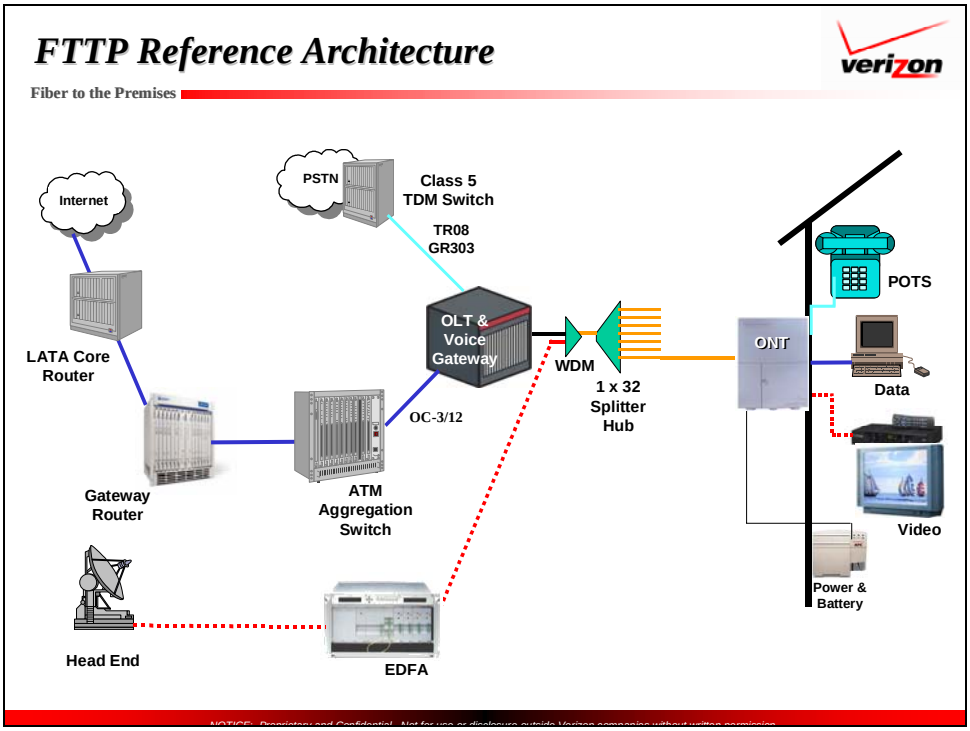
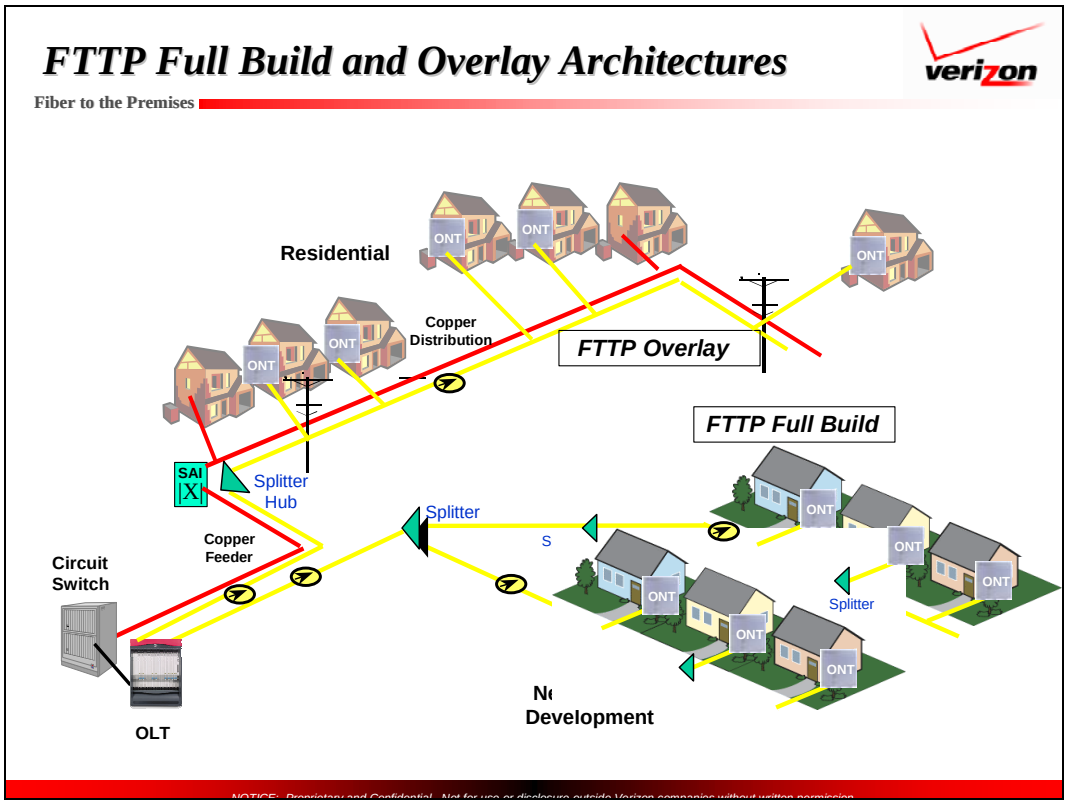


Figure 2-FTTP Full Build and Overlay Architectures



At the national or regional level, a "super" headend (SHE) shall serve as the single point of national content aggregation (see Figure 1). All content shall be encoded into MPEG2 streams and transported over nationwide SONET services. In each market where Verizon seeks to offer service, the broadcast cable television traffic is off loaded from the long haul network and terminated at a Video Hub Office (VHO). Network redundancy and route diversity shall extend from the SHE to the VHO.

The VHO serves as the metro or local point of aggregation. It is here that off-air and public, education, and government (PEG) channels (where appropriate) are combined with the broadcast cable television coming from the SHE. Interactive Program Guides (IPG) shall be controlled from this site, also. The service that exits the VHO shall look like the final product viewed by the end user subscriber.

Cable television traffic is converted to optical signals at the VHO and transported over Verizon's metro area, inter-office facilities (IOF) to Video Serving Offices (VSOs). Voice and high-speed data signals are combined with the cable television at this location for final transport to the subscriber premises over Verizon's FTTP Passive Optical Network (PON).

At the premise, the optical cable television signal is de-multiplexed and converted to an electrical signal, which meets cable television industry standards for cable services. Standard home wiring

practices, using coaxial cables, as well as alternative media, shall distribute the signal to cable ready TVs and standard set top boxes (STB).

There will be 24x7 control and surveillance of the cable television platform from a remote location. This Network Operations Center (NOC) will be centrally located and shall be responsible for the operation and maintenance of the Conditional Access System (CAS), which directs the encryption functions performed back at the VHO.

Super Headend (SHE)

A "super" headend (SHE) shall serve as the single point of national content aggregation. At general service availability, Verizon shall deploy a primary SHE and an additional SHE for redundancy.

Both the primary and redundant SHEs will be strategically located to ensure technical and environmental requirements are met.

The key functions of the SHE include:

Content Reception

Signal Processing

Encoding

Network Interface

The majority of cable television sources shall be individual content provider programming. A mix of standard and high definition formats shall be supported. All content shall be encoded into MPEG2 streams, formatted for SONET, and transported via an OC48c to a local point-of-presence (POP) for wide area (national) transport.

Wide Area Transport

In support of the cable television service, Verizon will use OC48c SONET facilities in the POPs serving target cable markets. Where multiple POPs exist within a market, redundancy options shall dictate if a single or multiple POPs shall be designated for supporting the cable television traffic.

In most cases, it is expected that the cable television traffic shall traverse multiple interconnected rings between the SHE and the destination market. Once the cable traffic reaches a POP located in a target market, it will be forwarded to an OC48c SONET interface connected to metro/local SONET facilities. These facilities shall connect the POP to a Video Hub Office (VHO). VHOs are capable of serving multiple communities within a target market. If more than one VHO is required, the metro SONET ring(s) would be deployed to cover multiple sites.

Video Hub Office (VHO)

The VHO serves as the metro or local point of aggregation. The VHO location is based on a combination of technical factors, metro fiber/IOF availability, local channel reception characteristics, and municipal regulations (e.g., zoning ordinances).

Under current network design plans, the anticipated functions of the VHO include:

WAN Interface for Cable television Transport

Ad Insertion

PEG Content

Signal Grooming and Multiplexing

Emergency Alert Service

Interactive Program Guide

Conditional Access

Local Content

The VHO shall aggregate three basic sources of content: national broadcast channels, local broadcast channels, and public, education, & government (PEG) channels. The national content is the traffic sent from the SHE and is delivered via an OC48c SONET interface from the SONETPOP. The local broadcast channels shall be received off-air via antennas or terrestrial fiber transport located at the VHO site. The PEG channels shall be collected via terrestrial connections from each local franchising area (LFA) served by the VHO. Finally, based on Verizon service tiering requirements to support an analog tier, a certain subset of channels shall be converted from digital to analog signals at the VHO (or kept in analog format if local or PEG).

The final collection of content is placed into the RF spectrum between 50 – 870 MHz as either an analog AM-VSB signal or, as part of a digital multiplex, into a 256-QAM modulated carrier. Digital content requiring encryption by the CAS shall also be multiplexed into QAM modulators and combined with other analog and digital carriers. In addition, an out-of-band downstream channel is generated which carries the Interactive Program Guide (IPG), provisioning, and management messages to STBs. The combined RF signal is converted to optics and fed into EDFAs at egress from the VHO. These optical cable television signals are transported on the 1550 nm wavelength of the G.983-specified Enhancement band to Verizon Video Serving Offices (VSOs).

As noted previously, it is intended that the broadcast cable television traffic/service that exits the VHO shall look like the final product viewed by the end user subscriber.

Metro Area Transport

The optical cable television signals coming from the VHO are transported on the 1550 nm wavelength over fiber available within Verizon's inter-office facilities (IOF).

Video Serving Office (VSO) & Passive Optical Network (PON)

The Video Serving Office (VSO) is a location within the central office containing FTTP equipment. If technically feasible or otherwise appropriate, PEG insertion may occur at this location in the network.

The key function of the VSO is to combine Broadcast Cable television into the Voice and High Speed Data FTTP Network

Once in the VSO, the optical cable television signal is sent through an EDFA and then to a Wave Division Multiplexer (WDM) combiner and splitter, which is used to add the cable signal to the voice and high-speed data signals' wavelength (1490nm) – coming from the Optical Line Terminal (OLT) – together with the cable wavelength onto a single optical source. This optical signal is then sent towards the subscriber premises via a PON. The VSO will also play a role in supporting upstream signals from the customer premises for pay-per-view services. Pay-per-view usage data uses the data service's 1310nm upstream wavelength. The upstream data communications shall be sent back to a subscriber database located in the Operations Center located in the VHO.

Customer Premises

At the premise, an Optical Network Terminal (ONT) de-multiplexes the 1550nm optical signal and simply converts it to a voice, data and cable television electrical signal, which meets cable television industry standards for cable services.

It is expected that, in many cases, standard home wiring practices, using coaxial cables, will distribute the signal to cable ready televisions (for analog-only subscribers) and to STBs for digital subscribers.