

FiOS Cost Efficiency

Rajesh Yadav

Verizon Communications

117 West Street

Waltham, MA 01721

rajesh.yadav@verizon.com

Abstract: As part of FiOS deployment Verizon is constantly looking for opportunities to reduce overall deployment cost. This paper focuses on some of the ways VZ has achieved cost efficiency and ongoing initiatives looking at possible cost reduction in the future FiOS deployments.

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1. Introduction

Verizon started deploying BPON (Broadband Passive Optical Network) technology based on ITU 983.x specifications in 2004 as part of FiOS deployment. FiOS deployment evolved to GPON technology based on ITU 984.x specification starting in 2H 2007 which increased the available bandwidth per PON by 4x in the downstream and 8x in the upstream direction compare to BPON deployment and significantly reduced per Mbps cost. Current FiOS service offering includes Triple play with Voice, Internet data and TV services.

2. FiOS architecture

As depicted in Figure 1, VZ GPON deployment uses three wavelengths architecture to support voice, video and data services. FiOS uses 1490nm and 1310nm wavelengths for downstream and upstream traffic respectively for supporting Internet data, Voice, VoD and IP TV services and 1550nm wavelength for the overlay Broadcast Video. An optical splitter in the outside plant provides for sharing of a PON across up to 32 ONTs which can serve up to 64 living units with a mix of single family (SFU) and multi-dwelling units (MDU) ONTs.

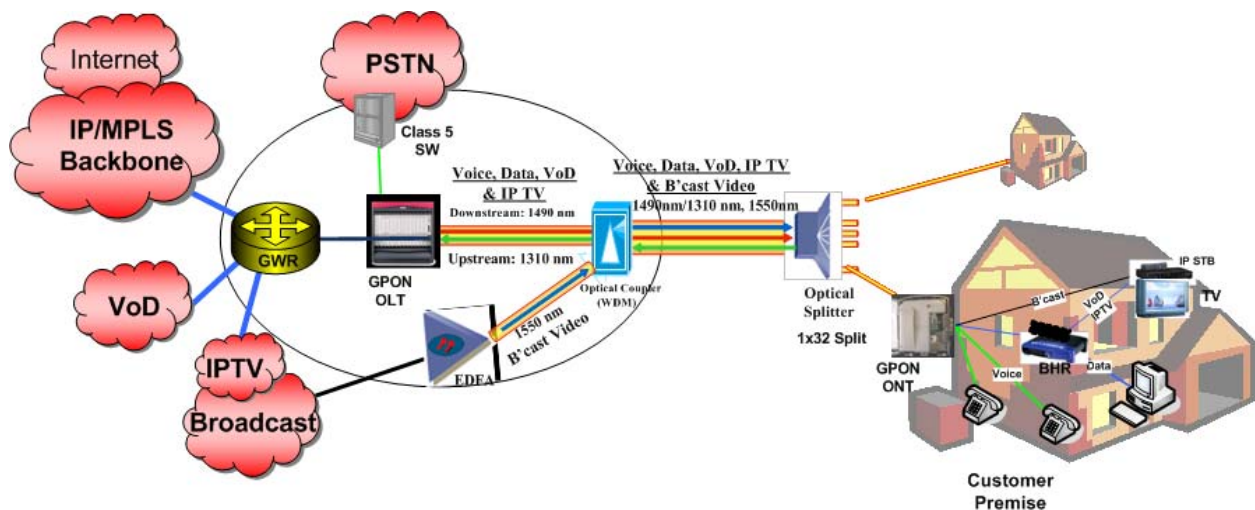


Figure 1: Verizon FiOS Architecture

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3. FiOS cost efficiencies

Over the 5 years of FiOS deployment Verizon has made many optimizations to FiOS deployment in an effort to reduce the overall cost of deployment. Following are some of the initiatives which have either already achieved significant cost efficiencies in FiOS deployment or are under investigation.

Increasing PON split and use of higher power optics

Currently Verizon uses 1x32 PON split for up to 11 km reach and 1x16 split beyond 11 km up to 20 km. Verizon is exploring use of 1x64 split to allow sharing of network component such as PON, EDFA and feeder fiber across larger number of customers. Along with higher split Verizon is investigating the better optical components with lower optical loss and higher powered optics to extend the range of 1x64 split to close to 11 km and 1x32 split to 20 km. This could significantly reduce per household passed cost for FiOS deployment.

Sharing FiOS infrastructure with business services

FiOS deployment is primarily driven by providing Triple play coverage to residential areas but at the same time also provides coverage to many business locations with Internet access and special services needs. To meet the business services need for these customers, business services can potentially be supported on existing deployed FiOS infrastructure with minimal incremental cost. Verizon is exploring support of special services (DS1 and below), which are currently only offered over copper plant, over FiOS infrastructure with an integrated business ONT or an external EIAD (Ethernet Integrated Access Device). This would allow deployment of new special services, which still have high volume even though declining, over FiOS infrastructure with lower cost compare to PMO (present method of operation). This strategy also puts Verizon in good position to provide smooth transition for business customers from special services to Ethernet based services in the future as well as provide an enabler for copper migration over to FiOS in the future.

As part of new business services one major opportunity for FiOS is supporting wireless backhaul from cellular cell sites to centralized mobile switching centers (MSC). With the increase in cellular wireless data demand and evolution of the wireless network towards 4 G technologies such as LTE the current TDM based backhaul (Multiple T1s per cell site) will not scale to support projected bandwidth demand in a cost effective manner. FiOS is well positioned to support the current TDM based wireless backhaul and providing transition to “pay as grow” Ethernet based wireless backhaul as traffic demand grows. With GPON deployment, FiOS is able to meet the requirements for expected bandwidth demand with flexible classes of service model and ability to provide various frequency and timing synchronization mechanisms.

CO Bypass

FiOS deployment utilizes local central office to provide FiOS coverage in the homes currently served by that central office. Existing central offices were designed based on certain technological limitation of copper outside plant and existing regulatory issues. Fiber based outside plant does not have similar reach and conditioning limitations which allows FiOS deployment to be optimized by using more centralized location to provide FiOS coverage in areas covered by multiple current central offices. This centralization of deployment is expected to provide better sharing of video and IOF infrastructure and reducing the overall cost.

Just Inside (“JI”) ONT

Verizon deploys battery back unit (BBU) along with ONT power supply for providing battery backup support for the ONTs to maintain services during power outages. As part of ONT design evolution Verizon has worked on a single enclosure design to allow ONT vendors to preinstall ONT along with power supply and battery back unit in the enclosure (An example shown in Figure 2). This integrated design allows technician to easily install ONT at a

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customer premise inside a basement or garage. This integrated “Just Inside” ONT enabled Verizon to realize savings of up to 45 minutes in installation time compared to standard outdoor installation.



Figure 2: ‘Just Inside’ ONT

MoCA based home networking architecture

In the initial deployment of FiOS, ONT was connected to a home router over Ethernet interface. This required technician to install in-home CAT-5 wiring from ONT, located outside the customer home, to home router location. This resulted in significant extra labor for FiOS installation. With the addition of FiOS TV service which requires data connectivity from home router to all the set top boxes (STB) the extra in-home wiring became even more significant. To reduce the need for in-home wiring for FiOS data and TV services Verizon adopted MoCA (Multimedia over Coax) technology which allows transport of Ethernet data over exiting Coax wiring inside the home and along with use of Coax for RF/QAM based linear content. Verizon integrated MoCA interfaces on its ONTs, home router as well as on the STB to seamlessly connect home devices to data network over existing Coax home wiring. This resulted in significant savings in the overall FiOS installation time

Some additional optimizations Verizon has implemented in the FiOS network include use of connectorized fibers to reduce the need for splicing in the field as well as use of bend insensitive fibers in the MDU environment to provide installation flexibility and labor savings.

4. Summary

Over the periods of FiOS deployment Verizon has undertaken many designs and architecture changes to optimize the FiOS deployment. Verizon continue to look for ways to further reduce the overall cost of FiOS deployment and has various ongoing initiatives to achieve further network efficiency.