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Passive Optical Networks Beneficial to Cloud Computing

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ABSTRACT
The focus of the paper is on BPON (Broadband Passive Optical Network) with Metropolitan Area Network in Cloud user perspectives. The model focuses on effect of jitter on cloud computing environment with PON. The study show that data transfer rate with the help of jitter on cloud at different length for multimedia file in wired (optical) network is efficient.

Keywords
CBN (Cloud Based Network),CEN(Cloud Enabled Network), PON (Passive Optical Network), OLT (Optical Line Terminal), ONT (Optical Network Terminal), ONU (Optical Network Unit), ATM (Asynchronous transfer mode).

1. INTRODUCTION
The cloud is transforming IT infrastructure and making it possible for any size business to adopt and afford enterprise-class apps, computing and storage without the cost, complexity and constraints of traditional networks [1]. As we know that cloud computing is internet based technology. Today Cloud demands high speed internet to provide services to users as upload and download multimedia files are more demanded. Cloud doesn't depends on single network but it uses hybrid network that is wired or wireless LAN, MAN, WAN and hybrid topology . Various user and distant recourses utilized by cloud act as distributed system between numbers of system spread all over the world .multimedia files need high bandwidth to upload and download especially video file because consumers watch multiple HDTV channels often on several TVs in the same household at the same time.

Fiber optics is used for high speed data transfer as G.983 series of ITU-T broadband PON (BPON). Design and deployment activities for FTTH (fiber-to-the-home) and FTTP (fiber-to-the-premises) access networks are on the rise in order to support the increasing demands and delivery of new multimedia services to the customer premise such as interactive video, voice and high-speed Internet [2].

2. CLOUD NETWORK
Cloud networking is a new networking paradigm for building and managing secure private networks over the public Internet by utilizing global cloud computing infrastructure. In cloud networking, traditional network functions and services including connectivity, security, management and control, are pushed to the cloud and delivered as a service. There are two categories within cloud networking: Cloud-Enabled Networking (CEN) and Cloud-Based Networking (CBN) [3]. CEN moves management and certain aspects of control (such as policy definition) into the cloud, but keeps connectivity and packet-mode functions – such as routing, switching and security services – local and often in hardware.CBN only require an Internet connection and work over any physical infrastructure, wired or wireless, public or private. Cloud network is a hybrid network consisting of local area network, metropolitan area network, and wide area network even virtual machines along with provider and user perspectives as shown in Figure 1.

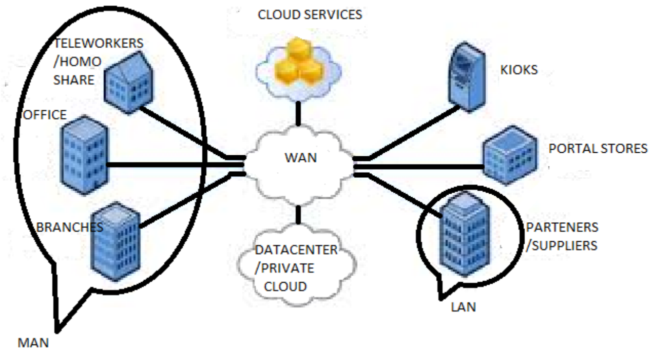

Figure 1 Cloud hybrid Network

Most cloud networks utilize per user or device subscription pricing, so there is little to no upfront costs and users pay-as-you-grow [4].

3. BPON NETWORK
Fiber-To-The-Home (FTTH) for broadband access applications may be considered as an effective solution for higher capacity access networks as optical fiber in telecommunications have huge capacity, small size, light in weight, very high bandwidth and immunity to electromagnetic interference etc [5]. There are many types of FTTH technologies; the most popular one is based on the concept of using a passive fiber distribution network known as a passive optical network (PON). FTTH employing PON access architecture is the accepted choice of delivery channel for triple-play services (voice, video and data) from service providers to the home and business users [6]. The APON format used by FSAN was accepted as an International Telecommunications Union (ITU) standard (ITU–T Rec. G.983.xseries). The ITU started releasing the G.983 series recommendations and amendments in1998. These deal with the broadband optical access systems based on BPONs. Passive optical networks (PONs) address the last mile of the communications infrastructure between the service provider's CO, head end, or point of presence (POP) and business or residential customer locations [7]. The APON format

developed by the FSAN alliance was used as the basis for an international standard released by ITU-TS (Rec. G. 983.x), designated by BPON (Broadband PON)[8-9]. This standard supports more broadband services, including high-speed Ethernet and video distribution. In a PON, the active optoelectronics are situated on either ends of the passive network. An optical line termination (OLT) device is installed in the central office (CO), and an optical network termination (ONT) device is installed on the other end, in or near each home or business site. Fiber distribution is done using a tree-and-branch architecture. A single fiber connected to the OLT can be split up to 32 times and connected to multiple ONTs.

4. SIMULATION WORK

Current simulation model is a typical BPON FTTH design with 32 subscribers and 20-Km reach as represents in Figure 2 and perimeters are defined in Table 1. The technique used in simulation is coarse wavelength division multiplexing (CWDM).

Table 1. Simulation attributes

Attributes	**Value**	
Data rate	1.25 Gb/s downstream	
Distance	20 Km	
Subscribers	32	
Splitter	1:4 at 15 Km SMF	
	1:8 at 4.5 Km form 1:8 splitter	
ONT drop off Cables	100 to 900 feet	
Subcarrier multiplexed	16-QAM	
Wavelength Range	Voice and data	1500 nm
	Video	1550 nm

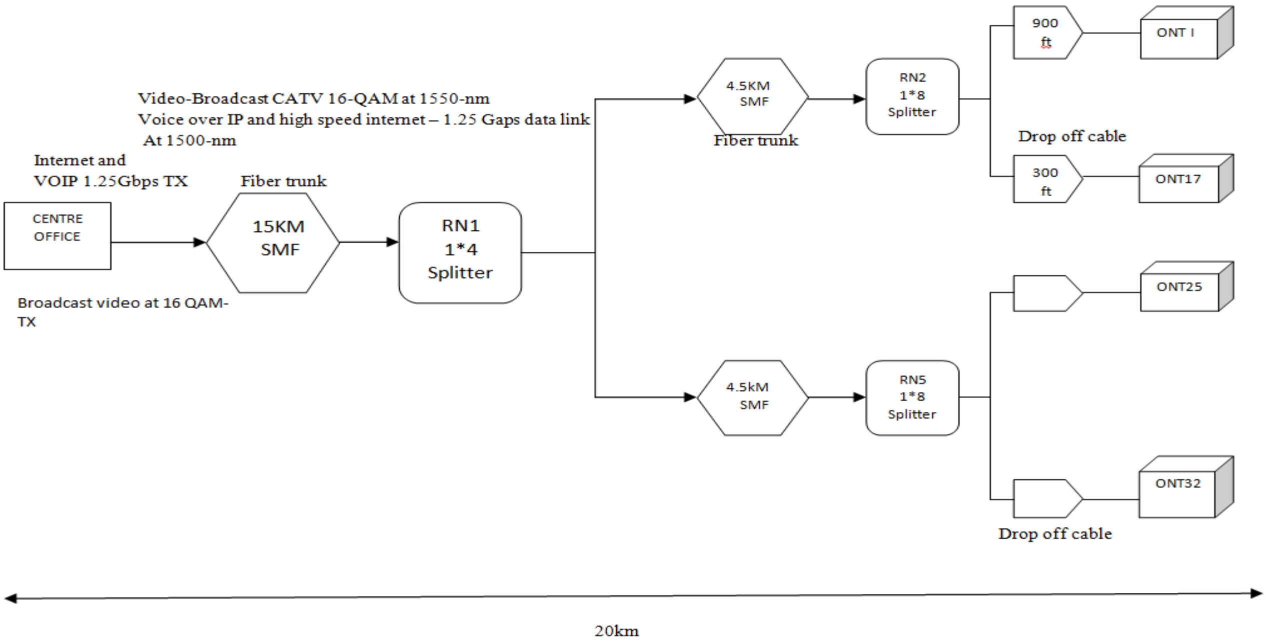

Fig 2: FTTH BPON systems

The triple-play (multimedia) service is realized as a combination of data, voice, and video signals. The voice component can be represented as VOIP service (voice over IP, packet-switched protocol), which is gaining popularity as an alternative to traditional PSTN (public switched telephone network) with POTS (plain old telephone service) at the customer end. A downstream link with one ONT unit attached at 10Km and 20Km. The optical signal first de-multiplexed into data/voice and video components. The data component goes to the optical receiver. Jitter is the distortion in signal such as material losses, losses with length. Jitter is compared at different length with the help

of Output Spectrum, signal constellation diagram, eye diagram. Data transfer stream with Figure 3 shows the signal spectrum output from OLT with data/voice signal at 1500 nm and video signal at 1550 nm where distance is 0 Km as fiber is not used. Figure 4 and Figure 5 describes the jitter at distance of 10Km and 20Km with output spectrum where transmission is done through OLT to ONT.

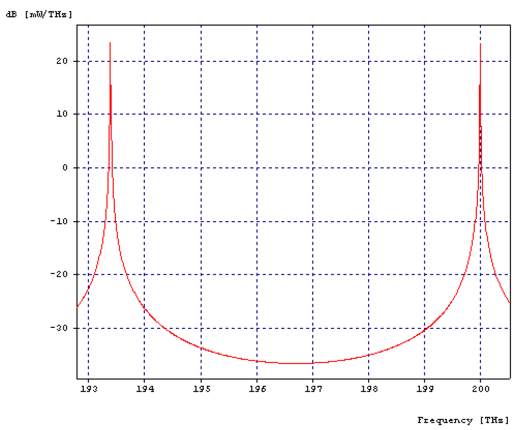

Fig 3: output spectrum for CO at 0Km

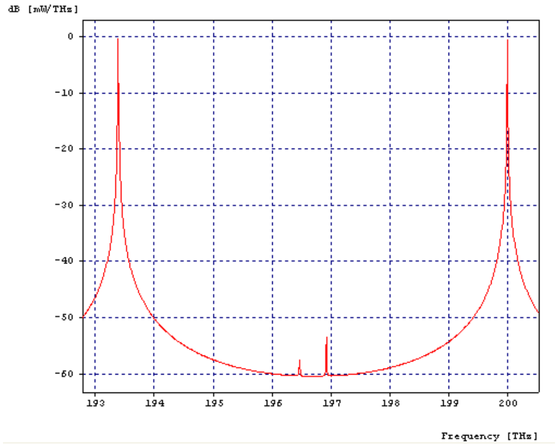

Fig 4: output spectrum at 10Km

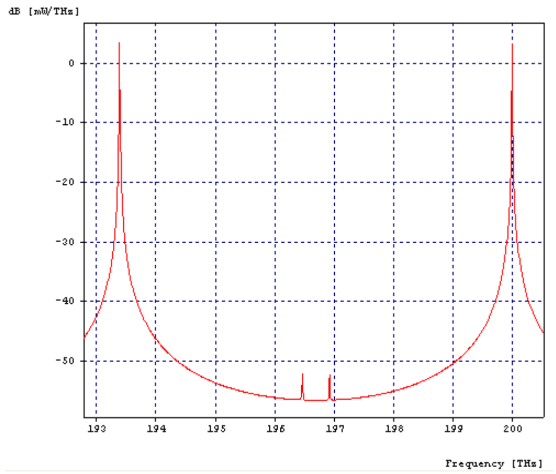

Fig 5: Output spectrum at 20 Km

Fig 6 demonstrates 4-level signal constellation plot for 16-QAM encoder at CO.

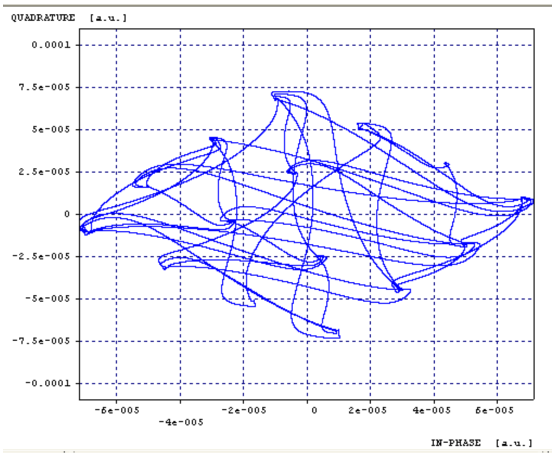

Fig 6: Signal constellations at 0Km

The video component of the received signal enters 16 QAM decoder. Fig 7 demonstrates 4-level signal constellations plot for 16-QAM decoder at 10 Km for ONT 1 and Figure 8 demonstrates 4-level signal constellations plot for 16-QAM decoder at 20Km.

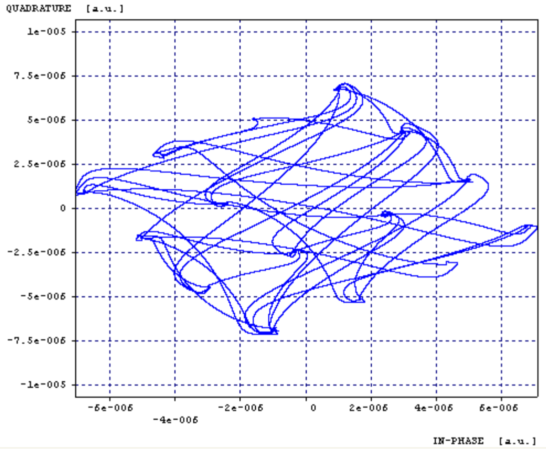

Fig 7: Signal constellations at 16-QAM encoder 10 Km

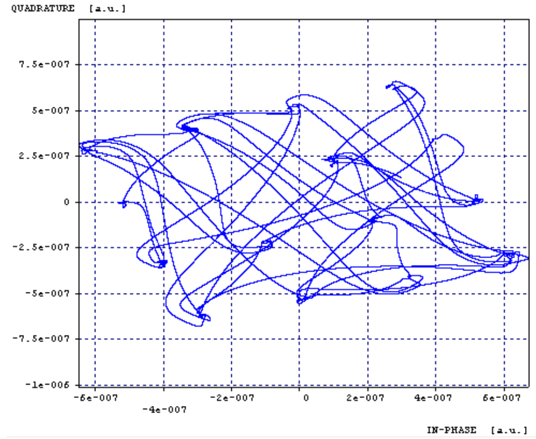

Fig 8: Signal constellations at 16-QAM encoder 20 Km

The eye diagram at the input to ONT (0 Km) is shown at Fig 9 and Fig 10 , Fig 11 depicts receiver eye diagram at 10Km and 20Km.

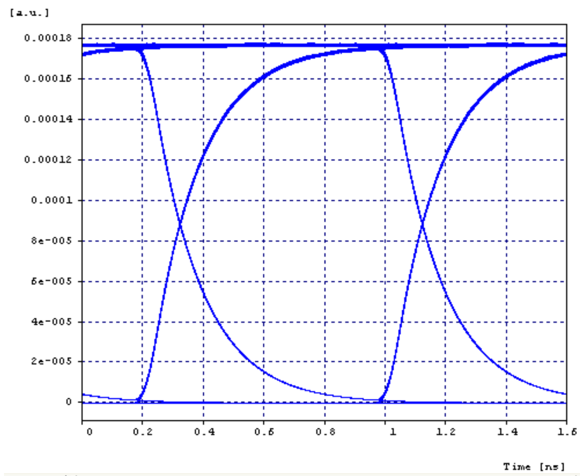

Fig 9: eye diagram ai input CO at 0Km

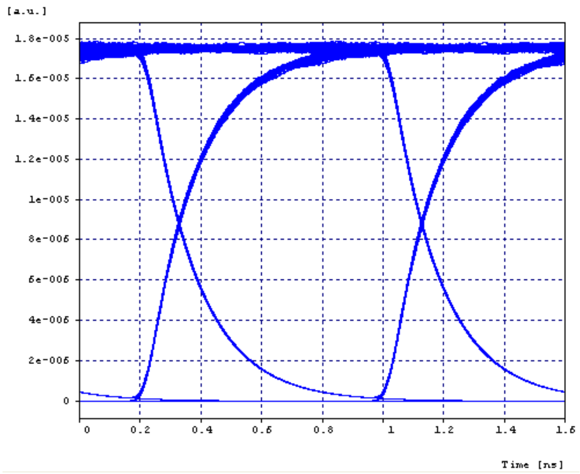

Fig 10: Receiver eye diagram at 10Km

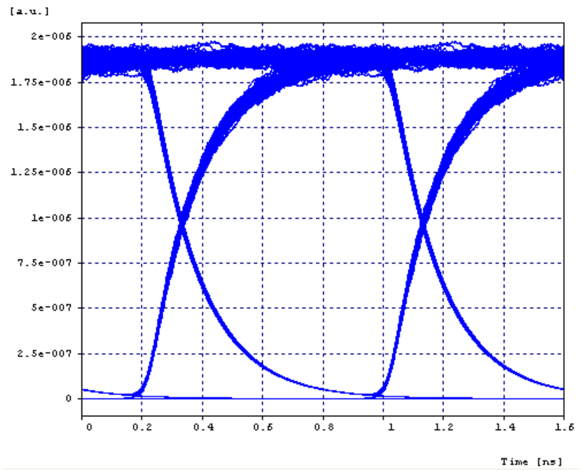

Fig 11: Recever eye diagram at 20Km

Fig 12, Fig 13 and Fig 14 depicts multilevel eye pattern at 16-QAM decoder at 0Km, 10Km and 20Km.

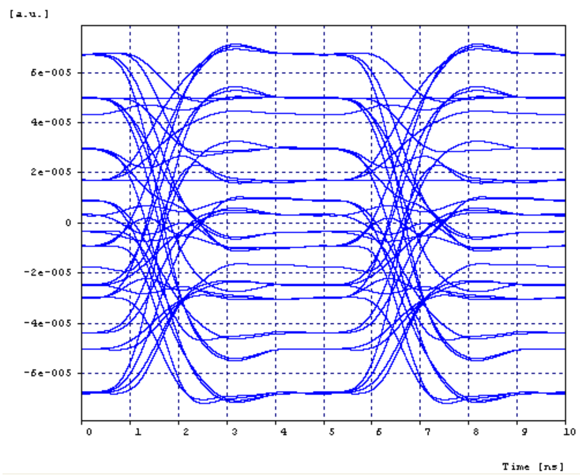

Fig 12: Eye-pattern at 16-QAM encoder

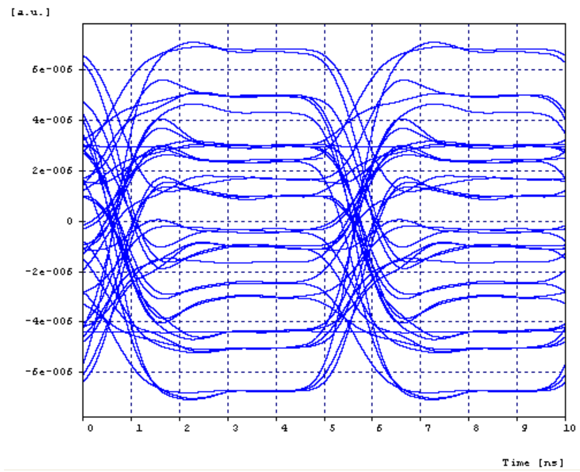

Fig 13: Eye-pattern at 16-QAM Decoder at 10Km

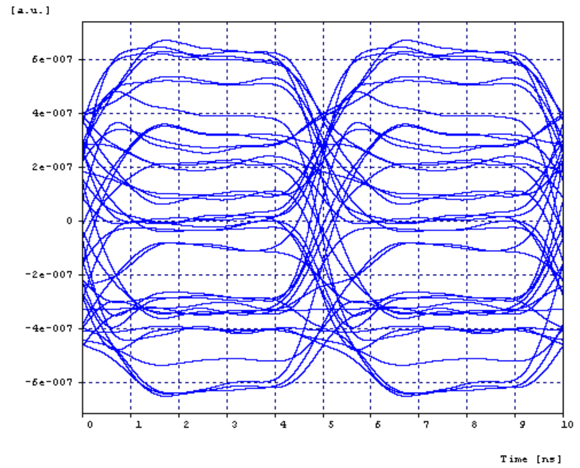

Fig 14: Eye-pattern at 16-QAM Decoder at 20Km.

5. CONCLUSION

This paper targets the impact of cloud computing in BPON systems. It has been observed the performance on BPON at distance 0Km, 10Km and 20Km and concludes that is more suitable for 20Km for metropolitan network in cloud multimedia data. Thus enhance the internet speed for cloud user and video streaming will be better at speed 100 Mbps per end user in 20Km area for MAN. BPON can overcome the high bandwidth for video streaming according to the need with less power as shown in simulation. Thus the result shows QoS increases with speed as time decrease. It has been concluded that near future, Live video streaming in cloud computing can be done efficiently for high definition, Online video play can be done very least buffering time, BPON network may be expended to long distance by adopting the proper frequency for data, audio and video file transmission with lesser jitter. Hence the quality of cloud computing can be enhanced for multimedia files in future for wide area networks

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