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Design and implementation of Rayleigh scattering parameters and their effects on WDM passive optical networks

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Abstract— **This paper proposes a Rayleigh scattering parameters and their effects on WDM passive optical networks subject to requirements of fairness, efficiency, and cost. To circumvent issue of Rayleigh noise reduction in wavelength division multiplexed passive optical network, it provide a source of Rayleigh noise, and confirm that the suppression of carrier Rayleigh backscattering should be the primary target in the design of Rayleigh noise resilient upstream receiver module. In this research work, the issue of connection provisions and performance analysis in WDM network ensuring the quality of service requirement of the connection requests from the client in the network in optical networks. While designing WDM system is explored, it consider the physical layer impairments incurred by non-ideal optical transmission media, accumulates along the optical path. For high transmission speed dispersion become a considerable degradation factor and in this work concentrated on the effects of dispersion on fiber design parameters such as bandwidth, delay and bit rate. This studies alternative network architecture with dynamic wavelength allocation to provide a scalable optical architecture with a guaranteed quality of service in the presence of dynamic and bursty traffic loads. The dependence of carrier RB suppression on DI's extinction ratio and optical carrier's line width is also theoretically analysed. In this research work, a delay-constrained admission control mechanism is presented. The relation between different parameters of optical network unit is also studied.**

Keywords— **Differential phase-shift keying (DPSK), wavelength-division passive optical network (WDM-PON), optical line terminal (OLT), optical network unit (ONU).**

I. Introduction

An optical network connects computers (or any other device which can generate or store data in electronic form) using optical fibers. optical communication has provided us very high speed communications with enormous bandwidth potential. Although fibers can support very high data rates, the associated electronic processing hardware will typically not be able to keep up with such speeds. Hence electronic handling of data network nodes basically limits the throughput of the network. Further, electronic processing is required because optical storage and processing technologies are not mature yet. Hence a packet that must be stored or processed at an intermediate node has to be converted to its electronic form and stored in an electronic buffer memory.

Optical Networks

Optical network are high-capacity technologies and components that provide routing, grooming and restoration at the wavelength level as well as wavelength-based services. It uses Optical Fibers for data transmission. The header is then extracted, processed and a routing decision is made based on the information provided in the header and the routing protocol. The packet is then queued at the output port, converted back into its optical form and transmitted towards its final destination. To improve the throughput of the network and to minimize transmission delay, the network architecture must both reduce the number of times a message is processed by the intermediate nodes and must streamline the processing at each node. But because of many real world constraints, a regular uniform pattern in building a network may not be feasible. Optical networks provide the required bandwidth and flexibility to enable end-to-end wavelength services and meet all the high-capacity and varied needs. Optical fiber offers much higher bandwidth than conventional copper cables.

Passive Optical Networks:

Passive optical networks have high bandwidth Point-to-Multipoint (P2MP) optical fiber network based on the Asynchronous Transfer Mode (ATM), Ethernet or TDM.PONs rely on light waves for data transfer. Only passive optical components are used such as optical fiber, splices and splitters. PONs minimizes the fiber deployment in both the local exchange office and the local loop. PONs provides higher bandwidth due to deeper fiber penetration, offering gigabit per second solutions.

The PON is an access network based on Optical Fiber. It is designed to provide virtually unlimited bandwidth to the subscriber. A passive Optical network is a single, shared optical fiber that uses a passive optical splitter to divide the signal towards individual subscribers. PON is called passive because other than at the central office there is no active element within the access network.

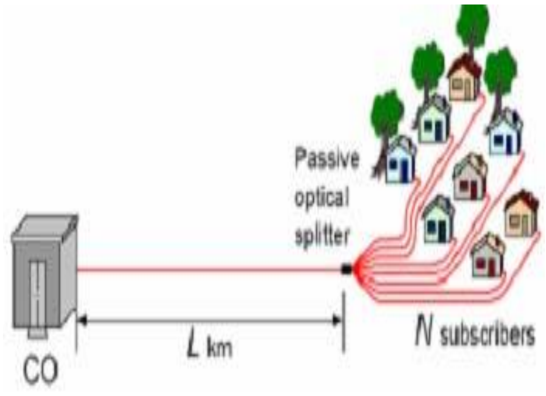

Figure 1

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PON Architecture

The elements of a PON are
(i) Optical Line Terminal (OLT)
(ii) Passive Optical Splitter and
(iii) Optical Network Unit (ONU).

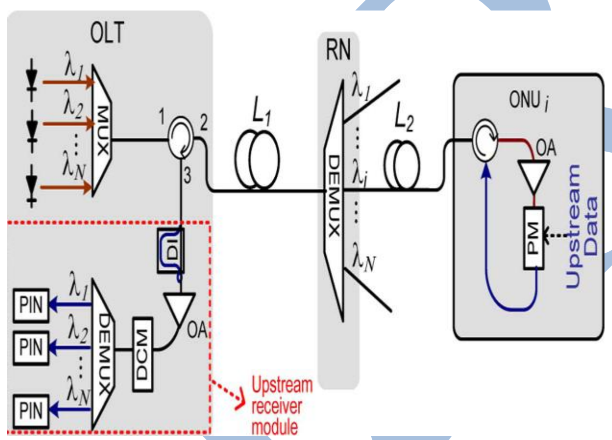

Figure 2

The Optical Line Terminal is the main element of the network and is usually placed in the Local Exchange. It is a network element with PON line card, basically a aggregation switch. Optical Splitter is a passive device with single input and multiple output. Optical power at input is split evenly between outputs. Not only signal travels from input to the outputs, signal can also travel from the output to the input. Splitters can be placed anywhere in between CO and Subscriber premises. It is used to connect an optical port of OLT with multiple subscribers. Optical Network units(ONUs) serve as an interface to the network and are deployed at customer premises. It provides several interfaces for accessing triple play services and in the upper side it connects with the OLT via optical splitter. Although PONs can exist in three basic configuration (tree, bus and ring), the tree topology is favored due to smaller variation in the signal power from different end station. PON uses 1490 nm for the downstream wavelength and 1310 nm for the upstream wavelength. Signals are inserted or extracted from the fiber using a coarse wavelength division multiplexer (CWDM) filter at the CO and subscriber premises.

II. LITRETURE SURVEY

Zaineb Al-Qazwiniet. al. [1] proposed colourless optical transmitter for the optical network unit is composed of an electro-absorption modulated laser (EML), an optical coupler, and an RSOA. Through cross-gain modulation in the RSOA, the upstream data from the EML pump light are imposed onto a continuous-wave probe light provided from the central office (CO). An optical delay interferometer at the CO tailors the chirp of the upstream signal to improve the bandwidth of the system and dispersion tolerance. The proposed upstream optical transmitter is based on the fast gain recovery of the RSOA governed by carrier-carrier scattering and carrier-phonon interactions. Thus, it can potentially operate at Gb/s. Two separate wavelength bands are allocated, one for the pump signals and the other for the probe signals. Therefore, the proposed transmitter operates in a colourless manner since the EML can have any arbitrary wavelength within the pump band. We demonstrate the transmission of a 10.7-Gb/s upstream signal generated by the proposed scheme in a single-fiber loopback- configured network.

Jing Xuet. al.[2] proposed challenging issue of Rayleigh noise reduction in wavelength-division-multiplexed passive optical network (WDM-PON), It provide an insight into the source of Rayleigh noise, and confirm that the suppression of carrier Rayleigh backscattering (RB) should be the primary target in the design of Rayleigh noise-resilient upstream receiver module for a transmission reach up to 60 km. Then we propose and demonstrate a novel scheme to effectively suppress the carrier RB in carrier-distributed WDM-PONs. By simply replacing the upstream modulation format of conventional on-off keying (OOK) with differential phase-shift keying (DPSK), the system tolerance to carrier RB is substantially enhanced by 19 dB, as the carrier RB can be considerably rejected by the notch filter-like destructive port of the delay-interferometer (DI) at the optical line terminal (OLT), which is used simultaneously to demodulate the upstream DPSK signal. The dependence of carrier RB suppression on DI's extinction ratio (ER) and optical carrier's line width is also theoretically analyzed.

Q. Jin et. al.[3] proposed a end-to-end real-time optical orthogonal frequency-division multiple-access (OOFDMA) passive optical networks (PONs) with adaptive dynamic bandwidth allocation (DBA) and colourless optical network units (ONUs) are experimentally demonstrated, for the first time, at aggregated 10.375 Gb/s over 26.4 km standard single-mode fibers based on intensity modulation and direct detection. The colourless ONU operation for several representative wavelengths across the *C*-band is successfully achieved by utilizing cost-effective reflective semiconductor optical amplifier intensity modulators, whose narrow signal modulation bandwidths are fully exploited through adaptability of the OOFDM transceivers and adaptive DBA.

Luying Zhouet. al. [4] proposed a new passive optical network (PON) architecture that applies an optical multicast capable switch (OMS) to direct wavelengths to a set of PON branches and enables them to share the transceivers in the central office (CO) on demand. The OMS is composed of fiber splitters and switching gates, and by controlling the on-off gates the wavelengths at the inputs can reach any outputs of the OMS.

Fu-Taiet. al. [5] proposed a Ethernet-based Passive optical network (E-PON) which is the key for next generation access networks. It must have the property of high efficiency, low cost, and support quality of service (QoS). We present a novel media access control (MAC) protocol that maximizes network efficiency by using dynamic bandwidth allocation (DBA) algorithm suitable for E-PON. This protocol minimizes packet delay and delay variation for high priority traffic to ensure QoS. Simulation results show excellent network throughput. Simulation results also show low packet delay and packet delay variation for high priority traffic compare with traditional MAC protocol of E-PON. When the network performs ranging, this protocol ensures zero interruption of high priority traffic, such as audio or video applications.

Michael Düseret. al. [6] proposed a concept of optical burst switching (OBS) aims to allow access to optical bandwidth in dense wavelength division multiplexed (DWDM) networks at fractions of the optical line rate to improve bandwidth utilization efficiency. This paper studies an alternative network architecture combining OBS with dynamic wavelength allocation under fast circuit switching to provide a scalable optical architecture with a guaranteed QoS in the presence of dynamic and bursty traffic loads. In the proposed architecture, all processing and buffering are concentrated at the network edge and bursts are routed over an optical transport core using dynamic wavelength assignment.

III. PROBLEM FORMULATION

We have to assign a different wavelength to PON (passive optical network).

1 In this we have to suppress the back scattering problem in the network.
2 We have also to find Rayleigh back scattering parameters.
3 Calculated parameters are bit error rate and blocking probability.

we have to handle the network using the two fibers L1 and L2 instead of single mode fiber.

IV. WORK DONE

1 using the MATLAB the parameter which are calculated with the using of two fiber length L1 and L2 and by using single fiber length L also

a. Power
b. Gain
c. Attenuation (10/l)log (pi/po)
d. Delae
e. Blocking probability
f. Bit error rate
g. Load
h. System noise

V. CONCLUSION AND FUTURE SCOPE

In this paper, it investigated the rayleigh scattering parameters and their effects in WDM network with optical carrier regeneration. This first reviews the evolutionary path of optical networks and shows the drivers from technology and business perspectives for high bandwidth and low cost. A variety of research challenges in this optical passive network is reviewed. The wavelength assignment problem was transformed into the vertex colouring problem. In this dissertation, various performances related issues have been considered which arise in wavelength division multiplexed networks. An optical delay interferometer at the central office tailors the chirp of the converted upstream signal to improve the system bandwidth and the dispersion tolerance.

Future Scope

In WDM network, an additional performance measure is the capacity which can be increased to a particular extent for the future networks. Future work may include the designing of mathematical models for increasing the capacity of optical WDM network. So the research study needs to be done over this area. This dissertation proposes performance evaluation of WDM OPN using single mode fiber. There is also scope for increasing the performance of WDM PON by changing the optical amplifier more than one amplifiers. This distance can be increase by increasing the stages of amplifier. In this dissertation work is done to find out the bit error rate, bandwidth & delay analysis can be determined.

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