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A Review on Design and Development of Core Routers for High Speed Optical Cloud Computing Environment

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ABSTRACT: The limitations of the electronic routers results in the need of optical cloud networks. The real issue engaged with the optical cloud system is the switch/router structure which can perform exchanging operations efficiently at the high information rates. These can be named 'all'- optical cloud or photonic switches. On the whole optical cloud mode, the propagation and the handling of information is thought to be in optical cloud domain. As of now, optical cloud computing switch is not innovatively practical because of the absence of optical cloud RAMs. As an alternative option data stays in the optical cloud domain without having any O/E and E/O transformation at the intermediate nodes, yet control task is carried out in electronic domain. Here, we present a review on various issues related to Routers used for High Speed Optical Cloud Computing Environment.

Keywords: Computer networks, Next generation networks, Cloud computing, Data Centers, Routers.

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I. INTRODUCTION:

In the recent past, the demand for higher bandwidth has increased tremendously, due to the data centric applications like TV on demand, internet etc. The current electronic technology have shown bottleneck in providing very high speed data communication. Thus in near future an alternative technology would be required to support such a high data rates (160 Gbps) [1]. The optical cloud fiber cable has the potential to support tremendous data (Tbps). Therefore, optical cloud communication is considered as next generation data transfer technology.

The roadmap of optical cloud communication technologies is shown above[3]. In 1990, digital cross connect (DXC) was introduced. Five years later, optical cloud add drop multiplexer (OADM) was developed. Then optical cloud cross connect (OXC), passive optical cloud network (PON), optical cloud label switching (OLS), optical cloud burst switching (OBS) and optical cloud packet switching (OPS) was introduced and some of the technologies are also implemented in some part of the globe as test bed [14].

Depend upon electricity-down and energy-off methodologies, the performance of those strategies is at best constrained. In reality, an idle server can also devour about 2/3 of the height load [9]. Because the workload of data middle fluctuates on the system structure is made out of core and customer (client) networks. The edge switches acts as an interface between the client and the core network.. These electronic switches suffer from constrained speed. Subsequently, electronic switches can't deal with high information rate [10]. The limitations of the electronic switches results in the need of optical cloud networks. The real issue engaged with the optical cloud system is the switch/router structure which can perform exchanging operations efficiently at the high information rates. These can be named 'all'- optical cloud or photonic switches. On the whole optical cloud mode, the propagation and the handling of information is thought to be in optical cloud domain. As of now, optical cloud computing switch is not innovatively practical because of the absence of optical cloud RAMs. As an alternative option data stays in the optical cloud domain without having any O/E and E/O transformation at the intermediate nodes, yet control task is carried out in electronic domain [13]. The photonic packet switching gives rapid, organized productivity and adaptability in the arrangement because of the exchanging task in physical layer. A bottleneck, thereby limiting the overall system performance.

II. RELATED WORK:

In Optical Cloud Packet Switching (OPS) various work is proposed in past, a brief review of the work detailed in this section.

Barry and Pierre (1995) developed a traffic model for circuit-switched all-optical cloud networks to evaluate the blocking probability with and without wavelength conversion this paper develops an idea to evaluate the packet loss rate in optical cloud networks.

Singhet al.(2007) examined the routing wavelength assignment problem in optical cloud network without wavelength conversion as due to wavelength continuity problems.

Maite et al. (2009) presented a new heuristic offline wavelength assignment mechanism. In this work, QOS is also discussed by considering both BER and latency. This paper discusses two algorithms for the wavelength assignments such that QOS can be maintained. complexity and its computation is quite efficient.This model is also used to evaluate the blocking performance of NSFNet topology and used to improve its performance.

Wang and Wen (2012) have proposed two light path-level active rerouting algorithms, which are the least resources rerouting algorithms and the load balanced rerouting algorithms. Simulation results show that the proposed load-balanced active rerouting algorithm yields much lower connection blocking probability than the least resources rerouting algorithms. This result shows that the performance of the networks can be significantly improved. In the above mentioned papers, the researcher looked into the routing algorithms, and minimizing the blocking probability with and without wavelength conversion.

Josep et al.(2012) in this work, accumulation of physical layer impairments on the signal along optical cloud transparent paths is discussed, therefore limiting the system reach and the overall network performance. Such challenges require the use of cross-layer approaches, which involve dynamic interactions between the physical layer and the network layer to enable the compensation for mismatching of requirements and resources. Heprovides an overview of such challenges, reporting comparative analysis with a selection of existing solutions and to cast a glance at the open issues for future research.

Mariño et al.(2013) transparent optical cloud networks are the enabling infrastructure for converged multi-granular networks in the Future Internet. The cross-layer planning of these networks considers physical impairments in the network layer design. This is complicated by the diversity of modulation formats, transmission rates, amplification and compensation equipment, or deployed fibre links. Thereby, the concept of Quality of Transmission (QOT) attempts to embrace the effects of the physical layer impairments, to introduce them in a multicriterium optimization and planning process. This paper contributes in this field by the proposal and comparative evaluation of two novel offline impairment aware planning algorithms for transparent optical cloud networks, which share a common QoT evaluation function.

Shukla et al. (2014) discusses the design improvement of AWG based optical cloud packets switch along with detailed power budget analysis. The analysis presented in the paper suggest that the proposed design can operate successfully in sub-micro watts in comparison to the earlier optical cloud computing switch which operates in mili-watts regime.

Shukla et al.(2015) compare the recently proposed two optical cloud computing switch which can be used in cloud computing environment. The analysis of the switches is performed in terms of in terms of physical and network layer parameters, and it has been found that our design outperforms the other recent published design in terms of both physical and network layer parameters.

Shukla et al. (2016) demonstrate the design of an Arrayed Waveguide Gratings (AWG) based optical cloud computing switch. This has been found that at higher bit rates, BER is not affected with number of buffer modules. Network layer analysis is done to obtain performance in terms of packet loss rate and average delay.

Singh et al.(2017) Requirement of network capacity is increasing due to growing demand of internet traffic. Data centre network traffic is boosting steadily due to arising mobile, internet and cloud services. In this research four photonic packet switched architectures namely feedback loop buffer and arrayed waveguide grating (AWG) based switch, loss compensated feedback loop buffer and AWG based switch, electronic memory and AWG based optical cloud computing switch, and buffer less optical cloud computing switch PETABIT have been analysed for their optical cloud cost and physical loss. Cost of these architectures has been evaluated using fibre-to-chip coupling (FCC) and wavelength speed-up model (WSU). FCC model assumes fixed cost and doesn't account for wavelength conversion range. To include the influence of wavelength conversion range WSU model has been used. Optical cloud cost itself may not reflect the true performance of the architecture so physical loss of these architectures has also been estimated. The results of this work shows that the optical cloud cost of electronic memory and AWG based optical cloud computing switch is the least but its physical loss is the highest and for buffer less optical cloud computing switch PETABIT it is vice-versa. Also the optical cloud cost and physical loss of feedback loop buffer and AWG based switch, and loss compensated feedback loop buffer and AWG based switch are almost similar. So, feedback loops buffer and AWG based switch is better among the architectures explored.

Singhet al.(2018) Optical cloud packet switching has the potential to be used as next generation data transfer technology. This paper, introduces an Arrayed Waveguide Gratings (AWG) switch where hybrid buffer (electronic + optical cloud) is used for the buffering of contending packets. Power budget analysis has been carried out under various switch designs. Comparison of optical cloud and electronic buffering is done in terms of power required for the correct operation of the switch. Energy consumption per bit is also evaluated for both optical cloud and electronic buffers for various buffering time ranges from nano-seconds to milli-seconds.

Singh et al. (2018) Due to the explosive growth in internet traffic, servers are facing bottlenecks in speed and bandwidth requirements. To meet these ever increasing demands fibre optic technology can be used. He discusses, a hybrid buffer based optical cloud packet switch design with its pros and cons. This hybrid buffer offers both electronic and optical cloud buffering. This paper investigates the packet loss rate (PLR) performance of hybrid buffer under a variety of conditions. The performance of switch is also investigated in a hypothetical five nodes network, and PLR is obtained under four different combinations of buffering and deflection of contending packets.

III. CONCLUSION:

Future networks must bring a couple of new offerings to support the clever society. a design for optical cloud node will be presented. The physical layer impairments will be discussed and a mathematical framework be presented to estimate the BER performance of the optical cloud node. The physical layer analysis would concentrate on how packet size and bit rate affect the performance of the switch. The power dissipation analysis will also be performed to visualize the power requirement in as a switch. At the network layer packet loss performance would be evaluated.

IV. OBJECTIVES:

To propose an improved design of a core router for high speed optical cloud computing environment.

To set the QOS parameters to evaluate performance of the model to be proposed.

To evaluate performance of the model to be proposed with existing ones.

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