ON DEMAND SERVICE BASED FLEXIBLE ROUTING ARCHITECTURE FOR 2D MESH BASED OPTICAL NETWORK ON CHIP

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Abstract: *Now days, optical network-on-chip (ONOC) has gained more attention and evolving as a cost effective technique to interconnectdifferent processing cores. This emerging technique strives to utilize lesser bandwidth and energy. While dealing with optical based circuit switching the combination of factors like low congestion level, less bandwidth utilization, less latency and less energy consumption needs to be accounted simultaneously. In this work, an architecture named as enhanced reservation-priority routing was proposed especially for ONOC with 2-D mesh topology. Amodified routing algorithm with wavelength assignmentwas designated in order to reduce the number of hops for packet-switched optical network on chips.*
Keyword: Optical NoC, wavelength, packet switching, WDM.

1. INTRODUCTION

Under optical network on chips speed enhancement with more conservation of power is significant along with wavelength multiplexing system. The transmission speed depends on chip level data exchange among multi-core processors [1]. Under ONOC with core processors the placement of coresplays an important role.This set up can further be managed in terms ofdifferent clusters. Inorder to transfer bulk data the planar based waveguide with optical arrangement was adopted with core processors. This comes on the basis of inter-cluster based core to core communication [2]. While concentrate on less power consumption, the parameters such as throughput, latency, transmission time were considered during the wavelength assignment. Apart from the aforementioned parameters, transparency [3] is playing an important role. This can be made efficient by coinciding ONOC with silicon photonics and hence many real-time applications would be made feasible. This application can be even more adaptive with on-demand bandwidth requirements. The existing applications concentrates on ID based fast Fourier transform with kernel function for better bandwidth utilization for real-time based applications.

The photoelectrical devices have been improved by reducing insertion loss and thus by improving the efficiency with the aid ofONOS's. The insertion loss is a vital aspect for modulation and generation of optical signals. This will further applicable for the power constraints [4]. Among various topologies and techniques some of the system level based method has to be chosen to reduce the complexity [5]. This work deals with novel algorithm for route computationwhile reducing the congestion levels by improving the real-time transmission with less insertion loss.

Problem identification:

- In optical routing, the two traffic modules are static and dynamic. In the static level the pathway of light were already known and hence the required wavelength to overcome the traffic can be predicted by linear programming. But this is not suitable for large scale network.
- In some of the networks with no wavelength conversion it is impossible to provide route without converting the wavelength for a longer distance. Apart from this there are some process such as tunablity dispersions has made the routing a very complex problem [6].
- The process of wavelength conversion is a tedious process and further make many issues during design
- Another problem is allocation of resources with which schedulingof traffic can be exercised. The numbers of scheduling techniques are less and further it makes the innovation in resources allocation limited.
- A light path involved by an association can't be re-allotted to a contending association except if it is discharged, bringing about undesirable deferrals and decreased execution
- The versatility prerequisite isn't bolstered by the disconnected calculations. Online calculations bolster flexibility however are intricate in nature[7].

- Crosstalk turns into a functioning part over huge separations and debases the exhibition. QoS can't be ensured under high crosstalk.

2. LITERATURE SURVEY

Xiaolu Wang et al., (2015)designed a ring based topology based on RPNOC architecture by using packet switching method. For this architecture the author concentrated in deadlock free deterministic routing method for minimizing the total hop counts. The comparisons are done with previous packet-switched based ONOCS. For the simulation purpose 64-node RPNOC has chosen with to patters such as uniform & realistic and hence the results shows that this proposed method is providing better throughput, less latent time & more power conservation.

Yaoyao Ye et al.,(2013) suggested a mesh based ONOC with three dimensional basis especially for the microprocessor SoCs with the block concept of 4*4, 5*5, 6*6, 7*7 routers with dimensional order. Even though 3-D topology was opted with all the components that were inbuilt in single layer it used more number of waveguides. The optimization processes were made to be processed in a single optical layer. A system C-based accurate NOC simulator was adopted for static and dynamic traffic applications and further it was compared with 2-D mesh based ONOC and 2-D with electronic based ONOC in terms of energy efficiency.

EdoardoFusella et al.,(2017) suggested a hybridization concept of electronics and photonics as a novel concept to overcome the countless properties. Various analysis had done to reach the benchmarks and real-time applications by compare with hybridization based mesh network and it is noted that insertion loss is calculated about 13%-18% and the energy conservation is about 8% with the traffic rate of 74%. This will further enhance the signal to noise ratio range.

D. Vantrease et al (2007), suggested writer-reader concept with multiple-single based photonic ring topology. This limitation was more complex to implement and required more arbitrary based overhead.

Pan et al. (2009) suggested firefly based optimization algorithm with global crossbar concept.This concept is enchanted with token-method for overcoming the contention process. The inbuilt waveguides were considered with reservation reader configuration concept. It reserved the bandwidth in channel to minimize the energy and increasing the latency.

Beausoleilet al. (2011)suggested optical network on chip concept for crossbar with inbuilt component of sixty-four waveguides along with 256 waveguides are separates for controlling and broadcast process.

Shachamet al. (2014) analyzed various decision problems namely path making and tear down process. This was done by blocking 4*4 switch optical based enlarged ONOC.

Feeroet al. (2012)suggested 3-dimensional based electronic and mesh by comparing with two dimensional mesh by enhancing the integration process with linear dynasties. Apart from the two topologies like mesh and tree there are 2 techniques like graph and honeycomb properties were proposed.

3. PROPOSED METHODOLOGY

This section is partitioned into three phases: phase-1 construction of diagonal linked 2D mesh topology with internal blocks. The Phase2- focuses about proposed hybrid algorithm and its performance to overcome the contention in the network. The Phase-3 focuses about resource management in the ONOC based optical network.

3.1 WDM with 2D mesh topology

An integration process was done with diagonal based D-mesh network. This network contains various blocks such as router, internet protocol based memory, application block. This router coincides with 4 routers through 6 bi-directional linking processes.

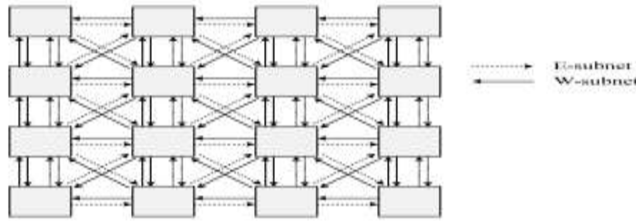

Figure-1 diagonally connected 2-D mesh

While deal with D-Mesh nodes each node contains 10 diagonal with 64 bit bidirectional process. Along with 10 output ports (N1/N2/S1/S2/E/W/NE/NW/SE/SWout) and (N1/N2/S1/S2/E/W/NE/NW/SE/SW-in).In addition to this, some of the parts such as IntR, IntL, Intwere particularly connected with internal processors. The 2 sub networks were being used along with highlighted D-Mesh. They were E-Subset and W-Subset abbreviated as east and west direction's subset. The data exchange in those directions were taken care by those two subnets. When the data are transfer from the source primary element the injection process takes place from right to left. This direction was decided by the destination element. Injection of packets in E-subnet was made by IntR and w-subnet by IntL.At that point the parcels cross in one of the sub-systems to their goals. At the point when packets reach the appropriate destination , they were shot out from the Int port. By then the bundles cross in one of the sub-frameworks to their objectives

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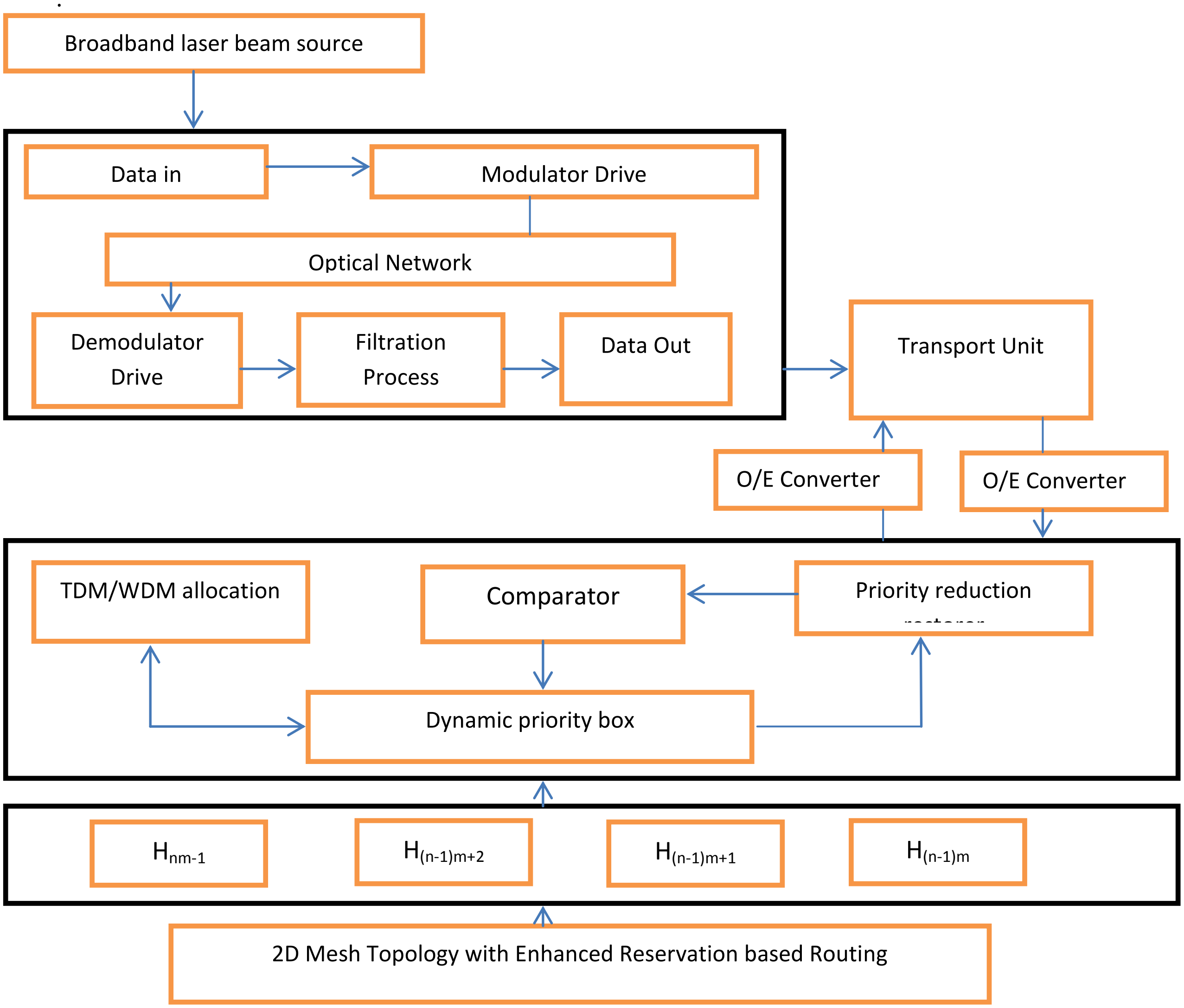

Figure-1a. WDM with 2D mesh Topology

3.2 Routing Algorithm

The injection of packets was done in given network the source router starts to find the traffic level between the path ABC which was named ad Sa,Sb,Sc and its destination path denoted as Da,Db,Dc. Once the traffic level was diagnosed and found as no traffic the flow happen via VCO with B dimensional based. It was further forwarded by ABC routing algorithm. In other case when the traffic was detected the data started to pass by VC1 path with A dimensional based. It was further forwarded by BAC routing algorithm. Suppose both of the routed AB and BA were having more congestion.A probability based method was followed with less distance founded between the allocation regions. This will further remove the complications in the hotspots also. Some of the parametric issues are there in hotspots and that can be done by re-routing method in minimum region. For the purpose of re-routing the nodes in middle which is named as intermediate nodes like Ma,Mb,Mc had be allocated for both AB & BA path with VCO routing for forward and VC1 routing for backward process. Sometimes livelock happens in the network and hence that can be avoid by enhancing the properties of the intermediate nodes in the network.In the event that a transitional hub is accessible, at first, the parcel was sent through VCO to push toward the middle of the road hub, at that point it was sent from the moderate hub to the goal through VC1 by crossing BAC-way. Something else, the bundle is chosen one of the most limited ways (for example ABC or BAC), in which the blockage is less, to limit jump check.

3.3 Communication process

During the communication process of the core processor a packet named as setup packet enchanted into the electronic control unit in local level. This enchanted was done by using some routing algorithm. The switching based optical fabrics are then setup packet in the westward port and reservation process in the eastward port with the enhancement micro resonator operation. To know the perfect obtain of parameters in the destination, the acknowledgment was done to the sender once the packet reached the destination. If the source receives the acknowledge bit, it will send payload data along the reserved optical path. A tail packet would be sent out with the last flit of the payload packet. It travels along the routing path and tears down the optical path by configuring related optical switching fabrics.

3.4 Resource management

The reason for managing the resource is to reduce traffic clog by permitting bundles originating from congestion areas to move first. For a switch with M input ports and N yield ports, reasonably we proclaim an information need line to store the information ports as per a predefined need plot. The need plan can be settled, round-robin, first-start things out served, blockage put together thus with respect to. Toward the start of the directing system, we set up a need line PQi. Each information port has a key related with it, and these keys were utilized to choose the need of each port. After PQi is built, the methodology begins to settle on steering choice from the yield port perspective. That is, it first picks a yield port and picks an info port which has bundles proposed for this yield port. This decision depends on the need of information ports. On the off chance that there are various information ports requesting a similar yield port, the one with the most astounding need will get to. In info port determination, clog files sent from neighboring switches are utilized to choose the need. Each info port is related with a blockage file from its upstream switch.

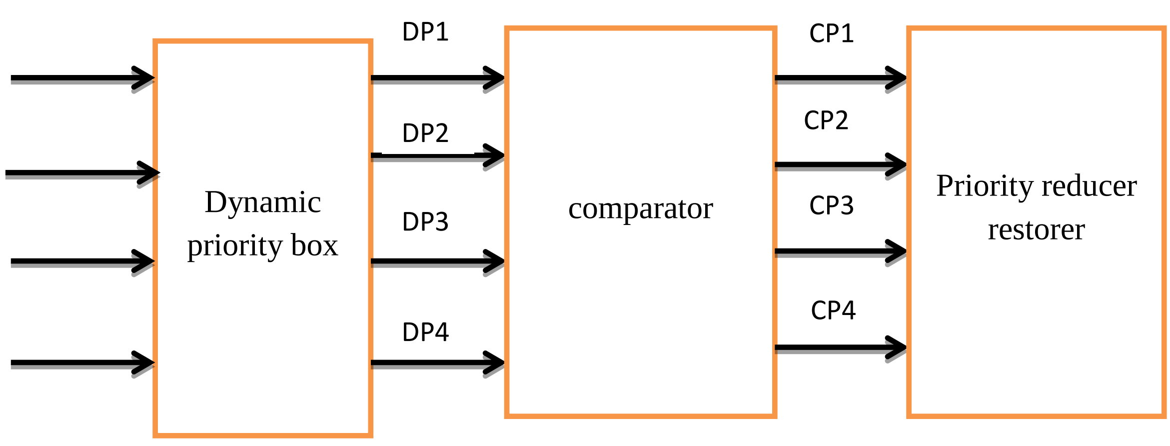

Figure-2 Priority restorer

In order to avoid the congestion in the network the flow of packets are based on queuing technique. Under the normal network load the queue is scheduled using a first come first served basis(FCFS).The source nodes detects the events and assign the priorities based on the type of data. One bit in each packet header was reserved for the priority assignment. Hence the priority assignment helped in preventing of critical packets during congestion.

4. EXPERIMENTAL ANALYSIS

Table-1 Simulation parameter configuration

Parameter name	**value**
Path setup length (bit)	**1024 bits**
Ack length (bit)	**1024 bits**
Transmission bandwidth (Gbps)	**400 Kbps**

Table-2 Comparison of various algorithms

parameters	**TDM-WDM mesh**	**2D-mesh with packet switching**	**OCS mesh**
Energy Efficiency	**68 percent**	**84 percent**	**73 percent**
Throughput	**187 Kbps**	**308 Kbps**	**237 Kbps**
Energy consumption	**32 percent**	**16 percent**	**27 percent**
Delay	**443 ms**	**266 ms**	**387 ms**

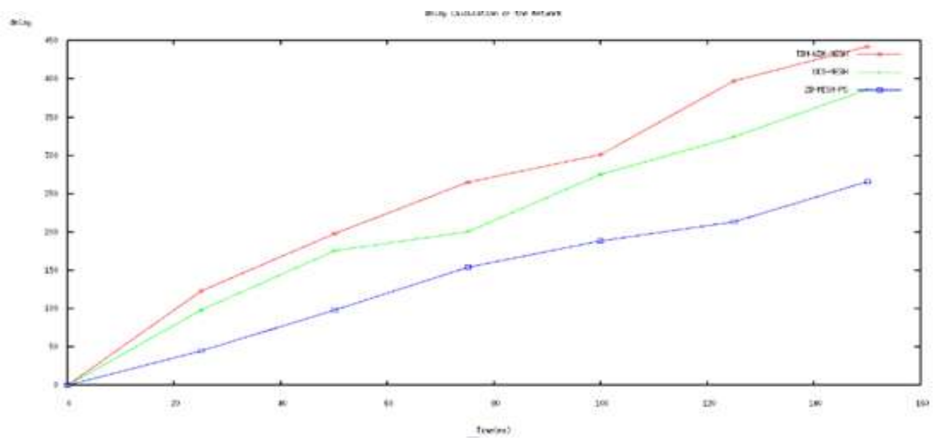

Figure 3-calculation of delay

Fig 3 shows that proposed 2D-mesh with packet switching has 266ms of delay and it can be concluded that is has very minimum delay when comparing with existing algorithm

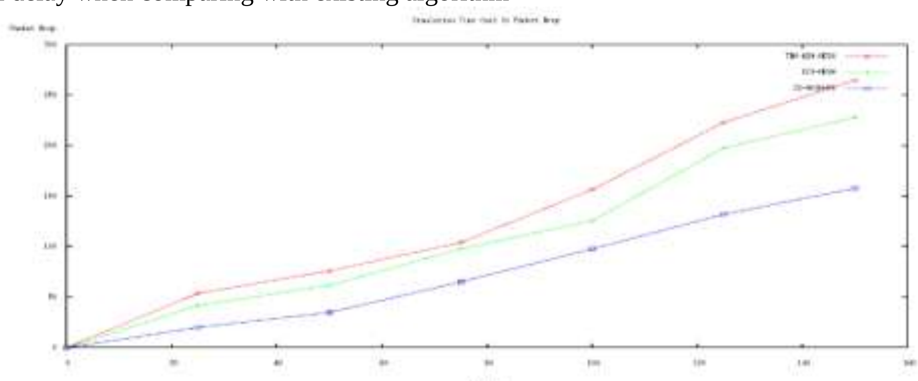

Figure 4-packet drop during transmission

Fig 4 shows that proposed 2D-mesh with packet switching has 20% , TDM-WDM mesh has 60%, OCS mesh has (85% of packets drop during particular transmission time

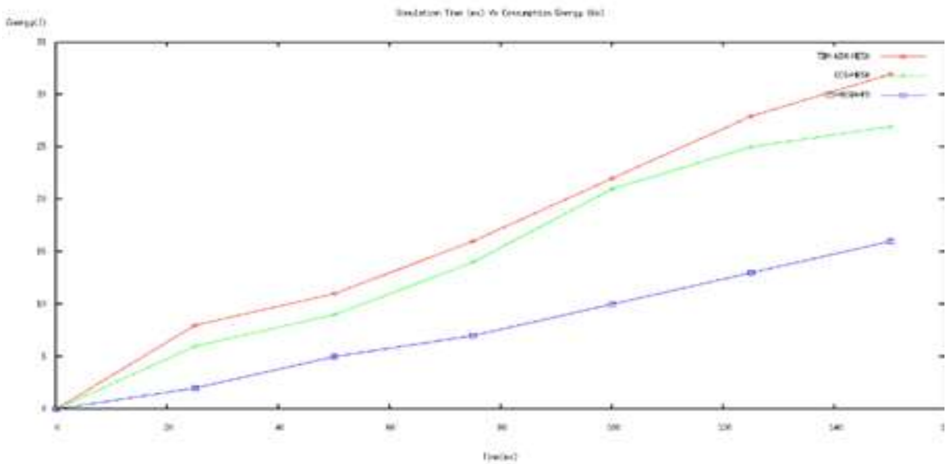

Figure 5- energy conservation

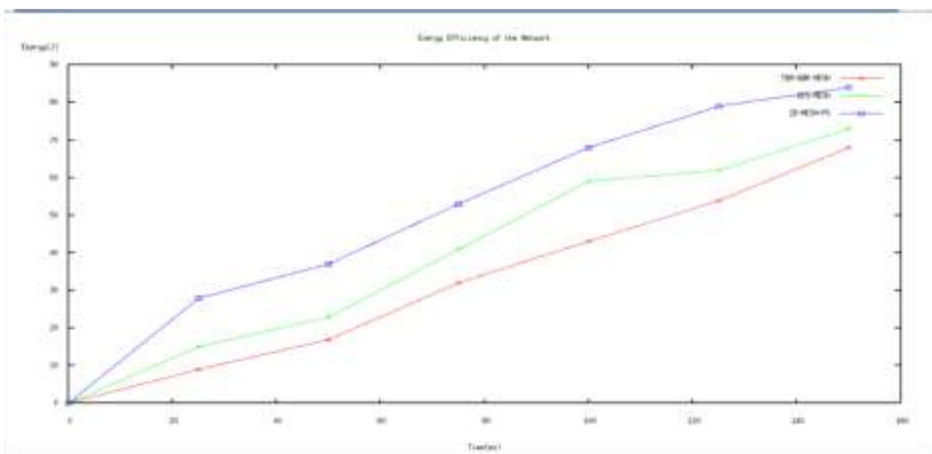

Figure 6- energy efficiency

From figure 5 and 6 we can find that the proposed method have better energy efficiency of about 16% when comparing with existing methods

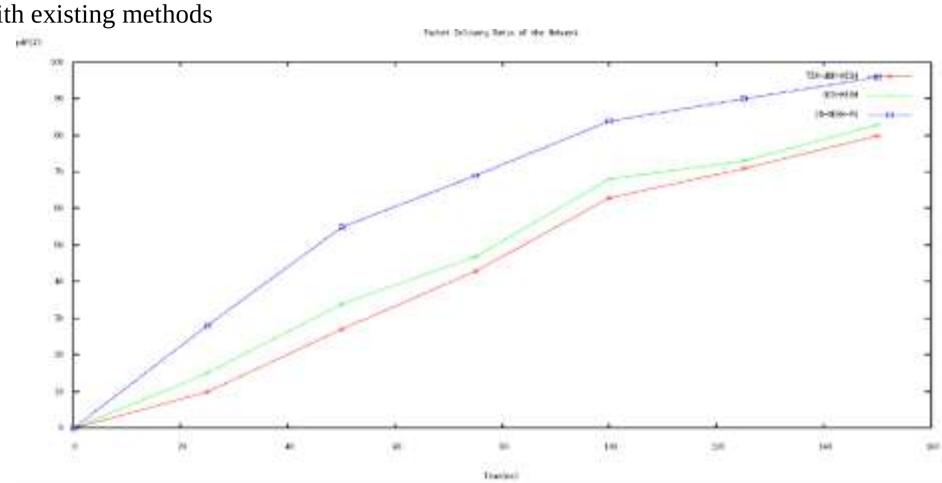

Figure-7 packet delivery ratio

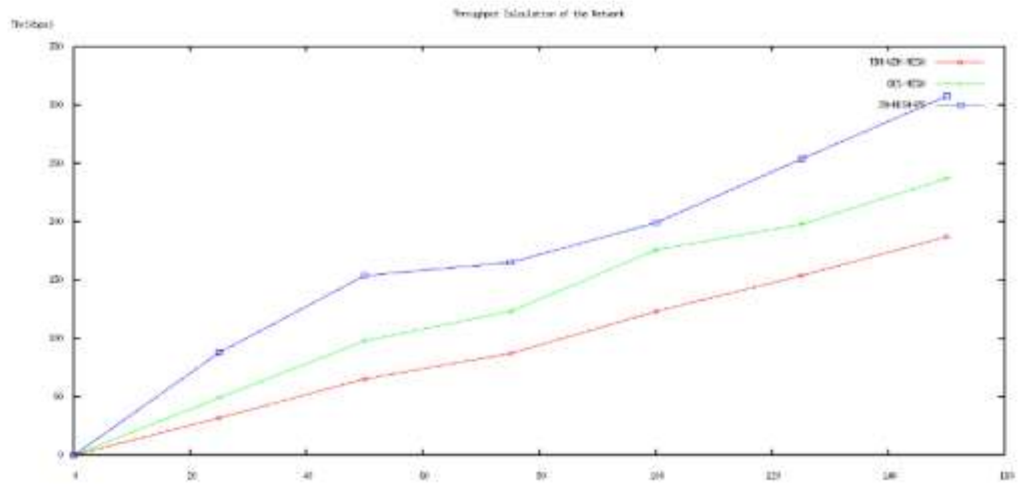

Figure-8 Throughput calculation

From figure 7 and 8 showed that it can capture the tradeoff between wavelength throughput and efficient use of bandwidth in a meaningful way.

5.CONCLUSION

The congestion-awarerouting algorithms addressthe issue of finding optical routes and forwarding packets toward less congested regions. In this work, a congestion-awarerouting algorithm was proposed for the 2D-mesh topology based optical packet routing and switching. The proposed scheme was demonstrated with the simulation study and routes were assessed with higher rate throughput with congested control, by rearranging the order of dimensions and transposing the optical virtual channels.

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