Simulation of Energy Efficiency in Virtual Topology

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***Abstract*-- In this paper, an efficient utilization of bandwidth in optical networks is reduced and does not meet the user needs like Speed. Because of the technology users are increasing. In previous models, the configuration of the nodes are static and each node should know each other. Due to this purpose the Nodes are not able to re-configure itself and WRON (Wavelength routed optical network) is not possible. To reconfigure the nodes, design the virtual topology with consider Q Factors like Quality of transmission, Energy Efficient etc. Energy Efficient is a factor to choose the number of transmitters in a light path. So, it had relationship with power consumption like number of transmitter is directly proportional to power consumption. By reducing the power consumption and saving resources; the proposed algorithm take it as a GREEN TECHNOLOGY in optical communications.**

Index Terms-- Virtual Topology, WRON, Q Factors, Energy Efficient.

I. INTRODUCTION

The design of a virtual topology (i.e., the set of light paths established in an optical network [1]), taking into account the impact of physical impairments, is a very complex problem that can take advantage of using reconfiguring techniques.

A virtual topology consists of virtual nodes and virtual networks, and the physical network consists of switches and links interconnecting multiple physical nodes that can host the virtual nodes.

To demonstrate this statement, Design the network without priority of topology and more than five nodes, route the packets into the particular path of the network until to meet the threshold level of the traffic load. Then wake up the node from sleep for routing packets in another path of network. To obtain the optimal virtual topology that optimize the network capacity (by minimizing congestion, i.e., the traffic carried by the most loaded light path) and the energy consumption (by reducing the number of transceivers in operation). The performance of has been analysed by means of simulation and compared with different networks demonstrate the advantages of reconfiguring of the virtual topology.

In general form, a virtual network Gv=(Nv,Ev,Cv) must be allocated from a physical network G = (N,E,C), where Nv and N are the node sets, Ev and E are the link sets, Cv and C are the constraint sets on the network elements of Gv and G respectively. The solution includes mapping the virtual nodes to the physical nodes and routing the virtual links as path over the physical links.

In this paper we study the virtual topology environment. Firstly, it has to be efficient in terms of capacity, energy consumption and quality of transmission of the connections established.

Secondly, it should be adapted to traffic and network conditions. Thus, it is necessary to develop methods to design efficient virtual topologies in a relatively short period of time, so that reconfiguration mechanisms can be triggered on real time if required. Moreover, the virtual topology design problem is a Multiobjective optimization problem, since several parameters should be optimized rather a single one. As there are trade-offs between different solutions in terms of the different parameters, the most interesting approaches to solve Multiobjective optimization problems are targeted to obtaining the Pareto optimal set, i.e., a set of solutions where each solution (e.g., a virtual topology) is characterized because it cannot be simultaneously improved in terms of all the optimization objectives

In particular, a reconfiguring optical network should be able to provide effective decision, by based on cognition, on:

- How to route with new traffic demands either with existing path or new light path in the virtual topology?
- How to design the new light path based on the shortest path and traffic load? How to ensure the energy efficient path is designed?

By seeing the conditions on above statement, the network is decision based system, by checking status of the traffic load, minimum number of hop count between the source and destination, and with a set of control and management mechanisms to implement the decisions that are made for the system.

While both centralized and distributed control architectures are implemented with reconfiguration mechanism the nodes. See Section 2 for summary of related network.

II. PATH COMPUTATIONAL ALGORITHM

The basic function of a PCE is to find a network path that satisfies multiple constraints. Given the QoS metrics, the network status and the QoS requirements of a path computation request, the problem is to determine a path that maximizes the chances of the request to be successful with the minimum negative impact on the network ability to accept future requests.

QoS metrics

Routing metrics are links features used to represent a network. Given the metric d (I, j), associated to the link (I, j), and the path p= (i, j, k,…, l, m), the metric d is:

Additive if $d(p) = d(i,j) + d(j,k) + \ \dots\ + d(l,m)$ (1)

Multiplicative if $d(p) = d(i,j) * d(j,k) * \ \dots\ * d(l,m)$ (2)

Concave if $d(p) min[d(i,j); d(j,k);\ \dots\ ; d(l,m)]$ (3)

In the case of QoS routing protocols and constrained-based path computation algorithms, instead, the network is described by means of multiple metrics. The most common ones are the following:

Cost: it is an additive metric, because the cost of a path is the sum of the costs of the links.

Bandwidth (or residual bandwidth): it is a concave metric. Indeed, we define the bandwidth of a path as the minimum of the residual bandwidth of all links on the path (bottleneck bandwidth).

Delay: it is an additive metric, since the delay of a path is the sum of the delays of its links. It consists of three components: propagation delay, transmission delay and queuing delay.

Energy Efficient: Avoid the no. of nodes between the source and between.

$$E \alpha N \quad (4)$$

Initially the nodes in the network in sleep mode, so that the node are used in the path is less, it effects on the energy. And also No. of hop counts is also directly proportional to the energy and relies on nodes.

In particular, given a random sequence of N path computation requests, our algorithm checks whether they can be satisfied Energy Efficient. If some of them is rejected (Z < N), we compute the number of requests that can be accepted when:

1. They are sorted top-down according to the bandwidth requirements;
2. They are sorted bottom-up according to the Energy Efficient requirements.

Finally, the best solution according to a pre-defined cost function (e.g. the maximum number of reservation requests that can be accepted) is chosen. Therefore, Reconfiguration node in the virtual topology makes energy efficient and resolve the request rapidly compare with other methods.

PHASE 1: ROUTING PATH USING SHORTEST PATH ALGORITHM

INITIALIZATION:

```
S = {u}
for all nodes v
if v adjacent to u {
D(v) = c(u,v)
else D(v) = ∞
Loop
find w not in S with the smallest D(w)
add w to S
update D(v) for all v adjacent to w and not in S:
D(v) = min{D(v), D(w) + c(w,v)}
until all nodes in S
```

PHASE 2: RWA ALGORITHM FOR ENERGY EFFICIENT OPERATIONS IN STATIC SCENARIO

CALCULATE THE SHORTEST PATH BETWEEN SOURCE AND DESTINATION

```
If traffic_load < value
Then
  Pass the packet through the node
Else if traffic_load > value
Then
  Pass the packet through the another node
End if
```

III. IMPLEMENTATION

In this section, we describe the most important functionalities virtual topology in OMNET simulator. The main enhancements concern the following components:

- Design the different network for computing the congestion, based on the node reconfiguration;
- Establishing light path with QoS constraints;
- Recovery to initial configure nodes of network with QoS constraints.

- ***Network Establishment***

The following functional and script allows to set-up a network with node reconfiguration by using path computation algorithm:

Add the node, design the modules of the network; add the ports to establishment the connection between the network. In the node, add the functional components Iapp, routing and the queue size. Iapp is used for the interface to the network like IN and OUT gates.

Net Node:

```
network Net5 {
```

```
types:channel C extends DatarateChannel      {}
 submodules:
rte[5]: Node {       }
connections:
……. }
```

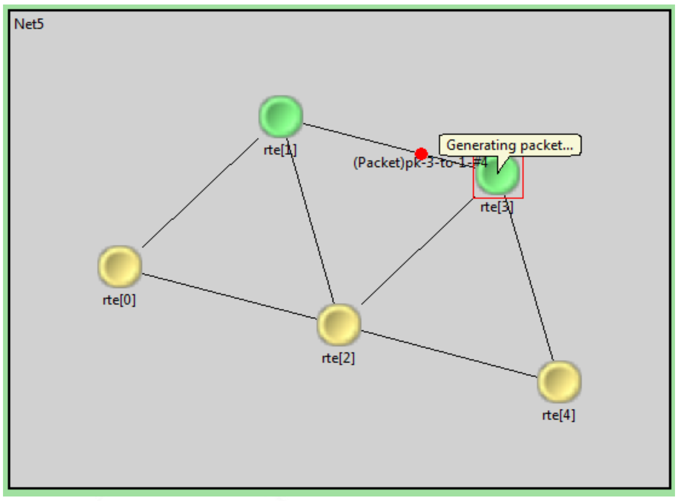

Fig 1. Five-Node virtual topology

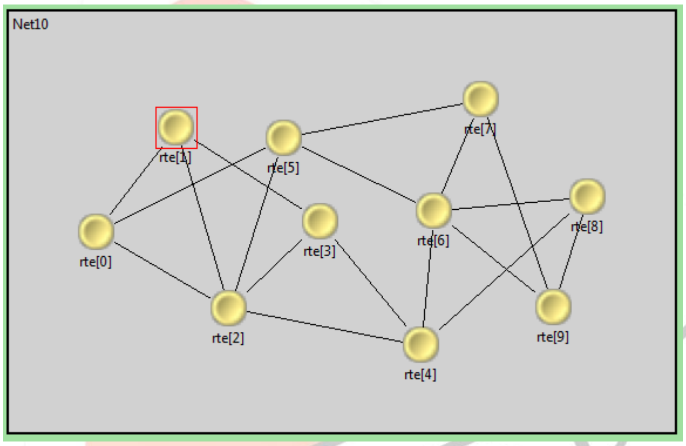

Fig 2. Ten-Node virtual topology

Routing interface for switching the packets in the network. L2Queue interface is used for build the packets in buffer, by the help of routing packets in the networks

VI. SIMULATIONS

Simulations have been considering the physical configuration of the 5 node or 10 node virtual network, where each telecasting between two network nodes consists of two fibers, one per each path. The volume of a wavelength has been set to 1Mbps, the maximum number of wavelength per fiber to 12, the delay with 0.1ms to 1ms in the network. The limit of transmitter in each node to 26.

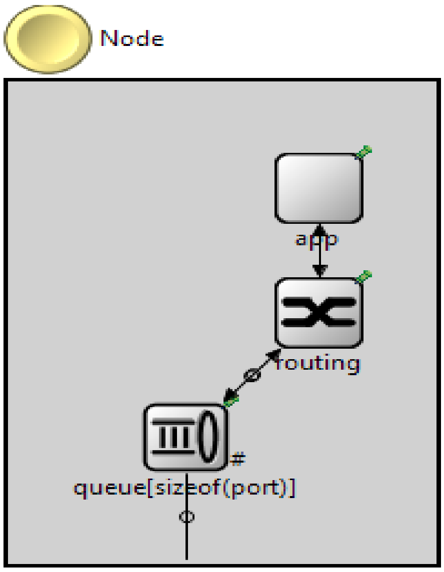

Fig 3. Architecture of the IP over WDM optical network for Energy Efficient.

TABLE 1. POWER CONSUMPTION PER COMPONENT

Elements	Power Utilization
Avg power utilise per IP router card (E_r)[a]	8.4KW for DC 9 KW for AC
Power Consumption per transceiver (E_t)[b]	86KW

a. Router Cisco 8 Slot CRS -1 router data sheet
b. Transceiver: Alcatel-lucent data sheet

The simulator has been developed in OMNET++ and Q-Factor of each light path in the survivable virtual configuration and results will be inputs to the formulation in the MATLAB. Threshold of the Q-Factor is set to 9.12dB. The modelling employed for cognition use assessment is that described in Section I. The power demand of the various network elements shown in Fig. 3 is provided in Table. I

We hold run simulation of network operation where, each period, one substance to design a new survivable virtual topology arrives at the system. When braving each of these requests, interact knob executes one of the algorithms previously presented to determine how to reconfigure the virtual topology of the network.

It considers that the interchange from client node s (source) to end node d (destination) at time t (in sec) is the presented by Equation where:

- On virtual topology connection matrix V_{ij}

$$\sum_j V_{ij} \le T_i \quad \forall i \tag{5}$$

$$\sum_i V_{ij} \le R_j \quad \forall j \tag{6}$$

- On virtual topology traffic variables λ^{sd}_{ij}

$$\sum_i \lambda^{sd}_{ik} = \sum_j \lambda^{sd}_{kj} \quad if\ k \ne s,d\,. \tag{7}$$

$$\sum_{s,d} \lambda^{sd}_{ij} \le V_{ij} \cdot C \tag{8}$$

In request to speed that proportion, the average determine of the solutions from the methods Fig. The corresponding values of the proportionality of the solutions in the joint POS that has been organized by each rule is shown in Figure 4

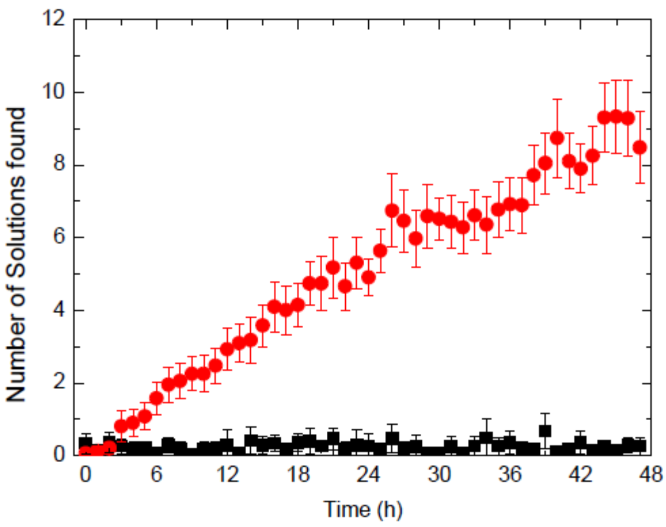

Fig 4. Energy Efficient of the Virtual topology

The graph is plotted by using MATLAB tool for the Energy Efficient general purpose.

V. CONCULSION

Constraint-based path process is a key function in MPLS and GMPLS networks. Various algorithms get been proposed in literature to provide the QoS requirements of LSPs part requests and to take traffic engineering strategies. Varied types of algorithms change been implemented and integrated in the simulator. In peculiar, a new rule (WCS) has been planned to turn the execution of WC when a centralized near is used. Finally, the theme reports the results of some simulations, performed in an endeavor network scenario, to evince how the matured software ability can be utilized to fill a set of LSP allocation requests with triplex QoS constraints.

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