INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT

ISSN: 2278 – 0211 (Online)

Development Of An Improved Adaptive Energy Saving Scheme For Green Optical Networking

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Abstract:

Global IP traffic is predicted to reach 63.9 exabytes per month in 2014. This growth rate has not only driven up demand for bandwidth from the Internet backbone infrastructure but has also presented providers with new challenges such as Enormous Energy Consumption, which causes Global Warming. To address these issues, Load adaptive energy saving schemes were proposed which is for backbone IP networks use dynamic transport circuit services to adapt the active network resources to the current traffic demand in order to reduce the network's energy consumption. Recently, several approaches, categorized as Switch-Off schemes, have been proposed which attempt to reduce the energy consumption of already existing networks by switching-off IP ports and links during periods of low traffic. Although it has been shown that these schemes can notably decrease the network's energy consumption, they are prone to instabilities in the IP routing service and decreased resilience due to reduced connectivity. To address these challenges, Switch-On scheme in an IP-over-WDM network was proposed, where the network is designed so that the essential IP connectivity is maintained during low traffic periods while dynamic circuits are switched on in the optical layer to boost network capacity during periods of high traffic demand.

This Project Work has implemented the Switch-On Scheme and from our experimental results, it is observed that the Switch-On approach in IP-over-WDM networks carry significant potential for improvement in energy efficiency. However, it is realized that this scheme consumes energy inefficiently due to poor energy-load proportionality of network equipment which causes a vast amount of energy consumption even in an idle state. To address this issue, this Project Work is proposed an efficient Traffic Grooming Framework for Switch-On approach. From our experimental results, it is revealed that the proposed work outperforms the existing Switch-On Model interms of Power Consumption, Throughput, Router Utilization.

Key words: *Cross-layer design, minimum energy control, networks, optical communication equipment, traffic grooming, energy efficiency, IP-over-WDM, load adaptive, network optimization, routing stability.*

1.Introduction

In this chapter discuss about Increase in internet traffic brings a significant issue of the energy consumption problem as well as the network capacity problem. Network equipment consumes 22 GW globally which is equivalent to 14 percent of energy consumption of the information and communication technology (ICT) sector in 2007. If internet traffic increases as predicted, the problem of energy consumption of networks will be the most critical issue that requires significant research effort for the energy-aware solution[1]. In order to cope with such rapid increase in energy consumption in networks, a lot of research efforts are dedicated to solve the problem recently. Energy consumption analyses for network equipment have been also reported for understandings of the energy consumption of networks. Traffic grooming technique is one of the prime candidates to save energy consumption of networks, because it can maximally utilize a WDM optical layer that consumes relatively very little energy[2].

2. Related Work

Chankyunlee [1, 2] says that Energy consumption measurement of network equipment has been studied in order to accurately model energy consumption of network equipment. Energy consumption of network equipment in an idle state is reportedly huge according to the energy proportionality index (EPI) of network equipment is proposed to model how much network equipment consumes energy proportionally to a network load. In addition to that energy savings impact by traffic grooming technique in network provisioning[3], and the equipment cost, operation cost, and energy consumption[4] of networks Provisioning for dynamic traffic and investigates energy consumption by ILP with algorithm. Marce Caria has proposed load adaptive energy efficiency schemes are mechanisms to dynamically adapt the network's capacity to the actual traffic demand in order to shutdown idle Equipment so that electrical power can be saved. The analyze of the relationship between reliability, performance, and power consumption, with the result that using power consumption[5] as the foremost parameter in network planning creates networks with concentrated connections, leading to reliability problems. The performance of IP link Switch-Off schemes was analyzed where not only idle links but also certain nodes can be completely switched off, since the authors assume that zero traffic is generated or terminated at some nodes. For the Switch-Off scheme, it is assumed that the network links consist of multiple cables whose capacities are aggregated and that individual cables can be powered down to save energy [6].

3. Proposed Work

In this paper, our proposed new algorithm is the discussed which provides better performance than that of the existing algorithm. However, from the literature survey, this work realized that current network equipment consume energy inefficiently due to poor energy-load proportionality of network equipment which causes a vast amount of energy consumption even in an idle state. To address this issue, this work is planned to introduce an efficient Traffic Grooming Framework called energy proportionality index (EPI) with Switch-On approach, which could optimize the energy consumption of IP/WDM. In our proposed system, the Load balancing concept is used to reduce the energy consumption by the network, so the System will be,

- Low Power Consumption.
- Increases the throughput.
- Reduces the delay.
- Router Utilization increased.

3.1 System architecture design

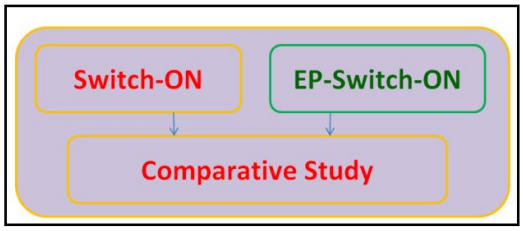

Figure 1: Architecture diagram

3.1.1 Switch-On

Switching off optical fibers has the disadvantage of a large delay for reactivating them. In order to minimize this effect, fibers should remain activated even with a very small amount of traffic (utilizing one channel). In this manner, our proposed algorithm still results in reducing energy consumption in network and we could assume that these fibers are switched off. In this architecture diagram represented a comparative study of Switch on and EP-Switch On scheme as shown in Fig.1 Switch off scheme Proposed load adaptive energy efficiency schemes are mechanisms to dynamically adapt the network's capacity to the actual traffic demand in order to shutdown idle Equipment so that electrical power can be saved.

3.1.2 .EP Switch On

Energy consumption measurement of network equipment has been studied in order to accurately model energy consumption of network equipment. Energy consumption of network equipment in an idle state is reportedly huge according to the energy proportionality index (EPI) of network equipment is proposed to model how much network equipment consumes energy proportionally to a network load. In our EP SWITCH-ON system, the Load balancing concept is used to reduce the energy consumption by the network.

3.2.Proposed Algorithms

The objective of our algorithm is to optimize routing and to adapt the logical topology of IP layer to the variations of traffic in network. Different routing configurations lead to different logical topologies and different level of utilization in network links and channels. Based on the router utilization we have designed an algorithm for improving the energy consumption which is given below,

- If U_R<=15% Make Router to
  - Sleep State
  - (Switch-OFF)
- Else If 60%< =U_R<=80% Call Router From
  - Sleep State (If Exist)
  - (Switch-ON)
- If U_R>80% Restrict New
  - Connection
    - (Admission Control Mechanism)

4. Implementation And Results

In our implementation the Fig.3 shows that the form design. The form shows the labels like Number of Nodes, CBNS_RUN, set nodes, LAESS, CLD, IP_WDM, Create infrastructure, Capture, Analysis, Report file, Graph, Exit.This paper work implemented

Cisco Boson Netsim for developing and testing optical networks, which are discussed as shown in Fig.2.

4.1.Cisco Boson Netsim Network simulator

Figure 2: Boson NetSim Network Simulator

The Boson NetSim Network Simulator is an application that simulates Cisco Systems' networking hardware and software. Boson NetSim provides more versatility and support than any other network simulation software on the market. Boson NetSim makes it possible to design and configure a network with 42 different router models and 6 different switch* models to choose from without having to pay a lot of money, or worrying about transporting and damaging valuable equipment.

4.2.Execution

The execution consists of four stages: setting the nodes, fixing the type of the network, creating infrastructure and running the tool.

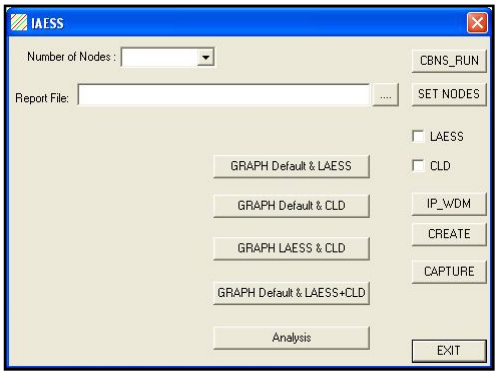

Figure 3: Initial window

4.3 Report

After completing the execution, the report can be generated for Default and proposed system. The report can be shown in the Fig.4 contains Power in percentage (%), Throughput in mbps, Number of router, Router utilization in percentage (%).From the report window it shows that IAESS technology outperforms in terms of power consumption, throughput, and router utilization compared to LAE+CLD.

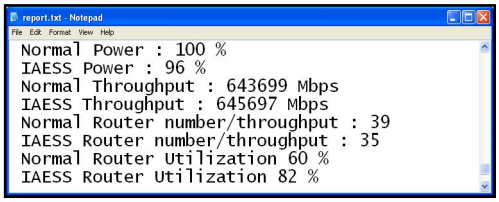

Figure 4: Report Creation

5.Performance Analysis

The result comparisons with existing and proposed graph representations are shown as following sections.

5.1.Power Consumption

The power consumption comparison is shown in Fig.5. It Shows that the power consumption for compare with LAE and CLD (96%) which is less than the Default power consumption (100%).It represent the get reduced power in proposed system.

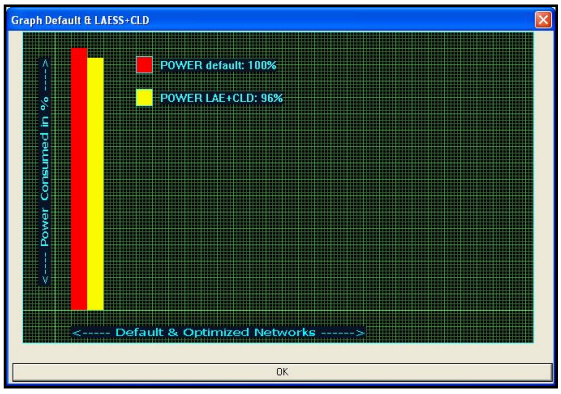

Figure 5: Power consumption comparison

5.2.Throughput

The throughput comparison is shown in Fig.6. It Shows that the throughput for compare with LAE and CLD (645697 mbps) which is higher than the Default throughput (643699 mbps) It represent the get increased throughput in proposed system.

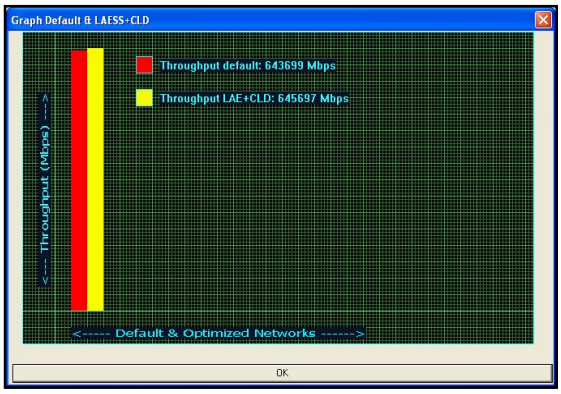

Figure 6: Throughput comparison

5.3 Router/Throughput

The Router/throughput comparison is shown in Fig.7. It Shows that the Router/throughput for compare with LAE and CLD (35) which is less than the Default Router/Throughput (39) ,It represent the get off the some of the router under utilization of less than or equal to 15% in proposed system.

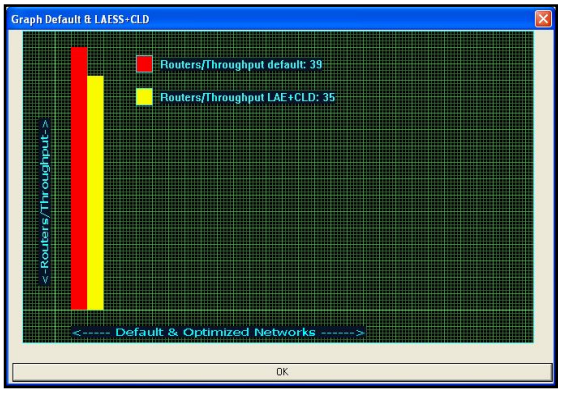

Figure 7: Router/Throughput comparison

5.4 .Router Utilization

The Router Utilization comparison is shown in Fig.8. It Shows that the Router Utilization for compare with LAE and CLD (82%) which is higher than the Default Router Utilization (60%) It represent the get increased Router Utilization in proposed system.

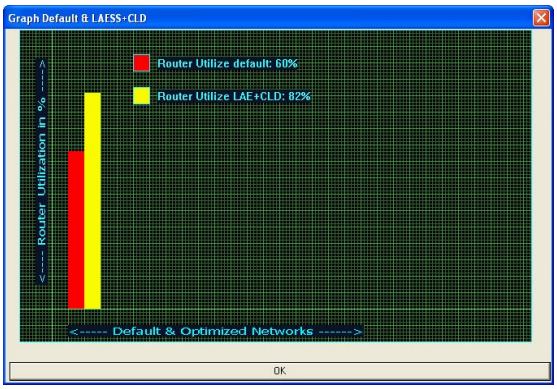

Figure 8: Router Utilization Comparison

6. Conclusion And Future Work

This tremendous growth rate of Internet faces a few challenges such as Enormous Energy Consumption, Communication Delay, Throughput and Bandwidth Requirement. The Enormous Energy Consumption causes Global Warming. To address this major issue, this Project Work designed and implemented an Intelligent Adaptive Energy Saving Scheme (IAESS). From our experimental results, it is noted that the proposed work outperforms the existing Switch-On Model interms of Power Consumption, Throughput, Router Utilization and Bandwidth Utilization. However, from our experimental results, it is revealed that the proposed Improved Load Adaptive Energy Saving Scheme which is integrated with Switch-On Technique for Saving Energy in Optical Networks causes considerable computational complexity. This could be minimized, if we are designing an independent Energy Saving Scheme, which will reduce the computational complexity, which will further improve the performance of Optical Network in terms of Power Consumption, Throughput, Router Utilization and Bandwidth Utilization, this will be the Future work

7.Reference

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