

GREEN NETWORKING: STRATEGIES TO SAVE NETWORK FOR NEXT GENERATION

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ABSTRACT

Information and communication technology is a multi-billion dollar field that has incredible economic, social, and environmental effects. It is the dynamic balance amongst these three aspects in which green information networking technology is used to promote more environmentally friendly products. In this paper, we surveyed the research in the area of green networking. We presented analysis both at software-middleware-level, as well as hardware-level techniques. The analysis suggested that certain changes can be easily implemented at the current time, such as simple modifications to protocols to allow systems to idle, or using server management techniques. Finally, the paper examined intricate approaches to evaluate the success of green networking technologies, and presented case studies to illustrate the ideas.

Keywords: Green Network, Networking, Energy Efficient networking

INTRODUCTION

Green networking is a component that is becoming very popular in this 21st century. Since the reduction of environment pollution and saving energy has become the key factors of this component. Green networking has a strong influence on both economically, environmentally and also mainly in networking field, in a time zone where the data storage and data processing is becoming more and more enormous. For a matter of fact, data-centers and networking infrastructure involve high-performance and high-availability machines which makes them rely on more powerful devices which require energy consuming air conditioning to strengthen their operation. In recent years, many valuable efforts have been put in reducing unnecessary energy expenditure which is caused because of the massive data traffic growth. It is usually named as 'greening' of the networking technologies.

The topic of greening all the networks have been widely explored throughout these couple of years, because of the problem occurred due to the vast amount of data being collected every second of the day. Most of the greening work can be categorized into two groups in general. The most straightforward and successful way is designing energy-efficient topologies which can provide similar connectivity while using low-powered network devices. As energy related networks are concerned, wired networks, wireless networks and hybrid networks are specifically discussed in this paper. The key research component is to explore widely about algorithm-based and natural strategies that can be used in order to reduce energy-consuming network usage. Also the major impact on nature because of the chemical revolution happening, based on high energy usage is also discussed throughout the rest of the paper.

When considering about wireless networks almost all the smart phones, tablets and laptops are taking over the world with the term of ‘wireless’ using only mobile networks to local Wi-Fi networks. And rest of the communication is done by wired network connections which also a reason in high network usage. This rapidly increasing usage of wireless and wired networks has become two of the main reasons to develop energy-efficient strategies with the concept of ‘greening’. Wired and wireless networks differ in power consuming. In wired networks more than 70% of power is consumed in user premises whereas only 10% of power due to mobile user. this following figure shows about the growth in 2014-2019.

Global Mobile Data Traffic Growth / Top-Line

Global Mobile Data Traffic will Increase 10-Fold from 2014–2019

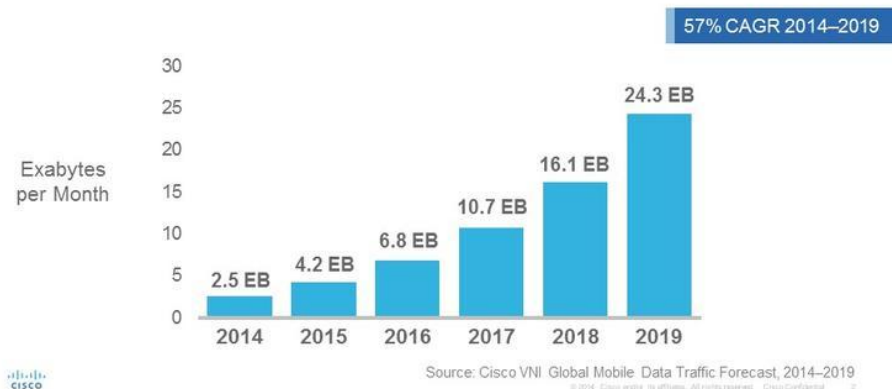


Fig .1

Since hybrid network contains network hardware and equipment or network infrastructure from multiple vendors, it also has a contribution on heavy usage of network. As hybrid networks are becoming popular day by day in this era, it is also an important component when considering about ‘greening’ the networks.

II BACKGROUND WORK

Wang et.al states that the major objective of this research is to incorporate rate adaption into green data center networks in order to achieve energy conservation. They approached network-wide energy proportionality by routing optimization based on simulations which confirms that more than 40% of the energy can be saved while introducing very slight stretch on network delay. Wang et.al formalized the problem of high network usage with an integer program and propose an efficient approximation algorithm – Two-Step Relaxation and Rounding (TSRR). They solved the problem quickly while guaranteeing a constant performance ratio. In this paper rate adaption is considered as advantageous because of the better stability when applied in networks. Also this network-global routing optimization, which is discussed in this paper can bring up to 40% energy savings, even without switching off any network devices. But the major weakness of this project is network unsteadiness brought by the frequent change of the network topology when traffic move in a wavelike pattern very fast .

This paper covers different forms of modeling, analysis, design, management, deployment and optimization of algorithms. Protocols and architectures based on green communication and networking. Those areas may include lots of points which are very important when considering present and future energy usage. Such as energy efficiency, resource management, relay techniques, cross-laye design and optimization, rate adaption etc. Neely presents a methodology for optimizing time averages in systems with variable length frames. Zhang and Cheng developed another new model for green communication called, Demanding-Based Resources Trading (DBRT). Also Attar st.al introduced a novel solution named, “Broadband Wireless Access with Fiber-connected Massively Distributed Antennas” (BWA-FMDA). The advantages of BWA-FMDA architecture are its’ flexibility of deployment, scalability of coverage from a few meters for indoor access and superior performance in terms of throughput as well as power efficiency In this survey article, the authors investigate the key research topics in the area of future Internet construction, challenges and usage. This aims to draw an overall picture of the current research development on the future Internet architecture. Future Internet architectures are required to provide extensible and flexible explicit interfaces among many stakeholders such as users, Internet service providers, application service providers, data owners, and governments. However, many technical and non-technical challenges have emerged during this process, which call for potential Internet usage. Technically, the current Internet was designed over 40 years ago with certain design principles. Its continuing success has been blocked by more and more sophisticated network attacks due to the lack of security embedded in the Internet architecture .

This research focuses on exploring the insights that the principles of network engineering and what architectural changes will be required to meet these new challenges in the future. It says that one recurrent theme in the debates over Internet policy is the claim that the Internet’s future success depends on preserving the architecture that has made it successful in the past. Identifying future trends is inherently speculative and in retrospect will turn out to be

mistaken without any doubt in a number of important respects. According to this research wireless broadband market since 2008 and the emergence of wireless as the leading broadband platform in other countries both suggest that wireless broadband will become increasingly important in the years to come. Bianzino et.al observed few techniques and categorized them as Adaptive Link Rate, Interface-Proxying, Energy Aware Infrastructure and Energy Aware Applications. Since a significant amount of CO₂ emissions are produced by the Information and Communication Technology (ICT) sector, they also mentioned that the massive Green House Gas emissions cause problems to the environment which are not limited. As solutions for CO₂ emission problem, researchers have stated four Solutions; Recourse Consolidation, Virtualization, Selective Connectedness and Proportional Computing. They proposed to use the Benchmark methodology and metrics in handling this green networking research. In their Economical point of view, as a disadvantage there is a huge technological challenge lies in performing service migration without any service disruption, preserving fault-tolerance and data security. They concluded by mentioning as it is necessary to understand where the major energy expenditure occurs to pinpoint the place where the larger energy savings could be obtained

This research is about three issues that are relevant and possible of research in the field of green networking. They specifically focused energy efficiency in wireless networking. They stated that development of more energy-efficient hardware, the introduction of energy-proportional equipment and the adoption of sleep modes for the network elements can be used to achieve energy efficient in any type of networks. Marshan and Meo have mentioned three solutions for their three questions named as Base stations and hot spot, Sleep modes, Centralized and distributed algorithms. They considered a cellular network setting with an algorithm to state the importance of sleep modes and low-power modes for base stations. They have used centralized algorithms and distributed algorithm to identify the optimal network configuration. As a disadvantage there are some problems in sleep modes for base stations like identifying an optimum subset of element for traffic, choosing base stations to off and on and management of transients due to base station switch-off.

A measurement study of the energy consumption characteristics of three widespread mobile networking technologies; 3G, GSM and Wi-Fi and they develop through TailEnder module. 3G and GSM is the largest fraction (60%) of the energy; referred to as the tail energy and is take high power state after the completing for transfer. Energy for uploads it's nearly 30% more than that for downloads for 100 KB transfer. Wi-Fi had overhead tail energy and its transferring data itself is significantly. Wi-Fi composed of scanning, association and transfer for 50 k download. They show that the TailEnder scheduling algorithm is probably within a factor of the energy consumed by an optimal offline algorithm that knows the complete arrival pattern of alteration a priori. Furthermore, they show that no deterministic online algorithm can be better than 1.62 competitive than an optimal offline adversary. First, is the transmission energy that is enough capacity to the length of a transmission and the transmit power level. Second,

is the Radio Resource Control (RRC) protocol that is responsible for channel apportion and scaling the power consumed by the radio based on inactivity timers .

Interconnect the large number of data center servers and provide efficient and fault-tolerate routing service to upper layer application. Fat-tree and BCube topology are represented to data center network. They using energy aware routing to save energy consumption in high density. It suffering from the problem of the low scalability high cost as well as single point of failure and they solve the problem through they own pseudo code algorithm. When the number of outflows is less than 1000, more than 20% energy are saved; and the amount increases to 80% if the number of outflows is less than 100. As expected, the energy-saving effectiveness degrades as the network load increases.

III WIRED NETWORKS

In computing terminology, the term "wired" is used to differentiate between wireless connections and those that involve cables. While wireless devices communicate over the air, a wired setup uses physical cables to transfer data between different devices and computer systems. A wired network is a common type of wired configuration. Most wired networks use Ethernet cables to transfer data between connected PCs. In a small wired network, a single router may be used to connect all the computers. Larger networks often involve multiple routers or switches that connect to each other. One of these devices typically connects to a cable modem, T1 line, or other type of Internet connection that provides Internet access to all devices connected to the network. Wired may refer to peripheral devices as well. Since many keyboards and mice are now wireless, "wired" is often used to describe input devices that connect to a USB port. Peripherals such as monitors and external hard drives also use cables, but they are rarely called wired devices since wireless options are generally not available. While many peripherals are now wireless, some users still prefer wired devices, since they have a few benefits over their wireless counterparts. For example, an Ethernet connection is not prone to signal interference that can slow down Wi-Fi connections. Additionally, wired network connections are often faster than wireless ones, which allows for faster data transfer rates. Some users also prefer wired peripherals since there is no need to replace batteries on a regular basis. Gamers especially prefer wired keyboards and mice since they have lower latency and can be backlit, thanks to the power provided by the USB connection.

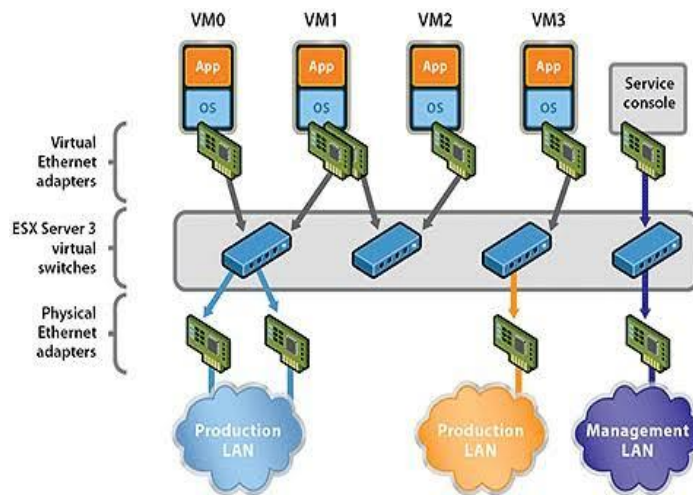


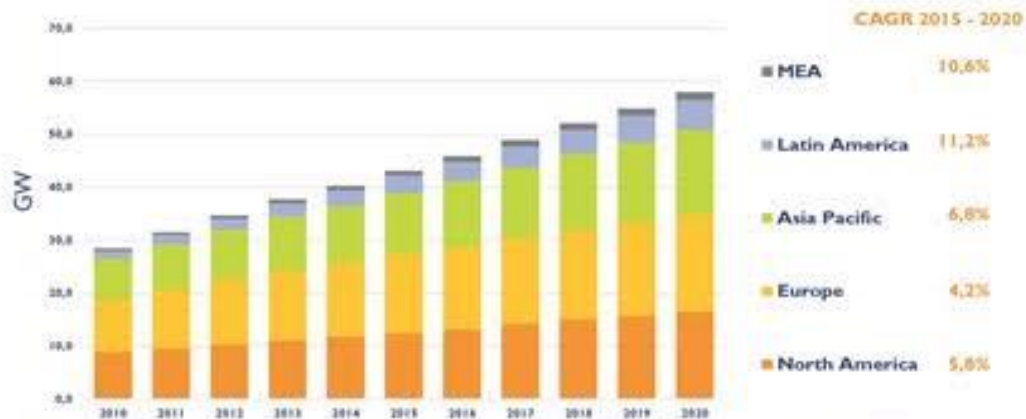
Fig 2

IV CHEMICAL DAMAGE

The Climate Group, GeSI Report says, the emission of Carbon dioxide from PCs, peripherals and printer is 57% (820m tons CO₂), Telecoms infrastructure and devices is 25% (360m tons CO₂), Data centers is 18% (260m tons CO₂) in 2007. And it is expected to grow by 4% by 2020. The traffic growth in the internet is doubling every two years. The traffic of internet videos is higher than the traffic of wireless data and wireless voice.

WORLDWIDE DATA CENTER FACILITIES – POWER NEEDS IN GW

(Source: New Technologies and Architectures for Efficient Data Center report, July 2015, Yole Développement)



With no slowdown in new facility construction, data centers worldwide will have an increasing need for power.



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Fig 3.

WIRELESS NETWORK

A wireless network is a computer network that uses wireless data connections between network nodes... Wireless networking is a method by which homes, telecommunications networks and business installations avoid the costly process of introducing cables into a building, or as a connection between various equipment locations. Wireless telecommunications networks are generally implemented and administered using radio communication. This implementation takes place at the physical level (layer) of the OSI model network structure.

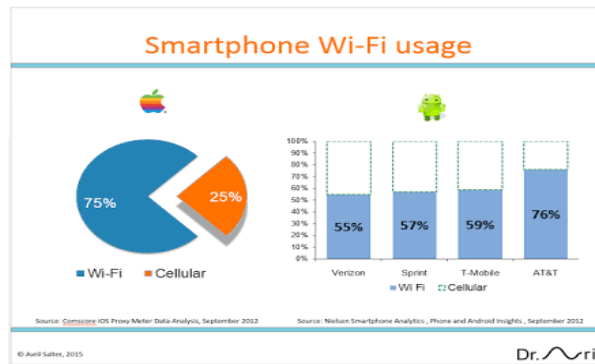


Fig.4

Examples of wireless networks include cell phone networks, wireless local area networks (WLANs), wireless sensor networks, satellite communication networks, and terrestrial microwave networks.

DATA CENTERS

Present data centers, containing thousands of switches and servers, run data-intensive applications from cloud services such as search, web email, to infrastructural calculation. (GFS, CloudStore, and MapReduce) The goal of Data Centre Network (DCN) is to combine the huge number of data center servers, provide productive and fault-tolerant routing service to over layer applications. It is well known that the current practice of tree architecture in data centers suffers from the problems of low scalability, high cost as well as single point of failure. Hence, recently a lots of advanced network architectures are proposed to restore the tree topology, represented by Fat-Tree, BCube and etc. As a solution for that, BCube (BN, BL) topology, where BN indicates the number of ports in a switch and BL denotes the number of levels, where there are different values of BN and BL to vary the topology scales. Similarly, it varies the couple of ports in switch in Fat-Tree, denoted as FP. It can be assumed that the network capacity of all links in these topologies are 1Gbps. The number of flows in a topology can be changed to simulate different network load, and the traffic matrix is one of normal way generated upon servers.

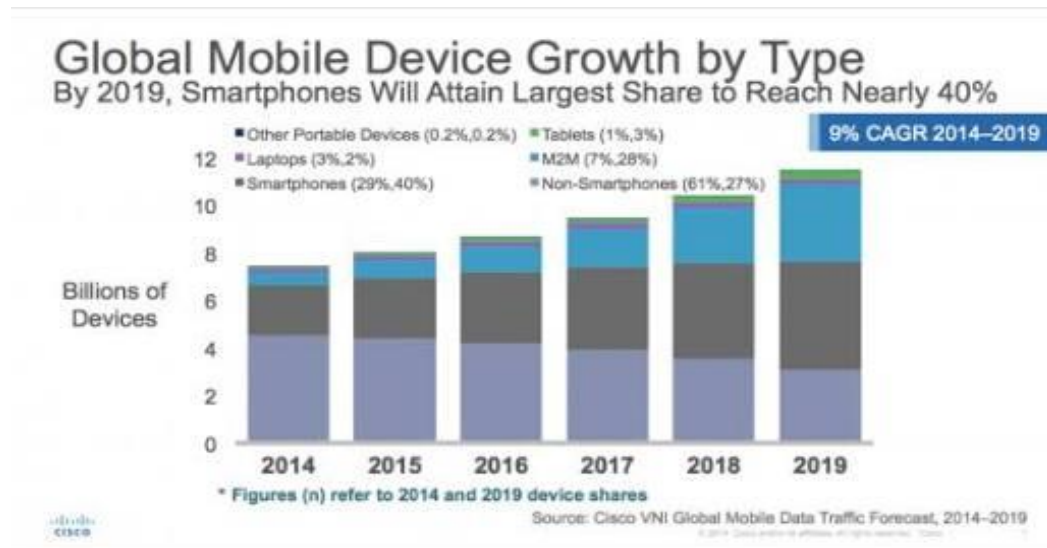


Fig.5

VII CONCLUSION

Currently since the world has faced a critical problem in terms of power consumption it is indeed important to start saving energy in the networking perspective. High use of internet can be effected in internet loss in the near future. As the internet is an essential part of lifestyles, using it efficiently is a solution than limiting the usage. This research paper introduces some strategies towards greening the networks based on wired networks, wireless networks, chemical environment and data centers. Furthermore, in this paper, some strategies are applied to save network which are currently being used in different sections other than networking. As the main objective, this paper has presented many strategies to save network for future generations by greening the networks efficiently

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