International Journal of Advanced Trends in Computer Applications
www.ijatca.com

A Review on Recent Advancements in Green Networking

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Abstract:-*Energy consumption is that the issue we can't neglect. It affecting our economy system and it's not only hitting economically but also it's affecting the environment and marketing. As we all know networking needs big setups that have machines of larger size with higher performance. There are many reasons that are affecting the environment in networking but the most and therefore the big reason behind the environmental issue is Green House Gases (GHG). It increases the worldwide temperature day by day. We've to stay the temperature below and for this we have introduced green networking. During this review paper, further we have discussed the precise definition of green networking. We further more described the objectives and motives. We will provide the taxonomy of this work with special specialize in wired networks. we'll also identify the four branches of Green networking research that come from different observation and are the basis causes of energy waste namely 1)Adaptive link rate , 2) interface proxy , 3) energy -aware infrastructures , 4) energy -aware applications. We will overview the present state of green networking and identify some of the paradigms. We'll also discuss green networking solutions that are basically strategies. Then we'll cover conclusion then future work supported green networking.*

Keywords: Green Networking; Energy; Temperature.

I. INTRODUCTION

Energy consumption is basically an enormous issue for industrial level. This is a problem due to some reasons like economic, environmental and marketing. For networking base we'd like high performance and liability machines which commit on powerful devices. Their setup process leaves an outsized room for energy savings because they're not utilized in normal operation .In recent years, worthy efforts are given to reducing redundant energy expenditure, which is typically referred to as greening of networking technologies and protocols or green networking. The main explanation for environmental problem is Green House Gases (GHG) [1-2]. It not only affects the environment but the economy too. A European research says there should be decrease in emission volume of 15%-30% before year 2020 to keep the worldwide temperature increase below 2 degree Celsius. The aim of green networking is to attenuate the GHG emission. The primary step so as to attenuate the emission is to use of renewable energy in ICT (Information and Communication technology).The differently is to style low power components without compromising the performance. Dislocating network equipment towards strategic places also lead to substantial savings. There are two reasons associated with this; first one is said to losses during energy transportation. This will help during this way that the closer the consumption point to the assembly point, losses will get reduced and therefore the second reason is said to cooling of electrical devices [3].

Some of the most strategies related to green networking involve consolidating devices or otherwise optimizing a hardware setup. Software virtualization and efficient server use can contribute to the present general goal. Green networking could also include such diverse ideas as remote work locations, energy use in buildings housing hardware, or other peripheral aspects of a network infrastructure. Ideas related to green networking also address tech services or user relationships which will ultimately be built on a network. This includes green search or studies of the

energy use of search engines, alongside many other forms of study of modern networks and tech systems. As we all know studies associated with energy in wireless networks are very specific and need a better dedication so we'll mainly focus on wired networks, although we'll cover wireless networks too because our main focus is to conserve energy in networking. As we consider our daily use gadgets such as mobile, laptop and tablet, they are ruling all over the world in terms of wireless networks using mobile network or local wifi. Rest of communication is dependent on wired networks. As the research says wired network consumes 70% of energy and mobile users consume only 10%of power. Here is the figure that shows the internet usage.

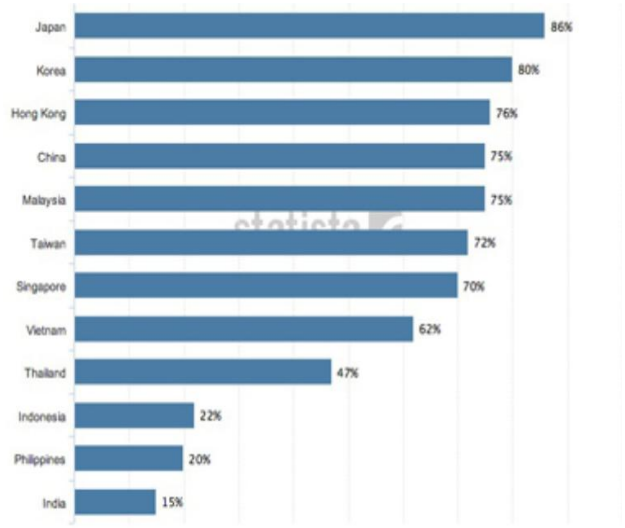

Figure 1: Mobile traffic growth percentage

Energy saving often needed to scale back network redundancy. Here real challenge is efficient plans to limit the network energy consumption because we've to think about the compromise between the performance of network and energy savings. Although green networking field remains within the early stage of development, variety of interesting works are done and overviewed within the present survey. In remainder of the paper we cover as follows: II) Objectives and motivations. III) Overviews of paradigms. IV) Green networking solutions. V) Recent researches then we'll cover conclusion then future work and eventually summary.

II. MOTIVATION AND OBJECTIVES

2.1 Why we should always save energy

First and very important reason to save energy is our environmental problems that are basically created by GHG (greenhouse gases). It gets increased in recent years. Various research all across the world started highlighting the effects affecting the environment due to GHG. Massive emission of GHG majorly affects the climate. According to a research we have to decrease the rate of emission because we have to keep the temp low. GHG is not affecting the environment but also the economy. It influenced on economy and financial damage to the country [4-5]. It is investigated that 1/3 of emission rate lead to the economic benefits that the investment to reach the goal. GHG reduction objectives involves especially ICT sector that is information and communication technology that lead to increase in 2% of total man made emission.

2.2 Where to save energy

Before we get to know that how to save energy we have to identify that where to save energy. It is important to identify that from where maximum improvement could be done. First thing from where we can identify is internet. We use internet on daily basis .For internet we use different types of equipment and that equipment consumes different amount of energy. Studies shows that local area networks, through hubs and switches, are responsible for 80% of total internet consumption. It also said that NICs (network interface cards) consumes50% of power [6-7]. From this we conclude that internet is the place from where we can save really good amount of energy. Studies say that the power consumption of the network core will be equal to the network access incoming years.

2.3 Definition of green networking

As the word says green it means networking which will not harm the environment and therefore the economy that much. It will be beneficial for us. the most objective of green networking is to attenuate GHG emission [8] . Use of renewable gases is that the obvious step we will absorb way of green networking. Other step toward green networking is to design low power consumption components.

III. OVERVIEW OF GREEN STRATEGIES

3.1 Virtualization

As the word represent virtual means that we are talking about creating virtual rather than actual. Creating a new version with more energy efficiency. Virtualization reduces energy costs.

Table 1: Taxonomy of green networking research

	Timescale		OSI layer	Input process	Approach	Comments
	Online	offline				
Adaptive link rate	local		Data link	Math model and simulation	history	Rate switching, Q
	global		Data link	Traffic analysis	forecast	Coordinate sleeping mode
	local		Data link	trace driven sim.	history	Sleeping mode, AP
Energy aware proxying	Local		Cross	Traffic analysis	Instantaneous	Motivates NIC and external
	Local		Application	H w prototype	Instantaneous	External proxying for Gnutella protocol
	Local		Network	S w prototype	Instantaneous	Trace driven evaluation
Energy aware infrastructure	Global		Datalink network	Simulation	Instantaneous	Coordinate sleeping
		Design		Operational research		Router power profiling
Energy aware applications	Local		Transport	S w prototype	Instantaneous	TCP split connection
		Design	Transport	S w prototype	Instantaneous	TSP optimization of FreeBSDv5

Virtualization increases the level of computers. It allows the user to operate one or more system, running different environments using single hardware. We can take the example of operating system. With virtualization, we can use Linux operating system and Microsoft windows operating system on one server. we can conduct a windows xp desktop and windows 7 on a single workplace alternatively. It is classified in three types:-
Desktop virtualization
Server virtualization
Storage virtualization
To practice Server consolidation which means practicing the way to the efficient uses of resources of computer server? This strategy is mainly for reduction of global consumption because of underutilized devices at the given time. It can be done by shutdown of unrequired devices (low load devices) means when they are not in use but still active.

Up gradation of old equipment's in new one with more energy efficient. For energy increment employment of system management. For travelling purpose we can substitute telecommuting, videoconferencing and remote administration.

IV. TAXONOMY ON GREEN NETWORKING RESEARCH

Due to unawareness of energy consumption of various network devices and protocol, many research works have started to work on energy awareness in fixed networks. In this section we are discussing the criteria which will help in classify the green techniques.

A. Classification criteria

There are mainly four categories fall under this.

Timescale: Timescale in order of nanosecond to microsecond which apply to CPU which is relevant to the computer and industrial work. Timescale is directly proportional to the architectural level; shorter the timescale, lower will be the level means less interaction between the components. There are two solutions we prefer online and offline solutions. It is for simplifying the taxonomy. In online solutions on the basis of type and amount we further classified into global and local to be more précised. Local plan need information that pertains to single link whereas global plan need data consist in deciding how to use that resources which have been chosen in the 1st step.

OSI layer:- According to the TCP/ IP protocols each solution can either implemented at single layer or cross layer interaction.

Input process:- It is about decision taken in the solutions. The decisions are taken on the basis of their situations. 1stis instantaneous situation, second one is on the basis of history observation and the third one is on the basis of forecast (depending on both). For online solutions we take decisions on the basis of all three situations but for the offline one instantaneous situation is not considered.

Approach:-By approach we mean for hardware prototyping or formal models with numerical solutions or discrete even solutions. Approach is for evaluate the project proposal.

B. Classification proposal

Adaptive Link Rate:-There is an increasing demand of increasing the bandwidth of Ethernet. Using Ethernet at a rate of 10 Gbps is not impossible and will soon be reality. As the rate of Ethernet will increase,

the energy consumption will increase simultaneously. So adaptive link rate is a proposal that Ethernet rate changes dynamically according to the traffic levels [11]. It is of two types 1) Rate switching 2) mode switching. Rate switching is something that reduces the capacity of link based on its utilization and the mode switching as the suggests changing of mode means changing link status between working mode and non-working mode or we can say that sleeping mode according to the traffic load.

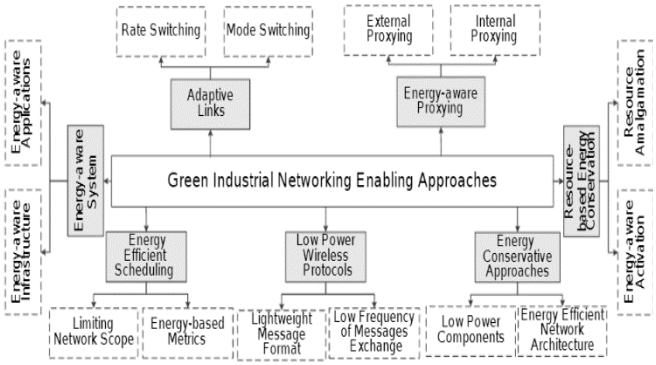

Figure 2: Green enabling approaches

Energy Aware Proxying:- Handing over a job from one component to another component which is more energy saving and efficient is called energy aware proxying. Energy Saving proxying can be applied in two ways 1) External proxying 2) internal proxying. Internal proxying needs to be done in same device between two different components. It performs the network traffic monitoring on the low computing NIC board. This allows the CPU to work according to the need. In external energy aware proxying the component which is handing over the job to another more energy – efficient component of another device.

Resource -based Energy Conservation:-As we know there are many active power consuming equipment's in industries which being partially used but it consume the energy during the peak hours. It causes the unnecessary utilization of energy and also affects economically. There are two ways for the conservation of energy based on resource based energy conservation 1) resource amalgamation 2) energy aware activation. In resource amalgamation global energy conservation is done by ambulating the small resource consumption of each component of network. Energy aware activation work on the basis of energy level of the device or we can say that it work according to the energy requirement of protocol [12].

Energy Conservative Approaches:-Energy Conservative approaches are also one of the solutions to prevent from energy wastage. It is divided into two parts 1) deploying low power components 2) Energy - aware architecture. Deploying low power components should be done while maintaining the same level of working. We can undergo two ways in energy – aware architecture. First is incremental way [13], during this process we build over existing infrastructures and therefore the second way is fresh start approach which means we've to create totally new infrastructures without using any existing infrastructures.

Energy efficient scheduling:-Energy Efficient scheduling is the process of making jobs according to the energy requirements. It can be done when we limit the scope of network and adopt the energy based metrics. We can limit the network scope by transmitting using low powers and we can adopt the energy based metrics by balancing the marking between energy consumption and performance.

Energy Aware System:-Only significant amount of energy can be saved from local equipment using green solution. We need more improvement on this that's why we need energy aware infrastructures. It can be done in two ways 1) incremental way 2) cleans ate approach the processes we have discussed in energy aware architecture is same as in energy aware infrastructure.

VI. CONCLUSION

From this survey we conclude that we'd like to save lots of energy and that we need to use less power consumption components for our use. Energy conservation is really the necessity in our present life and for our future too. In this survey we understand the importance of energy conservation and the ways of conservation for this we've to decrease the emission rate of GHG. And for decrement of emission we've discussed the strategies and following things that's categorized as 1) adaptive link rate, 2) Energy Aware Proxying 3) Resource-based energy conservation 4) Energy conservative approaches 5) Energy efficient scheduling 6) Energy-aware system. We have discussed many ways to conserve energy that is being sub categorized under the topics mentioned above. Energy conservation is really the necessity in our present life and for our future too. In this survey we understand the importance of energy conservation and the ways of conservation.

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