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RECENT INCLINATIONS AND TECHNOLOGIES IN GREEN COMPUTING

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Abstract:

The concept of Green computing is the environmentally responsible use of computers and associated resources. Besides the widespread responsiveness to ecological issues, such interest also stems from economic needs, since both energy costs and electrical requirements of IT industry around the world show a uninterrupted growing trend. The principle behind energy systematic coding is to save power by getting software to make less use of the hardware, rather than continuing to run the same code on hardware that uses less power. Such practices include the implementation of energy-efficient central processing units (CPUs), Servers and Peripherals as well as reduced resource consumption and proper disposal of electronic waste (e-waste).Green computing is the study and practice of efficient - learning methods have hugely changed the educational environment as well as reducing the use of papers and ultimately reduce the production of carbon footprint. E-learning methodology is an example of Green computing. Green Computing or Green IT refers to the study and practice of using computing resources in an eco-friendly manner in order to tone down the environmental impacts of computing. The best practices for green computing and the trade-off between green and high-performance policies is debated. This article helps to identify key issues relevant to green computing and evaluate different approaches to these problems. To reduce unnecessary energy consumption due to hazardous materials has become a major topic of concern today.

Keywords: Green Computing, Green Manufacturing, E-learning methodology, Telecommuting

INTRODUCTION:

Green technology focuses on reducing the environmental impact of industrial processes and innovative technologies caused by the Earth's growing population. It has taken upon itself the goal to provide society's needs in ways that do not damage the natural resources. This means creating fully recyclable products, reducing pollution, proposing alternative technologies in various fields, and creating a center of economic activity around technologies that benefit the environment. Green computing is the environmentally responsible use of computers and related resources. Such practices include the implementation of energy-efficient central processing units (CPUs), servers and peripherals as well as reduced resource consumption and proper disposal of electronic waste (e-waste).E-learning can provide an environmentally friendly way to bridge this training gap, particularly in business sector where the staff are spread across different offices, regions or even countries. E-learning comes in many forms from fully featured interactive Web based courses that user can take in their own time to interactive virtual instructor led training (VILT) delivered using advanced training delivery interfaces such as Microsoft Live

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Meeting or the widely used Webex system. This saves lot of money and the environment also. E-learning adopts green computing methodology, where "Green Computing" is a term that implies a good, healthy and economically sensible environment. In Today's world Global Warming, greenhouses gases, climatic changes and sustainable development are the key challenges. Thus for a sustainable environment Green Computing should be enabled for the ecological balance in the environment.

The goals of Green Computing are:

Technical issues of green technology includes: Green infrastructure (energy-efficient buildings, intelligent cooling systems, renewable power sources), green hardware (Multicore computing systems, energy efficient server design and solid-state storage and green Software and applications - parallelizing computational science algorithms to run on modern energy efficient multi-core clusters, intelligent load distribution and CPU switch-off (Snell, Weinberg, Katz, Yun, Wilson, Narayanan, Mo, Calzetti, Moss, Shenoy, Weems

Nowadays in order to achieve social awareness and promotion of green technology solutions,

I. Main four complementary approaches are employed:

a) ***Green Use:*** Reducing the power consumption of computers, information systems and their

Peripheral subsystems in environmentally friendly manner.

b) ***Green Disposal:*** Refurbishing and reusing existing old computers and other electronic associated devices. Recycling unwanted used computers and other electronic-waste by IT vendors using their "take back" policy in order to take responsibility for the full lifecycle of

products they produce.

c) ***Green Design:*** In broader aspect connecting companies, government agencies and environmental organizations in order to develop inventive management, business and regulatory processes that can improve environmental quality while enhancing economic development ==. In narrow and practical aspect designing power efficient and eco-friendly Computers and its subsystems like servers and cooling equipment.

c) Green Manufacturing: Process of production of computers and associated devices include Methods of manufacturing and biodegradable components for minimal or no impact on environment. This approach allows to provide economic benefits like long-term cost savings, and business process efficiency improvements. Computer manufacturers and vendors contribute directly to pollution, whereas the IT industries have a hidden impact on environmental pollution caused by unconscious consumption of power and inefficient use of hardware devices (Agarwal, Datta & Nath, 2014, p. 5). The ICT industry is responsible for about 2% to 2.5 % of all worlds' greenhouse gas emissions. Although it is not a large percentage, very disturbing is fact that the rate of ICT consumption is increasing by 20% a year so if nothing is done the contribution to global greenhouse gas emission is projected to nearly double – to about 4% - in 2020. Hence, there is a necessity to balance the dramatic growth of utilizing computing resources with green technology to reduce environmental impact at the same time maintaining overall development. The need for green computing is obvious, if world is determined to pursue the assumptions of sustainability.

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II. LATEST DEVELOPMENTS

a) Green Cloud Computing

The Gartner report from May 2009 defines cloud concept as "a style of computing where scalable and elastic IT capabilities are provided as a service to multiple customers using Internet technologies". The use of the potential of cloud computing model interacts with the concept of sustainable development, understood in three dimensions: economic, environmental and social. Clouds consolidate environment, saving power, cooling, space and money. Cost savings and flexibility of operations are among the most frequently mentioned benefits associated with a decision to adopt the cloud computing solution. Fixed costs related to the investment in infrastructure (which in the traditional business model generally increases with time and the need to update the software) are reduced, as well as energy costs feeding the infrastructure. Traditional costs related with the licenses, number of users, equipment, operation, repairs and applications are replaced for payment for functionality that is actually used by the company or other organization that also obtain access to the latest technology. This solution allows to adjust supply to demand, eliminating incurring unnecessary costs associated with the overestimation or underestimation of customer needs. At the same time, it affects the reduction of occurrence of lost sales opportunities risk and cost of incorrect demand forecasting and company's supply planning. Some aspects of cloud's ICT infrastructure allow to identify the model as the one providing green benefits.

These aspects may include:

• **Dynamic provisioning and multi tenancy:** lower energy consumption and associated carbon

emissions than the traditional approach of over-provisioning (Pooja Kallange, p. 27).Automatic processing of computing environment supports user needs, operating under the cloud may acquire or release the resources (instances) where it is appropriate (according to the demand). Dynamic resource allocation is done automatically, thus datacenters maintain active servers according to current demand. With virtualization technology, which allows to connect disparate resources in one great set of resources it is possible to release them more selectively to all customers at the same time increasing the level of their use. Without virtualization cloud computing would never arise. The entire pool is shared by many customers of a one supplier, in the way of dynamic allocation and releasing precisely defined portion of virtual resources. Level of use of the pool is proportional to changes in demand for computing resources.

• **Optimal server utilization:** traditionally, many servers remain idle of 85-95% of the time using

nearly as much power as they do when they are active. Virtualization technology enables hosting of multiple applications through one server. The number of active servers is reduced and the power consumption is lower.

• **Energy-efficient client devices:** the public cloud model reduces the number of energy

Consuming clients through small energy-efficient devices (e.g. thin clients)

b) Carbon aware green cloud architecture

The aim of this unified solution is to deliver both users and providers, high-level architecture for supporting energy efficient service allocation which is based on cloud technology. Cloud providers, being profit oriented are looking for solutions which can lower their electricity bills without losing their market share. The goal of

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satisfying the demand for high-level computing services on the users side and saving energy on the providers side, can now be achieved by implementing the green cloud infrastructure.

The below figure shows the architecture for supporting energy-efficient service allocation in green cloud computing infrastructure. The cloud services (SaaS, PaaS, IaaS) are registered in the form of public offering in Green Offer Directory. The Green Broker has the full access to all services which are available and registered in public directory. Green Offer directory is incentive for the providers who, list their services with discounted prices and green hours. A typical cloud broker lease cloud services and schedule applications Green broker's responsibility is to select these offerings in terms of requirements of end user.

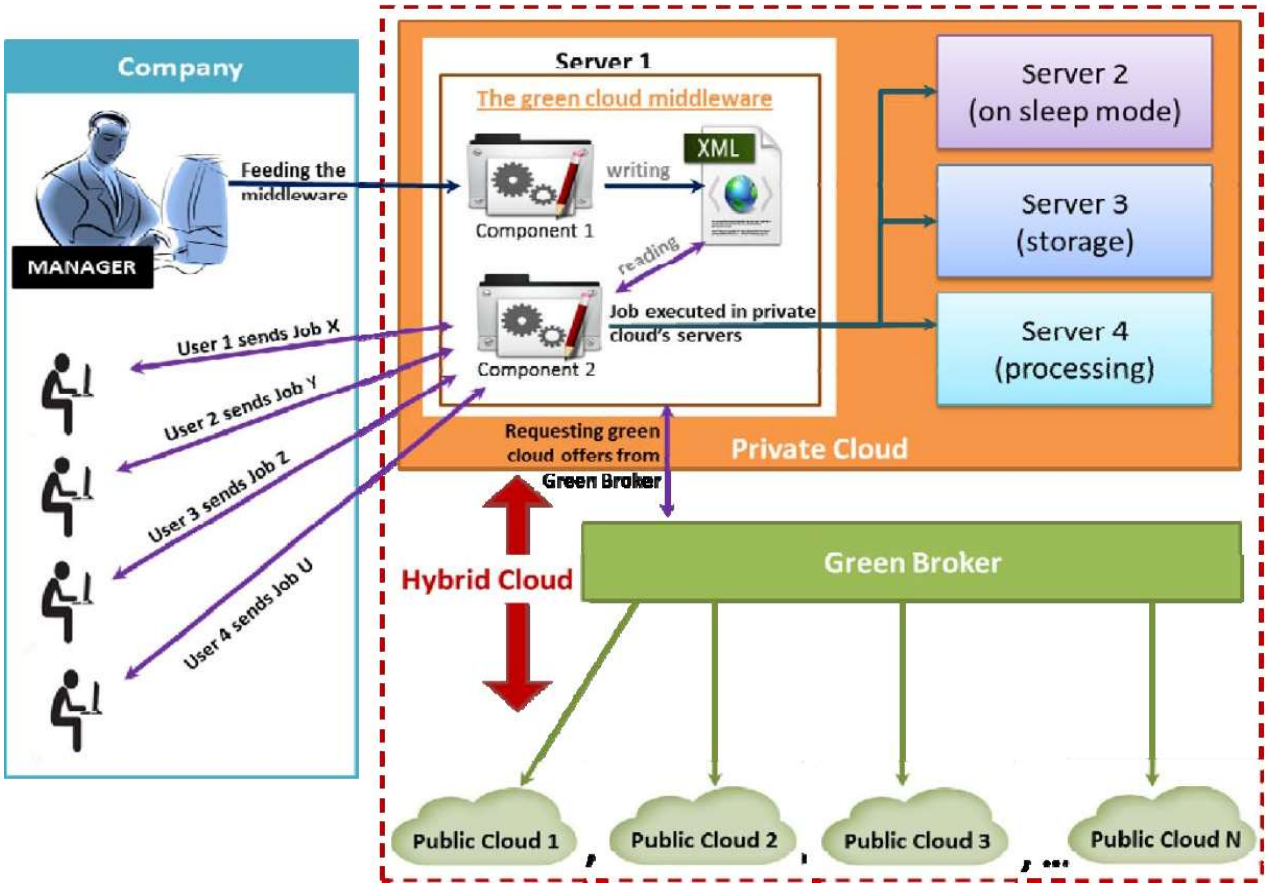

Figure: Integrated carbon aware Green Cloud Architecture

c) Data Center sustainability improvements

The rising energy costs, desire to make existing investments more and more profitable are making today's cloud providers to implement best practices to make datacenters operation green. To build eco-friendly data center, several best practices in key areas has been proposed for improving sustainability:

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• Proper location which allows clean energy consumption through renewable sources (solar energy generation, wind power generation, fuel cells, cogeneration).

• Cooling system (new systems based on liquid cooling, nano-fluid cooling systems, and in server, in-rack and in-row cooling by companies such as Spray Cool; free cooling, spot cooling, using cable grommets to reduce cool air leakages).

• Building design (heat insulation, optimizing floor layout, recycling water)

• ICT platform (middleware-facility linkage, dedicated racks & servers, virtualization technologies).

• Deployment of newest power efficient servers and

• Energy linking (power sharing between company centers, locating data center near power station).

d) Solar Computing

solar power in gaining more and more attention throughout the world. Solar energy is power derived from the sun through the use of solar panels. Good example of powering PC's with the

sun is Taiwanese manufacturer VIA Technologies Inc. VIA Solar Computing initiative is a part of VIA Green Computing projects. VIA Solar Computing use advanced, cost-effective solar panel technology in cooperation with Motech Industries – one of the largest and leading solar product manufacturers and innovators. Solar cells combined with VIA processor platforms and system technologies developed complete solar-powered computing solutions that are less polluting, more affordable, more reliable and more flexible for a wide variety of new markets, applications and environments. VIA Solar Computing is focusing on photovoltaic (PV) solar power to take advantage of the numerous benefits for both emerging market and urban computing installations:

• Solar power is clean non-polluting energy.

• Once capital costs are covered (like purchasing and installation) solar cells require very little maintenance, hence in further perspective of time they provide energy at virtually no cost

• Solar panels are silent in operation.

• Solar panels do not require refuelling; they are self-sufficient

e) Telecommuting

Telecommunications-related technologies, such as teleconferencing, also are often implemented in green computing initiative. "Advances with communications devices and with the aid of computer networking systems have made it possible for people to work from remote locations and for telecommuting to become an ever-more feasible option for many companies. With the aid of telecommuting it increased satisfaction between the two parties, reduction of greenhouse gas emissions related to travel, and increased profit margins as a result of lesser costs for workplace space, heat, lighting and many more. This technology is currently running in taking green computing initiatives" Through IT/IS systems telecommuting can also be used for remote administration, group document management and cooperative knowledge management. It is estimated that one-fifth of all travel is associated with commuting. Thus, the wider use of teleworking would greatly reduce the negative impact on the

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environment. Unified Communications leads to an increase in the level of cooperation between employees. Video solutions enable real-time collaboration which is one of the most important environmental initiatives in the business environment.

III. CONCLUSION

Computers and related infrastructure (e.g. data centre) are not only costly to maintain, but also harmful to the environment due to the carbon emission. Nowadays, with a greater concern for the environment, green computing reduces the negative effects of ICT on sustainability. This solution protects the environment by dealing with the power management techniques, saving electricity and reducing e-waste. Paper summarized some of the useful practices and has given leads for optimized utilization of newest technologies. Green computing is not only manufacturing, using and destroying the computers in environment friendly way, but also exploiting existing computing resources in more efficient way by implementing new concepts like green clouds. Cloud providers need to reduce the electricity demand of clouds and take major steps in using renewable energy sources rather than just looking for economic incentives like cost minimization. Green ICT sustainability addresses issues such as: using renewable energy sources to power data centres,reducing e-waste, designing energy efficient hardware, middleware and software, running multiple operating systems via virtualization, providing information to customers in order to encourage them make green choices, reducing transportation cost and emissions by telecommuting

REFERENCES:

[1]. Asad, Zakia, and Mohammad Asad Rehman Chaudhry. "A two-way street: Green big data processing for a greener smart grid." *IEEE Systems Journal* 11.2 (2017): 784-795.

[2]. AlMusbahi, Ibtehaj, et al. "Survey on Green Computing: Vision and Challenges." *International Journal of Computer Applications* 167.10 (2017).

[3]. Farooqi, Abdul Majid. "Comparative Analysis of Green Cloud Computing." *International Journal of Advanced Research in Computer Science* 8.2 (2017).

[4]. Han, Guangjie, et al. "Resource-utilization-aware energy efficient server consolidation algorithm for green computing in IIOT." *Journal of Network and Computer Applications* 103 (2018): 205-214.

[5]. Kharchenko, Vyacheslav, and Oleg Illiashenko. "Concepts of green IT engineering: taxonomy, principles and implementation." *Green IT Engineering: Concepts, Models, Complex Systems Architectures*. Springer, Cham, 2017. 3-19.

[6]. Kern, Eva. "Green Computing, Green Software, and Its Characteristics: Awareness, Rating, Challenges." *From Science to Society*. Springer, Cham, 2018. 263-273.

[7]. Kumar, Sushil, Omprakash Kaiwartya, and Abdul Hanan Abdullah. "Green computing for wireless sensor networks: Optimization and Huffman coding approach." *Peer-to-Peer Networking and Applications* 10.3 (2017): 592-609.

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[8]. L. Lakhani, "*Green Computing - A New Trend in It*", *International Journal of Scientific Research in Computer Science and Engineering,* Vol.4, Issue.3, pp.11-13, 2016

[9]. Lin, Kai, et al. "Green video transmission in the mobile cloud networks." *IEEE transactions on circuits and systems for video technology* 27.1 (2017): 159-169.

[10]. Murugesan, San. "Harnessing green IT: Principles and practices." IT professional 10.1 (2008).

[11]. Mesaad, Mariam, et al. "Survey on the Global Green Computing Initiatives." *International Journal of Computer Applications* 167.7 (2017).

[12]. More, Nitin S., and Rajesh B. Ingle. "Challenges in green computing for energy saving techniques." *Emerging Trends & Innovation in ICT (ICEI), 2017 International Conference on*. IEEE, 2017.

[13]. Nanath, Krishnadas, and Radhakrishna R. Pillai. "The influence of green IS practices on competitive advantage: mediation role of green innovation performance." *Information Systems Management* 34.1 (2017): 3-19.

[14]. Pahlevan, Ali, et al. "Joint Computing and Electric Systems Optimization for Green Datacenters." *Handbook of Hardware/Software Codesign* (2017): 1163-1183.

[15]. Sharma, Prateek, et al. "Design and Operational Analysis of a Green Data Center." *IEEE Internet Computing* (2017).

[16]. Shaikh, Faisal Karim, Sherali Zeadally, and Ernesto Exposito. "Enabling technologies for green internet of things." *IEEE Systems Journal* 11.2 (2017): 983-994.

[17]. Soomro, Tariq Rahim, and Muhammad Sarwar. "*Green computing: From current to future trends." World Academy of Science*, Engineering and Technology 63 (2012): 538-541.

[18]. Sen, Deepanjan, and Dilip Roy Chowdhury. "Green Computing: Efficient Practices And Applications."International Journal of Computer Sciences and Engineering 04.01(2016):38-47.

[19]. Sharma, Manoj Kumar. "Software Level Green Computing with Multi-Core Processors using Fork-and-Join Framework." (2017).

[20]. Sofia, A. Sathya, and P. Ganesh Kumar. "Energy efficient task scheduling to implement green cloud." *Asian Journal of Research in Social Sciences and Humanities* 7.2 (2017): 443-458.

[21]. Saha Biswajit."Green computing." *International Journal of Computer Trends and Technology (IJCTT)* 14.2 (2014): 46-50.


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[22]. Tyurin, Sergey, and Anton Kamenskih. "Green logic: models, methods, algorithms." *Green IT Engineering: Concepts, Models, Complex Systems Architectures*. Springer, Cham, 2017. 69-86.

[23]. Usvub, Kafiyah, Abdul Majid Farooqi, and M. Afshar Alam. "Edge Up Green Computing in Cloud Data Centers." International Journal of Advanced Research in Computer Science 8.2 (2017).