INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

A PATH FOR HORIZING YOUR INNOVATIVE WORK

SPECIAL ISSUE FOR NATIONAL LEVEL CONFERENCE "RENEWABLE ENERGY RESOURCES & IT'S APPLICATION"

GREEN COMPUTING: A TECHNICAL APPROACH FOR REUSING ENERGY

RADHIKA A. BANG, PAYAL D. WANKHADE

Assistant Professor, Computer Science & Engineering Department, C.O.E.T. Akola, Maharashtra, India.

Abstract: The perception of cloud computing has not only reshaped the field of distributed systems but also fundamentally changed how businesses utilize computing today. Cloud computing is offering utility oriented IT services to users worldwide. It enables hosting of applications from consumer, scientific and business domains based on pay-asyou-go model. However data centres hosting cloud computing applications consume huge amounts of energy, contributing to high operational costs and carbon footprints to the environment. With energy shortages and global climate change leading our concerns these days, the power consumption of data centres has become a key issue. The area of Green computing is also becoming increasingly important in a world with limited energy resources and an ever-rising demand for more computational power. Therefore, we need green cloud computing solutions that can not only save energy, but also reduce operational costs. In this paper, an architectural framework and principles that provides efficient green enhancements within a scalable Cloud computing architecture with resource provisioning and allocation algorithm for energy efficient management of cloud computing environments to improve energy efficiency of the data centre. Using power-aware scheduling techniques, variable resource management, live migration, and a minimal virtual machine design, overall system efficiency will be vastly improved in a data centre based Cloud with minimal performance overhead.

Keywords: Cloud Computing, Green Computing, Virtualization, Energy Efficiency, Resource Management, virtualization, Scheduling.

Corresponding Author: MS. RADHIKA A. BANG

Co Author: MS. PAYAL D. WANKHADE

Access Online On:

www.ijpret.com

How to Cite This Article:

Radhika A. Bang, IJPRET, 2016; Volume 4 (8): 153-160

PAPER-QR CODE

153

INTRODUCTION

Green computing is the study and practice of using computing resources efficiently. 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).Green computing is very much similar to movements like reducing the use of environmentally effecting hazardous materials like CFC's, promoting the use of recyclable materials, minimizing use of non-biodegradation materials, encouraging use of sustained resources. One of the spins off green computing is EPEAT-Electronics Product Environmental Assessment Tool. EPEAT products serve to increase the efficiency and life of computing products. These products tend to minimize energy expenditures, minimize the maintenance activities throughout the life of product and allow re-use of materials. Energy Star served as a kind of voluntary label awarded to computing products that succeeded in minimizing the use of energy while maximizing efficiency. Energy Star applied to products like computer monitors, television sets and temperature control device like refrigerators, air conditioners, and similar item

Benefits of Green Computing

1. Reduced energy usage from green computing techniques translates into lower carbon dioxide emissions, stemming from a reduction in the fossil fuel used in power plants and transportation

2. Conserving resources means less energy is required to produce, use, and dispose of products.

3. Saving energy and resources saves money.

4. Green computing even includes changing government policy to encourage recycling and lowering energy use by individuals and businesses.

5. Reduce the risk existing in the laptops such as chemical known to cause cancer, nerve damage and immune reactions in huma

Technologies for green computing

a. Carbon-free computing

One of the VIA Technologies' ideas is to reduce the "carbon footprint" of users — the amount of greenhouse gases produced, measured in units of carbon dioxide (CO_2). Greenhouse gases naturally blanket the Earth and are responsible for its more or less stable temperature. An increase in the concentration of the main greenhouse gases — carbon dioxide, methane, nitrous oxide, and fluorocarbons — is believed to be responsible for Earth's increasing temperature, which could lead to severe floods and droughts, rising sea levels, and other environmental effects, affecting both life and the world's economy. After the 1997 Kyoto Protocol for the United Nations Framework Convention on Climate Change, the world has finally taken the first step in reducing emissions. The emissions are mainly a result of fossil-fuel-burning power plants. (In the United States, such electricity generation is responsible for 38 percent of the country's carbon dioxide emissions.) VIA aims to offer the world's first PC products certified carbon free, taking responsibility for the amounts of CO_2 they emit. The company works with environmental experts to calculate the electricity used by the device over its lifetime, generally three years. From this data, one can conclude how much carbon dioxide the device will emit into the atmosphere during its operation. This estimate will serve as an indicator, and the company will pay regional organizations for the —sequestering,‖ or offsetting, of the emissions. Offsetting carbon dioxide can be achieved in different ways. One way is to plant trees that absorb CO_2 as they grow, in the region in which the processors were purchased. The necessary amount of trees per processor is represented by VIA's TreeMark rating system. VIA promotes the use of such alternative energy sources as solar power, so power plants wouldn't need to burn as much fossil fuels, reducing the amount of energy used. Wetlands also provide a great service in sequestering some of the carbon dioxide emitted into the atmosphere. Although they make up only 4 to 6 percent of the Earth's landmass, wetlands are capable of absorbing 20 to 25 percent of the atmospheric carbon dioxide. VIA is working closely with organizations responsible for preserving wetlands and other natural habitats, and others who support extensive recycling programs for ICT equipment. The amount paid to these organizations will be represented by a proportion of the carbonfree product's price. Carbon-emissions control has been a key issue for many companies who have expressed a firm commitment to sustainability. Dell is a good example of a company with a green image, known for its free worldwide product-recycling program. Dell's Plant a Tree for Me project allows customers to offset their carbon emissions by paying an extra $2 to $4, depending on the product purchased. AMD, a global microprocessor manufacturer, is also working toward reducing energy consumption in its products, cutting back on hazardous waste and reducing its

eco-impact. The company's use of silicon-on-insulator (SOI) technology in its manufacturing, and strained silicon capping films on transistors (known as —dual stress liner‖ technology), have contributed to reduced power consumption in its products.

b. Solar Computing

Amid the international race toward alternative-energy sources, VIA is setting its eyes on the sun, and the company's Solar Computing initiative is a significant part of its green-computing projects. For that purpose, VIA partnered with Motech Industries, one of the largest producers of solar cells worldwide. Solar cells fit VIA's power-efficient silicon, platform, and system technologies and enable the company to develop fully solarpowered devices that are nonpolluting, silent, and highly reliable. Solar cells require very little maintenance throughout their lifetime, and once initial installation costs are covered, they provide energy at virtually no cost. Worldwide production of solar cells has increased rapidly over the last few years; and as more governments begin to recognize the benefits of solar power, and the development of photovoltaic technologies goes on, costs are expected to continue to decline. As part of VIA's —pc-1‖ initiative, the company established the first-ever solar-powered cyber community center in the South Pacific, powered entirely by solar technology

c. Quiet computing

A central goal of VIA's green-computing initiative is the development of energy-efficient platforms for low-power, small-formfactor (SFF) computing devices. In 2005, the company introduced the VIA C7-M and VIA C7 processors that have a maximum power consumption of 20W at 2.0GHz and an average power consumption of 1W. These energy-efficient processors produce over four times less carbon during their operation and can be efficiently embedded in solar-powered devices. VIA isn't the only company to address environmental concerns: Intel, the world's largest semiconductor maker, revealed eco-friendly products at a recent conference in London. The company uses virtualization software, a technique that enables Intel to combine several physical systems into a virtual machine that runs on a single, powerful base system, thus significantly reducing power consumption. Earlier this year, Intel joined Google, Microsoft, and other companies in the launch of the Climate Savers Computing Initiative that commits businesses to meet the Environmental Protection Agency's Energy Star guidelines for energy-efficient devices. Kevin Fisher, Intel's EU standards director, says that while the company is dedicated to its green-computing plans, it is important to not blame the IT industry alone for carbon emissions worldwide. He argues that the industry also helps in saving huge amounts of power due to the Internet, enabling, for example, online shopping and billing. Worldwide,

standby power is estimated to account for as much as 1 percent of global greenhouse emissions. Most of the energy used by products on standby does not result any useful function. A small amount can be needed for maintaining memory or an internal clock, remote-control activation, or other features; but most standby power is wasted energy. Energy Star–enabled products minimize this waste.

d. Lead-Free and RoHS computing

In February 2003, the European Union adopted the Restriction of Hazardous Substances Directive (RoHS). The legislation restricts the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment. The directive is closely linked with the Waste Electrical and Electronic Equipment Directive (WEEE), which sets collection, recycling, and recovery targets for electrical goods and is part of a legislative initiative that aims to reduce the huge amounts of toxic e-waste. Driven by these directives, VIA implemented a set of internal regulations in order to develop products that are compliant with these accepted policies, including the use of nonhazardous materials in its production of chipsets, processors, and companion chips. In 2001, they focused on lead-free manufacturing, introducing the Enhanced Ball Grid Array (EBGA) package for power efficient VIA processors and the Heat Sink Ball Grid Array (HSBGA) package for their chipsets. In traditional manufacturing processes, lead is used to attach the silicon core to the inside of the package and to facilitate integration onto the motherboard through tiny solder balls on the underside of the package. VIA's lead-free manufacturing technologies do not require a lead bead, and the solder balls now consist of a tin, silver, and copper composite.

e. Energy-efficient computing

A central goal of VIA's green-computing initiative is the development of energy-efficient platforms for low-power, small-form-factor (SFF) computing devices. In 2005, the company introduced the VIA C7-M and VIA C7 processors that have a maximum power consumption of 20W at 2.0GHz and an average power consumption of 1W. These energyefficient processors produce over four times less carbon during their operation and can be efficiently embedded in solarpowered devices. VIA isn't the only company to address environmental concerns: Intel, the world's largest semiconductormaker, revealed eco-friendly products at a recent conference in London. The company uses virtualization software, a technique that enables Intel to combine several physical systems into a virtual machine that runs on a single, powerful base system, thus significantly reducing power consumption. Earlier this year, Intel joined Google, Microsoft, and other companies in the launch of the Climate Savers Computing Initiative that commits

157

businesses to meet the Environmental Protection Agency's Energy Star guidelines for energy-efficient devices.

f. vision through the pc-1 initiative

VIA isn't focusing only on the technological aspects of its eco-friendly devices, it's also taking a look at their applications. The VIA pc-1 initiative seeks to enable the next 1 billion people to get connected, by providing wider access to computing and communications technologies. The company is concentrating on empowering new, emerging markets, looking at models that reach beyond individual ownership of a PC, such as local pay-for-use facilities. Products built for such a use are characterized by ultra-efficient energy consumption and the ability to withstand heat and dust in harsh environments. In VIA's own words: "Pc-1 brings together business ingenuity with corporate responsibility and altruism. Helping to build skills and literacy throughout the world and incorporating and preserving cultural content are goals now within our grasp. Information is the oxygen to nurturing social mobility, economic equality and development, and global democracy. Providing not just the tools and the know-how, but the support and the maintenance, is all part of what makes pc-1 the next generation of information technology, the next generation of global development".Among the

Green Initiatives in Information Technology

The remarkable green initiatives in IT are:

1) **Improved Data Center Cooling Methods**: This is achieved by improving the data center cooling configuration, eliminating considerable amount of energy leaks. IT can result in efficient data centers by following leading practices in data centre layout and rack and server arrangements. Effective approach include raised floors to improve airflow, moving cooling systems closer to servers to concentrate cold air in the right place, alternating hot and cool server passageway to improve airflow and using water-based air conditioning systems

2) **Efficient Servers usage by Virtualization:** Generally, IT companies have been using many server farms or data centers, dedicated to a specific task. These data servers must be efficiently used. One of the mechanisms is load balancing which chooses the optimum resource among many. Also by using virtual software to perform these tasks, a single server may be used to power these virtual servers, dramatically reducing energy consumption.

3) **Alternative Storage Methods:** Storage drives are another main element of data center infrastructure and, as organizations storage needs increase; more energy is used to power

these hard drives. It can be reduced by using large capacity drives and performing data center audits to eliminate redundancies in the system

4) **Using Thin Clients**: With thin clients, each employee has a virtual desktop that includes a mouse, keyboard and screen while the remaining unit is shared by all at a central location.

5) **Strengthen Printer's Output Management:** Centrally located printer may be used to handle all printing tasks virtually eliminating numerous machines being left on all day sucking up energy and driving up costs

6) **Explore Alternative Sources of Energy:** The efficient resource utilization leads towards efficient methods to evolve**.** With time renewable and natural energy sources are being used to power data centers, such as nuclear or hydroelectric power, solar energy etc. This saves money and generates fewer CO_2 emissions

7) **Energy saver initiatives:** This includes using energy saving settings and encouraging employees to turn off equipment at the end of the work day and on weekends.

8) **Proper Disposal and Recycling:** This is so important because it potentially eliminates the threat of harmful toxins being released into the environment and allows for the reuse of equipment reducing the amount of waste. These initiatives exhibit the requirement of going green. Along with above mentioned IT initiatives every sector and area of IT is practicing green strategy and policies because sustainable development of ICT is the future need

CONCLUSION

Overall the effects of green computing with its benefits, practicality, and uses are all positives. All which are great for not only the individual, but also all around the globe. By going "green" in technology we help promote an eco friendly and cleaner environment, along with our own benefits by reducing costs, conserving energy, cutting down on waste and greenhouse gases. Green computing has definitely come a long way, but with so many new innovations coming along in regards of preserving the environment, it is safe to say that green computing is a great development. The need to educate people about green computing is a necessity in order to fully maximize the people's awareness regarding the study on how they can save computing resources for their computing activities.

REFERENCES

1. Aditya Harbla, Dr. Priti Dimri, Deepti Negi, Dr. Yashwant Singh Chauhan, "Green Computing Research Challenges: A Review" Volume 3, Issue 10, October 2013 ISSN: 2277 128X International Journal of Advanced Research in Computer Science and Software Engineering.

2. Amritpal Kaur "Green Computing: Emerging Trends in Information and Communication Technology"International Journal of Engineering Inventions e-ISSN: 2278-7461, p-ISSN: 2319-6491 Volume 3, Issue 9 (April 2014) PP: 42-46".

3. Gaurav Jindal, Manisha Gupta Green Computing "Future of Computers" International Journal of Emerging Research in Management &Technology ISSN: 2278-9359.

4. Dr. Pardeep Mittal, Navdeep **Kaur, "**Green Computing – Need and Implementation" International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 2, Issue 3, March 2013.