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Promoting Green Computing To Provision Backup Management of Disaster Recovery Cloud

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***Abstract*— Recent day situation show that frequently occurring natural disasters destroy large amount of data that are of prime importance. The use of Cloud Computing permits to have redundancy spread across the world and makes it possible for us to retrieve data that is lost or damaged from another centre using DRaaS as a sequence of Business Continuity Plan .The DR sites need to be powered throughout to ensure recovery. The power required to run these secondary sites can utilize the widely available renewable sources of energy and promote a green backup service to consumers.**

***Keywords*— Cloud Computing, DRaaS, Business Continuity, Solar energy**

I. Introduction

Cloud Computing is a model that enables convenient, on-demand network access to a pool of shared and configurable computing resources that are rapidly provisioned with minimal management effort or service provider interaction. Cloud computing is purely based on internet. A cloud actually is a grid of computers serving as a "service-oriented" architecture to deliver software and data. The cloud's pay-as-you go model also provides a way by which Disaster Recovery as a Service (DRaaS) could be utilized. Cloud being a centralized and secure storage could actually make DR cheaper and help Business Continuity for large enterprises.

A. Advantages of Cloud Computing

- Maximises the affect of sharing resources
- Avoids upfront infrastructure cost
- Cloud Computing allows enterprises to run applications faster
- Helps achieve higher economies of scale
- Provides a centralised storage mechanism

II. Cloud Environment

A typical cloud environment consists of the following services and models:

A. Categories of Service

- *Infrastructure as a Service(IaaS):* provides virtual machines and other abstracted hardware and operating systems
- *Platform as a Service(PaaS):* allows customers to develop new applications using APIs, implemented and operated remotely. The platforms offered include development tools, configuration management and deployment platforms.
- *Software as a Service(SaaS):* is software offered by a third party provider, available on demand, usually through a Web browser, operating in a remote manner.

B. Cloud Deployment Models

- *Public cloud:* Infrastructure is available to the general public or large industry group and is owned by an organization selling cloud services.
- *Private cloud:* Infrastructure is operated entirely for a single organization. It may be managed by organization or a third party, and may exist in-premises or off-premises. *Community cloud:* Infrastructure is shared by several organizations and supports a specific community.
- *Hybrid cloud:* Infrastructure is composed of two or more clouds (private, community or public) that are bound together by standardized or proprietary technology that enables portability of data and application.

III. Backup In Cloud

Enterprises hugely rely on the cloud based services. Some characteristics that make the cloud suitable for choosing it as a backup strategy include its scalability, high availability, agility, cost-effectiveness, reliability and security. Clouds provide Disaster Recovery as a Service to support Business Continuity (BC).

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A. Disaster Recovery as a Service

Organizations these days consider the cloud for provisioning of Disaster Recovery as a Service to overcome system failures due to natural disasters or man-made disasters. Cloud based recovery approach eliminate large CAPEX and instead pay a monthly charge OPEX for use of DRaaS.[1]

B. Reliance on data

Emergency management during environmental disasters calls for lot of planning and also efficiently deals with the management process. Companies store their business information on multiple data centres across servers in different countries. These multiple copies of data sets that have been replicated need to be synchronised in a timely manner that requires an apt computation capability that needs to be powered 24/7.It is evident that if a natural disaster occurs there is a high risk of losing important data. Disasters occur unconditionally and destroy everything in the process and an effective backup mechanism is the need of the hour.[2]

C. Traditional backup mechanism [5]

- *Hot Backup Site:* Provides a set of mirrored stand-by servers that are ready to run an application when a disaster occurs. This mechanism uses synchronous replication to prevent data loss due to disaster.
- *Warm Backup Site:* A Warm backup site keeps the state up to date with either synchronous or asynchronous replication schemes. Some standby servers are available to run the application after failures and these are kept in a "warm state" where it takes just minutes to bring it online.
- *Cold Backup Site:* Here data is replicated on a periodic basis. Servers to run application after a failure are not readily available and there could be large delay

IV. PROS AND CONS OF USING CLOUD COMPUTING FOR BACK UP SERVICE

- The challenge of providing the data to support Business Continuity to allow the services to be rapidly available online when a natural disaster occurs.
- Pay-as-you- go enables large business organizations to restore services based on the subscribed services.
- High availability of cloud makes sure that the DR requirements of Recovery Point Objective(RPO) and Recovery Time Objective(RTO) are optimised.[4]
- Consistency in ensuring that after a failure occurs the applications are restored to a consistent state.

In order to provide a cloud for backing up data the data centres need to be powered constantly that requires a reliable supply

V. GREEN COMPUTING

The world today for almost the last two decades has the biggest challenge of global warming. Along with it comes the depletion of natural resources. This calls for a desperate need for organizations to operate on a "green manner". Cloud computing and Green computing can join hands to contribute to the reduction of carbon dioxide emission and provide an environmental friendly approach to the energy consumption

VI. HOW EXACTLY DOES GREEN COMPUTING CONTRIBUTE TO DR?

It is well known that the backup sites need to be run on a 24/7 basis in order to be able to provide business continuity to vendors. Hence the electricity required to run the secondary data centres can be generated by renewable sources of energy. In fact these secondary recovery sites will be used only rarely on the probabilistic basis that a failure occurs at the primary site due to some human error or natural disaster. The proposed usage of renewable sources of energy that are abundantly available in the particular location can contribute to an environmental friendly approach. The Disaster Recovery sites can be located in the geographic areas that can provide uninterruptable services that can be powered by renewable sources of energy. Some specific sources are described in this paper that could be utilized to power the DR site

VII. RENEWABLE SOURCES OF ENERGY

A. Solar Energy

The sun's energy is carried through space towards the earth as electromagnetic radiation. Light is one such form of radiation. Solar cells can use this light energy to generate electricity. The possibility to make electricity from light was first noticed by Edmond Becquerel in the year 1839. The relationship between light, matter and electricity was further studied by many scientists.

Photovoltaic cells are made semiconductors usually made with silicon and other chemical elements such as phosphorous and boron. This process of adding impurities is called doping and is necessary since silicon is a poor conductor.

Silicon doped with Phosphorous forms one layer called the N-type while silicon doped with boron forms the p-type.

When the silicon atoms absorb light, the light's energy knocks some electros out of the atoms. The free electrons flow between the two layers to make electric current. Solar cells are linked together in groups to form modules and modules are joined together to form an array. [6][7]

Flat Plate Photovoltaic (PV):

Initially Photovoltaic panels along with batteries were used as a cost effective solution to provide power at remote locations usually for communication towers. Most PV panels can produce electricity with direct light and indirect scattered light that is available during overcast days.

Concentrating solar power (CSP):

These are solar systems that use mirrors or lenses to focus a large area of sunlight into a small beam. The concentrated heat is used as a source to run a conventional power plant like a steam turbine, gas turbine or a Stirling engine.

Alternatively, the beam is concentrated on to PV panels to generate electricity. Concentrating solar panels (CPV) plants generate power by focusing solar radiation through mirrors or lenses onto special photovoltaic receivers to produce electricity. Some of the CSP in use today are Parabolic trough

Power tower, Dish engine, Linear Fresnel, Concentrating PV.[8] Energy derived is available only for a certain fraction of the day and hence effective technology to preserve is also required.

B. Wind Energy

What is wind? Wind is "A natural movement of air of any velocity; especially: the earth's air or the gas surrounding a planet in natural motion horizontally" [6]

Wind is caused by the difference in atmospheric pressure between two regions. The origin of wind resource is the Sun. Winds are caused by the difference in heating of the Earth's surface by the Sun. The amount of solar radiation absorbed around the equator is much greater than that is received at the poles. Hot air rises up and leaves behind a void which is filled in by cooler and heavier air. Global winds are caused by the movement of hot air around the equator flowing towards the poles and the cold air flowing towards the equator. Adding to this, the Earth's rotation plays a role in shaping the course of the winds.[7]

A similar effect is present around any large water body. The land near a large lake or an ocean gets heated up faster than the water. Which in turn heats up the air above the land faster and the hotter air tends to rise up and creates a void which is filled in by the cooler air causing a breeze or wind flowing towards the land. Similarly during the night the opposite happens and there is a steady flow of wind in the reverse direction. These winds are called onshore and offshore winds.

Mountain valley breezes are caused by the heating up of the valley floor and the air above them rising up towards the mountain during the mornings and the cooler air flows downward the hill during the afternoon. Perhaps the very first use of wind energy was in sailing. The very first windmills originated in Persia and date back to about 500-900 A.D. The first use probable use was to pump water. First documented wind mill application was used to grind grain and later on to pump water.

Producing electricity with the use of a multi-blade large windmill dates back to the late 19^{th} century by Charles F.Brush. It was the first mill to incorporate a step-up gear box.Large scale bulk power generation started in Russia in 1931with a 100kWh Balaclava wind generator

Most wind turbines these days are what is known as Horizontal axis wind turbines or HAWT's the other being vertical axis wind turbines or VAWT. In the HWATs the rotor is placed on top of a tower facing either upwind or down wind. Those facing the upwind side are called the upwind turbines and those facing downwind side are called downwind turbines.

Wind is absolutely air in motion. What causes the air to move is due to the uneven heating of the earth's surface by the sun. The wind's kinetic energy is converted to mechanical energy that thus helps turbines to produce electricity. The electricity that it generates can thus empower the secondary data centres located at different sites. Since the DR sites have to be powered throughout this alternative source of energy can be used.

C. Hydro Power

This is the most commonly used source of energy. Hydropower is the energy that comes from moving water. Water is constantly replenished. The flowing water can run over a turbine that in turn generates electricity. Two other forms of hydropower are Ocean Thermal Energy Conversion (OTEC) and tidal power.

D. Geothermal Energy

The heat produced by the earth constitutes geothermal energy. The hydrothermal energy has two basic ingredient water and heat. Water comes in contact with heated rocks that gets converted to steam that can power the turbines to generate electricity.

VIII. CONCLUSION

The proposed system of incorporating Green Computing in Cloud Computing by using renewable sources of energy to power Disaster Recovery sites and restore services for the Business Continuity plans can be viable by carefully locating the secondary sites. In case of using tidal power to generate electricity for the secondary backup centre it must be ensured that natural disasters that occur at the bay should not affect the data centre. The geographic separation of the primary and backup data centres should also be considered. Through the Green approach not only is the environment preserved but by using Cloud Computing's Green DRaaS the backup can also be preserved effectively. Since all other renewable resources have large-scale investments, wind and solar can also be done on small scale, at the site. In most cases existing sites would be able to utilize these two power sources with the grid. It can provide at least a fraction or a percent of their energy requirement. This way the already existing data centres have a chance of contributing to the environment, however small it might be. As the saying goes, little drops of water make the mighty ocean.

REFERENCES

[1] Wood, Timothy, et al. "Disaster recovery as a cloud service: Economic benefits & deployment challenges." 2nd USENIX Workshop on Hot Topics in Cloud Computing. 2010.

[2] Li, Juan, et al. "Community-based cloud for emergency management." System of Systems Engineering (SoSE), 2011 6th International Conference on. IEEE, 2011.

[3] Wood, Timothy, Alexandre Gerber, K. K. Ramakrishnan, Prashant Shenoy, and Jacobus Van der Merwe. "The case for enterprise-ready virtual private clouds."Usenix HotCloud ,2009

[4] Alhazmi, Omar H., and Yashwant K. Malaiya. "Assessing Disaster Recovery Alternatives: On-site, Colocation or Cloud." Software Reliability Engineering Workshops (ISSREW), 2012 IEEE 23rd International Symposium on. IEEE, 2012.

[5] Velev, Dimiter, and Plamena Zlateva. "A Feasibility Analysis of Emergency Management with Cloud Computing Integration." International Journal of Innovation and Technology,Vol.3, No.2, 2012

[6] Hantula, Richard. How Do Solar Panels Work?. Infobase Publishing, 2010

[7] Smith, Eric. DIY Solar Projects: How to Put the Sun to Work in Your Home. Creative Publishing int'l, 2011

[8] Vine, Edward, and Jan Hamrin. "Energy savings certificates: A market-based tool for reducing greenhouse gas emissions." Energy Policy 36.1 (2008): 467-476.

[9] Manwell, J. F., J. G. McGowan, and A. L. Rogers. "Wind energy explained: theory, design and application. 2002." John Wiley&Sons Ltd, UK (2002): 577.

[10] Chiras, Daniel D. Wind Power Basics. New Society Publishers, 2010.

[11] Dodge, Darrell M. Illustrated history of wind power development. Darell M. Dodge, 2001