TPCT's

College of Engineering, Osmanabad

Department of Computer Science and Engineering

Laboratory Manual

Green IT

For

Final Year Students

Manual Prepared by

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Author COE, Osmanabad

TPCT's

College of Engineering
Solapur Road, Osmanabad
Department of Computer Science and Engineering

1) Vision of the Department:

To achieve and evolve as a center of academic excellence and research center in the field of Computer Science and Engineering. To develop computer engineers with necessary analytical ability and human values who can creatively design, implement a wide spectrum of computer systems for welfare of the society.

2) Mission of the Department:

The department strives to continuously engage in providing the students with in-depth understanding of fundamentals and practical training related to professional skills and their applications through effective Teaching- Learning Process and state of the art laboratories pertaining to CSE and inter disciplinary areas. Preparing students in developing research, design, entrepreneurial skills and employability capabilities.

College of Engineering

Technical Document

This technical document is a series of Laboratory manuals of Computer Science & Engineering Department and is a certified document of College of Engineering, Osmanabad. The care has been taken to make the document error-free. But still if any error is found. Kindly bring it to the notice of subject teacher and HOD.

Recommended by,

HOD

Approved by,

Principal

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FOREWORD

It is my great pleasure to present this laboratory manual for Final year Engineering students for the subject – “ Green IT”.

As a student, many of you may be wondering with some of the questions in your mind regarding the subject and exactly what has been tried is to answer through this manual

Faculty members are also advised that covering these aspects in initial stage itself will greatly relieve them in future as much of the load will be taken care by the enthusiasm energies of the students once they are conceptually clear

H.O.D.

LABORATORY MANUAL CONTENTS

This manual is intended for the final year students of Computer Science and Engineering in the subject of green IT. This manual typically contains practical/Lab Sessions related to the subject on the various aspects of the subject to enhance understanding.

Students' are advised to thoroughly go through this manual rather than only topics mentioned in the syllabus as practical aspects are the key to understanding and conceptual visualization of theoretical aspects covered in the books.

Mr. S N Holambe

Do's and Don'ts in the laboratory

1. Make entry in the Log Book as soon as you enter the Laboratory.
2. All the students should sit according to their roll numbers starting from their left to right.
3. All the students are supposed to enter the terminal number in the log book.
4. Do not change the terminal on which you are working.
5. All the students are expected to get at least the algorithm of the program/concept to be implemented.
6. Strictly observe the instructions given by the teacher/Lab Instructor

Instruction for Laboratory Teachers::

1. Submission related to whatever lab work has been completed should be done during the next lab session. The immediate arrangements for printouts related to submission on the day of practical assignments.

2. Students should be taught for taking the printouts under the observation of lab teacher

SUBJECT INDEX

1.

EXPERIMENT NO. 1

Title:A Case Study
on
Climate Change and Low Carbon Society

The economic impacts of climate change:

The world needs to reduce global emissions of greenhouse gases (GHGs) sharply and rapidly if the risks associated with human induced climate change are to be kept under control. The speed with which emissions fall will determine the ultimate rise in global temperatures.

At the UN Climate Change Conference in Cancún in 2010, countries agreed that deep cuts in global greenhouse gas emissions are required as documented in the Fourth Assessment Report of the Inter-governmental Panel on Climate Change (IPCC), to reduce global greenhouse gas emissions so as to hold the increase in global average temperature below 2°C above pre-industrial levels, and that Parties should take urgent action to meet this goal.

Global emissions currently stand at around 48 gigatonnes of CO2 equivalent (GtCO2e) per year. Judging by the projected relationship between cumulative GHG emissions and the probabilities of global temperature increases, this requires that global emissions peak before 2020, fall back to 40-48 GtCO2e per year by 2020 and continue to fall, to between 6 and 17 GtCO2e per year by 2050.1

Achieving significant and lasting reductions in GHG emissions on this scale requires policy actions on several fronts by all countries with significant levels of emissions, including those in the EBRD region. Without policy intervention, the incentives facing emitters and users of GHG-intensive products to change their behavior will be inadequate. In most countries, emitters do not bear the social cost of GHG emissions; social returns for the development of low-emission technologies often exceed their private returns; and incomplete information and other barriers stand in the way of realising energy-saving opportunities.

If policy-makers start to take action now, it would allow a more measured response, early capture of various co-benefits of climate-change mitigation such as reduced local air pollution, and the timely reallocation of resources from the types of capital accumulation and innovation rendered inappropriate by the need to switch to low-GHG growth paths. Early action could

position the EBRD region well in the energy-industrial revolution that the decarbonisation of the global economy is expected to bring.

Instead of being in a catch-up situation, the EBRD region can and should propel itself to the forefront of technological progress in the green economy.

The required policy actions are likely to have significant economic consequences for transition countries. These include impacts on the value of aggregate output, the balance between consumption and investment over time, real wages,2 trade patterns, relative prices, the relative performance of different industry sectors, and long-run growth. Some of these impacts are likely to affect different households' well-being differently.

This reviews the likely economic consequences of ambitious long-term climate change mitigation targets in the EBRD region. It starts by drawing out some of the general lessons of the economic literature on climate change mitigation.

It then considers what economic models suggest about the macroeconomic impacts in the EBRD regions. Next, it investigates some of the sectoral implications, drawing on results from a specially commissioned analysis using the World Induced Technical Change Hybrid (WITCH) integrated assessment model. Lastly, the chapter reviews some of the possible social implications of climate change policy for EBRD countries.

Model results such as those presented here are useful to highlight trends, sensitivities and the relative importance of different economic factors in understanding the costs of mitigation. The actual numerical results should, however, be viewed as illustrative only. Furthermore, they illustrate only of the trade-offs that are captured in the model. As a result, the interpretation of the results is almost as important as the results themselves.

Climate change mitigation measures may have much the same effect as an adverse supply shock (for example, a sudden hike in the oil price) if introduced very rapidly. By sharply changing relative prices, for example introducing carbon pricing and inducing changes in the pattern of investment, mitigation measures risk disrupting economies and creating unemployment.

At the same time, it is important to underline that modeling mitigation policy like a "supply shock" constitutes a simplification which will tend to overestimate the costs and underestimate the benefits of mitigation policy, particularly in resource-rich countries in which legacies of wasteful energy use continue to exist, such as in the transition region.

For one, macroeconomic models generally assume that resources are fully utilised and allocated in a cost-minimising way. Hence, these models cannot capture the benefits of bringing into use idle workers or resources. They also do not capture mitigation through energy efficiency improvements that pay for themselves.

However, bottom-up calculations suggest that the potential for such improvements could be very significant in the transition region.

In addition, the models do not take account of the fact that climate change mitigation can generate significant co-benefits, such as reduced particulate pollution. Reducing GHG emissions in line with a 2oC global scenario would reduce air pollution control costs in Russia by US$2.2 billion per year by 2030, a reduction of 16 per cent relative to the reference scenario. The reduction for the new European Union (EU) member states would be around 7 per cent, and around 5 per cent for the rest of the transition region.

Tackling other barriers inhibiting decarbonisation can also generate co-benefits. This is demonstrated by efforts to resolve the information and incentive problems that lead to inefficient and excessive use of energy.

Perhaps most importantly, de-carbonisation policies may increase long-run growth, through several channels. In many countries with large fossil fuel sectors, the dependence on these sectors is widely regarded as a growth obstacle, rather than a boon. This “resource curse”, which operates through both macroeconomic and institutional channels, is likely to apply particularly in countries with weaker institutional environments, which are typical for the transition region. By creating incentives for reducing the size and economic significance of the natural resource sectors, climate change mitigation may also mitigate the “resource curse”, allow other sectors to develop, and help these countries attain higher growth in the long run.

Policies designed to encourage innovation in low-carbon technologies may also stimulate innovation and growth more widely. This possibility underpins the arguments of advocates of “green growth” strategies. A carbon-free economy will require a wholesale transformation of the technologies that underpin modern economies today and this process of technological change may provide economic opportunities on the scale of an energy-industrial revolution.

EXPERIMENT NO. 2

Title: Carbon Management Systems

Introduction:

Carbon management systems (CMS), defined as software that provides information and tools used to calculate, monitor, and reduce carbon footprints, represent a new category of Green IS that is starting to gain a foothold in practice. Many different CMS have been developed and are available for organizations and individuals. At an organizational level, a CMS supports practices related to managing and reporting carbon emissions across a wide range of business practices and, when implemented for individual use, can foster more environmentally responsible behaviors by employees. Because organizations see value in using CMS to support a variety of carbon-reducing initiatives, the market for carbon management software solutions and services is growing.

At an organizational level, a CMS measures the impacts of operational activities, such as facility energy consumption and business travel, and supports management decision making and the prioritization of carbon-reducing initiatives. Additionally, carbon footprint calculations provided by CMS may have implications for legal or regulatory compliance, financial costs associated with carbon trading and offsetting and perceptions regarding an organization's level of corporate social responsibility. At the individual level, personal CMS focus on individual actions with the objectives of creating awareness about the impact of specific behaviors on one's carbon footprint. They also focus on motivating users to make ecologically responsible choices, such as purchasing green products, buying carbon offsets, or changing personal travel behaviors. A large number of personal CMS are publicly available on the Internet (for an example, see www.epa.gov/climatechange/emissions/ind_calculator.html) and many have been enhanced beyond basic carbon footprint calculators to include options for setting goals, recommending actions, monitoring carbon emissions, purchasing carbon offsets, and social networking.

Although CMS are principally designed for either organizational or individual use, there are cross-over CMS applications in which personal (individual-level) CMS are sponsored by organizations. This may occur, for instance, where organizations make a CMS (or components of a CMS) available to customers in order to drive more-sustainable buying behaviors. This practice is common with airline companies that allow customers to calculate the carbon footprint of a flight and then neutralize it by buying carbon offsets. Some organizations are also recognizing the potential of using personal CMS in their organizations to change employees' personal behaviors. This study investigates three such examples. There are several points of distinction between a cross-over CMS application and a traditional organizational or individual-level IS. A personal CMS is designed for individuals but sponsored, implemented, and used in a given organizational context. Employees are not required to use the system to complete job functions. When using the CMS, employees act as private individuals and may change personal behaviors. Some behavioral changes may impact the organization directly, but many others do not. Although the organization might hope to improve its environmental performance as a result of CMS, the way in which the system achieves these results is different than traditional organizational IS. Thus, viewing these cross-over applications as traditional organizational or personal IS may prevent the discovery of new insights that could enhance our understanding of IS.

For organizations, employees' actions, such as turning off lights or computers, reducing paper consumption, and commuting can directly impact the achievement of organizations' carbon reduction objectives

The aim of carbon management system is to reduce greenhouse gas (GHG) emissions. The system includes organisational structure for emission control, reduction targets and actions, assessment of carbon risks, GHG accounting, carbon performance evaluation and reporting. Manager must make strategic decisions to establish such a system and determine the details of all the elements. However, it is often difficult to determine what elements are most effective in translating strategic objectives into achieved performance. On the other hand, there is scarce research addressing these important issues. This study attempts to fill this gap. We use cross-sectional data of Australian firms that have an explicit interest in carbon management and test a model to evaluate the associations between specific elements of management system and carbon performance. Overall, we found firms with more effective internal carbon management have

achieved better reduction performance. Particularly risk identification process, reduction targets, actions, GHG accounting and external carbon disclosure are the most effective elements of the system. We also find evidence of interactive effect of these elements, suggesting a combination of these elements in a system has better effect than piecemeal adoption of these broadly defined managerial tools. In sum, our results provide initial evidence of how Australian firms handle climate change challenges in this transitional period toward low carbon economy characterised by enormous uncertainty. We show that an effective carbon management is essential for carbon mitigation, and firms that take proactive mechanisms, commit resources and prioritize actions are more likely to succeed in GHG control.

Carbon Management in German Companies:

Basic carbon management practices of German companies regulated by the EU ETS are described in two surveys carried out in 2010 and 2011 (Löschel et al., 2011; Löschel et al., 2010a; Löschel et al., 2010b). The surveys revealed that in Germany 63 % of regulated firms had scheduled abatement measures since the EU ETS was introduced in 2005. Larger emitters (> 25,000 tCO2) are in general more active in terms of abatement. While 68 % of larger emitters had scheduled abatement measures, 54 % of smaller emitters (≤ 25,000 tCO2) did so. By far the most prominent way to realise abatement was process optimisation, accounting for roughly two thirds of scheduled abatement measures (e.g. retrofitting existing machinery or reorganisation of production). Investment in energy efficient technology also played an important role (about 60 % of scheduled measures). Fuels switching or the utilisation of renewable energy as abatement options played a less prominent role in 2009 and 2010. The largest share of realised abatement occurred as a side effect (95 % of cases), e.g. as an effect of retrofitting of existing machinery or investment motivated by other reasons than the carbon price. With decreasing free allocation in the EU ETS from 2013 onwards, it is expected that abatement will become more important. 25 % of surveyed firms in Germany stated that they plan to schedule measures with the primary aim of CO_2 abatement from 2013 onwards. The existing installations regulated by the EU ETS have a relative long remaining technical lifetime. Until the year 2026, about nine % of cumulated emissions will be affected by reinvestment in new machinery. From 2026 until 2031, most installations will likely be replaced, which could heavily affect overall emissions by the utilisations of new and more energy efficient equipment (Löschel et al. 2011).

In 2009 and 2010, about 50 % of firms became active in the carbon market by selling or purchasing allowances. The most important reason for not being active on the market was a sufficient amount of freely allocated permits. Currently, more than 70 % of German companies regulated by the EU ETS receive free allocation that exceeds actual emissions and consequently being over-allocated. This image will change dramatically when free allocation is reduced in 2013. Based on individual expectations of surveyed companies it is estimated that 63 % of companies will receive free allocation that will not cover actual emissions. Although the amount of allowances that must be purchased will be comparably small in many cases, a larger number of firms will have to participate in the market in 2013. In many cases firms might have banked allowances from previous years. Consequently, trading activities might gradually increase, starting in 2013. Most firms traded once per year in 2009 and 2010 (36 % in 2010). Frequent trades (e.g.) monthly, weekly or daily are conducted almost exclusively by very large emitters. Since allowances are regarded as a commodity, "avoiding speculation" was a frequently named reason for backing away from trading.

In terms of general management issues, most firms (56 % in 2010) organise carbon management by assigning one person as responsible for all relevant tasks. In 29 % of cases, a team is responsible for the management. In about 15 % of cases, there are no clearly defined competences. In most cases, where one person is responsible for the management of the EU ETS obligations, an engineer or environmental officer is responsible. Given the current over-allocation and moderate trading activities, most firms focus on compliance. In the management of the EU ETS, considerable transaction costs occur. 69 % of transaction costs stem from compliance obligations, such as MRV. Roughly 20 % stem from allowance trading and 11 % from informational costs for abatement technologies.

Limitations:

1. Whether the results would be the same for CMS deployed by organizations in different industries or geographical locations. This limitation is partially addressed by the multiple case study approach, which included three fairly different organizations. However, all organizations espoused a strong commitment to environmental sustainability, a characteristic that was purposefully specified as part of the selection criteria. The effect of this choice may be an overstatement of the level of changes in employees' behaviors attributable to the CMS. It is

possible that employees in these organizations were already disposed to green choices or that they were influenced in part by other factors in the organization. Thus, the results of this study should be viewed as preliminary and interpreted in the appropriate context.

2. Another limitation of this research was the inability to investigate employees' responses to CMS at a more granular level. Although participants represented a range of demographic characteristics (e.g., gender, age) and job positions, there was an insufficient sample to compare results across different sub-segments of the population. Based on level of environmental concern, GfK Group has identified five green consumer segments, ranging from the true blue greens who are environmental leaders and activists, to the basic browns who have no interest in environmental issues. Given different personal motivations, individuals may respond more positively to different persuasion techniques. For instance, those who are highly motivated (true blue greens) may be both interested in and capable of dealing with direct messages, such as suggestions made by the CMS, while those at the other send of the spectrum might respond more favourably to indirect persuasion messages. In the latter case, features that reflect the design principles of social networking and facilitation might be more persuasive. The presence of different green intentions at the individual level adds another layer of complexity to the design and study of Green IS.

3. A third limitation of this study relates to equivocality of the dependent variable. For this study, the assessment of ecologically responsible behaviors was based on subjective self-reports by participants and it was not possible to objectively confirm whether these changes actually occurred. Thus, it is possible that changes reported by participants were favorably biased toward pro-environmental responses. Even if individuals' actions could be objectively measured, there is still significant ambiguity about whether they would constitute ecologically responsible behaviors because such a determination is highly contextual. For example, in the simple case of "turning off the lights" (an ecologically responsible behavior), the impact of such an action on an individual's carbon footprint might be vastly different if the electricity for the light is coal-generated (high carbon footprint) or hydro-generated (low carbon footprint). As a result, there remains some degree of fuzziness associated with the dependent variable.

EXPERIMENT NO.3

Title: Green IT and Disaster management

What is green IT?

Green IT aims to use computers and IT resources in a more efficient and environmentally responsible way.

What is disaster management?

The United Nations defines a disaster as a serious disruption of the functioning of a community or a society. Disasters involve widespread human, material, economic or environmental impacts, which exceed the ability of the affected community or society to cope using its own resources.

The Red Cross and Red Crescent societies define disaster management as the organisation and management of resources and responsibilities for dealing with all humanitarian aspects of emergencies, in particular preparedness, response and recovery in order to lessen the impact of disasters.

Types of disasters:

There is no country that is immune from disaster, though vulnerability to disaster varies. There are four main types of disaster.

- Natural disasters: including floods, hurricanes, earthquakes and volcano eruptions that have immediate impacts on human health and secondary impacts causing further death and suffering from (for example) floods, landslides, fires, tsunamis.
- Environmental emergencies: including technological or industrial accidents, usually involving the production, use or transportation of hazardous material, and occur where these materials are produced, used or transported, and forest fires caused by humans.
- Complex emergencies: involving a break-down of authority, looting and attacks on strategic installations, including conflict situations and war.

- Pandemic emergencies: involving a sudden onset of contagious disease that affects health, disrupts services and businesses, brings economic and social costs.

Any disaster can interrupt essential services, such as health care, electricity, water, sewage/garbage removal, transportation and communications. The interruption can seriously affect the health, social and economic networks of local communities and countries. Disasters have a major and long-lasting impact on people long after the immediate effect has been mitigated. Poorly planned relief activities can have a significant negative impact not only on the disaster victims but also on donors and relief agencies. So it is important that physical therapists join established programmes rather than attempting individual efforts.

Local, regional, national and international organisations are all involved in mounting a humanitarian response to disasters. Each will have a prepared disaster management plan. These plans cover prevention, preparedness, relief and recovery.

Disaster prevention:

These are activities designed to provide permanent protection from disasters. Not all disasters, particularly natural disasters, can be prevented, but the risk of loss of life and injury can be mitigated with good evacuation plans, environmental planning and design standards. In January 2005, 168 Governments adopted a 10-year global plan for natural disaster risk reduction called the Hyogo Framework. It offers guiding principles, priorities for action, and practical means for achieving disaster resilience for vulnerable communities.

Disaster preparedness

These activities are designed to minimise loss of life and damage – for example by removing people and property from a threatened location and by facilitating timely and effective rescue, relief and rehabilitation. Preparedness is the main way of reducing the impact of disasters. Community-based preparedness and management should be a high priority in physical therapy practice management.

Disaster relief

This is a coordinated multi-agency response to reduce the impact of a disaster and its long-term results. Relief activities include rescue, relocation, providing food and water, preventing disease

and disability, repairing vital services such as telecommunications and transport, providing temporary shelter and emergency health care.

Disaster recovery

Once emergency needs have been met and the initial crisis is over, the people affected and the communities that support them are still vulnerable. Recovery activities include rebuilding infrastructure, health care and rehabilitation. These should blend with development activities, such as building human resources for health and developing policies and practices to avoid similar situations in future.

Disaster management is linked with sustainable development, particularly in relation to vulnerable people such as those with disabilities, elderly people, children and other marginalised groups. Health Volunteers Overseas publications address some of the common misunderstandings about disaster management.

Disaster management - How individual physical therapists can contribute?

Physical therapists can contribute to disaster management in many ways, not only before, but also during and after a disaster. They can:

- Contribute to policy development and local disaster planning;
- Work with their member organisation to support the organisation's disaster management planning;
- Learn about risks and prevention strategies and prepare to react to disasters in their own homes, places of work, locality, region and further afield;
- Donate to relief efforts or raise funds for NGOs involved in disaster management;
- Support disaster relief organisations and raise awareness of the need for linkages between disaster relief, rehabilitation and development;
- Advocate for vulnerable groups, such as the elderly or persons with disabilities, raising awareness of their needs at times of disaster.
- Actively engage in relief efforts, usually by volunteering to provide rehabilitation to survivors.

Contributing to local disaster planning and preparation:

Physical therapists can contribute to disaster planning in their own area. Regional and local governments, cities and individual businesses and organisations all plan for emergency situations.

Physical therapists should ask themselves:

- Is there a disaster management plan for my practice environment and region?
- Can I contribute to planning for emergencies in my place of practice?
- If there is no local plan, how can I contribute to the development of one, making sure there is adequate consideration of the needs of people with disabilities and for those who acquire disabilities as a result of the disaster?

Donating money or supplies

Donation of money to established non-governmental agencies is the most efficient way of responding to disasters. Financial contributions allow professional relief organisations to purchase exactly what is most urgently needed and pay for the transportation necessary to distribute these supplies. The supplies can often be purchased locally, reducing transport and storage costs, stimulating local economies, providing employment and ensuring that supplies arrive as quickly as possible.

Donating equipment and supplies can be more complicated. Before organising collections of physical therapy equipment and assistive devices, it is important to confirm with the relief agencies that there is a need for the items. It is important to have an accurate analysis of need in the disaster-stricken area before determining the response.

Many groups raise money for disaster relief. Many are reputable, but some may not be. Whenever you make a donation it is prudent to take steps to ensure the money you are giving will be used for the intended purpose.

Supporting disaster relief organizations :

You do not have to move from home to assist those affected by disasters. Volunteering at the local office of relief organisations may provide them with much needed support. You may be able to help with campaigning or awareness-raising work and disaster preparedness activities. Note that organisations are unlikely to want new volunteers at the time of a disaster when all their energies are on the relief effort.

Volunteering :

If you wish to be actively involved in a disaster area, it is important that you do this through an established group, rather than going it alone. Numerous individuals and small organisations getting involved can be more problematic than supportive. Governments and their administrations and major aid agencies already working to capacity to bring relief in as short a time as possible are unable to deal with numerous individual efforts, however well intentioned. A list of organisations involved in volunteer relief programmes can be found on the disaster management - volunteering section of this website.

Volunteer programmes organised by non-government and charitable organisations aim to bring health personnel and resources to areas where local resources are insufficient to meet needs in the disaster area. These organisations recruit individuals to provide health services free of charge. Although some organisations assemble teams to serve in the country for a few weeks, others establish clinics staffed by volunteers serving for months or years. Volunteers on short-term missions do not aim to rectify local shortage of health personnel but to meet existing need until the local system develops to take over.

Most agencies require professional practice experience and some internationalexperience before recruiting people for disaster relief. Volunteers without prior experience are generally not selected for relief assignments. It is not unusual to ask that volunteers make a commitment to spend at least three months, and often more, working on a particular disaster.

Organisations involved in disaster management :

Disaster management is a complex process involving international, national and local organisations each with a distinct role to play. To respond to disaster situations a coordinated effort is required.

- The United Nations and its organisations
- Health Care in Danger project
- The International Federation of Red Cross and Red Crescent Societies
- The International Committee of the Red Cross
- International non-governmental agencies
- National organisations

The United Nations and its organisations

The Office for the Coordination of Humanitarian Affairs (OCHA) in collaboration with the Inter-Agency Standing Committee (IASC) is the arm of the United Nations responsible for bringing together national and international humanitarian providers to ensure a coherent response to emergencies. OCHA also ensures that a framework is in place within which each provider can contribute to the overall response effort. It also advocates for people in need, promotes preparedness and prevention and facilitates sustainable solutions.

The Food and Agriculture Organisation of the UN (FAO) provides early warning of impending food crises, and assesses global food supply problems.

The International Organisation for Migration (IOM) is an intergovernmental agency which helps transfer refugees, internally displaced persons and others in need of internal or international migration services.

The Office of United Nations High Commissioner for Human Rights (OHCHR) provides assistance and advice to governments and other actors on human rights issues, sets standards and monitors rights violations.

The United Nations Development Programme (UNDP) assists disaster-prone countries in contingency planning and with disaster mitigation, prevention and preparedness measures.

The United Nations High Commission for Refugees (UNHCR) provides international protection and assistance for refugees, stateless persons and internally displaced persons, particularly in conflict-related emergencies.

The United Nations Children's Emergency Fund (UNICEF) works to uphold children's rights, survival, development and protection by intervening in health, education, water, sanitation, hygiene and protection.

The World Food Programme (WFP) is the principle supplier of relief food aid.

The World Health Organization (WHO) provides global public health leadership by setting standards, monitoring health trends, and providing direction on emergency health issues. WHO's role is to reduce avoidable loss of life and the burden of disease and disability. A range of technical guidelines for health action in crises and pre-deployment training courses are available. A set of technical hazard sheets on earthquakes, drought, floods and landslides, is also available.

Health Care in Danger project

Publications include the Responsibilities of health-care personnel working in armed conflict and other emergencies and Ethical Principles of health care in times of armed conflict and other emergencies which WCPT supports.

Health Care in Danger project: new e-learning module (November 2014). The module introduces health personnel to the principles underpinning ethical considerations when working in conflict situations and other emergencies. Using a multimedia interface, the module presents various dilemmas that health personnel face every day. Users can explore these issues in depth by interacting virtually with experts in the field, studying real-life issues, and receiving guidance that helps them to make decisions in difficult situations.

The International Federation of Red Cross and Red Crescent Societies

The International Federation of Red Cross and Red Crescent Societies is the world's largest humanitarian organization made up of 186 member Red Cross and Red Crescent Societies. The International Federation's mission is to improve the lives of vulnerable people by mobilizing the power of humanity.

The IFRC coordinates and directs international assistance to victims of natural and technological disasters, to refugees and in health emergencies. It combines its relief activities with development work to strengthen the capacities of National Societies and through them the capacity of individual people. The IFRC acts as the official representative of its member societies in the international field. It promotes cooperation between National Societies, and works to strengthen their capacity to carry out effective disaster preparedness, health and social programmes.

The International Committee of the Red Cross

The International Committee of the Red Cross (ICRC) is a Swiss-based humanitarian organisation and founding member of the International Red Cross and Red Crescent Movement(1863). It is mandated by the international community to be the guardian and

promoter of international humanitarian law, working around the world to provide assistance to people affected by violence.

The ICRC provides physical rehabilitation to people injured by explosive weapons or other types of incident. ICRC organises, in collaboration with WHO, the Health Emergencies in Large Populations(HELP) course to upgrade professionalism in humanitarian assistance programmes.

The ICRC runs programmes to support the development of physical therapy education and welcomes the involvement of individuals or physical therapy institutions in supporting these developments. Opportunities are added to the working and studying abroad page of our website

The ICRC publication Health care in danger: the responsibilities of health-care personnel working in armed conflicts and other emergencies provides guidance, in simple language, on rights and responsibilities in conflict and other situations of violence for health personnel.

International non-governmental agencies

Leading international non-governmental agencies work through volunteers to fight poverty in developing countries. Their strong role in development works side by side with the recovery from a disaster and prevention and preparedness for any future disasters.

CARE is a humanitarian organisation fighting global poverty. Women are at the heart of CARE's community-based efforts to improve basic education, prevent the spread of HIV, increase access to clean water and sanitation, expand economic opportunity and protect natural resources. CARE also delivers emergency aid to survivors of war and natural disasters, and helps people rebuild their lives. CARE works alongside poor women because, equipped with the proper resources, women have the power to help whole families and entire communities escape poverty.

Handicap International works in partnership with local organisations and government institutions. It raises awareness of both governments and the general public on disability and landmine issues, mobilises civil society and implements action in emergency situations.

Health Volunteers Overseas (HVO) is a network of health care professionals, organisations, corporations and donors united in a common commitment to improving global health through

education. The website includes a volunteer toolkit and an informative newsletter Volunteer Connection.

IMA World Health is an inter-church not-for-profit organisation based in the United States of America, which partners with USAID, the World Bank and many other organisations to build sustainable health care systems.

International Rescue Committee (IRC) offers lifesaving care and life-changing assistance to refugees forced to flee from war or disaster and provides emergency response by experienced personnel for short-term assignments.

Médecins Sans Frontières (MSF) provides medical services in emergency situations. It recruits some physical therapists and other health professionals as well as physicians.

Oxfam is an international confederation of 14 organisations working together and with partners and allies around the world to bring about lasting change. Oxfam works directly with communities and seeks to influence the powerful to ensure that poor people can improve their lives and livelihoods and have a say in decisions that affect them.

Rehabilitation International (RI) is a global network of expert professionals who work to empower people with disabilities and provide sustainable solutions for a more inclusive and accessible society. It advocates for inclusion of people with disabilities in climate change and disaster management planning.

National organisations

Most nations have a national disaster management plan. National disaster management plans are aligned to the most commonly experienced disasters in that country or region and the resources available. Look at the disaster management plan for your country and region. Links to the national disaster management plan for Australia and India are provided here as examples.

Government funded aid programmes coordinate national responses to disasters in another country. They may also run development projects that support countries in the recovery following a disaster.

EXPERIMENT NO. 4

Title: Green IT and Decision Support System

A **decision support system** (**DSS**) is a computer-based information system that supports business or organizational decision-making activities. DSSs serve the management, operations, and planning levels of an organization (usually mid and higher management) and help people make decisions about problems that may be rapidly changing and not easily specified in advance—i.e. Unstructured and Semi-Structured decision problems. Decision support systems can be either fully computerized, human-powered or a combination of both.

While academics have perceived DSS as a tool to support decision making process, DSS users see DSS as a tool to facilitate organizational processes.[1] Some authors have extended the definition of DSS to include any system that might support decision making; Sprague (1980)[2] defines a properly termed DSS as follows:

1. DSS tends to be aimed at the less well structured, underspecified problem that upper level managers typically face;
2. DSS attempts to combine the use of models or analytic techniques with traditional data access and retrieval functions;
3. DSS specifically focuses on features which make them easy to use by non-computer-proficient people in an interactive mode; and
4. DSS emphasizes flexibility and adaptability to accommodate changes in the environment and the decision makingapproach of the user.

DSSs include knowledge-based systems. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from a combination of raw data, documents, and personal knowledge, or business models to identify and solve problems and make decisions.

Typical information that a decision support application might gather and present includes:

- inventories of information assets (including legacy and relational data sources, cubes, data warehouses, and data marts),
- comparative sales figures between one period and the next,
- projected revenue figures based on product sales assumptions.

History

The concept of decision support has evolved mainly from the theoretical studies of organizational decision making done at the Carnegie Institute of Technology during the late 1950s and early 1960s, and the implementation work done in the 1960s.[4] DSS became an area of research of its own in the middle of the 1970s, before gaining in intensity during the 1980s. In the middle and late 1980s, executive information systems (EIS), group decision support systems (GDSS), and organizational decision support systems (ODSS) evolved from the single user and model-oriented DSS.

According to Sol (1987)[5] the definition and scope of DSS has been migrating over the years: in the 1970s DSS was described as "a computer-based system to aid decision making"; in the late 1970s the DSS movement started focusing on "interactive computer-based systems which help decision-makers utilize data bases and models to solve ill-structured problems"; in the 1980s DSS should provide systems "using suitable and available technology to improve effectiveness of managerial and professional activities", and towards the end of 1980s DSS faced a new challenge towards the design of intelligent workstations.[5]

In 1987, Texas Instruments completed development of the Gate Assignment Display System (GADS) for United Airlines. This decision support system is credited with significantly reducing travel delays by aiding the management of ground operations at various airports, beginning with O'Hare International Airport in Chicago and Stapleton Airport in Denver Colorado.[6]Beginning in about 1990, data warehousing and on-line analytical processing (OLAP) began broadening the realm of DSS. As the turn of the millennium approached, new Web-based analytical applications were introduced.

The advent of more and better reporting technologies has seen DSS start to emerge as a critical component of managementdesign. Examples of this can be seen in the intense amount of discussion of DSS in the education environment.

DSS also have a weak connection to the user interface paradigm of hypertext. Both the University of Vermont PROMISsystem (for medical decision making) and the Carnegie Mellon ZOG/KMS system (for military and business decision making) were decision support systems which also were major breakthroughs in user interface research. Furthermore, although hypertext researchers have generally been concerned with information overload, certain researchers, notably Douglas Engelbart, have been focused on decision makers in particular.

Taxonomies

Using the relationship with the user as the criterion, Haettenschwiler[7] differentiates *passive, active,* and *cooperative DSS*. A *passive DSS* is a system that aids the process of decision making, but that cannot bring out explicit decision suggestions or solutions. An *active DSS* can bring out such decision suggestions or solutions. A *cooperative DSS* allows for an iterative process between human and system towards the achievement of a consolidated solution: the decision maker (or its advisor) can modify, complete, or refine the decision suggestions provided by the system, before sending them back to the system for validation, and likewise the system again improves, completes, and refines the suggestions of the decision maker and sends them back to them for validation.

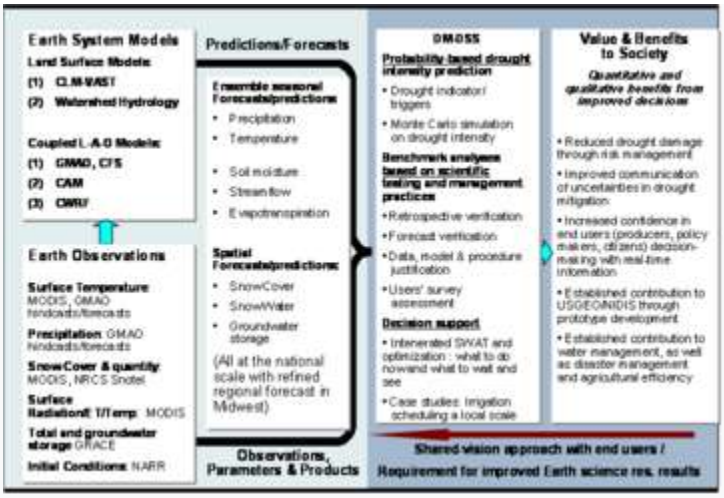
Another taxonomy for DSS, according to the mode of assistance, has been created by Daniel Power: he differentiates *communication-driven DSS*, *data-driven DSS*, *document-driven DSS*, *knowledge-driven DSS*, and *model-driven DSS*.[8]

- A **communication-driven DSS** enables cooperation, supporting more than one person working on a shared task; examples include integrated tools like Google Docs or Microsoft Groove.[9]
- A **data-driven DSS** (or data-oriented DSS) emphasizes access to and manipulation of a time series of internal company data and, sometimes, external data.
- A **document-driven DSS** manages, retrieves, and manipulates unstructured information in a variety of electronic formats.
- A **knowledge-driven DSS** provides specialized problem-solving expertise stored as facts, rules, procedures, or in similar structures.[8]

- A **model-driven DSS** emphasizes access to and manipulation of a statistical, financial, optimization, or simulation model. Model-driven DSS use data and parameters provided by users to assist decision makers in analyzing a situation; they are not necessarily data-intensive. Dicodess is an example of an open source model-driven DSS generator.[10]

Using scope as the criterion, Power[11] differentiates *enterprise-wide DSS* and *desktop DSS*. An *enterprise-wide DSS* is linked to large data warehouses and serves many managers in the company. A *desktop, single-user DSS* is a small system that runs on an individual manager's PC.

Components



Design of a drought mitigation decision support system

Three fundamental components of a DSS architectureare:

1. the database (or knowledge base),
2. the model (i.e., the decision context and user criteria)
3. the user interface.

The users themselves are also important components of the architecture.

Development frameworks

Similarly to other systems, DSS systems require a structured approach. Such a framework includes people, technology, and the development approach.[12]

The Early Framework of Decision Support System consists of four phases:

- **Intelligence** – Searching for conditions that call for decision;
- **Design** – Developing and analyzing possible alternative actions of solution;
- **Choice** – Selecting a course of action among those;
- **Implementation** – Adopting the selected course of action in decision situation.

DSS technology levels (of hardware and software) may include:

1. The actual application that will be used by the user. This is the part of the application that allows the decision maker to make decisions in a particular problem area. The user can act upon that particular problem.
2. Generator contains Hardware/software environment that allows people to easily develop specific DSS applications. This level makes use of case tools or systems such as Crystal, Analytica and iThink.
3. Tools include lower level hardware/software. DSS generators including special languages, function libraries and linking modules

An iterative developmental approach allows for the DSS to be changed and redesigned at various intervals. Once the system is designed, it will need to be tested and revised where necessary for the desired outcome.

Classification

There are several ways to classify DSS applications. Not every DSS fits neatly into one of the categories, but may be a mix of two or more architectures.

Holsapple and Whinston[15] classify DSS into the following six frameworks: text-oriented DSS, database-oriented DSS, spreadsheet-oriented DSS, solver-oriented DSS, rule-oriented DSS, and compound DSS. A compound DSS is the most popular classification for a DSS; it is a hybrid system that includes two or more of the five basic structures.

The support given by DSS can be separated into three distinct, interrelated categories: Personal Support, Group Support, and Organizational Support.

DSS components may be classified as:

1. **Inputs:** Factors, numbers, and characteristics to analyze
2. **User Knowledge and Expertise:** Inputs requiring manual analysis by the user
3. **Outputs:** Transformed data from which DSS "decisions" are generated
4. **Decisions:** Results generated by the DSS based on user criteria

DSSs which perform selected cognitive decision-making functions and are based on artificial intelligence or intelligent agentstechnologies are called Intelligent Decision Support Systems (IDSS)

The nascent field of Decision engineering treats the decision itself as an engineered object, and applies engineering principles such as Design and Quality assurance to an explicit representation of the elements that make up a decision.

Applications

DSS can theoretically be built in any knowledge domain.

One example is the clinical decision support system for medical diagnosis. There are four stages in the evolution of clinical decision support system (CDSS): the primitive version is standalone and does not support integration; the second generation supports integration with other medical systems; the third is standard-based, and the fourth is service model-based.

DSS is extensively used in business and management. Executive dashboard and other business performance software allow faster decision making, identification of negative trends, and better allocation of business resources. Due to DSS all the information from any organization is represented in the form of charts, graphs i.e. in a summarized way, which helps the management to take strategic decision. For example, one of the DSS applications is the management and development of complex anti-terrorism systems. Other examples include a bank loan officer verifying the credit of a loan applicant or an engineering firm that has bids on several projects and wants to know if they can be competitive with their costs.

A growing area of DSS application, concepts, principles, and techniques is in agricultural production, marketing for sustainable development. For example, the DSSAT4 package,[20][21] developed through financial support of USAID during the 80s and 90s, has allowed rapid assessment of several agricultural production systems around the world to

facilitate decision-making at the farm and policy levels. Precision agriculture seeks to tailor decisions to particular portions of farm fields. There are, however, many constraints to the successful adoption on DSS in agriculture.

DSS are also prevalent in forest management where the long planning horizon and the spatial dimension of planning problems demands specific requirements. All aspects of Forest management, from log transportation, harvest scheduling to sustainability and ecosystem protection have been addressed by modern DSSs. In this context the consideration of single or multiple management objectives related to the provision of goods and services that traded or non-traded and often subject to resource constraints and decision problems. The Community of Practice of Forest Management Decision Support Systems provides a large repository on knowledge about the construction and use of forest Decision Support Systems.

A specific example concerns the Canadian National Railway system, which tests its equipment on a regular basis using a decision support system. A problem faced by any railroad is worn-out or defective rails, which can result in hundreds of derailments per year. Under a DSS, the Canadian National Railway system managed to decrease the incidence of derailments at the same time other companies were experiencing an increase.

EXPERIMENT NO. 5

Title: Green Software Development

Introduction :

Green Software Development (GSD) is a methodical pro-cess which allows a systematic, disciplined and well-organized development of green software products. On the other side, Knowledge Management (KM) is a cyclic pro-cess with a set of activities, techniques and practices that will simplify the process of capturing, creating, storing, dis-tributing and sharing tacit and explicit knowledge. The main asset in software industry is the knowledge that held by em-ployees who develop software products. Moreover, knowledge is also becoming a significant intangible asset to achieve success in the matter of green sustainable develop-ment. As far as we know, there is no research about to im-plement concepts and methods of KM in order to facilitate effectiveness in managing knowledge of GSD. Therefore, there is a research gap on applying KM in GSD industry in order to assist Community of Practice (CoP) in managing their knowledge.

Green Software and Green Software Development (GSD) :

In general, green software is defined as software which of-fers direct and indirect positive effects to the economy, soci-ety and environment subjects from its development life cycle and usage [10]. The researchers narrowed down the defini-tion and defined green and sustainable software is: Software which focuses more in environmental requirements. Moreo-ver, green and sustainable software measures, evaluates and maximizes the optimization of direct and indirect consump-tion of natural resources continuously in development phase. Therefore, the software products can reduce depletion of natural resources and energy, and also minimize the direct and indirect negative impacts to the environment

Other researchers divided the impacts into three: First-order impacts or impacts of ICT supply, which are impacts that directly affect power consumption or natural resources, such as hardware requirement, performance requirement, software product packaging, network bandwidth etc.; Se-cond-order impacts or impacts of ICT usage, which are im-pacts that evolve

from the usage of services offered by the software itself; Third-order impacts or systemic impacts of ICT, which are impacts that caused by diverse interdepend-ent systems that trigger rebound influences. For example if more natural resources are used to produce one specific type of software, but the same amount of resources can produce more of other types of software, then it creates extra demand for these resources.

There is a difference between green software and green by software. Green software is software that runs on environ-mental sustainable manner, with the aim of producing as little as environmental waste and energy consumption as possible in the whole software development life cycle and operation. On the other hand,defined that green by software is the use of applications, methods with the inten-tion of producing as little as environmental waste and energy consumption as possible by means of IT.

GSD is a methodical process which allows a systematic, disciplined and well-organized development of green soft-ware products. It includes few phases: Requirement-Gathering, Design, Implementation, Testing, Deployment/ Installation, Maintenance and Retirement. Programmers need to be coached about the environmental sustainability concerns. Therefore they will be aware of the environmental issues and always write energy efficient code while developing software. A GSD Model that suggests various significant practices in different phases of software development life cycle that able to provide recommendations in developing software program in a more environmental friendly path. Moreover, also proposed a list of methods about how to produce green software products.

EXPERIMENT NO.6

Title: Case Study on Data Center Management Strategies

Data Center management refers to the role of an individual within the data center (data center manager) who is responsible for overseeing technical and IT issues within the data center. This includes computer and server operations, data entry, data security, data quality control and management of the services and applications used for data processing.

Data center management integrates into other IT systems for complete data synchronization including virtual systems, proprietary systems, and automation. Data center management requires a number of tools, IT policies and strategies to create and maintain a secure and efficient data center.

Data Center Strategies:

Business climate changes, business models change, Information Technology certainly changes, and data centers change. Wait – data centers change? Yes, the view that the data center is just a room or facility that is a large capital investment and built every 10 to 15 years, has changed.

This doesn't mean throw more money into it with greater frequency, it means approaching the data center in new ways and making intelligent decisions. The data center strategy is just as important as the IT strategy and the business strategy.

A data center strategy is anything but a panacea. It must address the exclusive requirements of the business and take special consideration for the growing complexity of choices available. Strategic planning is not an attempt to eliminate risk or to forecast what the data center will look like in 15 years, it is taking action to understand what risks to take and what paths will align with the business.

The Data Center Knowledge Guide to Data Center Strategies will explore three actions to take in order to formulate a pragmatic data center strategy:

- **Engage all stakeholders and apply appropriate cost modeling.**

- **Leverage the knowledge of data center trends and technologies to apply to your business.**
- **Evaluate capacity, cost and capabilities to build an optimized data center strategy**.

New installments of **The Guide to Data Center Strategies** will be posted in coming days. Bookmark this page to access the entire series.

Let's take a look at four strategies federal network administrators can adopt to help circumvent this challenge and make their data consolidation efforts a little more secure.

1. Create a clearly defined organizational structure

A tool doesn't know whether an anomaly is an outlier or a threat, but a person certainly does. That's why any modernization or consolidation initiative must be approached from a people-first perspective.

Ultimately, everyone in an agency has a hand in data center operations -- not just IT administrators, but also developers, managers and executives. Accordingly, a clearly defined organizational structure will help ease teams into new processes. Each responsible party should be assigned unique responsibilities and remain in contact with each other. That way, if a breach or outage occurs, the team will be able to work together to address the issue.

2. Follow up with lightweight and flexible procedures

One of the goals behind the federal government's modernization effort is to become more agile and flexible, but this should not be confined to hardware and software. Once the organizational structure is defined and it's time to put processes and procedures in place, agencies should ensure they are highly flexible and can adapt to changing conditions.

Agencies with poor processes and procedures may be tempted to ramp up hiring or double down on implementing rigid processes, but these tactics can create more problems than solutions, resulting in overstaffing and impractical and constantly outdated procedures -- precisely what government is trying to avoid.

3. Encrypt and segment data at rest and in flight

Implementation of the FDCCI was driven by the enormous growth in the amount of government data. In the years leading up to the FDCCI announcement, that growth was so great that agencies were building data centers by the hundreds, which became untenable.

It goes without saying that all data, whether at rest or in flight, must be encrypted, especially as agencies continue their data center transitions. There are simply too many risks involved in the transition process itself -- too many places where data is vulnerable and too many opportunities for increasingly savvy hackers to access information left in the open. Once the data is at rest, there are still areas of concern, including insiders who may or may not have malicious intent.

Data segmentation is also critical, as it can limit the attack damage to a subset of data. Segmenting can reduce the potential for cascading -- and often catastrophic -- network failures. It's another safety net that can minimize the risk of data leaks and ensure five nines of availability.

4. Automate security and gain complete control

As the amount of data increases and data center management becomes more complex, it's no longer feasible to manually coordinate security processes. Therefore, all of the aforementioned strategies should be supported by software that automates data center security management.

Regardless of the size of the data center, administrators must implement solutions that can monitor applications and network activity and deliver patches and updates as necessary. These goals can be achieved with modern performance monitoring software that gives data center managers a complete view of the health of every aspect of their data centers, including compute, storage, network and applications.

Administrators willing to lay the security groundwork now will find their road toward data center consolidation easier to travel. Their efforts will also provide a solid foundation for managing what promises to be a tricky post-consolidation world -- where the amount of data continues to grow even as the number of data centers has shrunk.

Nowadays a data centre is a complex and sometimes daunting environment to manage. Efficient data centre management enables you to plan updates and schedule changes in line with your data

centres' build out. Expansions, data centre updates and server consolidation projects are more popular than ever, but can uncover many challenges.

This guide has been designed to improve your knowledge around data centre management, so you can stay compliant, hit green IT initiatives and targets, lower costs, and increase scalability, in addition to keeping the lights on. Let this data centre managers' guide be your one-stop resource centre for information and advice on data centre management.

This data centre management guide covers management tools, data recovery and virtualisation management.

Data centre management strategy:

Data centre management refers to computer and server operations, data security, data quality control and data entry. Data centre management also includes the management of services and applications that are utilised for data processing. A number of tools and IT policies are needed to firstly create and secondly to maintain a secure and efficient data centre.

How unified storage systems can cut data centre and data management costs
This tip explains how unified storage systems combine support for Fibre Channel, iSCSI, NFS and CIFS protocols in the same hardware to cut down cost and data centre management overheads for UK users.

Server technology and data centre management hot trends right now
Ever-changing server technology and trends are always challenging administrators looking to keep up with the best data centre management practices.

What will become of data centre management?
A member of the ISACA security advisory group paints a clearer picture of data centre management nowadays, compared to what it used to be.

How to keep control of data centre management
If data centre networks are becoming more important, why are networking pros losing their say in the battle for data centre management? Our expert reveals all.

Data recovery centres

Data recovery refers to the restoration of data from disks, tapes, CDs and digital memory cards, which may have been accidentally damaged, power surges, malfunctions or damaged by natural disasters. Part of your data centre management strategy, data recovery also includes disaster recovery planning.

SaaS disaster recovery to the rescue for Royal College of Nursing after hardware at on-premise contact centre fails
The Royal College of Nursing boosted its data centre management by implementing SaaSdisaster recovery, after its on-premise contact centre hardware failed. Found out what they did and how they managed to overcome several challenges.

How data backup and recovery software improved a financial services firm's virtual infrastructure
Tasked with improving data centre management, a financial services firm decided to use data backup and recovery software to optimise its newly virtualised infrastructure and remain compliant.

Disaster recovery and contingency planning security considerations
In a disaster all focus is, naturally, on getting critical business processes back up and running. Whether the disaster is natural or manmade, it's all about recovering business operations as fast as possible and getting employees back to work. You will be grateful that you remembered to work disaster recover into to your data centre management plan, when a disaster strikes.

Disaster recovery plan: Bringing your users back online
A WAN disaster recovery plan is a vital component of an organisation's overall disaster recovery plan, and data centres management, but is sometimes an overlooked one. This tip discusses bringing remote users back online, along with the company's data centres.

Make sure your business survives a disaster – learn how to write and build a disaster recovery plan
Looking to improve your data centre management techniques? Use this guide on developing a disaster recovery strategy and writing a disaster recovery plan, as a way of improving your company's chances of surviving a disaster.

How to select IT disaster recovery services: Top tips
IT disaster recovery services can provide technical expertise if and when your organisation needs to utilise its own DR process. Here are some tips on what to look out for when choosing IT disaster recovery services.

Virtualisation management

Virtualisation management refers to the tools used in managing a virtual environment. Once an environment has been virtualised data centre management is very important. Processes such

as provisioning, patching, troubleshooting and monitoring can become challenging, despite virtualisation offering many overall benefits.

Virtualisation management: Beginners guide to virtual data centre management
All you need to know about virtualisation management, including news and expert advice. Virtual data centre management tips are available here, including the latest on VMware, advice on licensing and capacity planning.

Managing virtualisation: How server virtualisation affects the network
Virtualisation has become a vital part of many IT systems; as a result, it affects all aspects of the network. IT managers need to understand the various ways in which server virtualisation affects the network, especially I/O bottlenecks. Better data centre management can enhance your data centre's network.

Virtual server networking: A guide to managing virtualisation and capacity planning
This virtualisation networking guide takes a look at capacity planning for virtual server networking and managing virtual networks.

A storage virtualisation directory for IT professionals
If you're working on expanding your data centre management skills, check out these storage virtualisation training courses. Courses include virtualisation instruction for storage professionals, with topics in beginner and advanced VMware virtualisation training.

How the Co-operative Group used desktop virtualisation to cut costs
The Co-op used AppSense's Environment Manager and Application Manager as part of itsCitrix XenApp environment in a bid to standardise some of it data centre management tools. The data centre management tool helped look after applications to meet governance and compliance issues on licensing. Read about the Co-op's project.

Open source in local government: Red Hat virtualisation implementation for Finnish city
Running multiple workloads on virtual servers has increased hardware utilisation from 10% to as much as 80% for the City of Kankaanpää, in Finland. In addition, the life span of existing desktop PCs has been extended. Due to this improvement in data centre management, desktop

PCs can now serve as re-purposed thin clients, hosting virtual desktops run in the data centre, which therefore require less capacity from physical clients.

EXPERIMENT NO.7

Title: Cloud computing as Green IT initiative through visualization

1. Overview

Due to the recent development in geographic sciences, massive data are available hosted by data vendors, which calls for a transparent and scalabe visualization system. With the emerging cloud computing and ubiquitous computing, new paradigm enabling fast interactive the spatial temporal visualization can be formed for different research communities. The new framework should handle the distributed data and computing sources, which also be able to adapt to various clients in a collaborative environment. At the same time, under the regulation of spatial principles, these techniques should be transparent and easy for scientists from Earth Sciences to develop their own visualization system and visual analytical tools.
Our center proposes a virtual globe based visualization framework to visualize large scale Earth Science data. The NASA's World Wind Virtual Globe is used as the multidimensional visualization platform to promote the understanding of scientific modeling. To enhance the ability to visualize massive data, we introduce octree based data organization as well parallel processing in distributed computing environment. Considering the limitation of bandwidth, progressive transmission strategy is developed as well.
The project starts from June 2009, and is funded by NASA GIO managed by Ms. Myra J. Bambacus, and the project is managed by Dr. Chaowei Yang.
To demonstrate the capabilities of this framework, we show three types of time enabled visualization based on the output by WRF (Weather Research and Forecasting) -NMM (Nonhydrostatic Mesoscale Model) model. 1)Display the transformation of climatic parameters, such as the dust density, from the ground surface to a certain height continuously, 2) show climate evolution clearly with time lapses, 3) simulate comprehensible climate change process with animations generated simultaneously by selecting interested routes and 4) volume rendering of dust storm. The development has been integrated into spatial web portals to support access by the public.

2. Activities

2.1 System Architecture

Figure 1 shows a general architecture of distributed visualization with Virtual Globe. The server side is responsible for the data generation, preprocessing and organization with support of cloud computing resources. The client side is responsible for the display or local visualization. The massive data are first processed at the server side and then send to the client in the form that the viewer of the client can display.

Currently, our work focuses on the 4D visualization of massive scientific data, where an integreated server is present. Beyond the computing environment, clients are able to view the visual analytical results in a timely fashion.

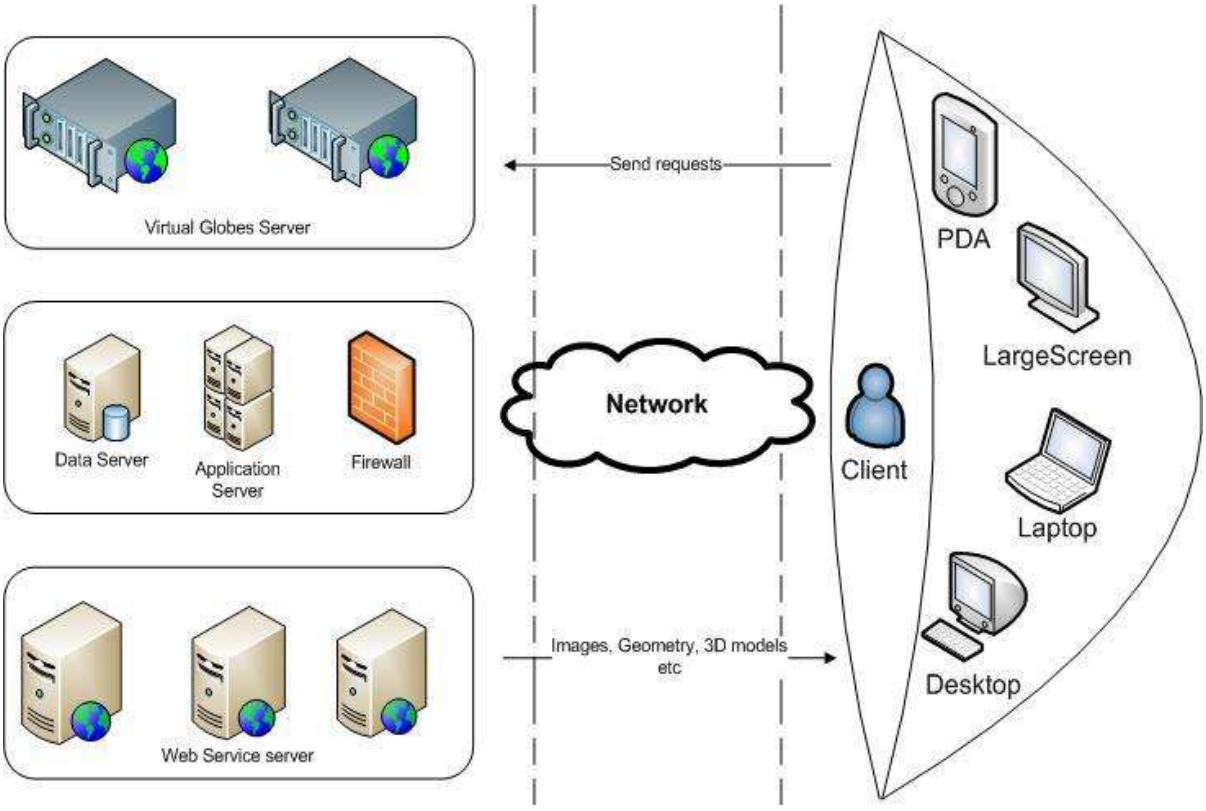


Figure1 System architecture of distributed visualization with Virtual Globe

2.2 Data organization and study area

Dust storm data produced by Nonhydrostatic Mesoscale Model (WRF) - Weather Research and Forecasting (WRF) are used to demonstrate the our work. The spatial coverage of data is from 25.560N to 41.480N along the latitude direction and from 123.000W to 96.510W along the longitude direction. The most southwestern states of United States are located in this region. In this area, due to the high possibility of dust storm, the observation dust storms are of highly

environmental concerns.

The original data from the model are stored in NetCDF files. These array oriented datasets also have spatial information associated with them. Due to the characteristics of the data structure, a regular octree is introduced to organize the 4D data, The octree structure is typically used to compress data and construct multiresolution model. In this case, the multiresolution model can reduce the transmission and visualization intensity by a Level of Details (LOD) mechanism.

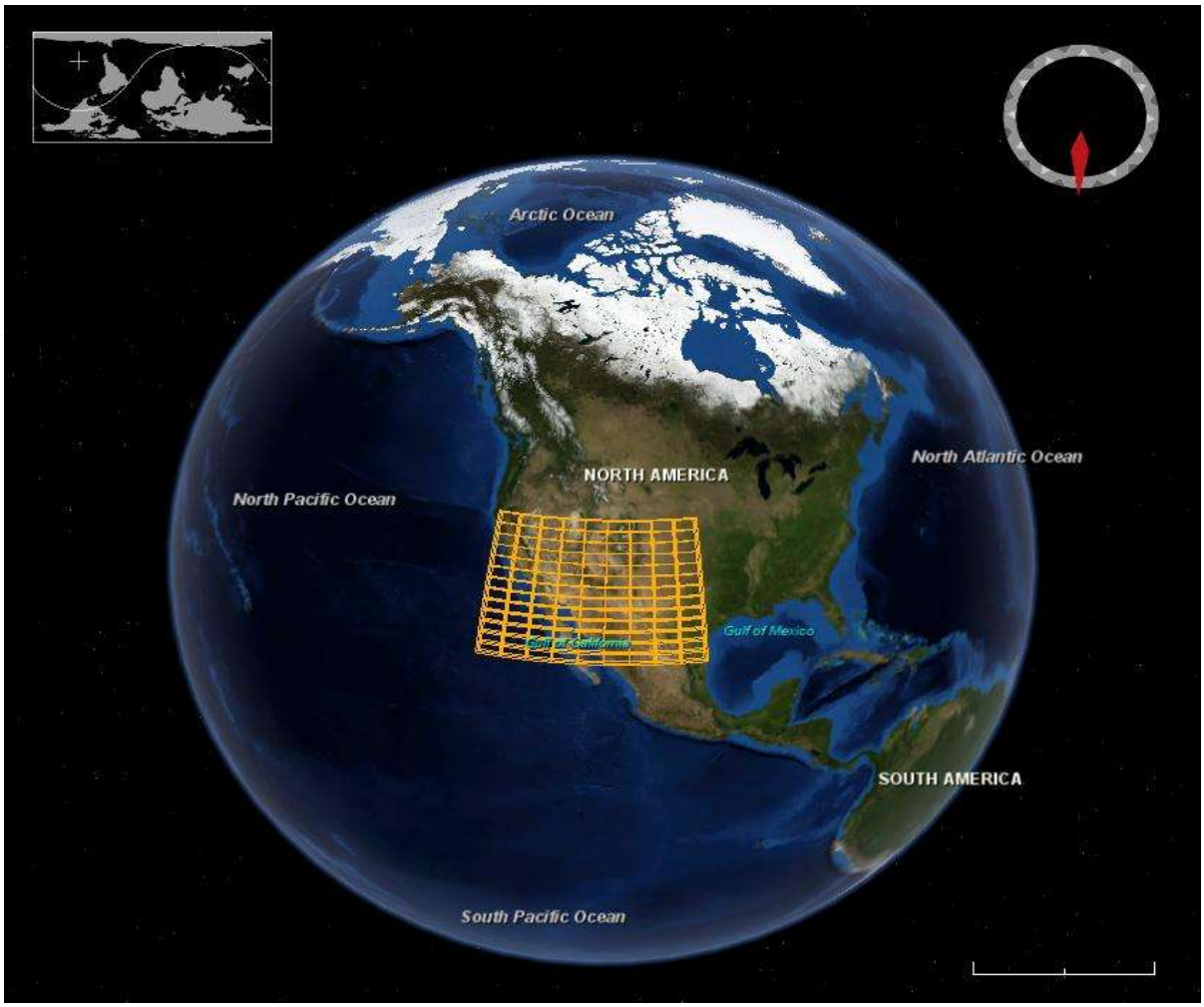


Figure 2 Study area of dust storm simualtion

2.3 Progressive transmission

With the multi-resolution model, the progressive transmission is implemented. The transmission process typically starts from lower resolution to higher resolution. A progressive rendering

process is implemented while the visualization intensity is under controlled. The levels of the octree correspond to the progressive transmission level in general. The node and the leaves of the octree are interactively inquired during the transmission process.

2.4 Multithreading processing with multicore machine

The parallel strategy makes use of available computing resources through assigning processing tasks to different computing units. This is critical when large scale data and computing resources are present. Under such circumstance, octree along can not meet the requirement of organizing increasing volume data. Therefore, based on the effective data organization, the task is further decomposed into several subtasks and distributed to different sources. In this way, the massive data can be handled and visualized.

Our current solution is to distribute original data into several data blocks and process each data block respectively. In this process, two bottlenecks may be encountered, which are the data overloading and excessive visualization intensity. So before each bottleneck occurs, a decomposition process is done to distributed data to computing resources. Thus the double multithreading processing promises a fully use of shared facilities.

2.5 Client visualization

Three types of visualization are developed to help researchers to understand and analyze the geospatial data. There are surface view providing information at the same pressure or elevation layer, vertical profiles showing the data along selected routes and volume representation replicating the dust storm event on the Earth. The first two types of visualization have less rendering intensity than the volume rendering, which could be implemented at the server side. The volume rendering is locally implemented in this framework, which will be further distributed in the next phase.

3. Accomplishment

3.1 Progressive transmission

According to the storage part, it is clear that from the coarser level to finer level, the data storage increases. The storage for Level 1 data is about 3KB, which is the coarsest level. By contrast, Level 6, as the finest level, costs more than 4MB memory space.

In terms of transmission speed, both wired and wireless based transmissions are done to test the performance of transmission. The test environment is internet with a speed of 23.3 mps also the

wireless with a speed of 18.5 mps. As the data is hosted by the data sever in our lab in the university, the test is done by off-campus access. Table1 shows the transmission time for each level of data. The average transmission speed for wireless is about 28KB per second and for wired is about 79KB per second.

For the first four levels, there are no significant differences in terms of transmission time, which are less than 1 seconds. When it comes to the fifth and the sixth level, a discernable increase in transmission time is observed.

Level	Evaluation			
	Storage	*Compression ratio*	*Total Time of Transmission*	
			Wired(ms)	*Wireless(ms)*
1	3KB	$6.2*10^{-4}$	37	107
2	4KB	$8.4*10^{-4}$	50	142
3	10KB	$2*10^{-3}$	126	357
4	73KB	$1.5*10^{-2}$	924	2607
5	577KB	$1.2*10^{-1}$	$7*10^{3}$	$20*10^{3}$
6	4782KB	1	$6*10^{4}$	$17*10^{4}$

Table 1 Progressive transmission results of the NetCDF file

3.2 Visualization

3.2.1 Surface view

Surface view exhibits the changes of dust density across the region of the same pressure layer. Figure illustrates the dust density at the lowest pressure level, which is the closest to the earth surface. The highest density of dust zones denoted by red color appear in while lowest density denoted by the blue color .Combing with the based map provided by the World Wind, these low

density areas are part of New Mexico, Texas in the United States and northern Mexico.

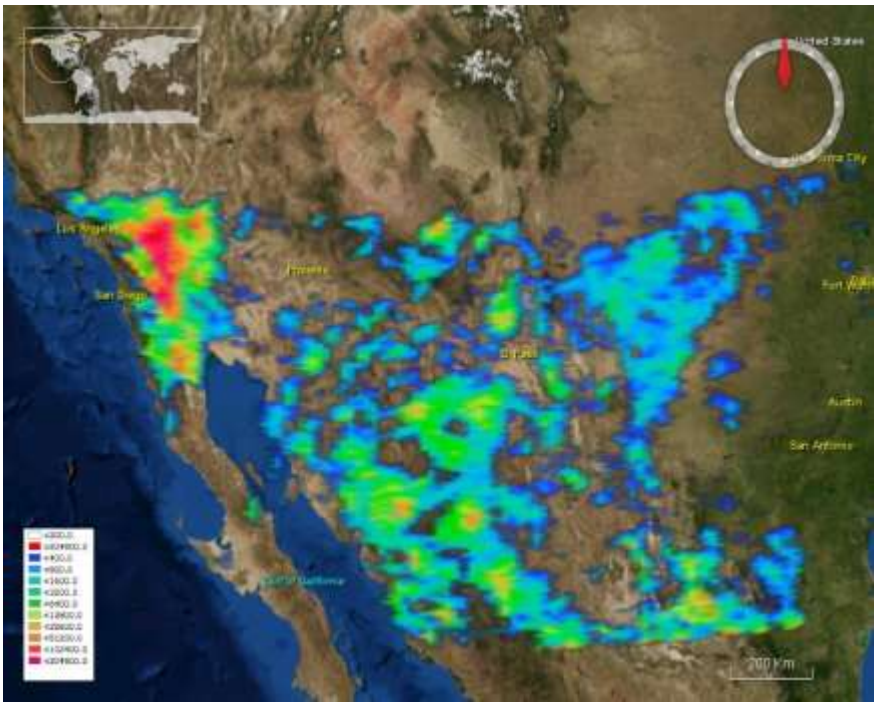


Figure 3 Surface view of dust storm density data Figure4 shows time series pattern of the dust storm through a vertical transaction. According to the figure 2, the density changes as elevation increases. Traversing the upper pressure layers, the density of dust storm decreased to zero. The vertical profile indicates the particular of dust storm is more likely to accumulate at lower layers and dissipate at upper layers. Similar to the surface view, the high density accumulates in northwestern area, which tends to be a center of the dust storm. And the value of density gradually decreased as the distance to the center increased. The six frames with an initial time of. According to the figure, the high density first appeared at the middle part of the routes and then moved to the end of the routes. This informs the transport process of dust particles to some degree. In addition, in figure (e), some dust particles were predicted in the upper pressure layers but few particles were found at their lower layers

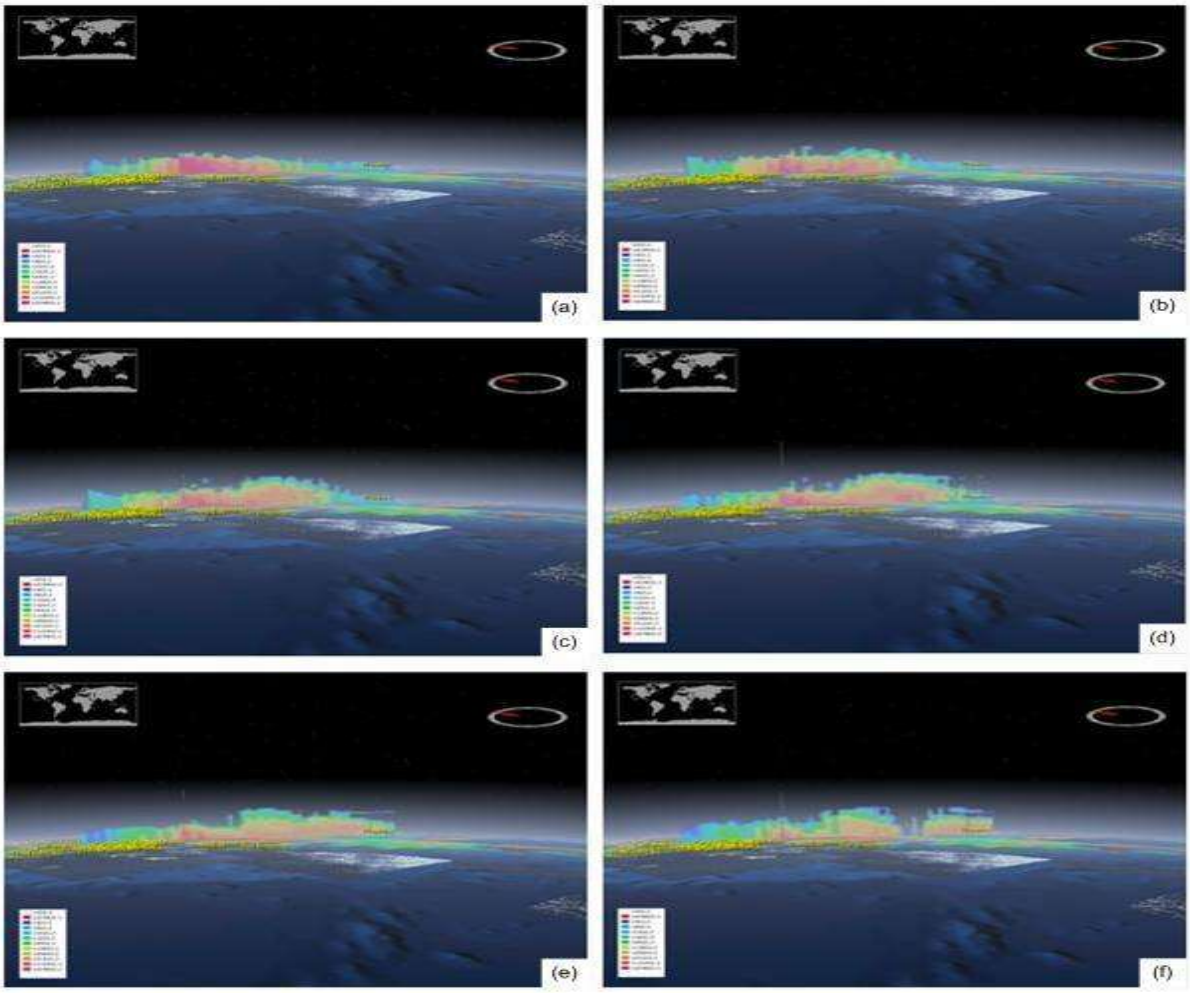
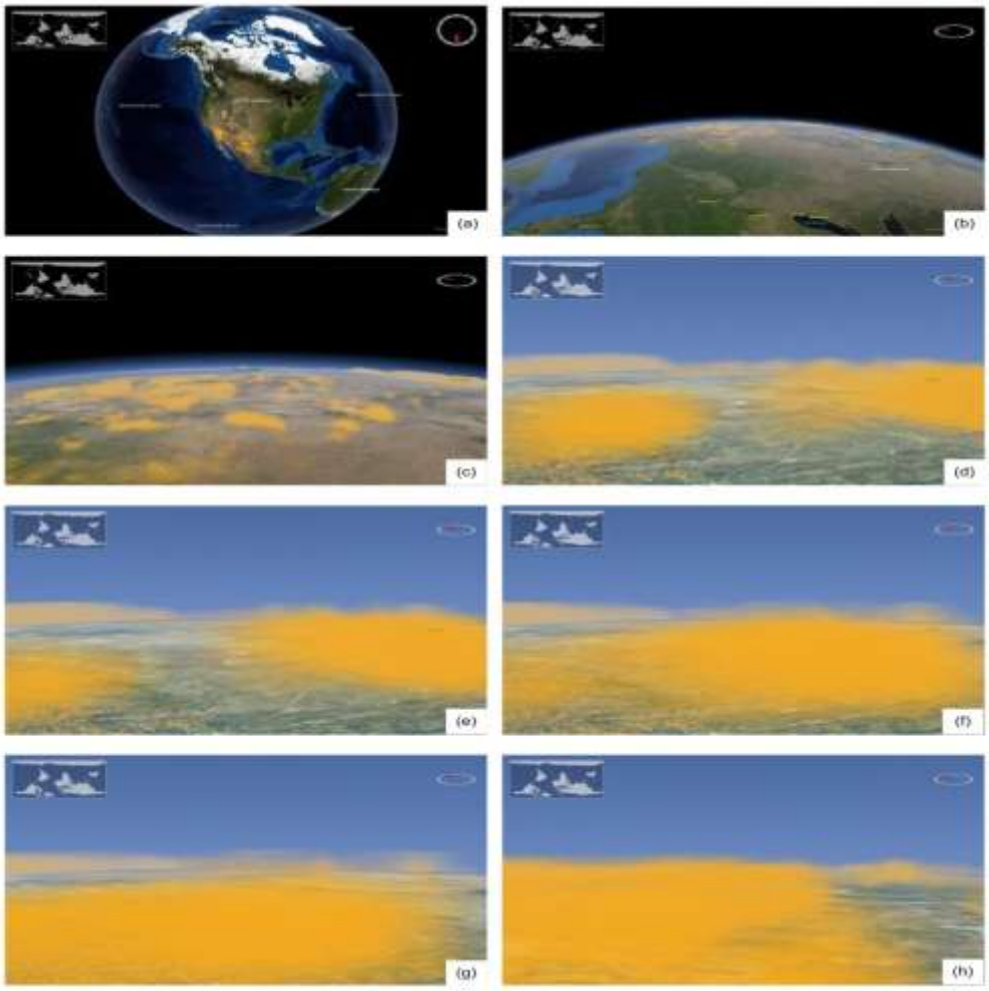


Figure 4 Vertical view of dust density along selected routes

3.2.3 Animation

Besides profile of data, the dust storm simulation through the volume rendering is another way to model the dust storm. This allows a complete view of dust storm particles. The figure below shows the 4D visualization in the World Wind. It is clear that with time changes, the particles moves forward.



4. Reasons Why Cloud Computing is Also a Green Solution:

Cloud computing has arrived, big time. Forrester estimates that worldwide spending on public cloud computing services will grow from $25.5 billion in 2011 to $160 billion in 2020, a 22 percent annual growth rate. Businesses are increasingly substituting cloud-based for internal resources to capture benefits like faster scale-up/scale-down of capacity, pay-as-you-go pricing, and access to cloud-based applications and services without buying and managing on-premises infrastructure.

But we've heard little so far about the efficiency and green attributes of cloud computing. That is starting to change as we hear from cloud or as-a-service providers about the architecture and power sources behind their cloud infrastructure, and as we all start to analyze customer implementations of cloud resources vs. on-premises alternatives.

Cloud infrastructure addresses two critical elements of a green IT approach: energy efficiency and resource efficiency. Whether done in a private or public cloud configuration, as-a-service computing will be greener for (at least) the following three reasons.

1. Resource virtualization, enabling energy and resource efficiencies.

Virtualization is a foundational technology for deploying cloud-based infrastructure that allows a single physical server to run multiple operating system images concurrently. As an enabler of consolidation, server virtualization reduces the total physical server footprint, which has inherent green benefits.

From a resource-efficiency perspective, less equipment is needed to run workloads, which proactively reduces data center space and the eventual e-waste footprint. From an energy-efficiency perspective, with less physical equipment plugged in, a data center will consume less electricity.

It's worth noting that server virtualization is the most widely adopted green IT project implemented or planned, at 90 percent of IT organizations globally into 2011.

2. Automation software, maximizing consolidation and utilization to drive efficiencies.

The presence of virtualization alone doesn't maximize energy and resource efficiencies. To rapidly provision, move, and scale workloads, cloud-based infrastructure relies on automation software.

Combined with the right skills and operational and architectural standards, automation allows IT professionals to make the most of their cloud-based infrastructure investment by pushing the limits of traditional consolidation and utilization ratios.

The higher these ratios are, the less physical infrastructure is needed, which in turn maximizes the energy and resource efficiencies from server virtualization.

3. Pay-per-use and self-service, encouraging more efficient behavior and life-cycle management.

The pay-as-you-go nature of cloud-based infrastructure encourages users to only consume what they need and nothing more. Combined with self-service, life-cycle management will improve, since users can consume infrastructure resources only when they need it -- and "turn off" these resources with set expiration times.

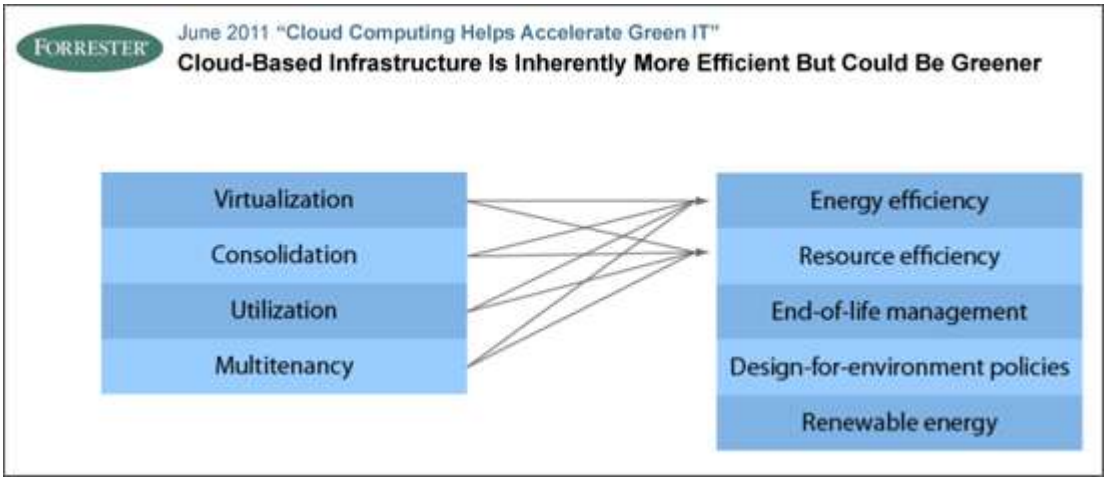
In concert, the pay-per-use and self-service capabilities of cloud-based infrastructure drive energy and resource efficiencies simultaneously, since users only consume the computing resources they need when they need it.

4. Multitenancy, delivering efficiencies of scale to benefit many organizations or business units.

Multitenancy allows many different organizations (public cloud) or many different business units within the same organization (private cloud) to benefit from a common cloud-based infrastructure.

By combining demand patterns across many organizations and business units, the peaks and troughs of compute requirements flatten out. Combined with automation, the ratio between peak and average loads becomes smaller, which in turn reduces the need for extra infrastructure. The result: massive efficiencies and economies of scale in energy use and infrastructure resources.

So migrating workloads to cloud resources, or developing new workloads in a cloud-native environment, can help an IT organization contribute to energy-efficiency and sustainability goals. But so far, cloud services and their providers are doing little to help their customers on three other facets of a green IT program (see chart below).



IT buyers that want to maximize the green contribution of cloud computing services should press their suppliers on these dimensions:

• **Renewable energy sources.** If cloud providers are truly going to position their services as green, they must invest in renewable energy sources. The reality is that even the most energy-efficient data center can have a significant carbon footprint because they are typically getting 70 percent of their electricity from greenhouse-gas-emitting fossil fuels, like coal. Ideally, centralized cloud data centers would be powered by renewable sources of energy, like wind, solar, or hydroelectricity.

To date, however, cloud providers have prioritized other factors in designing and locating their data centers, including the cost of land, cost of power, property taxes, data privacy regulations, and access to power, bandwidth, local skills, and customers.

• **Design-for-environment policies.** In 2010, 59 percent of IT buyers included green criteria in their evaluation and selection of IT equipment, up from only 25 percent in 2007. However, energy efficiency trumps all other design-for-environment characteristics, such as recyclability, reduction of toxic chemicals, reduction in packaging, and longevity.

Moreover, the weight of environmental criteria is used as a tiebreaker, not a deal breaker, and is always subordinate to price, features, and reputation. With that in mind, it's safe to assume that the same mentality is being applied in context to cloud-based infrastructure.

• **Environmentally sound end-of-life.** By pushing the limits of consolidation and utilization, cloud-based infrastructure minimizes the e-waste footprint upfront by requiring less physical equipment. But what happens when this equipment reaches its end-of-life?

While all organizations dispose of their end-of-life IT equipment in some shape or form, e-waste policies have long been an afterthought and are the least mature IT asset life-cycle management process. Just because cloud minimizes e-waste upfront, don't assume those managing cloud-based infrastructure have policies to ensure e-waste is redeployed, resold, donated, or recycled.

Cloud computing can be an important facet of an enterprise IT organization's push to be greener. And "the green cloud" (which certainly needs a better marketing label!) can also contribute to meeting critical operational goals:

- Reduce costs. Consolidation means fewer servers, which in turn means lower cooling and space requirements, which means lower energy costs.
- Comply with regulation. By tapping more efficient and therefore lower-emitting resources, cloud computing customers can reduce their carbon emissions and be better-positioned to meet regulatory standards.
- Improve resiliency. Consolidation and improved utilization create more space, more power, and more cooling capacity within the same facility envelope. And tapping into public cloud providers offloads management of those resources from the customer to the service provider.

Green IT and the Cloud

The claim is that cloud computing is ‘green’. Green IT is all about using less energy (and cleaner sources of energy).

To an extent, cloud computing does this by being more efficient at storing data and programmes and by ensuring that computer capacity is just right (so that idle servers aren’t sitting around drawing electricity from the grid. One of the techniques for achieving this is virtualisation).

There is also the possibility that because of the scale of shared cloud computing services, less resources and energy are used. In other words, it is more environmentally friendly to have ten companies' servers and software services in a single data centre than it is for each of those ten companies to have their own smaller data centres, servers, etc. This seems like good sense.

How the cloud supports green IT computing

Environmental issues are a common part of most IT strategies, as awareness of carbon footprints and the levels of energy use associated with technology have become widespread. But how can cloud computing help to improve sustainability, and what role should the cloud play in green IT planning? This HP whitepaper examines the green credentials of cloud computing.

What is green IT?

Green IT aims to use computers and IT resources in a more efficient and environmentally responsible way. Businesses are becoming increasingly dependent on technology, with staff working on desktops, laptops, netbooks and smartphones all day, which are connected to servers running 24/7.

Cloud adoption helps UK councils hit green targets

Adopting virtualisation and cloud computing systems can save companies a great deal in energy costs, as the number of internal servers used can be reduced and application management can be outsourced to a cloud provider. The cloud provider's energy usage can be consolidated and made more efficient by supporting multiple numbers of cloud customers with server capacity and application services - such as software-as-a-service (SaaS) - as a result.

Because the SaaS pay-as-you-go model allows firms to choose only the specific applications they need at any given time, instead of having to pay for an entire suite of software on their premises, they can save money. IT staff costs can also be reduced because upgrade and maintenance responsibilities will be shouldered by the cloud provider.

If firms use dedicated hosting services via the cloud, they can also shop for "green" hosting providers that use solar, hydro or wind power, as part of their energy supply from the grid. A number of hosting companies in the UK and other parts of Europe have already sourced some kind of green power supply.

Scalable computing

Infrastructure-as-a-service (IaaS) via the cloud offers scalable computing power to companies without requiring them to bring hardware services in-house. With IaaS, cloud providers supply the infrastructure as needed to support businesses running their own applications. By converting infrastructure to a periodic and predictable cost, a company can avoid unexpected repairs and upgrades while being assured of maximum uptime.

IaaS provides the scaling of processing power, so that users are never caught in the position of overload, while avoiding the costs of under-utilised capacity. Like SaaS, the cost of IT staffing is reduced through reduced internal maintenance and upgrade and support costs.

Another way to save power is to consider thin-client or "server-based computing" to cater to all or parts of your business. A thin-client computer using a simple web browser and/or remote desktop virtualisation software can use up to about half the energy of a standard desktop loaded with its own dedicated applications. The applications can instead be accessed on demand from a remote server from any location via the cloud.

In addition, firms can save further cash and become greener at the same time by moving their documents and other data into the cloud. Instead of staff being forced to use inefficient and time-consuming filing cabinets filled with hard copies, and copying and printing out endless pieces of paper for themselves and others, firms can make those documents available electronically by storing them securely in the cloud. Staff can then access them from any location at any time.

This saves on paper and ink and reduces printer carbon emissions. It can also reduce confusion, as often there is only ever one version of a document to cope with. Anyone who needs to can access previous versions or edits, and in most cases there is very little need to print anything. If you need to send a copy to someone you can simply email it to them.

Does the cloud have an environmental impact?

Environmental campaigning organisation Greenpeace has previously published reports which have questioned the amount of energy being used up by data centres hosting cloud services. The report criticised some large companies who use the cloud to deliver on-demand services to both consumers and businesses. These included Google, Yahoo, Facebook, Apple and Microsoft.

Greenpeace said these companies' data centres, providing cloud-based services, were not tapping into enough green power sources on the power grid, such as wind and hydro power. While Google and Yahoo have built individual data centres with an improved greener energy mix, Greenpeace said most of the power at those sites relied on "dirty" sources of energy, like coal and nuclear. The reliance on dirty power applied to other data centres used by those two firms and the data centres operated by the other companies covered in Greenpeace reports.

While some see nuclear power as a green energy when compared to energy created from coal, those in the green movement don't. And putting aside the Greenpeace reports, there are still many who believe that adopting cloud services may well save firms money through the consolidated

supply of services, but that the positive environmental impact is uncertain, as more energy is simply being used in extremely large and remotely connected data centres.

Power consumption and energy-efficiency

Basically, the impact of cloud computing on power consumption will depend on its energy-efficiency, its impact on overall demand for computing, and the extent to which cloud computing providers power their operations with electricity from sustainable sources.

Analyst Ovum says that cloud computing typically boosts energy efficiency per unit of output. But, on the other hand, the cloud could be expanding the scope of computing, thereby driving higher aggregate electricity consumption.

This effect – technological progress enabling greater efficiency, increasing usage, and driving power consumption upwards rather than downwards – is known as "Jevons paradox." The concept was invoked to explain the apparent increase in coal consumption, following the improvements in steam engine efficiency in the 19th century.

Greenpeace has challenged cloud providers to use their market clout to drive green changes in the electricity supply chain to reduce carbon emissions. Ovum agrees, saying, "In this regard, we agree with Greenpeace: greater reliance on renewable or zero-carbon energy sources in the cloud computing generation is imperative."

EXPERIMENT NO. 8

Title:Simplified Smart Grid
A Case Study

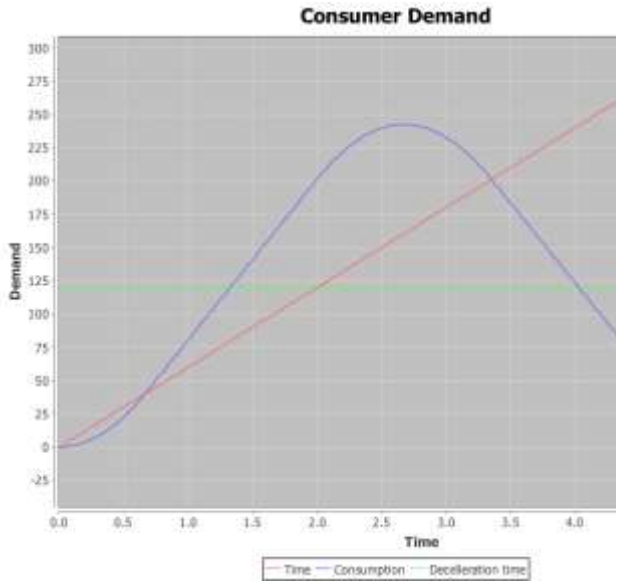
> Description_

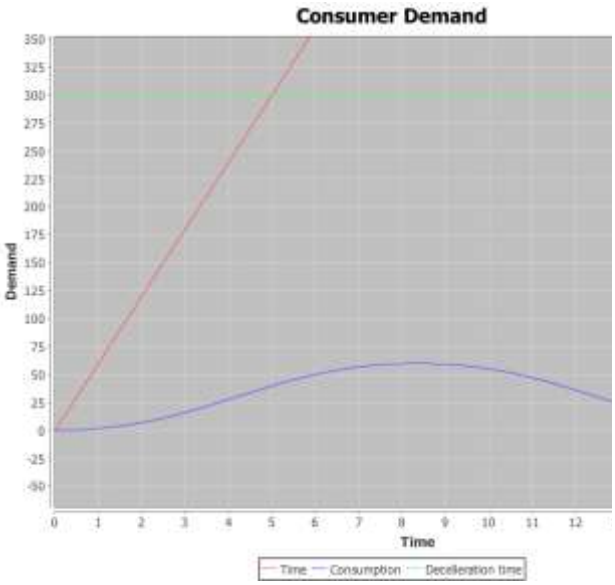
"A **Smart Grid** is a form of electricity network using digital technology. A smart grid delivers electricity from suppliers to consumers using two-way digital communications to control appliances at consumers' homes; this could save energy, reduce costs and increase reliability and transparency if the risks inherent in executing massive information technology projects are avoided. The "Smart Grid" is envisioned to overlay the ordinary electrical grid with an information and net metering system, that includes smart meters. Smart grids are being promoted by many governments as a way of addressing energy independence, global warming and emergency resilience issues."

> Model Description_

In this case study, we implement a simplified Smart Grid scenario in the Distributed Probabilistic-Control Hybrid Automata framework. Our objective is to establish a basic working Smart Grid infrastructure and then check its behaviour using Statistical Model Checking by verifying interesting properties specified in Quantified Bounded Linear Temporal Logic. We obtain traces of 24h duration in this case study, each representing one day's consumption. The model consists of 4 types of entities:

. **Consumer**: this type of entity generates power demand that varies according to the time of day and its own lifecycle. It is an abstract representation for sets of appliances that are turned on at roughly the same time for roughly the same duration. To more accurately represent daily consumption of energy, several elements of this type can exist at the same time, and the overall demand is nothing more than the sum of their demands. Depending on the type of day at which consumers are created in the system, they can behave in one of two ways: high-consumption short-span or low-consumption long-span, an illustration for which can be found below.

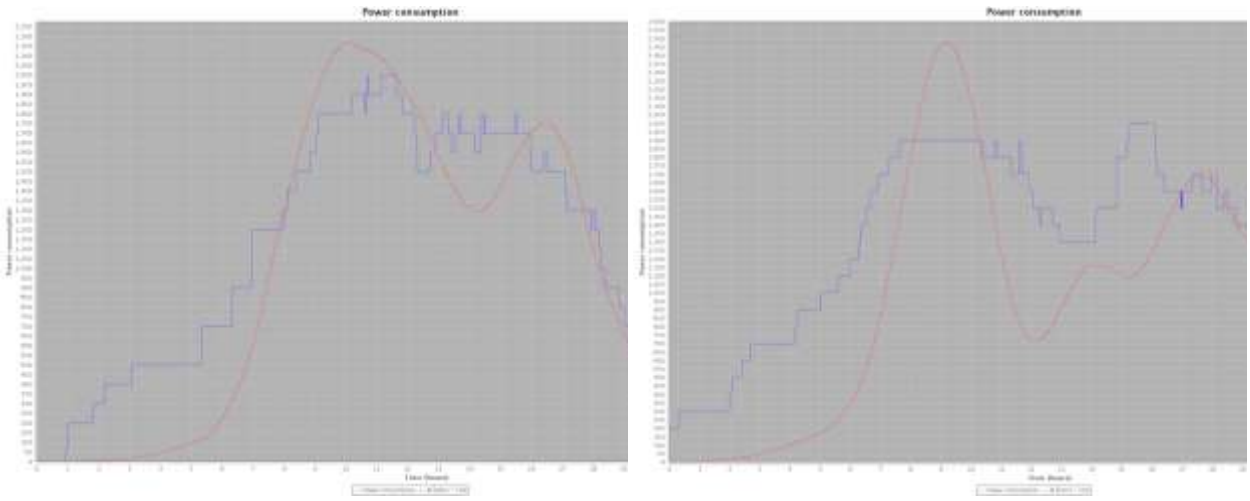




. **Power Generators** are the producers of energy. The Smart Grid must dynamically match the output of generators to the demand of the consumers. Generators can have different properties, mostly related to how fast they adapt power output (e.g. maximum values of its first and second derivatives). Our current model consists of a single, high-output generator.
. The **Power Controller** (PC) is the Smart Grid's nerve centre. It maintains up to date information about consumer demand and generator output. It is in charge of adapting each generator's output to match demand. Periodically, it applies a policy for changing a generator's requested output to match power and demand.
. The **Consumer Controller** (CC) is responsible for creating and keeping track of the consumers in the system. It represents the **probabilistic environment**. Each trace of the CC and its consumers contains energy consumption over the duration of one day. We have a bound of 20 on the number of consumers, and they are spawned with a different probability depending on the time of day. At an interval given by a Normal random variable of 5 minute mean and 1m variance, the CC decides whether to receive messages or spawn another consumer. The probability distribution over these choices changes according to the time of day. If there is a message indicated a consumer has left the system, it is received and the state updated accordingly. Otherwise, the probability of spawning a new element is given by the following table.

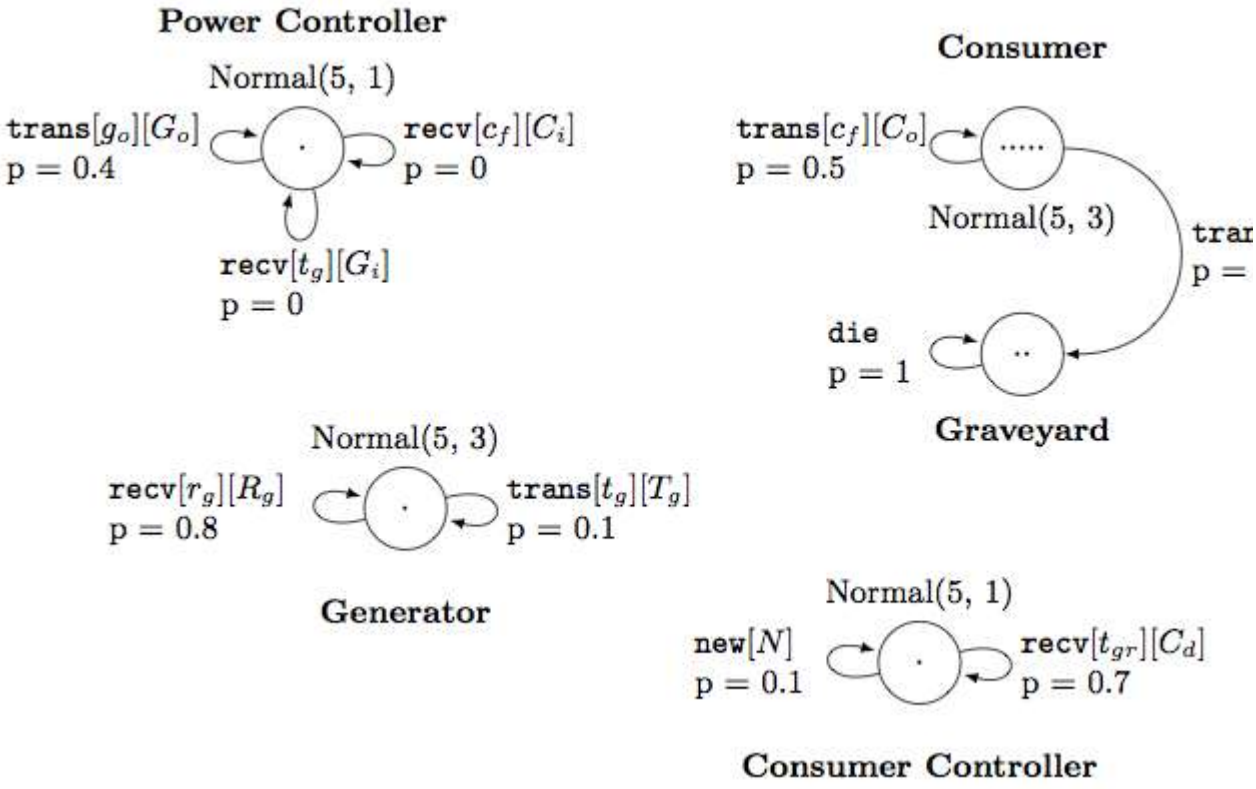
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
0.20	0.05	0.07	0.10	0.10	0.20	0.10	0.20	0.10	0.20	0.10	0.20	0.10	0.20	0.20	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

High-demand consumers are spawned between 4am to 12pm, and low-demand but long-span for the rest of the day. We thus model high consumption throughout the day and lower consumption during the evening and night. Two examples of daily consumption generated by the current model can be found in the following graphs.



> Automaton_

It is very hard to graphically represent DPCHA. An incomplete representation can be found below. We say it is incomplete because we do not show each element's state, nor do we show the transition probabilities for more than one element in each position (although there can be multiple elements at the same position, as the number of dots in each location node show).



Zero probability in receive action edges simply means that no messages are available, or that other edges, for one reason or another, are more important. For instance, more important messages may be received first.

. In the **generator** component of the automaton, r_g outputs a reusable channel based on the generator's ID (which is part of its state), through which messages directed at it can be received. R_g, associated with the receive action, updates internal desired power generation according to a message sent by the power controller. In the transmit action, t_g is a constant function that returns a channel for communicating generator output, and T_g updates the time of the last feedback message.
. In the **consumer**'s looped transmit action, c_f outputs a constant channel used for consumer feedback. C_o, as T_g, simply updates the time of the last sent message. The transmit action that jumps an element to the "graveyard" uses t_{gr} to get a channel for communicating the exit of a consumer element. In this case, I is the identity function, i.e. it has no effect on state. Once at the graveyard, the consumer immediately exits the system.
. The **power controller** receives generator output feedback messages through t_g and updates its internal expected generator output with G_i. C_i works the same way for consumer feedback. G_o and $g_o$use a policy for deciding to change the output of which generator (in our case, just one), and by how much. Internal state is changed to reflect the desired changes.
. The **consumer controller** maintains up to date information about which consumers exist. In particular, C_d changes the internal state of the CC to indicate that the consumer source of the message has exited the system. The CC is also in charge of creating consumers with the edge annotated with a new action. N is the function that decides the new element's state. Its location will always be the consumer location, but the state and evolution depend, as seen previously, on the time of day.

Messages sent over feedback channels that are used by several elements in the system generally contain an element's ID. This ID never changes over time. This allows the receiving element's state to be updated according to this ID. The PC, for instance, maintains information about all the generators and all the consumers stored in its state space, changing information using the indices received in messages.