A Cloud Computing Technology
for Smart Learning

Mohamed Al-Azab, Ph. D
Higher Technological Institute
10th of Ramadan City
Egypt
info@hdf.org.eg

Takeshi Utsumi, Ph.D., P.E.
Founder and V.P. for Technology and
Coordination of Global University System
New York, U.S.A.
utsumi@columbia.edu

Abstract:

This paper covered the basis of cloud computing and how it came into existence. The services involved, and the types of cloud platform used in the implementation of the cloud.

The educational system and the virtual interaction of the system was also analyzed, basing all facts on how the education system can comfortably migrate to the cloud irrespective of all its challenges.

The adoption of cloud into the education system was finally discussed with the software and hardware needed for the adoption process. Recommended were now introduced in making sure the entire adoption and implementation process into the cloud by the education system is a success.

Keywords: Cloud Computing, Virtual Environment, E-Learning, IaaS, PaaS, SaaS.

1- INTRODUCTION:

Cloud computing is a way to increase capacity or add capabilities without investing in new infrastructure, training new personnel, or licensing new software. Cloud computing delivers a single application through the browser to thousands of customers using a multitenant architecture. For the customer it

means no upfront investment in servers or software licensing; on the other hand, the provider with just one app to maintain, costs are low compared to conventional hosting.

Figure1, Cloud computing logical diagram

Cloud Computing is Internet-based computing, whereby shared resources, software, and information are provided to computers and other devices on demand, like the electricity grid. Cloud computing is a paradigm shift following the shift from mainframe to client–server. The term "cloud" is used as a metaphor for the Internet, where Typical cloud computing providers deliver common business applications online that are accessed from another Web service or software like a Web browser, while the software and data are stored on servers. Most cloud computing infrastructures consist of services delivered through common centers and built on servers. Clouds often appear as single points of access for all consumers' computing needs. The term paradigm shift(or revolutionary science), as a change in a fundamental model of events.
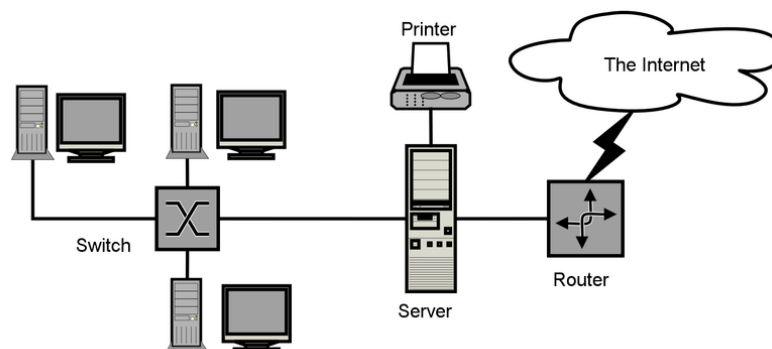

Figure2 Cloud computing function

It is known that business software is generally any software program that helps a business increase productivity or measure their productivity. Cloud computing derives characteristics from, but should not be confused with:

- Mainframe — powerful computers used mainly by large organizations for critical applications, typically bulk data processing such as census, industry and consumer statistics, enterprise resource planning, and financial transaction processing.

- Client–server model – Client–server computing refers broadly to any distributed application that distinguishes between service providers (servers) and service requesters (clients).

- Peer-to-peer – a distributed architecture without the need for central coordination, with participants being at the same time both suppliers and consumers of resources (in contrast to the traditional client–server model).

In general, Cloud computing customers do not own the physical infrastructure, instead avoiding capital expenditure by renting usage from a third-party provider. The users can avoid capital expenditure on hardware, software, and services when they pay a provider only for what they use. Consumption is usually billed on a utility (resources consumed, like electricity) or subscription (time-based, like a newspaper) basis with little or no upfront cost.
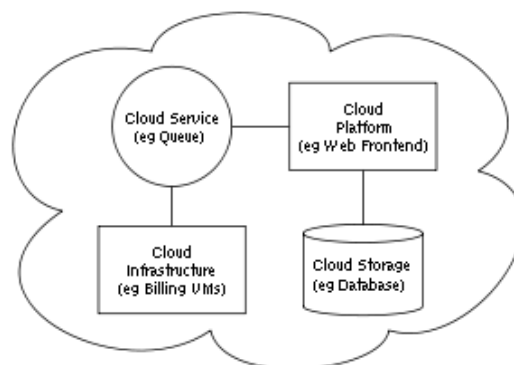

Figure3. Cloud computing sample architecture

Amazon played a key role in the development of cloud computing by modernizing their data centers after the dot-com bubble, which, like most computer networks, were using as little as 10% of their capacity at any one time just to leave room for occasional spikes. Cloud application services or "Software as a Service (SaaS)" deliver software as a service over the Internet, eliminating the need to install and run the application on the customer's own computers and simplifying maintenance and support, enabling customers to access applications remotely via the Web. Cloud platform services or "Platform as a Service " deliver a computing platform and/or solution stack as a service, often consuming cloud infrastructure and sustaining cloud applications.
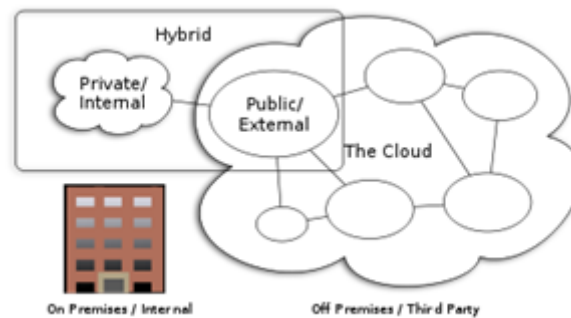

Figure 4. Cloud computing types

Cloud Computing types:

- Public cloud- via web applications/web services

- Community cloud-A community cloud may be established where several organizations have similar requirements and seek to share infrastructure so as to realize some of the benefits of cloud computing. this option is more expensive but may offer a higher level of privacy, security and/or policy compliance. Examples of community cloud include Google's "Gov Cloud".

Cloud computing security:

The relative security of cloud computing services is a contentious issue which may be delaying its adoption. Some argue that customer data is more

secure when managed internally, while others argue that cloud providers have a strong incentive to maintain trust and as such employ a higher level of security.

Cloud Computing Research:

A number of universities, vendors and government organizations are investing in research around the topic of cloud computing. IBM and Google announced the multi- university project designed to enhance students' technical knowledge to address the challenges of cloud computing .HP, Intel Corporation and Yahoo! announced the creation of a global, multi-data center, open source test bed, called Open Cirrus, designed to encourage research into all aspects of cloud computing, service and data center management. Open Cirrus partners include the NSF. In July 2010, HP Labs India announced a new cloud-based technology designed to simplify taking content and making it mobile-enabled, even from low-end devices. Called SiteonMobile, the new technology is designed for emerging markets where people are more likely to access the internet via mobile phones rather than computers.

2- GLOBAL UNIVERSITY SYSTEM (GUS)

The use of the modern digital telecommunications, will be needed to create mutual understanding among nations, cultures, ethnic groups, and religions.   GUS is a worldwide initiative to create advanced telecom infrastructure around the world for global e-learning and e-healthcare/ telemedicine. The philosophy of GUS is based on the belief that global peace and prosperity would only be sustainable through education. Education and job skills are the keys in determining a nation's wealth and influence. The aim is to achieve "education and healthcare for all," anywhere, anytime and at any pace.GUS helps higher educational and healthcare institutions in remote/rural areas of developing countries to deploy broadband Internet in order for them to close the digital divide. These institutions act as the knowledge center of their

community for the eradication of poverty and isolation through the use of advanced Information and Communications Technologies (ICT). Learners will be able to take their courses from member institutions around the world to receive a GUS degree, thus freeing them from being confined to one academic culture of a single university or country. Learners and their professors from participating institutions will also form a global forum for exchange of ideas and information and for conducting collaborative research and development with the use of emerging GRID networking technology.

GUS has group activities in the major regions of the globe in partnership with higher learning and healthcare institutions. They foster the establishment of GUS in their respective regions, with the use of an advanced global broadband Internet virtual private network. These will then connect the universities with secondary and elementary schools, libraries, hospitals, local government offices and NGOs, etc., by broadband wireless Internet at drastically discounted rates (Figure 5).
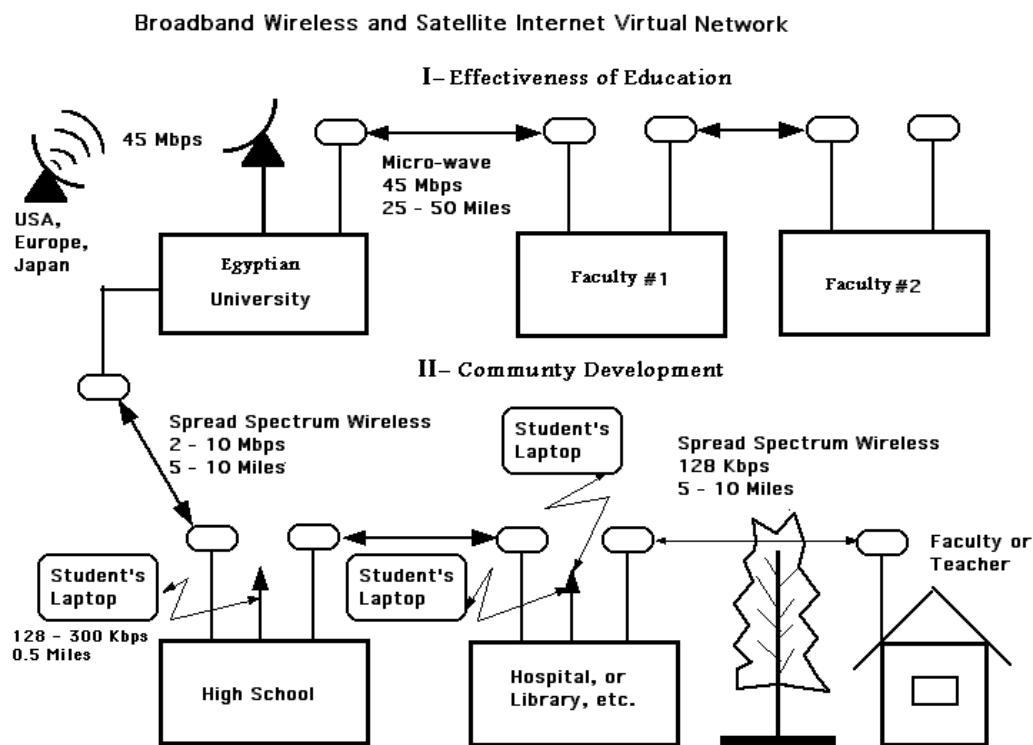

Figure 5. Broadband wireless and satellite Internet virtual network

GUS is headquartered at the Global E-learning Center at the University of Tampere in Finland, under the direction of the UNESCO/UNITWIN Networking Chair, held by Dr. Tapio Varis (Varis, et al, 2003). Those institutions affiliated with GUS become members of the GUS/UNESCO/UNITWIN Networking Chair Program. GUS projects are now starting in many countries of Africa, Asia and Siberia and have received inquiries from several other countries for review.

3- CREATION OF GLOBAL UNIVERSITY SYSTEM IN EGYPT (GUS/EGYPT)

3.1. Background

Egypt is one of the Middle East and North Africa countries (MENA). The country has a population of about 80 million. The literacy level stands at 25% as of UNDP Human Development Index (2010) (Table 1) [1]. Egypt's telecommunication teledensity (fixed and mobile) is 20% [1]. At the economic front, Egypt's statistics are as follows:

Egypt Human Development Report

Poor (as % of total households)	20.1
Ultra poor (as % of total households)	5.8
% of total public expenditure spent on:	
Education	19.7
Health	7.2
Social security	6.1
Public expenditure on education (as % of GDP)	6.7
Public expenditure on health (as % of GDP)	2.4
GDP per capita LE	5537.6
Unemployment rate %	9.0

[1] www.undp.org

Table 1

3.2. Concept

The Misr.Net and Local Community Development Network (LCDNs) (HDF, Private sectors, Universities, ITI, ..etc) will be established in Egypt to

foster the development of e-learning and e-healthcare/telemedicine pilot projects using broadband Internet technology in order to enhance teaching and learning capabilities. The project will partner with Global University System (GUS) to facilitate connectivity among current e-learning efforts around the world and provide support and guidance to selected pilot projects serving as models for adoption.

Satellite and fixed wireless broadband technologies will be used to connect universities, hospitals, libraries, local government agencies, elementary and secondary schools. University in Egypt will be used as a network regional hub and act as the secretariat of the consortium (GUS/Egypt) of those organizations. The network will link up the various project sites across the country using VSAT, microwave radio links and wireless local loops.

- Proposed GUS/Egypt will link rural communities and support distance learning and e-health/telemedicine for:

  1. Regional technological infrastructure and

  2. Programs and academic content to increase stakeholder capacity.

- Both infrastructure and programs are supported by:

  1. Exchanges of educational courses and their credits through broadband Internet,

  2. Promotion of community development, and

  3. Collaborative research.

- Immediate focus is on community e-health/telemedicine and participatory governance because those programs are foundational and best developed for rapid start-up.

- The E- University brings together resources of an extensive network of universities in Egypt as well as specialized programs from many international universities.

- GUS/Egypt will provide tools, systems, partnerships and funding opportunities to strengthen local efforts for remote learning and health system.

3.3. Objectives

The project aims to achieve the following objectives but not limited to:

a. To promote the development of communities (universities, elementary and secondary schools, hospitals and others), with the use of high-speed wireless Internet connections for e-learning and e-healthcare associated with content development.

b. To promote the use of information and communication technologies for economic development and wealth creation in the country by the participation of farming and pastoral communities for improving agricultural and animal husbandry practices and to engage them in knowledge and information sharing by harnessing the emerging broadband connectivity to enhance these activities as well as to improve welfare.

c. To promote the establishment of tele-immersion environment in the country, which emphasizes the critical elements of the people's cultural heritages, history of the people as well as their daily experiences based on their indigenous knowledge systems (IKS) by linking them to centers of learning and promoting ICT to local language development and use in research, recording and retrieval.

d. To create GUS/Egypt in order to establish technological alternatives to promote the above objectives as well as learning-ware, digital libraries, virtual laboratories and virtual universities with high-speed wireless and satellite technology, which is designed to deliver cost-effective transmission of voice, text, and video content anywhere in Egypt.

3.4. Goals

The goals to be pursued in this project are to establish:

i. Broadband Internet network (MISRNET) of universities, research centers and institutions of learning that will enhance interaction among these institutions and, at the same time, link them with their communities for enabling their life-long learning to increase their productivity for poverty eradication, and

ii. Local Community Development Networks (LCDNs), which is to link diverse rural communities for knowledge sharing through exchange of experiences.

4- PROJECT JUSTIFICATION

In view of the challenges that Egypt is facing in the education and healthcare sector, the project will help to mitigate the problems and its consequences. The exchange of quality and quantitative information in the broadband network will contribute to the efforts of Egypt in bridging the digital divide. The economic benefits that will come from connecting rural communities to the broadband network will be a meaningful and sustainable tool to poverty alleviation, which is in line with the Egyptian Initiative for Building The Information Society.

4.1. GUS/EGYPT

GUS/Egypt will affiliate with Global University System (GUS), which headquarters is located at the University of Tampere, Finland. LCDN will act as the secretariat of the GUS/Egypt to provide overall administration and co-ordination of GUS and emerging programs. The creation of GUS/Egypt will also be emulated in other developing countries.GUS/Egypt will be a consortium of higher educational and healthcare institutions and other local stakeholders, etc., and will serve as the overall framework for initiatives entailing rural and community-based development activities, especially (not exclusively) those pertaining to Healthcare, Education, Life Sciences, Physical Sciences, Earth Sciences, Communication Sciences, Management Sciences, Humanities, Economic and Social Sciences, Agriculture and Fishing.

GUS/Egypt is designed to provide tools to enable the people of the region to participate fully in their own development and to bring their culture forward, thriving with the influx of opportunities, and contributing to new prosperities. GUS/Egypt will provide a modernizing tool to fast-track peace-building, peace-consolidation and socio-economic development of the participating communities, and contribute to the accelerated integration of Egypt into the world economy, export and trade facilitation, rural and community-based economic growth.

5- WORKING GROUPS OF GUS/EGYPT

At the planning workshop (see below), following working groups will be formed, as following a previous project of creating GUS/Siberia (Utsumi, 2006-a) (Figure 2).

5.1.Infrastructure

GUS programs and services will be delivered via regional satellite hubs, typically located at a major university, that connect via broadband Internet to educational resource cites in the E.U., U.S., and Japan (Figure6). In a sense, the regional satellite hub is to be the major Internet Service Provider (ISP) for not-for-profit organizations in the region and the gateway to the outside world. The GUS/Egypt consortium member institutions will be connected to very high speed Internet. Hopefully, its member institutions will then connect with secondary and elementary schools, universities, libraries, hospitals, local government offices and NGOs, etc., through broadband wireless Internet at drastically discounted rates.

The buildings with a broadband Internet connection will then also become relay points for the low-cost "WiMAX (Worldwide Interoperability for Microwave Access)" networks that are now rapidly appearing in Japan, USA and Europe. This advanced wireless communication with laptop computer will make e-learning possible for anyone, anywhere, and anytime with capabilities of Internet telephony, fax, voice mail, e-mail, Web access, videoconferencing, etc. This is not only to help local community development, but also to assure close cooperation among higher, middle and lower levels of education.

The GUS/Egypt will assure broadband Internet availability with combined use of fiber optic cables and wireless, where feasible. The aim is to provide a solid IT backbone that ensures uninterrupted Internet connectivity and satellite-driven communication systems.
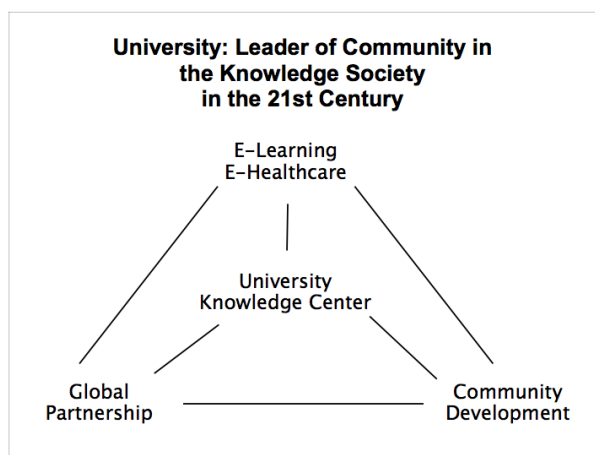
Figure 6: University as Leader of Community

5.2. Global E-Learning/ E-Healthcare/Telemedicine

The GUS will be anchored in universities in Egypt to enhance e-learning to their students and life-long learners in their community for the development of technical and professional human capital and attendant enlightenment etc., and to ensure the sustainability of global e-learning via links with universities and other academic establishments in North America, Europe, Japan and more industrially advanced countries.GUS/Egypt will increase access to customized communications and related resources which mobilize and encourage hospitals and e-healthcare centers to use the Internet and hybrid technologies to provide patients online second opinion for various infectious and chronic diseases, including malaria, HIV/AIDS, polio, cancer, heart disease and other conditions. Existing university and community programs will help define communications and medical information management systems, which reduce obstacles to good health management.

Doctors will also be taught (through a train-the-trainers program) how to use computers effectively to order tests and drugs, which has been shown in studies to reduce medical errors and flag patient drug allergies. Nurses will also

be taught to use computers to track patients as they go through the primary healthcare centers and hospitals.Medical records will be computerized, including lab results, drug data and records of office visits in text files, which would be standardized in a format that can be shared. Crosscutting priority will be to encourage government and donors to develop incentives to encourage health administrators, doctors, health workers to use the Internet.

6- COMMUNITY COLLABORATIVE RESEARCH AND DEVELOPMENT

Learners, faculties, and public policy makers can promote community development and many other advances at a local, regional and even on a global scale. GUS/Egypt consortium member institutions will act as the flagship of their community development, particularly on the facilitation of entrepreneurial initiatives for the creative economy of Knowledge Society in the 21st century.The learners and their professors from participating institutions will form a global forum for exchange of ideas and information and for conducting collaborative research and development. Researchers can partner with colleagues in more advanced countries, and perform joint collaborative research and development with the use of virtual reality/virtual laboratories on inexpensive Beowulf mini super-computers (clusters of PCs) for experiential/constructive learning and creation of knowledge through the emerging global GRID computer networking technology.The GCEPG project with a globally distributed computer simulation system, focusing on the issue of environment and sustainable development in developing countries, can be used to train would-be decision-makers in crisis management, conflict resolution, and negotiation techniques basing on "facts and figures." It will also help decision makers construct a globally distributed decision-support system for positive sum/win-win alternatives to conflict and war. The idea involves interconnecting experts in many countries via the global Internet to collaborate in the discovery of new solutions for world crises, such as the deteriorating global environment,

and to explore new alternatives for a world order capable of addressing the problems and opportunities of an interdependent globe. With global GRID computer networking technology and Beowulf mini-supercomputers using cluster computing technology we plan to develop a socio-economic environmental simulation system and a climate simulation system in parallel, both of which will be interconnected on a global scale. GUS will supply game players, simulationists and technical support from around the world.
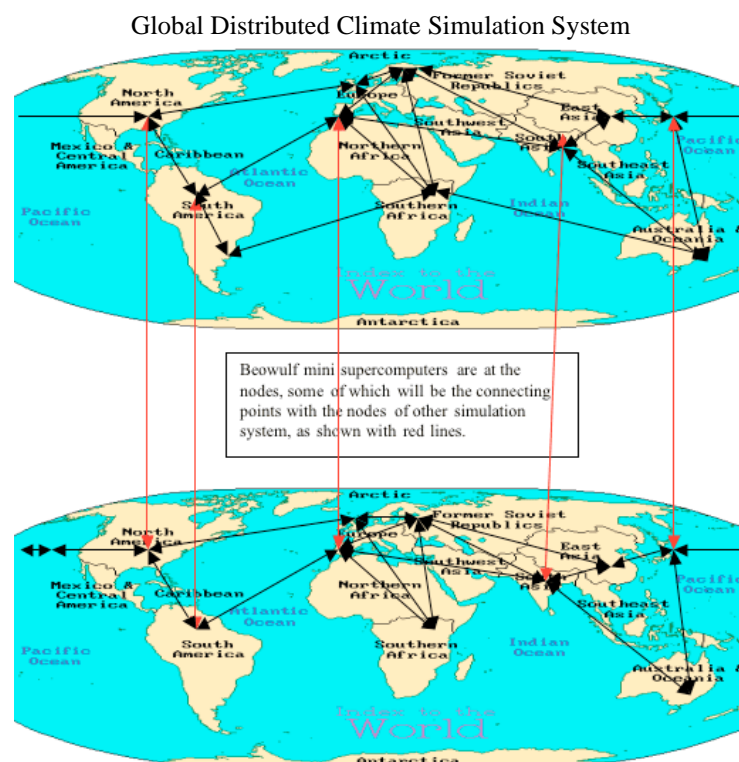
Global Distributed Climate Simulation System

Global Distributed Socio-Economy-Environmental Simulation System

Figure 7: Globally Collaborative Environmental Peace Gaming (GCEPG)

Gaming/simulation is the best tool we have for understanding the world's interwoven problems and the solutions we propose for them. Systems analysis for systemic change at the global level is a precondition for any significant resolution of today's global scale problems. The understanding gained by scientific and rational analysis and critical thinking based on 'facts and figures' would be the basis of conflict resolution for world peace and, hence, ought to provide the basic principles of global education for peace. On the other hand,

Quantitative Policy Analysis of Global Socio-Economic-Energy-Environment Development (GSEEED), GSEEED Project, an initiation of the GCEPG Project mentioned above, with a globally distributed computer simulation system will focus on the sustainable development of socio-economic-energy-environment system in Japan, the US, China, Russia, and the other relevant countries. Researchers in those countries will construct their simulation models, which will be interconnected through broadband Internet to form Globally Distributed Socio-Economic-Energy-Environmental Simulation System. GUS/Egypt will also join in this project as Egypt being a gateway to other Arabic countries.

The initial focus on energy security will be on the quantitative policy analysis of global interrelations and interdependencies among those countries with the deployment of gas pipeline from Tomsk, Siberia to China, and the construction of hydroelectric dam in the Republic of Altai, Siberia where .

This project will then demonstrate integrated and synergistic approach among grassroots, government, university, stakeholder, etc. Use of graphic info modeling/mapping and potential "gaming" on key issues and solutions will assist each group's ability for standardized data gathering and situational analyses, projecting out possible outcomes for more informed decision making and activities.   It brings together most sophisticated university-based mathematical modeling techniques and experts and regular people who can then more easily see--at a glance--how issues and outcomes can impact and interact each other.

This project will train local experts for leadership development, in relation to strategic use of technologies and cooperation among stakeholders for more effective advocacy, informed policy, public understanding and participation and concrete community development.This project will construct Globally

Distributed Socio-Economic-Environmental Simulation System through broadband Internet, which will have two tier system:

a. One for training young would-be decision makers in crisis management, conflict resolution, and negotiation techniques basing on "facts and figures" and

b. The other for helping decision makers construct a globally distributed decision-support system for positive sum/win-win alternatives to conflict and war.

Globally Collaborative Innovation Network (GCIN), As a powerful consequential extension of our GCEPG project, we will foster creativity of youngsters around the world. Researchers in developing countries can co-work with colleagues in advanced countries to perform joint collaborative research with use of virtual laboratories for experiential/constructive learning and creation of knowledge through the global GRID technology, thus forming Globally Collaborative Innovation Network (GCIN).

7- EXPECTED OUTPUT

It is expected that GUS will provide the following benefits to students and participating universities:

- Broadband Internet connection, supporting modern distance education via the World Wide Web

- Help member universities build a network of facilitators to support e-Learners

- Learners may take courses from different member universities, obtaining their degree from the GUS, thus freeing them from being confined to one academic culture of a single university or country

- Learners and faculties can promote the exchange of ideas, information, knowledge, and joint research and development of Web-based teaching materials

- Researchers in developing countries can partner with colleagues in more advanced countries, and perform joint collaborative research and development with the use of virtual reality/virtual laboratories for experiential/constructive learning and creation of knowledge through the emerging global GRID computer networking technology

- Learners, faculties, and public policy makers can promote community development and many other advances at a local, regional and even on a global scale.

The expected project output Social Benefitswill be in the following:

It is expected that broadband wireless and satellite Internet, available to universities, secondary, primary and elementary schools and hospitals, will promote the interaction among young people from different areas of Egypt with young people from the rest of the world. Content will be developed and delivered to the network users for education and telemedicine use. The success of Giza community pilot project will be used as a model for replication of the project in Egypt and other countries in Africa.The main focus of the proposed broadband Internet (see Figure 8) is either or both of satellite and terrestrial (microwave and/or spread-spectrum) wireless approach in viewpoints of the region's geographical constraints and their cost effectiveness. These infrastructures will be used by the participating institutions and their efficiency will be higher than the use of traditional networks. The project will involve the participation of the community and other interested groups. This will not only contribute to the bridging the digital divide, but also create new job opportunities to the graduates of the universities, and the local community.

The implementation of a modern communication technology will reduce the risks threatening the country. A faster communication network will increase the ability of people to engage in productive activities in a more satisfying way and thereby contributing to the drive for poverty reduction and improvement in their quality of life. Technological propagation is not an end in itself, but a means to a larger end with clear and compelling community benefit.

8- ACTION PLAN

The first practical step in this process is the preparation of a detailed program document encapsulating the diverse components of the enterprise. This requires a fact-finding mission to Egypt to be undertaken by Prof. Utsumi of GUS. During this period, an initial stakeholder meeting will be held for formal confirmation of project partners in Egypt, and to form working groups mentioned above. This trip must include following:

- Visits to participating colleges, universities, hospitals, local governments and community based programs in Egypt:

- Establishment of working groups for each aspect of collaborative proposal writing, with representation from the communities, institutions, and governmental agencies that will benefit from the initiative.

- Planning Workshop for Convening of Working Groups (about 4 months after the above action)

- Each working group will produce proposal with necessary steps to be taken during the following three months with their budgets, which will be summarized into a proposal. This proposal with precise budget for the next design phase will be used for the fund raising.

The emphasis will be placed on the design of tech/facilitator support and marketing survey for sustainability of GUS/Egypt with their applications and

others at anchoring institutions, mentioned above. This proposal will be submitted with endorsements from various UN, governmental, universities, NGO agencies to the nearby Japan Embassy for the Japanese ODA fund (see below).

9- DESIGN PHASE WORKSHOP

This phase will conduct market survey, feasibility study, system design of infrastructure; design of support system and administration structure, as well as to construct a business model for maximum effectiveness and sustainability and replication in other locations. This phase would produce a project proposal for deployment, for which Japanese ODA fund will cooperate with federal and regional government for funding as GUS/Egypt.GUS projects will combine the Japanese government's Official Development Assistance (ODA) funds and Japanese electronic equipment (including technical assistance and training) with the Internet technology and content development of North America and Europe.

10- CONCLUSIONS

The GUS program is a comprehensive and holistic approach to building smart and creative communities in developing countries for e-learning and e-healthcare/telemedicine. Initiatives are underway to create the necessary infrastructure and educational liaisons, and some near-term educational access is expected. Early efforts have included international teleconference technology workshops that have tested the satellite/wireless technology that will be used in GUS.

GUS and GCEPG are clearly ambitious programs that cannot be achieved by any one group, university, or national government. The programs require substantial collaborative contribution of ideas, expertise, technology resources and funds from multiple sources. Those who value the vision of GUS and GCEPG are invited to join this great and noble enterprise.

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