GLOBAL E-LEARNING FOR GLOBAL PEACE

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Abstract

The Global University System (GUS) [Utsumi, et al, 2003] is a worldwide initiative to create advanced telecommunications infrastructure for access to educational resources across national and cultural boundaries for global peace. GUS aims to create a worldwide consortium of universities to provide the underdeveloped world with access to 21st Century education via broadband Internet technologies. The aim is to achieve "education and healthcare for all," anywhere, anytime and at any pace.

The GUS works in the major regions of the globe with partnerships of higher education and healthcare institutions. Learners in these regions will be able to take their courses from member institutions around the world to receive a GUS degree. These learners and their professors from partner institutions will also form a global forum for exchange of ideas and information and for conducting collaborative research and development with emerging global GRID computer network technology.

Globally Collaborative Environmental Peace Gaming (GCEPG) project [Utsumi, 2003]) with a globally distributed computer simulation system is to train would-be decision-makers in crisis management, conflict resolution, and negotiation techniques basing on "facts and figures." Globally Collaborative Innovation Network (GCIN) will be its powerful consequential extension and foster creativity of youngsters around the world.

Keyword*: global education, GRID, globally distributed computer simulation, globally collaborative environmental peace gaming and innovation network*

1. Background

Economic interdependence among nations and cultures is spawning a global economy. Globalisation also highlights clashes of divergent cultures and belief systems, both political and religious. If global peace is ever to be achieved, global-scale education, with the use of the modern digital telecommunications, will be needed to create mutual understanding among nations, cultures,

ethnic groups, and religions. The Internet is the future of telecommunications and can be a medium for building peace.

GUS has a long history of concept development and testing of multiple hardware configurations suitable for remote Internet access. These initial steps are summarized in our recent book, *Global Peace Through the Global University System* [Varis, et al, 2003]. The purpose of this book is to make internationally known the philosophy, past and present actions, as well as future plans of the GUS, which have resulted from years of development and a seminal working conference at the University of Tampere, Finland, in 1999, with funds from the World Bank, US National Science Foundation and others.

The editors' paper in the book, "Creating Global University System" [Utsumi, et al, 2003] emphasizes the important role of higher educational institutions not only as the knowledge centers of their community for the eradication of poverty and isolation, but also as the gateway to the world for collaboration of creating new knowledge in global knowledge society of the 21st Century. This paper summarizes GUS accomplishments and shows that GUS is poised to begin implementation of broadband Internet access and academic programs in remote areas of the world.

2. Global University System

GUS is a worldwide initiative to create satellite/wireless telecommunications infrastructure and educational programs for access to educational resources across national and cultural boundaries for global peace. GUS aims to build a higher level of humanity with mutual understanding. The GUS helps higher educational institutions in remote/rural areas of developing countries to deploy broadband Internet in order for them to close the digital divide. Education and job skills are the keys in determining a nation's wealth and influence.

The GUS has task forces working in the major regions of the globe with partnerships of higher education and healthcare institutions. Learners in these regions will be able to take their courses, via advanced broadband Internet, from member institutions around the world to receive a GUS degree. These 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 with emerging global GRID computer network technology.

2.1 Proposed Infrastructure

As diagrammed in Figure 1, GUS programs and services will be delivered via regional satellite hubs, typically located at a major university, that connect via high-speed satellite (~ 45 Mbps) to educational resource cites in the E.U., U.S., and Japan. 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 major university may also be connected to very high speed broadband Internet, as similar to the optical fiber network at 3 Gbps of the Multimedia Broadband Internet (MBI) of the Ethiopian government.

Regional hubs link to branch campuses or other regional educational institutions via microwave (~ 45 Mbps) over relatively short distances (25-50 miles). Communication from the hub and branch campuses to local sites, over distances up to 10 miles, is to be achieved by spread-spectrum wireless (~ 2-10 Mbps) Internet networks, which do not require licenses in most countries.

The buildings with a broadband Internet connection will then also become relay points for the low-cost "Wi-Fi (wireless fidelity)" networks at 10 Mbps 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.

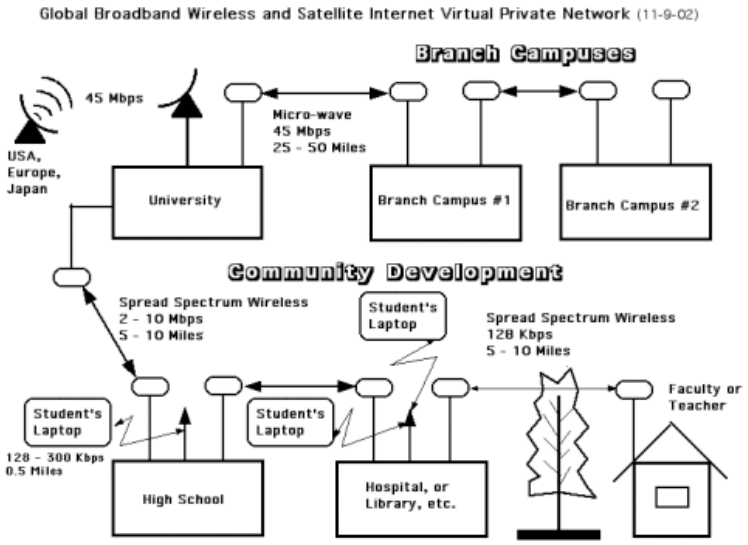


Figure 1

2.2 Current GUS Projects

The major university will then connect to secondary and elementary schools, libraries, hospitals, local government offices and NGOs, etc., with broadband wireless Internet at drastically discounted rates or free of charge. GUS projects are now starting in Ethiopia, Nigeria and Malawi in Africa, Cambodia in Asia, etc., and have received inquiries for the same from others, too.

2.3 Organization

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. Currently, institutions with faculty members who are participating in GUS development projects are numerous in various countries. GUS will serve as an educational broker for universities, thus helping them gain international influence and access to students that they would otherwise not

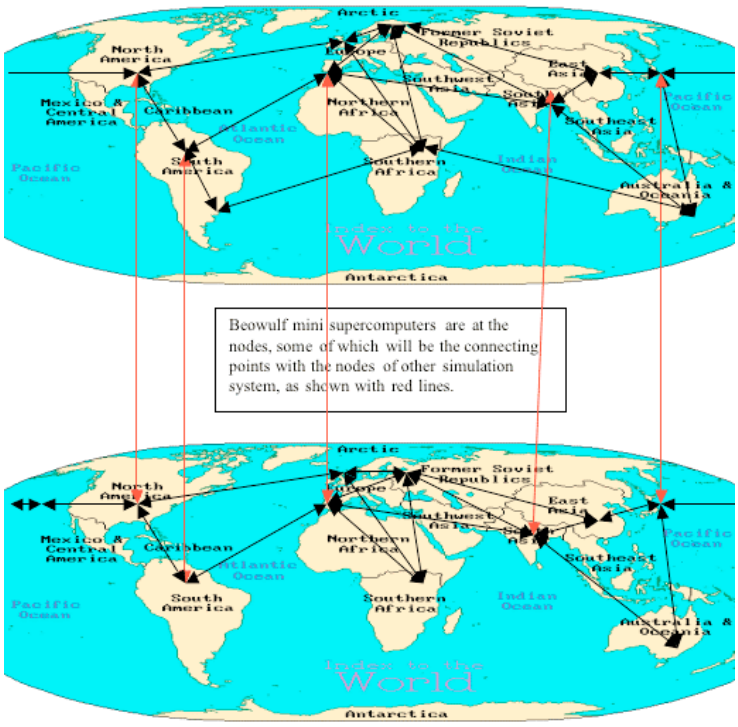
reach. Those institutions affiliated with GUS become members of the GUS/UNESCO/UNITWIN Networking Chair Program.

3. Toward Globally Collaborative Research and Development

3.1 Globally Collaborative Environmental Peace Gaming (GCEPG)

Globally Collaborative Environmental Peace Gaming (GCEPG) [Utsumi, 2003] with a globally distributed computer simulation system, focusing on the issue of environment and sustainable development in developing countries, is to train would-be decision-makers in crisis management, conflict resolution, and negotiation techniques basing on "facts and figures." The GUS will supply game players, simulationists, tech support from around the world. With global GRID computer networking technology and Beowulf mini-supercomputers of cluster computing technology, we plan to develop a socio-economic-environmental simulation system and a climate simulation system in parallel fashion, both of which are to be interconnected in global scale – see Figure 2.

Globally distributed climate simulation system



Globally distributed socio-economic-environmental simulation system

Figure 2: Globally collaborative environmental peace gaming networks

The GCEPG with a globally distributed computer simulation system is a computerized gaming/simulation to 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 global Internet to collaborate in the discovering of new solutions for world crises, such as the deteriorating ecology of our globe, and to explore new alternatives for a world order capable of addressing the problems and opportunities of an interdependent globe. Gaming/simulation is the best tool we have for understanding the world's interwoven problems and the solutions we propose for them. System analysis for systemic change at the global level is a precondition for any significant resolution to today's global-scale problems. The understanding gained with scientific and rational analysis and critical thinking basing on "facts and figures" would be the basis of conflict resolution for world peace, and hence ought to provide the basic principle of global education for peace.

The purpose of an interactive gaming mechanism is to help find appropriate alternative policies by establishing consensus among participating parties. It is suggested here that globally distributed computer simulation should be tested interactively with the game player inserting pseudo-policy parameters into the models whenever necessary, during the execution of simulation. This is called peace gaming/simulation [Utsumi, 1977] similar to war games practiced by military strategists [Schram et al., 1971]. With the advent of global broadband Internet and standard interface protocols for interconnecting various dispersed, dissimilar host computers, the potential exists for ensuring the coordination of international efforts by providing more frequent communications and an environment for shared development, enabling more credible simulation study than was previously possible.

3.2 Computer Simulation Models

Since I created Summer Computer Simulation Conference (SCSC) in Denver, CO in 1970, myriad of simulation models in almost every facets of our globe appeared. There are three major methodologies of socio-economic modeling; (1) econometric modeling (initiated by Professor Lawrence R. Klein of University of Pennsylvania and an economic Nobel Laureate), (2) input-output modeling (initiated by Professor Wassily Leontief of New York University, an economic Nobel Laureate), and (3) system dynamics modeling (initiated by Professor Jay W. Forrester of M.I.T.).

Prof. Onishi [Onishi, 2003] has already indicated his strong willingness to cooperate with this GCEPG project as providing his Futures of Global Interdependence (FUGI) model, the world largest econometric model. When we conducted US/Japan foreign trade peace gaming at the conference on "Crisis Management and Conflict Resolution" in New York City in July of 1986, we used it as a single simulation model residing in a supercomputer in Tokyo and we asked him to execute his model with the alternative policy parameters according to the progress of our gaming scenario proposed by noted U.S. economists (Prof. Lester C. Thurow of M.I.T., Provost William Nordhaus of Yale University, Mr. Keith Johnson of Townsend and Greenspan Company).

However, this time, his FUGI's sub-models will be split and be dispersed to the countries where the sub-models belong. We will arrange GUS in various countries to host the sub-models of their countries – along with construction and maintenance of its databases, revision and modification of

their sub-models, and supply of game players in cooperation with their overseas counterparts through the global GRID computer network.

Prof. Forrester has also indicated to me that his System Dynamics Group already constructed a US national model, which may be used in conjunction with FUGI model. The Millennium Institute <http://www.millenniuminstitute.net/> in Arlington, VA also has national system dynamics models of Bangladesh, China, Ghana, Guyana, Italy, Malawi, Somaliland, Tunisia, and the United States. As soon as we establish our GUS in these countries, we may ask their cooperation to tie together those national models.

Incidentally, after contributing to the early development of digital computers and inventing magnetic-core memory, Prof. Forrester pioneered "system dynamics," a computer simulation methodology for understanding complexity that extends far beyond servomechanisms and Cybernetics theory. He applied quantitative, system analysis and computer simulation technology to complex socio-economic, bio- and eco-systems to evaluate how alternative policies affect growth, stability, fluctuation, and changing behavior.

The system dynamics' cause-and-effect analysis based on feedback theory, along with computer simulation modeling, is the best tool to understand the inter-relatedness and inter-dependency of various complex world phenomena.

Under Forrester's leadership, pioneering schools are creating a new kind of pre-college education, starting in kindergarten that is built on a system dynamics foundation. Such education becomes inter-disciplinary with the same computer simulation concepts applied to the environment, biology, history, literature, and economics. We can expect future leaders with expanded abilities for crisis management, policy-making, and negotiation skills for corporate, national, and global issues. The resulting deeper understanding of social and economic complexity, arising from this new kind of education, will enhance mutual understanding among people of different countries and cultures, and facilitate world peace and a sustainable development of humankind in the 21st century.

3.3 GRID Technology

GRID-based technology enable the sharing, exchange, discovery, and aggregation of resources (processors, storage, scientific devices, information, knowledge, etc.) across geographically distributed sites. Many now consider GRID technology as the next generation Internet, which concept I initiated in 1972 [McLeod, 2000]. It has demonstrated all of the effectiveness in the scientific domains as becoming a de-facto e-Science technology infrastructure. This technology promises to do what the Internet has done with data on the applications. GRID computing extends the scope of distributed computing to encompass large-scale resource sharing, including massive data-storages, high-performance networking and powerful computers, highly expansive equipments (i.e., microscopes, telescopes, 3D Cave), etc. GRID technology defines a new powerful computing paradigm by analogy to the electric Power Grid. Users of the GRID will then be able (a) to use his/her private workplace to invoke any application from a remote system, (b) to use the best suited system for executing their desired particular application, (c) to access data securely and consistently

from remote sites, (d) to exploit multiple systems to complete complex tasks in an economical manner, or (e) to use multiple systems to solve large problems that exceed the capacity of a single one. In this vision, the sharing doesn't mean simply exchange of data or files but rather a concrete access to resources (e.g., computers, software, data, etc.).

GRID technology has great potential in education, offering a framework that opens new ways of teaching and learning that have not been possible before. E-mail and multimedia World Wide Web of Internet so far contributed significantly to the world society on the dissemination of information. The next phase of the Internet development with global GRID computer networks should be the globally collaborative experiential (the so-called "hands-on") learning and constructive creation of wisdom with interactive actions on virtual reality simulation models of joint global research and development projects on various subjects. It is said "Knowledge applied with interaction becomes Wisdom." Globally collaborative experiential learning through broadband Internet, across national, continental and oceanic boundarie would realize such wisdom creation. The principle of the 21st century education should be inheriting wisdom more than the mere transfer of knowledge.

3.4 Globally Collaborative Experiential Learning with ELeGI

European Learning GRID Infrastructure (ELeGI) Project [Allison, et al, 2003], which is now funded by the European Commission, aims to design and implement advanced service-oriented GRID-based software architecture for learning. This project with 23 prominent educational and industrial organizations in Europe will develop a new paradigm focused on knowledge construction using experiential based and collaborative learning approaches in a contextualized, personalized and ubiquitous way. This will replace the current information transfer paradigm, which is based on content, and on the key authoritative figure of the teacher who provides information.

GCEPG project could be a complete and powerful demonstrator of ELeGI Project to show (1) the advantages coming from using advanced technologies (i.e., GRID for accessing to computing resources and collaboration environments) for supporting simulations execution, data analysis, etc., and (2) simulations for learning through the definition of innovative pedagogical models (i.e., socio-constructivist contextualized learning approach), and (3) to show all the benefits coming from the harmonized and synergistic use of advanced technologies together with innovative pedagogical models for learning (i.e., ELeGI).

The cooperation with ELeGI project will assure the development of globally collaborative experiential, distributed learning with globally distributed simulation system for joint research and development on various subjects by youngsters around the world. This will then foster their creativity, and hence promoting mutual understanding among them, also, -- Senator Fulbright once said;

> "*Learning together and working together are the first steps towards global peace.*"

3.5 Globally Collaborative Innovation Network (GCIN)

Spreading the culture of creative and innovative society can only be done with education -- and this is much better, effective and peaceful way of spreading democracy rather than using any weapons! Thanks to the advent of global broadband Internet and GRID networking technology, this can now be done more readily than before — and more so, in globally collaborative fashion. Globally Collaborative Innovation Network (GCIN) with a globally distributed computer simulation system will foster creativity of youngsters around the world. Our GCEPG project will be its powerful demonstration.

The principle of packet-switching technology (the basis of Internet) is "SHARING" to bring drastic cost reduction of expensive high-speed telecom lines, -- we are extending this principle to the sharing of knowledge and even wisdom with the creation of GUS. The principle of GRID networking technology is "COLLABORATION." Those two principles of sharing and collaboration are the very basis of attaining global peace, which ought to be the ultimate aim of education rather than mere enhancement of job skills, as in the conventional educational institutions around the world. We hope to attain global peace by proliferating the use of Internet and GRID technologies around the world with e-learning and e-healthcare/telemedicine.

The growth of advanced economies is driven largely by knowledge workers, such as scientists, engineers, managers, professionals, and artists. We now need to bring youngsters around the world to become the world-class knowledge workers with global e-learning and create the environment for them to collaborate with the use of advanced Information and Communication Technologies (ICTs) and GRID networking technology. This is because the entire global economy increasingly revolves around innovations that flow from the creative classes.

3.6 Epilogue: Creativity and Innovation

The culture of America is particularly suited for the creative mind. It is a unique crucible for innovation. America is so much more innovative a place than any other country. America allows you to explore your mind. America is the greatest engine of innovation that has ever existed, and it can't be duplicated anytime soon, because it is the product of a multitude of factors **(**Friedman, 2004**)**:

- Extreme freedom of thought,
- An emphasis on independent thinking,
- A steady immigration of new minds,
- A risk-taking culture with no stigma attached to trying and failing,
- A non-corrupt bureaucracy, and
- Financial markets and a venture capital system that are unrivaled at taking new ideas and turning them into global products.

These institutions, which nurture innovation, are the real crown jewels of American culture. The whole process where people get an idea and put together a team, raise the capital, create a product and main-stream it -- that can only be done in the U.S. The U.S. tech workers must keep creating leading edge technologies that make their companies more productive -- especially innovations that spark entirely new markets. This is America's real edge.

An innovation economy demands that society be open, dynamic, educated, international, and risk-taking. Given chance, innovation can improve all our lives. Financial risk-taking is the fuel that powers the process of change. Worldwide innovation networks are the new keys to R&D vitality and competitiveness. Such networks – broadband, 24/7, wired and wireless -- in the knowledge economy society of the 21st century would nurture the "connected community" and build youngsters' collaborations to provide the kind of leadership the digital age requires; and above all else, begin promoting the process of enhancing, encouraging and fostering creativity and innovation in all its forms -- in the schools, in the workplace and throughout the community (Eger, 2005).

We are now in the early stages of a new era, "Creative Age," in which creativity and innovation will be the hallmarks of the most successful communities and vibrant economies. This age will thrive and prosper if the communities have tolerance for dissent, respect for individual enterprise, freedom of expression and recognition that innovation is the driving force for the new knowledge economy, not mass production of low-value goods and services.

At a time of intense division, with deep political and religious fault lines splitting the world, innovation stands out as a powerful integrative force. It ties countries, companies, and consumers together in creating value, solving problems, and generating wealth (BusinessWeek, 2004).

4. Expected Benefits

With rapid advancement of computer simulation with GRID networking technology, such a network of mini-supercomputers around the world can also be used by researchers, even in developing countries to perform with their counterparts in developed countries for joint collaborative researches with virtual reality and virtual laboratory of various academic and engineering subjects. They can also be used in high energy, nuclear and fusion energy physics, atmospheric science, geological sciences [Cole, 2005], micro-biology, chemical molecular study, human genomics, DNA analysis, medicine/bioscience, telemedicine, commerce, nanotechnology, joint advanced engineering design, etc. [Sterling, 2001].

In a sense, our GUS/UNESCO/UNITWIN Networking Chair project aims to construct global scale knowledge forum with advanced ICTs, i.e., with the use of massive parallel processors of globally distributed and yet interconnected mini-supercomputers through global GRID computer network. This will be a paradigm shift of research and development in global scale, out of the so-called isolated, academic "Ivory Tower" approach.

5. Financing GUS and GCIN

During the Okinawa Summit in July 2000, the Japanese government pledged US$15 billion to close the digital divide in developing countries and for the eradication of poverty and isolation. During the G8 Summit in Canada in June of 2002, and at the Environment Summit in South Africa in September of 2002 they also pledged US$2 billion to aid education and healthcare in developing countries, respectively.

GUS projects will combine (1) the Japanese government's Official Development Assistance (ODA) funds and (2) Japanese electronic equipment with (a) the Internet technology and (b) content development of North America and Europe.

6. Conclusions

The GUS program is a comprehensive and holistic approach to building smart and creative communities [Eger, 2003-a and Eger, 2003-b] 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.

GUS and GCEPG are clearly ambitious programs, one 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 visions of GUS and GCEPG are invited to join this great and noble enterprise.

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