Proceedings of the Trilateral Seminar on Science, Society and the Internet

Section I: Executive Summary

A. Rationale and Overview

Advances in science and technology often lead to new or deeper understandings of nature and to practical tools indispensable to further scientific advances in an expanding range of disciplines. These advances can also provide a basis for applications by the larger society. On occasion, such applications are so far reaching that their impacts go beyond practical economic impacts, and have political, social and cultural impacts as well.

Few such recent advances have had more profound impacts on both science and the larger society than the development and refinement of the Internet. Originally conceived of as a means for enhancing the security of defense-related communication, the Internet evolved into a useful means for exchanging simple e-mail messages first among scientists and engineers, then among members of the larger public. The power of the Internet for scientific communication expanded enormously when particle physicists developed the World Wide Web to permit the electronic exchange of massive quantities of data. These developments have resulted in significant changes in the ways that scientific research is conducted. They have, for example, facilitated new kinds of scientific collaboration by allowing scientists located in areas remote from leading research centers not only to have immediate access to research results, but in many cases to participate directly in the research itself.

The Internet, and particularly the World Wide Web, are also continuing to have broad economic, political, social and cultural impacts which are only now being subject to critical examination. Although, arguably, most of these broader impacts have been positive, negative aspects (both actual and perceived) have also been identified. Understanding and dealing with such negative aspects, preferably at an international level, will be essential if the Internet is to realize its full potential not only as a tool for conducting scientific research and facilitating scientific cooperation, but also as a means for effecting positive economic and social change by enhancing communications within and among societies throughout the world.

Venue and Participants. Against this background, the **National Natural Science Foundation** of China (NSFC), the **Japan Society for the Promotion of Science** (JSPS), and the US **National Science Foundation** (NSF), sponsored a trilateral seminar on Science, Society and the Internet at the East West Center in Honolulu, Hawaii, December 14-16, 2003. This seminar brought together a total of 35 participants: natural and social scientists and engineers from the three countries, individuals in other fields who are

concerned with and knowledgeable about the impacts of the Internet on science and society, and representatives from the three sponsoring organizations[1].

Balances and Tradeoffs. Many of the issues discussed at the seminar involve balances and tradeoffs: for example, between the desirability of open communication among scientists, and the imperatives to maintain national and international security and to protect personal and institutional privacy. The Internet provides a powerful tool for providing promising substantive and methodological advances in science education to remote populations, and to populations in less developed countries. Yet the internationalization of education can also be perceived as a threat to cultural values. The overall objective of the seminar was to identify and illuminate the most critical issues associated with the impacts of the Internet on science and society rather than to seek definitive solutions to significant national and international issues.

Organization. The seminar was organized into three plenary sessions, as follows, with two pairs of informal breakout sessions scheduled after each plenary.

I. Scientific Collaboration via the Internet
II. Access and Fair Use Issues
III. Societal Aspects of Information and Communication Technology (ICT)

Keynote Presentations. On December 14, during the evening preceding the first full day of the seminar, Judge **PAULINE NEWMAN** of the US Court of Appeals for the Federal Circuit in the District of Columbia, gave the first of three keynote presentations entitled, *Societal Aspects of Information Technology*.

Prior to the first plenary session on December 14, **TSUNEO NAKAHARA**, Executive Adviser to the CEO, Sumitomo Electric Industries, Ltd., presented the second keynote address on, Science and Society in the Internet Era.

Following dinner on the evening of December 14, **WANG ZHIQIANG**, Deputy Director-General, Department of Policy and Regulations, China Meteorological Administration gave keynote presentation entitled, *The Internet: Bridging the Gap between Science and Society.*

Convergence. The December 2003 trilateral seminar represented the convergence of two series of bilateral science policy seminars: the Japan-**US science policy seminars**, which have been organized jointly every three or four years since 1980 by the **Japan Society for the Promotion of Science** and the US National Science Foundation; and the **Sino-US science policy seminars** organized jointly on an approximately annual basis since 1999 by the **National Natural Science Foundation of China** and the US **National Science Foundation.**

The respective chairs of the Chinese, Japanese and US delegations to the December 2003 seminar were: **LI XIAOMING**, Department of Computer Science, Peking University;

1. A list of participants and their affiliations is appended.

TOSHIHIKO HAYASHI, Director General, Stanford Japan Center; and **WESLEY SHRUM**, Department of Sociology, Louisiana State University.

The seminar was supported in part by a grant from the US **National Science Foundation** to **George Mason University's National Center for Technology and Law, J. THOMAS RATCHFORD**, Distinguished Visiting Professor of Technology and Law, Principal Investigator.

B. Seminar Themes

By design, many of the invited presentations at the seminar dealt with the new modes for the conduct of scientific research that are being made possible by the Internet and associated information and communication technology such as remote on-line collaboration, access to large and unique data sets, and possibilities for real time simulations. The Internet is also making novel types of research possible, such as studies of evolving websites to obtain insights into social trends. Likewise, the Internet is changing and expanding modes of education. Web-based curricula not only permit students to take courses remotely, but also provide them with access to lectures by specialists throughout the world. By the same token, the Internet provides a set of tools to reach students in remote, often disadvantaged regions and countries.

Centrality of Data. Despite the rather specific character of the seminar presentations, a number of themes reoccurred in both the presentations themselves and in subsequent discussions. The centrality of data to the promise and potential of Internet use for both scientific and non-scientific purposes was one such theme. Ironically, although the Internet was devised as means to exchange data among scientists, its potential is now threatening to undermine the fundamental scientific norm of open access to scientific data. In addition to economic and legal issues associated with data access, the question of how to devote adequate resources to the analysis of large data sets so that they will be useful for scientific purposes and to assure their accuracy has received too little attention.

Although several of the data-related issues predate widespread Internet use, there is no doubt that they have been exacerbated and illuminated by the Internet. By the same token, the Internet is challenging ways in which the law has traditionally dealt with matters such as free speech, privacy, due process and intellectual property rights.

An International Code of Internet Ethics? Although legal remedies to the most egregious cases of Internet-based infringement of traditional rights can probably be devised, the law addresses only minimally acceptable standards of behavior. Ethics deals with more lofty standards. Thus more attention needs to be paid to the ethics of Internet use. Scientists, who designed and who first made extensive use of the Internet, can take the lead in this respect. Yet ethical considerations are rooted in culture. Can an international consensus regarding ethical codes for Internet use be obtained, even among scientists?

Beyond ethics, issues of value emerged throughout the seminar sessions. The ability of geographically dispersed scientific groups to collaborate via the Internet is no doubt a positive value, as is the ability of the Internet to serve as a platform for sophisticated, high quality distance education. Likewise, the Internet is making it possible for individuals throughout the world with common values and interests to form virtual communities, thus freeing them from restrictions of place. Yet the Internet might also undermine the sense of place that individuals develop through long, interactive familiarity with their local environment. Although the Internet makes it possible to disseminate information and ideas throughout the world, a great deal of available content remains somewhat standardized. An important challenge is to set targets for the development of the Internet which solve common problems or create new values for humans and human society. These targets should incorporate cultural and social features and originality on the part of participating countries and parties.

Values and Choice. Values often involve matters of choice. What fraction of their time are scientists likely to choose to spend on maintaining novel websites and developing effective Internet collaborations, as opposed to time spent on more traditional research activities? The Internet is becoming an indispensable platform for successful university-industry research collaboration. Should scientists with experience in Internet use also become more well versed in matters of intellectual property and entrepreneurship? To what extent should university faculty try to master the novel techniques of on-line instruction to the possible detriment of face-to-face meetings with students at their own institutions?

How can funding agencies be convinced to devote adequate resources to data analysis, perhaps reducing thereby funds devoted to primary research? Who will pay the costs of expanded data access for the purposes of research and education? How can institutions in less developed countries and remote regions in developed countries be provided with access to broadband Internet? How can technicians in these countries and regions be trained in the use of advanced applications designed for broadband use?

Internet Governance. Clearly more attention needs to be devoted to issues of Internet governance based, to the greatest degree possible, on international experience and fundamental scientific norms. To what extent should a system of Internet governance depend primarily on laws and treaties, as opposed to internationally agreed on ethical norms? Should scientists permit largely non-scientific interests to determine issues of Internet governance and adapt as best they can? Or should they work actively with governments, perhaps through one or more international networks, to try to assure that Internet governance will be consistent with scientific norms and in the best interests of society?

The Internet is altering the ways in which scientists conduct their research and education activities. It may also be imposing new responsibilities on the current and, particularly, on future generations of scientists.

Cultural Differences in Approaches to the Internet? Although this trilateral meeting included participants from China, Japan and the United States, very seldom if at all did presenters or commentators compare or contrast the approaches of the three cultures to the Internet.

In contrast with the American and Chinese presenters and discussants, however, the Japanese focused not only on the scientific and communications potential of the Internet, but also on its potential as a vehicle for improving society and creating human happiness.

Ubiquity and Expertise. The tenor of the presentations at the Honolulu seminar differed from the tenor of presentations at most meetings of scientific experts. The multiplicity of uses of the Internet and its ubiquity make it impossible for any one person to be an expert on the totality of the Internet. Presenters, discussants, and commentators approached the broad topic of Science, Society and the Internet from widely differing perspectives. In addition, many presentations and comments were necessarily conjectural and personal rather than definitive.

The Need for Empirical Research. It was evident that insufficient empirical research has been done on the question of the Internet's impact on science and scientific research. The presentations and discussions at Honolulu might be described as groping and seeking rather than as defining and testing. This was not bad, but it does point out the need for more empirical research on the interaction among science, society and the Internet. As Wang Zhiqiang suggested during the course of his keynote presentation Monday evening, perhaps the next time such a meeting is held, the subject order should be switched so that the Internet appears in between science and society as it is quickly becoming a major source of information as well as a bridge between scientists and the public.

C. Keynote Presentations

Three keynote presentations were made during the course of the seminar as follows:

> *Societal Aspects of Information Technology*, by **PAULINE NEWMAN**
> *Science and Society in the Internet Era*, by **TSUNEO NAKAHARA**
> *The Internet: Bridging the Gap between Science and Society*, by **WANG ZHIQIANG.**

PAULINE NEWMAN's presentation dealt with ways in which the Internet is generating unique and often difficult challenges to the law. For example, at least in the United States "there is no legal precedent that weighs the loss of personal privacy and its effect on human dignity and independence, and balances it against the ease of access to knowledge and the intellectual enhancements that result."

Challenges Pertinent to the Bill of Rights. Newman went on to provide additional, specific examples of ways in which the Internet challenges interpretations, by the courts, of fundamental rights guaranteed by the US Constitution. The First Amendment guarantees freedom of speech. But does it permit websites devoted to hate messages

aimed at specific groups? Does it protect sites that are blatantly pornographic? The Fourth Amendment concerns the "right to be secure in one's person and one's house and one's papers." But is such privacy consistent with provisions of the Patriot Act that permit monitoring of Internet mail, chat rooms, and web pages?

Due Process. What legal remedies against alleged illegalities perpetrated via the Internet are consistent with conventionally understood aspects of "due process of law" as, for example, that an individual cannot be sued in a remote or inconvenient place?

"There's a lot of resistance to placing legal burdens on Internet activity, national and international. But it's generally agreed that commercial violation must be subject to remedy. There is no significant international law on Internet behavior, no supra-national tribunal with authority to enforce rules and remedy infractions."

Intellectual Property Protection. Newman devoted considerable attention to issues concerning the applicability of intellectual property laws to the fields of computers, electronic commerce and Internet use more broadly. Traditional patent law has been challenged by uncertainties about whether it is permissible to use patented subject matter for research purposes. Regarding copyright, "the ease of electronic copying has led to a lot of litigation, since the commercial consequences can be enormous." She cited the recent Napster case as an example. As to the protection of trademarks and domain names: the bad faith registration of the trademarks of others, as domain names, is remediable under existing US law. On the other hand, the good faith use of marks that are territorially valid can come into conflict on the Internet where they are no longer territorially limited.

Database Issues. Newman next turned to issues associated with data base compilations where, in the United States, Congress and the courts have been wrestling with the design of "legislation that will meet the commercial needs of compilers and publishers of collections of data." Issues that come before the courts often involve questions of fair use: that is, how much and under what conditions can a commercial compilation of data be used for other purposes (e.g., educational) without obtaining the approval of, and often payment of a royalty to, the copyright holder? Of course this immediately raises questions concerning the extent to which compilations of publicly available data should be copyrightable.

Newman concluded by emphasizing that, "law is not science," but rather social policy as well as national policy, "with similarities and differences among nations. As applied to the Internet, the traditional legal issues of property rights, commerce and trade, national sovereignty, and international remedy are being examined in this new context."

"As the law catches up, it's essential that there be full participation of you who understand these systems and their capabilities. Adversary litigation of specific disputes does not produce optimum general rules; the future shouldn't be entrusted to the judges or the lawyers."

TSUNEO NAKAHARA's keynote address considered changes being brought about by the Internet in the relationship between science and society as it spreads and progresses. A good deal of his presentation referred to attempts by many governments to facilitate more effective university, industry, government research collaboration as a means to create new businesses as a necessary means for maintaining the long-term vitality of the global economy. He posited that the Internet has become essential to such collaborations, suggesting that, the Internet must inevitably oblige scientists to think about their roles and responsibilities more broadly, and governments to adjust their science policies accordingly.

Continued Investments in R&D are Essential. Although the present Internet system has numerous problems and disadvantages such as poor security and incomplete service quality, Nakahara is convinced that rapid technical innovation will overcome these, at least to some extent. However, a sustainable Internet era will only be realized if large investment in research and development (R&D) continue to be made by both the public and private sectors, leading to various technologies not only in information technology, but also in related areas of concern to industry such as cash and product flow.

According to Nakahara, in the Future Internet era or Ubiquitous Communication era, people can expect everything on IP (Internet Protocol) or IP on everything. They can also expect interaction of the Internet with terrestrial digital TV broadcasting. In the future, there will be further advanced additional tools such as super wide-band imaging, advanced virtual reality, "man to machine", and "machine to machine" communications associated with unlimited addresses and session initiation protocols.

In Nakahara's opinion, since science and society are becoming more directly and deeply connected, the role of the Internet will become more important and finally indispensable. Both the Internet system developed for science and that for society will therefore eventually be integrated and fused to each other.

The Internet as Indispensable to Research Cooperation. As a case in point, it is useful to consider research collaboration among industry, university and government. The missions of these three sectors differ considerably. However, the common goal of their collaboration is to facilitate the transition from invention (that is, from a potentially useful scientific discovery) to innovation (that is, to the commercialization of a new product or process and, perhaps, the creation of a new industry). To pursue this goal, it is first necessary to construct a platform consisting of fused human and information networks among industry, university and government.

In order to construct such a platform, industry should invest money and talented people, expecting a return of critical insights on how to create new industry. Universities should supply knowledge to the platform, expecting a return of research funds and a wider field of activity. Governments should promote the platform in every possible way, expecting a return in terms of increased employment and improved finances.

Expanded Responsibilities for Scientists. The responsibilities of scientists in the 21st century may well be modified to include a detailed understanding of intellectual property rights, to establish business know-how for industry, as well as to create start-up venture business as entrepreneurs. In such cases, natural scientists should have a fusion of experience in engineering science and social science. In other words, since science will have a closer relationship with social needs and, conversely, social needs will have closer relationship with industries, scientists must in the long run have a closer relationship with industry. The Internet is already demonstrating its power to bring about such relationships in an effective manner.

The Need for Virtual Spacecraft. Turning to the global business world, Nakahara noted the constant demand for new products. This, in his opinion, is akin to an expanding space with a lot of created stars of new products and disappearing stars of obsolete products. The values in this space are economic return and free competition under the rules of anti-trust and the WTO. Connecting a particular invention to a particular new product is becoming more and more difficult year by year. Fortunately, human and information networks will be available in contemporary time space domains. Pursuing his metaphor, Nakahara emphasized that industry, scientists and governments should prepare a fleet of spacecraft to navigate the stars of invention and innovation. The Internet can realize such fleets in terms of virtual reality.

Changing Nature of Science Policy. The philosophy of government administration will be delicate because national interest often conflicts with global interest. The compromised government mission will be to give comprehensive security to the people and companies within its geographical territory regardless of nationality. To do this domestically, governments should enhance investment in infrastructure, R&D and high technology venture business creation. Internationally, governments should promote cooperation in fundamental research, environmental protection, energy problems and so forth.

Nakahara concluded by stating that for the sustainable growth of global society, science in the 21st century should be moved to a new philosophy emphasizing interaction with human society. Society in the 21st century will be much more globalized, and global harmonization will become indispensable by fully utilizing the advanced Internet.

WANG ZHIQIANG began his keynote presentation by noting that in a very real sense, the presentations and discussion at the seminar caught the pulse of the larger society. Indeed, in many ways the Internet is challenging conventional human reasoning and thinking. The Internet was virtually unknown in China until approximately 10 years ago. Today there are approximately 30 million online computers in the country, and there are likely to be approximately 78 million Internet users by the end 2003. Long-distance learning, is creating opportunities for China's rural population to have access to the lessons which are offered far away. As another interesting example of Internet use for education in the country, he noted that during the SARS epidemic earlier in 2003, most of the students in Beijing obtained regular instruction from their teachers via the Internet

Internet Governance. Wang's principal emphasis was on the need to develop reasonable and internationally-acceptable rules for governing the use of the Internet to assure that its more positive aspects will be enhanced. Among the more salient positive features of the Internet, he enumerated the ease of information exchange via e-mail, exchange of scientific information, and reiterated the potential of distance learning to reach remote populations. Negative aspects included the demise of hand written letters (which are often taken more seriously than e-mail messages) and, of course, cybercrime.

Access and Cost Sharing. Internet governance requires more attention to the problem of access and, particularly, how to share costs associated with expanded access to information. As an example, the China Meteorological Administration now provides detailed weather-related information to a number of Chinese websites. Not only do these websites provide substantially more information than comparable television transmissions, but they can also be made interactive. As a result of strong public interest in weather information, these websites are attracting a good deal of advertising revenue. It seems reasonable that a portion of this revenue should be returned to the Meteorological Administration which provides the information in the first place. This revenue could help the administration upgrade its technology, and thus provide improved information to the relevant websites and ultimately to the public.

Building Bridges via the Internet. According to Wang, "the Internet is having profound effects on all social aspects, e.g. it connects human being with science, science with society, science with technology, and science with ethics. These connections are both concrete and abstract, both emotional and rational."

Wang concluded by suggesting that the Honolulu seminar on Science, Society and the Internet should be followed up by a conference in Beijing. If so, he would like that conference to be called, Science, the Internet and Society, to emphasize the essential bridge-building aspect of the Internet. Wang said he would gladly serve as toastmaster for such an event.

D. Scientific Collaboration via the Internet: Plenary Session I

Plenary Session I focused on how the Internet has influenced and will continue to influence and change the character of scientific collaboration. Some of what was discussed was retrospective–that is, how the growth of the Internet has made international communication among researchers much easier than it used to be–but a good deal of attention also focused on how the as-yet unfathomed potential of the Internet can be better understood and exploited.

Three papers were presented in the session:

International Collaboration and the Internet in China, by **FAN CHUNLIANG**
Activating a Scientific Collaboration Reflecting Cultural and Social Originality, by **MASAO SAKAUCHI**
International Collaborative Science on the Net, by **GARY OLSON**

FAN CHUNLIANG's paper began by suggesting that international cooperation is an intrinsic part of basic research. The rapid development of information technologies has facilitated international scientific cooperation on the part of Chinese scientists, particularly since the introduction of the Internet in the early 1990s. Fan highlighted the rapid growth of Internet use in China from the early 1990s to the present and its impact on scientific research, education, and society. He pointed out that students and technical personnel are the most frequent users of the Internet and that up to 47 percent of that use is for obtaining information. Perhaps surprisingly–perhaps not–the second highest usage is for pleasure (28 percent).

Fan then highlighted the impacts of the Internet on science in China including increased access to data, catching up with recent advances such as in bioinformatics, growth of collaborative networks such as the Virtual Research Center on Scientific Complexity at Peking University, increasing the capability for international collaboration including large scale global projects, and the developments of large scale research centers.

MASAO SAKAUCHI opened his presentation with a very basic question: will information technology be able to create new, *real* value as opposed to virtual value? Then he posited two visions of the Internet. The first, which is the present state of the Internet, he called the "Hamburger World." In this world, everything is the same, monocultural, mass produced. The world we should aspire toward, the "Roppongi World" or the "Hawaii World," will be marked by multi-culturalism and diversity just as are the Roppongi district of Tokyo and the Islands of Hawaii. His vision is to change the Internet into the more diverse, multicultural, sophisticated, homemade, customer-satisfying place that it should be.

Aspects of Happiness. Sakauchi mentioned three aspects of happiness: 1) heart, 2) life, and 3) social platform. Heart refers to things such as individuality and creativity. Life incorporates such things as food, and health. Social platform contains transportation, social security, and environmental protection. The common linkage in all three aspects is that information technology can contribute to their growth and fulfillment.

Sakauchi provided three examples of scientific cooperation in the information technology field with the potential to enhance the quality of our lives: 1) reducing traffic casualties by monitoring traffic flows and accidents to discern their causes; 2) digitally archiving cultural assets; and 3) virtual scientific research environments by grid computing, such as the NAREGI Project and Super SINET that involves the linkage of thirty Japanese universities.

GARY OLSON began his presentation by introducing the concept of the "collaboratory", defined as "a center without walls." But, by whatever name one calls it, the value of a collaboratory is that it 1) spans distance, 2) supports human interaction, and 3) provides access to data sources. The tools of the collaboratory are: 1) communication, 2) instrumentation, 3) computation, 4) repository, and 5) coordination, not all of which are essential to successful collaboratories.

Examples of international collaboratories include the Upper Atmosphere Research Project, now known as the Space Physics and Aeronomy Research Collaboration (SPARC). The **National Science Foundation** supported this collaboratory for 10 years. Another example is the International AIDS Research Collaboratory involving collaboration among institutions in Africa, the United States and the United Kingdom. One of the problems with the latter collaboratory has been the absence of adequately lab technicians. The success or failure of collaboratories is not well documented; however, there seem to be more failures than successes.

A Short Taxonomy. Olson then presented a short taxonomy of collaboratories, basically divided into two main branches: 1) research focused collaboratories, and 2) professional support collaboratories. An example of the former is the Alliance of Cellular Signaling. Further parsing the latter type of collaboratories–that is the professional service collaboratories–Olson listed several subtypes:

- Shared instrumentation, e.g., KECK Observatory in Hawaii
- Community data systems, e.g., Zebrafish Information Net
- Open community contribution systems, e.g., NASA Ames Clickworkers where the general public is asked to contribute its observations regarding possible crater sites on the moon. Olson pointed out that these mini contributions had proven as reliable as the professional's observations. This has given rise to the idea that the public itself could be thought of as another instrument or scientific tool made possible by the Internet.

Measures of success depend on ones goals. So far, the success of collaboratories is not seen as much in terms of scientific productivity as in such goals as influencing scientific careers, effects on learning, and public involvement, to name a few. Also, various conditions must exist for collaboratories to be successful. These include common or shared understanding, alignment of incentives, and skills in managing virtual institutions that differ from the skills needed to manage real institutions.

E. Access and Fair Use Issues: Plenary Session II

The key words in the session title inevitably raise the basic question: access and fair use to what and by whom? Thus, the prepared presentations and ensuing discussion broadened the range of concerns beyond those discussed in Plenary Session I, demonstrating both the power and the problems associated with expanding Internet use. It also became clear that Internet content and patterns of use provide a unique resource for research in the social sciences.

Three papers were presented in the session:

Development of Broader Coverage of Broadband Internet Infrastructure for Higher Education and Leading-edge R&D Activities, by **SUGURU YAMAGUCHI**

Creating a Global Research Commons for Scientific Data, by **PAUL UHLIR**
Some Characteristics of Web Data and their Reflection on Our Society, by **LI XIAOMING**.

SUGURU YAMAGUCHI began his presentation by reminding the participants that from the time when the Internet first evolved in the 1980's, higher education and leading-edge R&D communities, primarily in developed countries, have benefited from this dependable information sharing and communication infrastructure. Many countries soon launched their own national high speed research and education networks so that now almost all the relevant communities are connected to, and aggressively utilizing, the Internet.

However, around the year 2000 with the development of the second stage, broadband Internet, a new gap between leading groups and the others began to emerge and has become wider. In this sense, developing countries as well as rural areas in developed countries remain undeveloped or less developed. Even where technology for broadband Internet applications are freely available, applications require a well developed communication infrastructure, various kinds of advanced equipment, and adequately trained human resources so that many countries and regions cannot step forward to build their own second stage networks.

Constructing Foundations for Broadband Access in Southeast Asia. Yamaguchi went on to describe two related initiatives, started in 1996 and supported by the Japanese government, which are designed to facilitate broadband Internet development in the Asia Pacific region, with an emphasis on the developing countries of Southeast Asia. The first is the Asian Internet Interconnection Initiative (AI3)[2]; the second is the School of Internet for the Asian region (SOI-Asia)[3]. Based on research done before these projects were initiated, it was clear that not only infrastructure but also human resources capable of developing and implementing relevant advanced applications were required in many Asian countries and regions. The two projects were designed to address these requirements.

AI3 has been working on infrastructure development, mainly using a telecommunication satellite covering 13 universities and research institutions in 10 Asian countries and territories, in addition to Japan[4]. AI3 developed UDLR (Uni-Directional Link Routing) technology and in the year 2000 began using the satellite link for down linking from a hub station to member sites. Currently the AI3 project is using this technology for actual network operation and each member can obtain 8 Mbps shared link on C-band satellite transponder. Although this 8 Mbps is quite modest, it is sufficient to run many leading edge Internet applications, including multimedia applications and information sharing.

Sharing Coursework in the Asian Region. SOI-Asia is an initiative for human resource development using Internet and information technologies. The fundamental idea is to

2. Information about AI3 can be obtained from http://www.ai3.net/
3. Details and actual "digitized" courses are available at http://www.soi.wide.ad.jp/soi-asia/
4. China, Hong Kong, Indonesia, Laos, Malaysia, Myanmar, Philippines, Sri Lanka, Thailand, and Vietnam

digitize everything related to classrooms and make them portable on the Internet. SOI-Asia activities are currently based on the legacy of narrowband Internet. However, SOI-Asia is now beginning to use the AI3 infrastructure to make shared courseware available among universities in the Asian region.

PAUL UHLIR's presentation considered issues associated with data access, particularly data produced at government expense, independent of whether or not the Internet is involved. These issues, however, have been made particularly salient because of the current and projected future capabilities of digital technologies.

Uhlir began by listing key aspects of scientific research using global digital networks: 1) data-driven science through collection and creation of ever-increasing amounts and types of raw data; 2) interpretation and transformation of the data into unlimited new configurations of information; 3) collapse of the space and time in which data and information can be made available and used to advance science; and 4) facilitation of entirely new forms of distributed research collaboration and information production.

Traditional US Policies Regarding Data Use. The US legal and policy regime has traditionally supported the open availability and unfettered use of data, and placed a premium on the broadest possible dissemination and use of scientific data and information produced by government and, to a lesser extent, government-funded sources. On the one hand, there are several compelling reasons for placing government-generated data and information in the public domain. On the other hand, there are several countervailing polices and practices that limit the free and unrestricted access to and use of US government information: 1) statutory exemptions to public-domain access and use based on national security concerns, the need to protect personal privacy of human subjects in research and to respect confidential information (plus other Freedom of Information exemptions); 2) government-generated data are not necessarily provided without cost, even if there are no restrictions on reuse; 3) the failure of agencies to disseminate data and information, or to preserve them for long-term availability; and 4) the requirement for the US government to respect the proprietary rights in data and information that the private sector makes available for government use.

Government-funded databases and other forms of information in academia are presumptively protectible unless funding sources require sharing or open access. The US government policy of "full and open" data access or exchange is: "data and information derived from publicly funded research are [to be] made available with as few restrictions as possible, on a nondiscriminatory basis, for no more than the cost of reproduction and distribution" (that is, the marginal cost of data dissemination, which on the Internet is zero).

Negative Implications of Pressures on Open Access. Uhlir enumerated a number of economic, technological and legal pressures on the public domain status and on open access to publicly funded scientific data and information. He then discussed five broad negative implications of these pressures on public science: 1) a general diminution in the scope of science and technology data and databases in the public domain that can be

openly accessed and used; 2) sole-source problems exacerbated in the science and technology database market; 3) higher transaction costs; 4) less data-intensive research and significant lost opportunity costs; and 5) less effective international, inter-institutional, and interdisciplinary cooperation using digital networks.

These pressures could elicit one of two types of responses. One would be essentially reactive, in which the scientific community adjusts as best it can without organizing a response to the increasing encroachment of a commercial ethos upon its upstream data resources and disclosure of research results. The other response would require formulation of a strategy that would enable the scientific community to take more active control of its basic data supply to manage the resulting research commons in ways that would preserve its public-good functions without impeding socially beneficial commercial opportunities. The idea is to reinforce and recreate, by voluntary means, a public space in which the traditional sharing ethos of science can be preserved and insulated from commoditizing trends.

LI XIAOMING began his presentation by noting that by web data he would be referring to both public web pages accessible to every one on the web and the query logs collected by typical search engines. The former are what people want others to spend their attention on, and the latter are what people want to look for on the web. As the web has grown to its current status, both kinds of data are massive in volume, random in nature, and cannot be controlled by a central authority.

Li went on to describe some of the discoveries that he and his colleagues have made about the uses of the web in China, based on what he called a multi-angle analysis of web data. He began with statistics on the current Chinese web obtained from large scale data collections plus educated evaluations, including the number of pages, size of the pages, the number websites, and their geographical distributions. He then estimated the growth of Chinese web from 1995 through 2001 based on data collected in 2002 and a statistical model. The web literally grew exponentially during that period, since the number of pages doubled every year.

Li and his colleagues determined that page replicas or near replicas are common on the web, and devised an algorithm to calculate the average page replication rate. They also observed that the sequence of query logs to a search engine exhibits a very strong locality in content.

Two Case Studies of Internet Use Correlated with Public Events. Li summarized the results of two special case studies his group had carried out. The first was conducted for a sequence of query logs against actual stock market information during the 1995-2001 period. The second was a study tracking web data in a 30 day period that included the 16th Congress of the Chinese Communist Party in November 2002. They observed that the amount of information for this important event peaked at 30 percent of all new information on the web, and that that peak occurred several days later than the climax of the event itself.

Li is convinced that studying the relations of the web and society is a valid approach in understanding the direction in which our world is moving. He and his colleagues have not only applied scientific methodology to such a study, but suggested directions for future methodologies.

F. Societal Aspects of Information and Communication Technology: Plenary Session III.

This session dealt with a variety of topics related to one another through information and communication technology, particularly the Internet: 1) a case study on presentation of a specific interactive, web-based course, 2) the political potential of the Internet, and 3) a speculation on the impacts of advanced digital technologies on an individual's sense of place.

Three papers were presented:

> *Teaching Ethics of Engineering and Science Online*, by **JOAN SIEBER**
> *Internet Association in China: an Ethical Approach*, by **LIU GANG**
> *Sense of Place and the Information Society*, by **HISAKO KOURA**.

JOAN SIEBER began by suggesting several reasons why web-based curricula have become popular: one can reach students who cannot easily attend classes on campus; overcome barriers of weather, geography, and many human disabilities and cultural differences; and provide many kinds of information online via links to other web sites. Online instructional software permits various modes of student communication via computer, and enables teachers to supervise and test students in a variety of effective new ways. However, she noted, in many current online courses, the technology seems to drive the pedagogy, the educational goals are unclear, and the curriculum topics are short-sighted. In addition to these pedagogical shortcomings, the technology*, per se*, is often poorly implemented, leaving students to struggle with a virtual classroom that is not user friendly.

Planning Web-based Courses. Teachers planning web-based courses must answer many complex questions before they begin, such as: Who is the intended audience? What are students to be able to do as a result of taking the course? What psychological and pedagogical principles should the course build on? What issues should be covered, given that others have already developed online curriculum around various issues? How can the technical expertise that is currently available among computer scientists and web builders be located and wisely used? What features of instructional software will help students learn, and which will only lead to confusion or frustration?

Sieber offered brief answers to these questions, based on her experience with a web based course on Ethics of Engineering and Science via the Internet. She concluded by proposing that seminar participants engage in a brief course, via email, to experience not only the use of case-based assignments, but also the role of cultural differences and

differences in the contexts of science or engineering, in producing different perceptions of ethical issues.

LIU GANG[5] defined Internet associations as a tool-driven innovation in China's socio-economical life that combine the virtual community established over the Internet with the same functions as associations in the actual world. His presentation began with a functional analysis of the Internet association in China, taking as his point of departure an analysis of the concept of association as it relates to the political rights of Chinese citizens as enumerated in the nation's constitution. The paper then explained in some detail why Internet associations had considerably greater power to influence social and political decision making than more conventional "real" associations.

Internet Associations and Political Change. Liu's paper posited that the activities of members of Internet associations in China would be important in bringing about political change in the country. He illustrated this proposition by means of a case study which involved public reaction to a 2001 decision by the Chinese Securities and Regulation Commission on how to implement a reduction in the number of state-owned-shares listed on the Shanghai stock exchange. This decision was one of several initiated by China's State Council aimed at reforming the country's state owned enterprises. The Commission's implementation plan was widely discussed via the Internet, with over 4,000 alternative schemes and proposals suggested. Market shares appear to have been influenced by this Internet debate. Ultimately, the Commission announced that it would modify its original implementation plan in the direction of the apparently strong informed public support for an alternative approach.

An Ethical Approach to Internet-based Debate. Liu's paper went on to suggest an ethical approach to relations between the government and its citizens with respect to Internet-based debate on public policy. He based his suggested approach on the ethical principal of vulnerability which states that the stronger of two individuals or groups in a relationship has the obligation to respect the vulnerability of the weaker and not to exploit the lesser advantaged. In his opinion, Internet associations in China could well result in greater appreciation and application of this ethical approach to social and political life. He returned to the stock market case he had described earlier to support this conviction.

Liu's paper concluded by stating that Internet associations are good for assisting the government in achieving its administrative goals. In effect, prior to the issuance of public policies, the principal ideas can be issued over the Internet to be reviewed by different interest groups. This, he maintained, is definitely favorable to effective government administration.

HISAKO KOURA made what was possibly the most unique and, perhaps, provocative presentation during the two-day seminar. An urban planner, she began by noting that as an anthropological concept, there are two types of culture in a local society, one based on technology and the other on value. The culture of technology is characterized by

5. Since Liu was unable to attend the seminar, an abstract of his presentation was read by a colleague. The full text of his draft was also made available to all participants in advance of the seminar.

efficiency and promises advancement. On the other hand, the culture of value is unique to a place. Globalization and modernization in the 20th century promote universalization of the culture of modern technology related to science and the economy that often result in social and economic assimilation in any given place. The Internet and various information technologies are expected to free us from restrictions of time and distance in communication and activities. However, these technologies might also deprive us of the culture of value unique to places by promoting the standardization.

Sense of Place and Interactive Experience. Koura noted that people recognize place as a whole with townscapes or settings for living which generate a sense of place through interactive experience. Once we fail to preserve a sense of place, townscape and living settings lose their culture of value and confusion results as seen in many modern urban neighborhoods. A sense of place is important for the sustainability of local environment and local identity.

It is often said that we will be able to work in any place supported by the global network in the information society and to live in any favorable place without any restriction of location. The houses and buildings will be one of the nodes of interface within the network, and people will live in both real and virtual society.

Sense of Place and Cultural Values. Koura asked whether this is coming true. If so, people are not necessarily conscious about the place where their homes exist, as long as their inside living space is well controlled to be comfortable. Without one's consciousness, place loses social and cultural value and the context of history. With any comfortable space as a living choice, there may be no “place” to chose.

A sense of place is specific in real society and includes significant local context and manner of coexistence, which play an important role in local sustainability. Koura concluded by emphasizing that we should realize the negative and positive interaction of real and virtual place to generate a new sense of place for future sustainability.