

Understanding the Global Information Infrastructure

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The information technology revolution is upon us. It is crossing national and regional boundaries, undermining old social and economic institutions, and planting the seeds of new ones. It is challenging slow-moving bureaucracies, both public and private, and changing the way we learn, work, heal, and govern ourselves. This revolution is called the Global Information Infrastructure, or GII.

When fully realized, the GII will be a vast web of hundreds of thousands of networks that will affect everything from manufacturing and health care to the democratization of nations. These networks will run our factories, process our financial transactions, organize our work, increase our productivity, instruct us and our children, help physicians and hospitals to care for us, connect us more closely with friends and family, entertain us, and perform a myriad of other services not yet conceived. Electronic commerce is expected to expand quickly from about \$2 billion today to around \$300 billion by the year 2000.

In order to fully realize the benefits of the GII, it must be widely used and be accessible through a wide variety of products and networks. Privacy and data security rules and regulations must be adequate and they must ensure a high level of trust. The best way for governments to encourage the growth of the GII is to eliminate trade, investment, technical, and other barriers that hinder competition.

Global benefits of GII

Creating and expanding markets. The GII is creating and expanding domestic and international markets as well as reducing the cost of trade. Indigenous artisans, small and medium businesses and multinational enterprises are selling goods and services in markets they never reached before. Cheaper and easier-to-use computers, as well as improved access to advanced telecommunications networks--both private and Internet--are making this possible.

For example, after successfully implementing a pilot Asynchronous Transfer Mode (ATM) network in 1997, Bulgaria is now building a full-scale, state-of-the-art, broadband information infrastructure to facilitate communications and commerce. IBM is working with the Bulgarian Telecommunications Company to develop the first Eastern European high-speed network for transmitting data, voice and video using the advanced ATM technology. Bulgaria's capital, Sofia, will become one of the first European cities to provide ATM broadband telecommunications services that will enable large companies and their branches--cable television, banks and others--to offer and use video-on-demand, high-quality video conferencing and high-speed enhanced data services.

Expanding the economy. Developing the GII will add billions of dollars to the world economy. Integrating computing and information networks into the economy will make companies more productive, more competitive, and more adaptive to changing conditions. New job opportunities will be created in the processing, organizing, packaging, and dissemination of the commercial, information, and entertainment products that will flow through the GII. One of the most critical issues will be reforming education systems and training programs to prepare citizens to take advantage of emerging and future opportunities. Similarly, economies may need to adjust in order to produce goods and services more marketable in a global, networked economy.

Improving productivity. Expanding productivity is vital to the long-term economic viability of nations because firms are increasingly insisting on using fewer resources to create, provide, and maintain goods and services. As a result, overall costs will decrease while valuable resources will be freed to invest in other sources of

economic growth and productivity. For example, electronic trading will save stock buyers and sellers millions of dollars annually and permit more efficient trading.

Promoting democracy. The GII will permit individuals to learn more about their governments and to participate more actively in governing. Most agencies of the US, Canadian and European Union governments maintain home pages on the World Wide Web, as do international agencies such as the United Nations, Organization for Economic Cooperation and Development, World Trade Organization, World Bank, International Monetary Fund, and Asia Pacific Economic Cooperation. Many other governments are in the process of making their information available, and political parties are also using the World Wide Web to disseminate their messages and to provide services to members.

Exchanging ideas and information. Access to ideas and information from around the world will perhaps do more than anything else to empower people and improve their lives. In some instances, the ability to access information can help save lives. For example, the Pan American Health Organization conducted a hemisphere-wide teleconference to present new methods for diagnosing and preventing the spread of AIDS. Without the innovations of the GII, crucial information on personal health and safety would not reach populations in need as quickly or easily.

Sector benefits. GII applications will assist manufacturers in coping with the complexities of exchanging information and data about product development between companies and across international borders. GII will also continue to improve health care access and quality while reducing medical costs. Efficient access to adequate and reliable data can help determine how nations and societies can grow efficiently without damaging the environment. Information technology is also revolutionizing education around the world and changing the ways teachers instruct and students learn.

Benefits for developing economies

Nowhere on the globe are these potential benefits of the GII greater than in developing countries. The emerging GII, with its vast networks for connecting and processing data and images, can help countries leap-frog technological handicaps, thereby accelerating economic development and advancing social progress.

Some countries have incomplete telecommunications systems or have not invested heavily in infrastructure. They may actually be well positioned to rapidly join the GII because they will not need to write off large-scale investments in copper wire systems as will be required in other parts of the world.

The information infrastructure will also help developing countries compete on equal footing with their trading partners in industrial countries. Through the development of new networks, physicians in developing countries can have low-cost access to medical databases and experts in developed countries. School children can communicate with their national and international peers.

Realizing the benefits of the GII will require economic and technical resources beyond those ordinarily available in developing countries. Because market and other risks limit international private investment, multilateral development banks (MDBs) are critically important. These institutions can play a key role in providing project finance assistance to developing country governments and private firms. The MDBs have traditionally focused on such infrastructure projects as ports, dams and transportation systems.

In the future, however, they will need to put greater emphasis on developing the information infrastructure which can help improve education, communications, public safety, banking and finance, environment, and health. The possibilities of having more complete and timely access to information through the GII, whether in banking, manufacturing or agricultural sectors, will open new avenues of growth and stability for these countries.

Building the foundation of GII

To fulfill its promise, the GII must integrate the following four essential elements:

Communications networks. This first building block comprises interconnected and interoperable communications networks, including telephone, cable, cellular/PCS, and satellites. The networks will provide services over a range of speeds and bandwidths, allow a variety of uses, and be capable of transmitting information in a combination of varied formats including text, image, audio, and video.

Computers. High-performance computers resident on the communications networks will be central to the ability of the GII to provide intelligent switching and enhanced network services. Easy-to-use network computers, laptops, palmtops, personal computers and workstations will mask the power and complexity of the underlying system and enable individual users to tap into the GII as easily as they now dial a phone. Developing this type of system depends on software, including operating systems and application packages. Applications to help users perform tasks quickly and easily must be widely available and easily accessible over

the network.

Information and services. The vast range of information and services already available through the GII will continue to expand. For example, public and private databases and digital libraries that include material in text, video, image, and audio formats are already proliferating, as well as information services, network directories and search engines that assist users in locating, synthesizing and updating information. Two related features will also be important for successful GII implementation: multimedia and access through a single vendor. While the components of multimedia have been available individually for some time, it is the integration of these media that represents the sea change. Customers will seek a single vendor who can provide access to these multimedia services.

People. GII requires appropriate education and training, and this will affect what skills are taught and how the teaching is carried out at every level from grade schools to universities. GII will depend on the abilities of business people, medical personnel, educators, scholars, government employees, and ordinary individuals to take advantage of the rich and varied resources available through the system. The organizations that create, package, communicate, and sell information through the GII must be staffed by people with a high level of technical education.

Removing barriers to building GII

Outlined below are several public policy principles and recommendations that are critical to extending a robust information infrastructure to the developing world.

Private-sector leadership and competition. In order to realize the full benefits of the innovations in the information technology industry, the private sector and the competitive marketplace must be the driving forces behind the evolving GII. Many governments have agreed in principle on the necessity of opening markets but engendering the political will to move forward is often difficult. Dismantling the regulatory barriers is a prerequisite for enabling competition and the new services that GII generates.

Market access. Governments can best contribute to building the GII by promoting an environment of open competition. This involves eliminating regulatory, trade, investment, and other barriers that stifle competition. The GII involves not only the telecommunications sector, but also service providers and manufacturers of hardware and software that create the physical networks. All these sectors must be open and competitive.

Governments can also enhance market access by being committed to national treatment that should apply to all investors. A country that seeks to limit trade or investment in these markets will slow the rate of growth of its infrastructure, deprive its companies and citizens of the best products and services at the best price, and undercut its competitiveness and quality of life.

Promoting competition. To ensure a rapid transition to a competitive marketplace in the telecommunications industry, the following measures should be taken:

- All telecommunications services and infrastructure should be opened to competition.
- Incumbent telecommunications operators must provide competitors with nondiscriminatory access to unbundled network facilities and services.
- The incumbent telecommunications operator's tariffs should be rebalanced to reflect costs that are free of distorting cross-subsidies.
- Regulatory authorities should be independent, and they should use objective, transparent procedures.

Eliminating barriers. Eliminating trade, investment, technical, and other barriers that hinder or prevent foreign competition should be a high priority for governments that want to promote the GII and enjoy its benefits. These include trade barriers that stifle imports and exports, investment barriers that hinder domestic and international foreign investment, and other government barriers that discriminate against foreign suppliers.

The 46 countries that signed the Information Technology Agreement (ITA) in December 1996 largely eliminated tariffs on information technology products. Other countries--China and South American and African nations--should agree to the ITA as soon as possible. In addition, the signatories to the ITA should adopt the ITA II with as broad a product coverage as possible.

Export control policies may address legitimate national security and foreign policy requirements, but they can also create major market access disincentives for the GII. Export controls on sophisticated new systems, such as massively parallel computers that are ideally suited for serving the technology needs of the GII, must also be relaxed or eliminated. Export controls should also be rapidly adjusted in order to take into account the rapid pace of technological advancement. Otherwise, even laptop computers can be subject to control.

Discriminatory investment barriers must be eliminated. The GII will require massive domestic and foreign investment, much of it in the services sector. Investment impediments include lack of national treatment,

screening of foreign investment, restrictions on foreign service providers, market reservations, performance requirements, and domestic manufacturing requirements. In addition, withholding taxes on payments of dividends, royalties and interest should also be lowered.

Additional government policies contribute to restricting market access. These include discriminatory procurement practices; the absence of open and transparent procedures and regulations, such as the lack of harmonized trade-related administrative practices; inadequate or unenforced protection for intellectual property rights and licensing; restrictions on transborder data transmission; and restrictions on the transborder movement of people. These and similar government barriers and policies should be eliminated as soon as possible in order to promote the free flow of goods and services on which the GII depends.

Interoperability. The GII would be an impossibility without interoperability. Interoperability refers to the ability to use any information equipment to plug into any part of the GII and access any database or communicate through any network in any other part of the infrastructure. It allows diverse systems made by varied vendors to communicate with each other, thereby facilitating communications among users. User demand for enhanced interoperability is already driving the industry to respond aggressively, and market forces will cause interoperability to develop more rapidly compared to a formal standards process or governmental intervention.

Where appropriate, standards can further the goal of interoperability, however. The private sector is best positioned to weigh various factors in setting standards, including timeliness, breadth of support, technical superiority, and implementation costs. The industry-led, voluntary-standards development process is the best way to achieve the interoperability required for the GII.

In competitive markets, the private sector must lead the development of standards for interoperability. Competition drives innovation and the development of products. In noncompetitive markets, regulatory intervention may be necessary to ensure that internationally accepted standards are implemented.

Industry members of standards bodies and other forums that address GII interface specifications should ensure prompt action in accepting and adopting interfaces whose technical specifications are open to other manufacturers and service providers.

Developers of proprietary technology critical for GII interface standards should be able to license the technology on reasonable terms and conditions. This process is already functioning and can be seen in the work of the American National Standards Institute (ANSI), a nonprofit, privately funded organization. All interested parties are free to participate in the development of national standards under the procedures approved by ANSI. In 1994 ANSI established the Information Infrastructure Standards Panel (IISP) to accelerate the development of voluntary standards critical to the GII. The work of ANSI and IISP provides a model for the international standards-setting process that will ensure continuing interoperability in the GII.

Data security and privacy. The GII will evolve only if users are confident that their information and transactions are private. It is essential that sensitive, personal and proprietary information be protected and made available in accordance with internationally accepted guidelines.

Data security involves protecting information from unauthorized or accidental access, modification, destruction, or disclosure. Encryption is currently the best way to ensure security, particularly when transmitting information over electronic networks. Encryption can enable a number of security services, such as data integrity, authentication and data confidentiality.

Eliminating barriers

However, many countries, including the United States, impose export controls or usage restrictions that inhibit truly secure communications. These measures create an international environment that discourages or prevents businesses and other users from acquiring, employing, storing, or selling those cryptographic methods that best meet their needs. What is needed is an international policy that eliminates unnecessary barriers between nations and promotes broader international awareness of the importance of security on the networks without undermining legitimate government responsibilities and concerns.

Users need varied cryptographic techniques to fulfill the multiplicity of their needs. Users should have the freedom to choose the strength of the encryption, the method for encoding communication, and the key management system appropriate to its application and eventual destruction.

In order to ensure international acceptance and public confidence, encryption-based solutions must be available for public scrutiny. To assure complete interoperability, industry-led technical standards must be adopted in sufficient detail to meet the communication needs of users who employ varied cryptographic solutions. This will ensure complete disclosure and specification of interfaces.

Encryption methods must be widely accepted by business and governments around the world and remain free of unnecessary government control. National encryption methods that are not internationally acceptable do not satisfy the needs of international business for secure worldwide communications and can create serious harm to networks in home countries and abroad.

Encryption should be implemented in a flexible way. It should be usable in either hardware or software, and vendors and users should be free to make technical and economic choices about modes of operation and implementation.

The unauthorized disclosure of keys can have significant and possibly unrecoverable economic consequences. Therefore, those holding keys or key recovery information in trust for others should be liable for any improper disclosure. These trusted parties, including government agents, should be liable for theft, loss or any improper disclosure of keys.

Governments should agree that their lawful access to encryption keys or recovery information should be no greater than the access they have for the underlying plain text.

Intellectual property protection. Strong protection of intellectual property will fuel competition and innovations that are the engines for the GII. Creators of hardware, software and content will not participate in the GII unless there are appropriate systems in place internationally that enable them to set and enforce the terms and conditions under which their works are made available. Moreover, the public will not buy the products and services available on the GII unless they are provided under equitable and reasonable terms and unless reliability and integrity are assured.

The copyright, patent and other intellectual property issues involved with the global network are not fundamentally different from those faced by right-holders in the pre-networked environment. Copyright law, for example, protects intangible rights in authors' intellectual creations, regardless of their form. Copyright law is well suited as a framework to protect software and other types of works in the digital realm. Also, an effectively functioning patent system that encourages and protects innovations in technology should also address the requirements of the GII.

However, because of national variations in these laws, international harmonization has become increasingly important. Such international agreements as the Berne Copyright Convention and the GATT Trade-Related Aspects of Intellectual Property Agreement provide useful frameworks within which to develop greater international consistency to protect intellectual property rights.

The following critical issues illustrate areas where greater harmonization is necessary:

- Countries should not discriminate in granting and protecting intellectual property rights of their own nationals and foreign nationals. This rule prevents inequities in national legal schemes and reduces international retaliation in the fields of intellectual property and trade.
- Compulsory licensing of intellectual property rights should be prohibited. Intellectual property rights should be licensed and exercised only with the author's or right-holder's free consent.

PeopLink, a US-based, nonprofit organization, is using the Internet to enable indigenous artisans in Bangladesh, Guatemala, Haiti, Cambodia, Morocco, and other developing countries to market their handiwork around the world. Through the PeopLink Web site (<http://www.peoplink.org/gen/about.htm>), people around the world can learn about these artisans, their cultures, and their crafts as well as purchase their handiwork from an electronic catalog using a credit card. In this way, the Internet can give isolated artisans access to a global market and expose visitors to the Web site to cultures and peoples they never may have known about.

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