
Special issue on research and development for a next-generation info-communication network

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One of the main research areas in the Communications Research Laboratory (CRL), “Research and development for next-generation info-communication infrastructure”, is introduced with emphasis on future network researches. Brief introduction of the papers in this special issue, such as photonic network, high-quality contents transmission over IP, new AUP(Acceptable Use Policy) proposal for next-generation internet test-bed, and emergency communication technologies, is presented.

Keywords

Next generation info-communication infrastructure, Next generation network

1 Info-Communications as Infrastructure

“...TV will play a new and more important role in the near future. Specifically, it will deliver on-screen viewer responses while they are witnessing live broadcasts. For example, when the Prime Minister makes a presentation to the Diet, those watching him on TV will be able to send feedback through the TV screen on a real-time basis....In this way, TV will be a double-edged sword. If used maliciously, it may become a very dangerous tool, and if used wisely, it could be revolutionary. When a scene is broadcast worldwide, all three billion people worldwide will be witnesses. As a result, ...”(Soichi Ohya, “TV’s Magical Power Beats the Newspapers,” “Shori (Magazine in Japanese)”, December 1967^[1]).

The above citation, admittedly a bit long, is taken from an article written by Soichi Ohya, a leader among Japan’s media critics. This article, written about expectations and fears concerning the media, was written before ARPANET, the pioneer Internet experiment, was initiated. The article focused on the con-

frontational relationship between the then-emerging medium of TV and conventional newspapers. However, if you read the article again, and replace “TV” with “Internet,” and consider the relationship between the emerging Internet and conventional broadcasting media, it is still interesting, and clearly applies to certain aspects of the current situation surrounding the info-communication media. In fact, among the author’s expectations for broadcast media, the real-time downlink flow of information has been realized on a global basis, while the realization of a full-scale interactive medium can be found in the evolution and proliferation of the Internet.

Indisputably, info-communication systems (represented by the Internet) are vital for the development of industry, and will form a more and more important part of our infrastructure through its contribution to a number of fields, including medical care and social welfare, transportation, education, culture, administration, environment, and the labor market. Each individual’s ability to send and receive information has been remarkably improved in terms of both quality and quantity, regardless

of the individual's health condition or age. On the other hand, individuals must now grapple with information ethics and informational literacy, so that they may extract only useful and correct information from the large jumble of good and bad available data. The more the info-communication network works as an essential part of the infrastructure, the more we must be aware of the various threats to this infrastructure.

2 The Current Special Issue and "Research and Development for a Next-Generation Info-Communication Infrastructure"

2.1 The "e-Japan Priority Policy Program" and "Research and Development for a Next-Generation Info-Communication Infrastructure"

Japan has laid out a "Priority Plan for the Formation of an Advanced Information-Communication Network Society (e-Japan Priority Policy Program)"^[2] based on the "Basic Law for Formation of an Advanced Information-Communication Network Society"^[3] enacted on January 6, 2001. This plan includes the items shown in Fig. and presents a number of recommendations for each item and for the items as a group, noting subjects that should be addressed with urgent priority as subjects of national research.

The Communications Research Laboratory (CRL), Independent Administrative Institution, has drawn up a mid-term plan entitled "Research and Development for a Next-Generation Info-Communication Infrastructure," focusing on the rapid development of an Internet-centered info-communication systems for the home and for society as a whole. The plan aims to facilitate the implementation of the "e-Japan Priority Policy Program" and to encourage basic network, interface, and database research, in cooperation with domestic and overseas research institutes. As part of this network research plan (the subject of this special issue), the research and development in the following areas (excerpts from the "CRL

Mid-Term Plan") will be implemented based on the results obtained so far.

1. Construction of world-leading-class advanced info-communication networks
2. Promotion of education and learning and development of human resources
3. Promotion of "e-commerce"
4. Promotion of digitization of administration and utilization of info-communication technology in the public sector ("e-government")
5. Establishment of security and reliability in advanced info-communication networks

Fig. "e-Japan" Priority Policy Program

2.1.1 Next-generation platform technology

Next-generation platform technologies will be studied, with the aim of developing higher-speed and higher-quality Internet communications. One of the goals will be to realize a transmission speed of several Gigabits per second between Internet terminals. Research will also be conducted on guaranteeing quality of service for various types of content, as well as for network controls and high-precision media synchronization protocols, all elements of next-generation platform technology. Field tests will be conducted using test-beds, and the test results will inform future research activities.

2.1.2 Peta-bps class photonic network technology

The fundamentals of the photonic network will be studied, with the goal of meeting the bandwidth needs for all types of communication through its peta-bps transmission capabilities. Efforts will be focused on research into the architecture of a backbone network capable of providing highly reliable information efficiently, and also on the methods of dynamic control of such a network.

2.1.3 Info-communication crisis management technology

The modeling of crisis management and an emergency communications mechanism will be the subject of comprehensive study. This will consist of research into crisis management technologies that will ensure security in the face of “cyber terrorism” and natural disasters, and communication-access technology involving the registration and retrieval of multimedia data. The effectiveness of the model will be tested through demonstration experiments. One of the goals will be the institution of the developed technology as an international standard.

Needless to say, it is important to conduct verification tests using domestic and overseas advanced network test-beds, in cooperation with the relevant organizations. It is a well-known fact that it has become increasingly difficult for a single institution to create international *de facto* or *de jure* standards. Given this reality, we must make an effort to construct systems and international standards in cooperation with the relevant domestic and overseas organizations, and to coordinate with the private, academic, and public sectors.

2.2 The Current Special Issue

This special issue describes CRL’s plan, research survey, and the results of its research activities concerning future info-communication networks, given the considerations set forth above. The main points are as follows:

(1) Construction of a photonic network

Issues and research plans with regard to the methods of constructing photonic networks using photonic packet exchange, designed to handle a rapid increase in communication traffic.

(2) CRL next-generation Internet and APII test-bed

Analysis of next-generation Internet experiments using domestic and overseas test-beds and schedule of verification tests using test-beds of the future super-high speed and ultra-wide bandwidth IPv6 next-generation Internet.

(3) Proposal of a policy model for the next-generation Internet test-bed

Currently, super-high speed network development projects and their test-beds are under development and operation worldwide, with the construction of the next-generation network in view. Based on a survey of the AUP (Acceptable Use Policy) in such networks, issues in the interconnection of network test-beds have been identified. As a solution to the issues so identified, a new layer model is proposed for the next-generation test-bed.

(4) IP transmission technology for super-high quality media using high-speed networks

CRL has succeeded in TCP/IP-based transmission of uncompressed HDTV and D1 signals[4]. In connection with this result, communication-broadcast fusion technologies are discussed, including the high-speed network VoD (Video on Demand) service on the Internet.

(5) Research on emergency communications

Research activities and plans for “Emergency Communication Systems”[5] to support communication among victims in the event of large-scale natural disasters, as well as for “Network Crisis Management Systems” to deal with a variety of threats to the Internet.

3 New Prologue to the Info-Communication Era

Triggered by the widespread use of computers and the resultant release of networks to the public, the Internet is now in the course of explosive development. This now forms a huge decentralized processing system, connected to more than 100 million computers in the world, a system unmatched in scale in human history. We are witnessing another worldwide revolutionary event, on a par with prior communications revolutions — starting with remote communication tools such as signal fires in ancient times to the development of electricity, followed by wireless and photonic communications. Because of its projected impact on individual nations, global socie-

ty, and humanity as a whole, the Internet is often compared to the printing technology invented by Gutenberg. In the same way the Internet has developed in ways experts could not have predicted, so too may fast-moving info-communications technologies produce unpredictable turns of events.

For example, our experimental results indicate that it is possible to transmit professional-quality video signals (including HDTV data) through TCP/IP. With the evolution of wideband multicast technologies, it now seems more realistic than ever to attempt to provide conventional broadcast services on an Internet-based platform. If high-speed transmission lines are developed as planned, new research will focus on coding methods for information transmitted along such high-speed lines. If we think the 20th century as a time focused on the search for bandwidth economy (exemplified by the development of bandwidth compression techniques) in the field of communications, the 21st century may represent an era of media diversification, seeking to meet user needs by fully exploiting data-transmission capabilities.

On the other hand, as previously mentioned, important issues have been drawing attention, such as communications-related cri-

sis management, information ethics, copyright issues, privacy protection, and the digital divide. Corresponding legislation and related actions are thus to be expected. In the future, the info-communication system should be implemented throughout society with the aid of broad assessments that take into consideration the system's impact on individuals, society, and on the earth as a whole. The design of the system should extend beyond the goals or interests of the engineers and its purpose should extend beyond profits. Just as Soichi Ohya predicted, info-communications technology may just as easily be a threat as a boon to mankind.

The Communications Research Laboratory will work with the relevant institutes not only in engineering fields but in the human sciences, keeping emerging contexts in view. Through its research activities, CRL will contribute on a global basis to the realization of a sound info-communications network society that will help us lead happier, safer, more convenient lives. The planner and authors of this special issue sincerely hope that as many engineers and researchers as possible will read these articles and will find themselves encouraged to further extend and broaden their collaborations.

References

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