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SAKAI Yoshinori

「Development ,Research, and Policy Planning for Broadband Video Communication system」

略歴

Born on November 3, 1946

1969　graduated from the University of Tokyo

1974　Ph.D. Eng

1974　NTT Electrical Communication Laboratories

1990　Professor of Tokyo Institute of Technology

2012　Professor and director of Tokyo Shibuya Study Center, the Open University of Japan

2014　President of The Institute of Electronics, Communication and Information Engineers.

2016　Prsident, Japan Data Communications Association

2017　Guest professor, Tsuda University

Best author`s award: The institute of Image Information and Television Engineers.

Best paper`s award, The Institute of Image Electronics Engineers,

Achievement award, The Institute of Electronics, Communication and Information Engineers.

Member of Information and Communication Council,

Member of Information and Communications and Posts Administrative Council

1．Research activities for nearly 50 years in the field of communication

Nearly 50 years have passed since I was engaged in research and development at NTT laboratories after getting PHD degree. Communication network has entirely changed from exchanging telephone signal by circuit switching network to everything on IP where all kinds of information including picture and video signals is transmitted through IP network. Communication network is now the basic infrastructure of so called digital society. I was engaged in developing communication system for picture and video signals during 14 years at NTT laboratories. After I became the professor of Tokyo Institute of Technology, my research fields included the design and basic theory of new information communication network. After I retired from Tokyo Institute of Technology, I continued research concerning telecommunication industry policy.

When I was working for NTT laboratories, communication network was changing from analog to digital. However, most of information source is telephone signal and it was not easy to send picture and video signal through network. My research was concerning transmitting and developing of new system for picture and video signals.

When I became the professor of the Tokyo Institute of Technology, the network was changing from circuit switching network to packet type network on IP. However it was not easy to send live media video signal on IP. Packetized video was popular research theme. .

Recently, everything including data, voice, live video is transmitting on IP. High speed transmission with small delay is main target of 5G. It is strongly desirable that network does not disturb social activities. Platform operator has also big social impact as well as telecommunication industries.

I was engaged in the system development , basic research and government policy planning and have contributed to the progress of digital society in Japan.

2. Development activities at NTT laboratories

(1)PCM/FDM transmission system[(1)]

PCM/FDM transmission system enabled to transmit video signal through existing analog telephone network. We developed 32 Mb/s system, that was the highest speed system and contributed to obtain speed limit of automatic equalizer through mathematical analysis.

(2)Fcsimile communication system

Facsimile store and forward system was developed by NTT about 40 years ago.
We contributed to design distributed architecture and also system cost analysis to obtain service price of facsimile transmission.

(3) Multimedia teleconferencing[(2)]

Multimedia and multipoint teleconference system was developed, that made remote cooperative work possible watching the same document displayed on remote places. We proposed the new concept named common visual space and media synchronization , that was called groupware later. Further, to manipulate displayed document, we proposed and developed many new human interface.

3. Research at the Tokyo Institute of Technology

After I retired form NTT lab. I continued research to send video and data signal though packet network, information search system over the network and also human interface mainly for information retrieval, from theoretical point of view.

(1) Packet transmission system based on QoS[(3)]

When transmitting packet through each relay node, FCFS(First Come First Service) was

applied. However to transmit multi media packets, priority control of packet transmission was discussed. We proposed priority control method based on media property and proposed new priority control methods. When transmitting live video through packet network, packet delay t is not constant and probabilistic variable. We defined satisfaction level of packet delay t as S(t) . If probability density function of delay t is P(t), average quality is defined as $C=\int S(t)P(t)dt$. We proposed new packet priority control method where packet priority of each path is determined so that satisfaction of each path is nearly the same, based on feedback of satisfaction of each path. Priority control based on satisfaction of each path was the beginning work of QoS(Quality of Service) concerning IP network that was discussed in academic society later.

(2) Information search through the network[4][5]

We proposed the information searching method distributed over the network in the case that the retriever input keyword. Here, the total number of searching packet was considered as searching energy and we found the optimum method that maximize the probability that the target information was found under the condition of searching energy restriction.

At first, the uncertainty of target location was represented as entropy, and the searching method that maximize (entrpy reduction/searching energy) was proposed. Further, we proposed optimum meta-data location in the network.

(3) Media synchronization[6]

In the case that voice and video signal is transmitted through network, both two media should be transmitted and decoded at the same time. We studied the technology that video signal is transmitted and decoded at predetermined time. We developed scalable MPEG coding method that can reduce total amount of MPEG data considering network capacity. By combining scalable MPEG coding and network delay estimation using Kalman filter, new and efficient media synchronization method was developed.

(4) Protocol relay method through IP network[7]

IP router only transfers IP packet and does not have the protocol terminating capability such as TCP/IP. We studied the optimum location of protocol terminating node and showed that network delay caused by packet retransmission could be decreased. We also proposed the optimum protocol termination points in the case of multipoint transmission.

(5) Human interface design for the interactive image retrieval[8]

In the case that image in the data base is retrieved without keywords, it is important to get the features of image that retriever wishes to retrieve. We proposed the new interactive human interface where images that retriever wished to get was found through interaction.

(6)Reliability of information[9]

Reliability of information is one of the most important issues in future digital society. We

developed reliability of medical information in the network, and showed possibility of estimating reliability through the analysis in the network data.

4. Research activities after retiring the Tokyo Institute of Technology[10]

I have been engaged in planning communication policy for telecommunication industry, after retiring from Tokyo Institute of Technology. Recently we have published a journal paper, where transmission cost of IP packets of different priorities is analyzed. This analysis is applied to access charge of NGN(Next Generation Network) provided by NTT with priority control capability

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